The Late Prehistory of the Eastern Sahel

THE MESOLITHIC AND NEOLITHIC
OF SHAQADUD, SUDAN

Edited by
Anthony E. Marks
and
Abbas Mohammed-Ali

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A good number of Sudanese students took some part in the excavations, as did a smaller number of Americans. Even those who worked only a few weeks with us contributed significantly and their efforts and general good humor are deeply appreciated. Those who participated, their affiliation at that time, and when they worked are listed below. Should anyone's name have been left out, it does not reflect on their contribution but on our unwitting oversight.

First Field Season: 1981/82

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Finally, we would like to give particular thanks to Mrs. Lucy Addington for her outstanding artifact illustrations; Mr. Bill Westbury, who produced the final photographs for these volumes; Dr. Karim Sadr, who drafted most of the maps; Ms. Chris Christopher, who helped edit a number of chapters; Mr. Elanwar Magid, whose original profiles of Shaqadud Cave and midden were well above standard; and David Pease, Nuno Bicho, João Ladiera, and Stephen Mbutu.

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10. THE FAUNAL REMAINS FROM SHAQADUD

by Joris Peters

INTRODUCTION

The present study deals with the faunal material collected by members of the Joint University of Khartoum/Southern Methodist University Butana Archaeological Project over two field seasons (Marks et al. 1982, 1983). These sites are located at the southern end of an irregular, elongate sandstone outcrop, approximately 50 km. into the Butana at latitude 16° 15′, 13 km. east of Meroitic Naga. A more detailed description and a map of the Jebel Shaqadud area can be found elsewhere in this volume.

The faunal remains reported here were obtained from three sites: S21, a site on the plateau into which the valley of Shaqadud is cut; S1-B (the midden) which fills most of the valley; and S1-A; Shaqadud Cave, located at the back of the valley. Sampling was done by dry sieving with a mesh of 4 mm. Although this does not insure complete recovery of vertebrate microfauna (Payne 1975; Meadow 1976), the samples produced are comparable to those obtained at other Sudanese sites, where similar screens have generally been used (cf. Gautier 1983). The sorting into identifiable and not identifiable animal remains, excavated during the 1981/82 field season, was done by the excavators and ourselves. The bone material collected during the 1982/83 field season was sorted out entirely on the spot by Dr. Gautier and the present author. Some small samples of little significance, such as shell fragments, were discarded in the field, but most of the identifiable remains have been stored in the collections of the Laboratorium voor Paleontologie, Rijksuniversiteit Gent under number P3507.

S21 yielded an interesting faunal assemblage, comprising approximately 2,900 bone fragments from 2 cu.m. of deposit. They were generally coated by fine clastics with calcium carbonate which normally could be removed with dilute HCl. The cleaned bones are light yellow to yellowish brown. They generally exhibit weathering cracks and can be placed in weathering stage 1 sensu Behrensmeyer (1978). Radiocarbon analysis suggests a date of ca. 7,417 ± 67 B.P. for these deposits.

The midden deposits (S1-B) contain over 3 m. of cultural material, which can be divided into four units based on ceramics and lithics. The radiocarbon dates for this sequence range from ca. 7,056 ± 321 B.P. to 5,584 ± 74 B.P. The faunal assemblage consisted of some 3,300 fragments derived from approximately 20 cu.m. of deposits. They were heavily coated with poorly sorted clastics embedded in calcium carbonate and were very difficult to clean even with hot diluted HCl. Their color ranges from orange yellow to dark gray. The midden bone material can be classified in weathering stages 1 and 2 sensu Behrensmeyer (1978): weathering cracks and flaking of the outermost concentric thin layers of bone. Specimens cemented by kunkur are not frequent.

The cave (S1-A) contains over 3.5 m. of deposits, which can be divided into three units, dating from ca. 4,046 ± 101 B.P. to 3,615 ± 88 B.P. The cave has been partly excavated and yielded ca. 14,500 bone fragments in 33 cu.m. They were much comminuted (trampling?) and coated with fine clastics and small amounts of calcium carbonate, the latter being restricted to bone from the lower cave unit. This matrix could be removed without too much difficulty with dilute HCl. Cleaned bones are yellowish brown to dark brown, exhibiting weathering stages 1 to 5 sensu Behrensmeyer (1978), i.e., from weathering cracks to bones falling apart *in situ.* The upper unit also yielded some intrusive bone material, attributable to small livestock and a gerbil. Its color is yellowish white to light brown and the matrix consists of fine sand, easily removable with a brush. Because of the adhering matrix, especially for the midden material, sorting was sometimes rather difficult and no doubt some heavily coated, identifiable remains were overlooked.

The Shaqadud assemblages are dominated by mammals, but mollusks, amphibians, reptiles, and birds are also present. Some of the mollusks were identified by Mr. T. Pain (London) and Mr. A. P. H. Oliver (Crowhurst, Battle). The turtles and birds were examined by Dr. F. de Broin (Paris) and Mrs. D. Matthiesen (Gainesville, Florida), respectively. The other identifications could be made with the aid of the comparative collections of our laboratory, the Koninklijk Belgisch Instituut voor Natuurwetenschappen (KBINW, Brussels) and the Koninklijk Museum voor Midden-Afrika (KMMA, Tervuren-Brussels). In many cases, osteomorphological criteria are insufficient to identify bone remains. For these, other arguments such as the relative size of the specimens involved, the actual zoogeographic ranges of the species possibly present, as well as the assumed paleosynecological context (circumstantial evidence) may help to establish whether a certain species or genus is present in the assemblage.

Only a restricted number of measurements have been incorporated in the next part of this report. They were taken according to von den Driesch (1976), and are given in millimeters, unless stated otherwise (fig. 10-5, at end). A dash behind a column of measurements indicates that they pertain to one specimen or belong to the same individual.

A synopsis of the animals encountered, together with their absolute frequencies, can be found in table 10-1. The frequencies are based on specimen counts, a specimen being "all the remains that can be shown to derive from a single, once living individual, provided that the remains include at least one identifiable element . . ." (Holtzmann 1979:78). Tables 10-2 to 10-4 summarize the mammalian skeletal elements per group or species, encountered respectively in sites S21, S1-B, and S1-A. The numbers between brackets in all four tables indicate juvenile or subadult individuals.

DESCRIPTION OF THE FAUNAL REMAINS

Mollusks (fig. 10-1, 1–3).

The molluscan assemblage consists of marine, land, and freshwater gastropods and some freshwater bivalves. Table 10-1 summarizes the species encountered together with their relative frequency. The marine gastropods and some of the land snails were identified respectively by Mr. A. P. H. Oliver (Crowhurst, Battle) and Mr. T. Pain (London). Other identifications are based on Thiele (1931), Grasse (1960), and Oliver (1975). Information on the ecology and recent distribution of the species involved has been gleaned from Pilsbry (1919), Pilsbry and Bequaert (1927), Mandahl-Barth (1954), Van Damme (1976, 1984), and Brown (1980).

Marine Gastropods

Strombus gibberulus. S21 yielded an almost complete shell of a small gastropod, identified by Mr. A. P. H. Oliver as *Strombus gibberulus.* On the basis of its relative size and the recent distribution of the three subspecies known, our specimen can be assigned to *S. g. albus* (Oliver 1975:80).

Cowry (*Cypraea sp.*). One incomplete shell of a cowry was found in S1-B/III. According to Mr. A. P. H. Oliver, two possible identifications can be put forward: *Cypraea annulus* or *C. moneta,* which are both inhabitants of the Indian Ocean. Evidence from prehistoric sites along the central Sudanese Nile clearly demonstrates that cowries were used as beads for adornment in a fashion comparable to a custom still seen today, but our specimen does not show any signs of working or use wear. In any case, this find indicates exchange relations with the eastern part of the country.

Freshwater Gastropods

Pila sp. (including *Pila wernei*). This freshwater gastropod occurs in considerable numbers in the older deposits (S21, S1-B; see table 10-1). Due to the marked fragmentation of the shells and the problematic status of the genus *Pila* in the Sudan, only a limited part of the material could be identified specifically. At the beginning of the century, it was generally accepted that three species lived in the Sudan: *Pila ovata, P. kordofana,* and *P. wernei.* Somewhat later, Alderson (1925:90, 94) considered *P. kordofana* to be a synonym

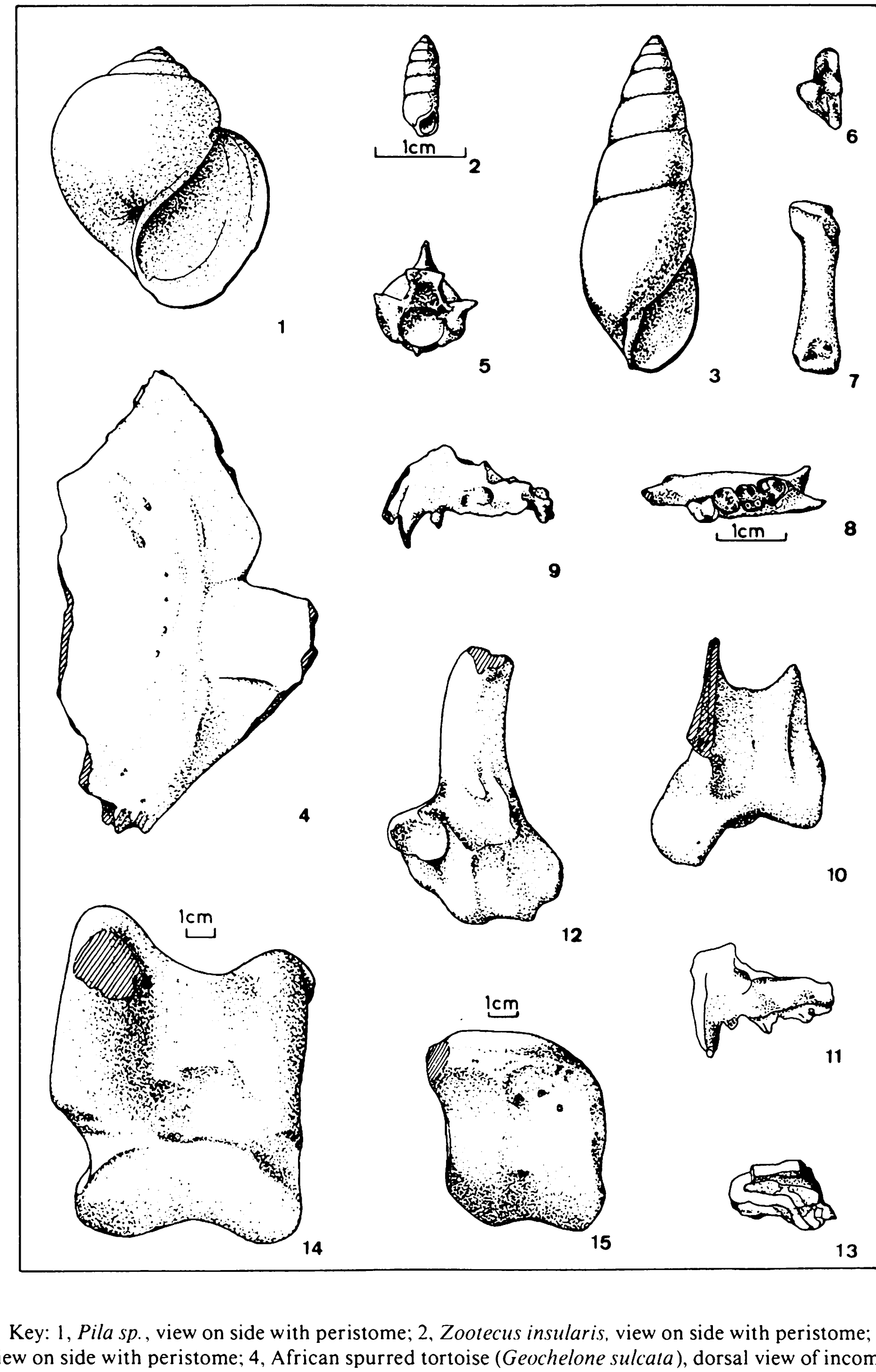

Figure 10-1. Key: 1, *Pila sp.*, view on side with peristome; 2, *Zootecus insularis*, view on side with peristome; 3, *Limicolaria cailliaudi*, view on side with peristome; 4, African spurred tortoise (*Geochelone sulcata*), dorsal view of incomplete carapax; 5, Snake, caudal view of a vertebra; 6, Cane rat (*Thryonomys sp.*), medial view of a calcaneus; 7, North African porcupine (*Hystrix cristata*), dorsal view of a metatarsal III; 8, Striped ground squirrel (*Euxerus erythropus*), occlusal view of a mandible; 9, Genet (*Genetta sp.*), lateral view of an upper jaw; 10, Striped hyena (*Hyaena hyaena*), lateral view of a distal scapula; 11, (African) wild cat (*Felis silvestris*), lateral view of an upper jaw; 12, Aardvark (*Orycteropus afer*), medial view of a distal calcaneus; 13, African elephant (*Loxodonta africana*), occlusal view of a molar fragment; 14, Giraffe (*Giraffa camelopardalis*), plantar view of a talus; 15, Giraffe (*Giraffa camelopardalis*), proximal view of an os carpale II+III. (All pictures are drawn on natural size by Jo Baetens, except indicated otherwise.)

TABLE 10-1

Absolute Frequencies of Animals Encountered

ANIMAL GROUP/SPECIES	SITE OR EXCAVATION UNIT	S 21	S1-B				S1-A			TOTALS
			I	II	III	IV	I	II	III	
MARINE GASTROPODS	*Strombus gibberulus*	1	-	-	-	-	-	-	-	1
	Cowrey (*Cypraea annulus* or *C. moneta*)	-	-	-	1	-	-	-	-	1
FRESHWATER GASTROPODS	*Pila* sp. (including *Pila wernei*)	FF	F	F	F	R	R	R	-	FF
	Cleopatra bulimoides	-	-	-	1	-	-	-	-	1
FRESHWATER BIVALVES	*Aspatharia* sp.	-	3	7	5	-	-	-	-	15
	Large bivalve	7	±30	±45	±30	2	3	±15	1	±130
	Caelatura aegyptiaca	-	-	1	-	-	-	-	-	1
	Corbicula consobrina	-	-	-	-	-	1	-	-	1
LAND SNAILS	*Zootecus insularis*	±120	2	2	3	1	8	3	-	±140
	Limicolaria cailliaudi	F	FF	FF	FF	R	R	R	P	FF
	Zonitarion sp., probably *Z. cailliaudi*	-	±35	±60	±15	-	-	-	-	±110
AMPHIBIANS	Frogs and/or toads	-	3	17	55	2	-	-	-	77
REPTILES	Terrapin (*Pelusios* sp.)	-	2?	-	-	-	-	3	-	5
	Hinged tortoise (*Kinixys* sp., probably *K. belliana*)	-	-	-	3	-	-	-	-	3
	African spurred tortoise (*Geochelone sulcata*)	-	-	-	-	-	-	74	-	74
	African spurred? tortoise (*Geochelone* sp., probably *G. sulcata*)	-	-	-	-	-	13	-	3	16
	True tortoise (Testudinidae indet.)	-	-	-	-	-	-	1	-	1
	Cape monitor (*Varanus exanthematicus*)	4	2	2	27	-	1	1	-	37
	Snakes (Serpentes indet.)	1	1	-	6	-	-	-	-	8
BIRDS	Pelican (*Pelecanus* sp.)	-	-	-	1	-	-	-	-	1
	Clapperton's francolin (*Francolinus clappertoni*)	-	-	-	1	-	-	-	-	1
	Helmeted Guineafowl (*Numida meleagris*)	4	1	-	7	-	1	2	-	15
	Dove (*Streptopelia* sp.)	-	-	-	1	-	-	-	-	1
	Owl (Strigidae indet.)	-	1	-	-	-	-	-	-	1
	Crow (*Corvus* sp.)	-	-	-	-	-	-	1	-	1
	Birds (Aves indet.)	1	-	-	-	-	-	2	1	4
	Ostrich (*Struthio camelus*; egg shell fragments)	2	3	3	10	-	19	58	28	123
WILD MAMMALS	Bats (Chiroptera indet.)	-	-	-	2	-	-	-	-	2
	Small cercopithecid (*Cercopithecus* sp.)	-	-	-	2	-	-	-	-	2
	Hare (*Lepus* sp.)	-	-	-	1	-	5	7	-	13
	Striped ground squirrel (*Euxerus erythropus*)	-	-	-	1	-	-	1	-	2
	Nile (grass) rat (*Arvicanthis niloticus*)	-	-	-	1	-	-	-	-	1
	Large gerbil (*Tatera* sp.)	-	-	-	2	-	-	-	-	2
	North African porcupine (*Hystrix cristata*)	4	3	2	25	-	3	24	2(1)	64

	Cane rat (*Thryonomys* sp., probably *T. gregorianus*)	2	-	-	-	-	-	-	-	2
	Small rodents	-	-	-	7(2)	-	-	1	1(2)	13
	Medium rodents	-	1	-	2	-	2	-	-	5
	Honey badger (*Mellivora capensis*)	-	-	-	1	-	-	-	-	1
	Slender mongoose (*Herpestes sanguineus*)	-	-	-	2	-	-	-	-	2
	Genet (*Genetta* sp.)	-	-	-	3	-	1	-	-	4
	Medium viverrids	1	-	1	3	-	1	-	-	6
	Striped hyena (*Hyaena hyaena*)	-	-	-	-	-	-	4	1	5
	(African) wild cat (*Felis silvestris*)	5	-	-	-	-	2	-	-	7
	Medium felids	-	-	-	4	-	-	-	-	4
	Small carnivores	1	-	-	2	-	1	1	-	5
	Medium carnivores	-	2	-	-	-	-	-	-	2
	Aardvark (*Orycteropus afer*)	-	-	-	-	-	-	5	2	7
	African elephant (*Loxodonta africana*)	4	-	-	-	-	-	-	-	4
	Warthog (*Phacochoerus aethiopicus*)	1	-	-	2	-	-	-	1	4
	Suid(s), probably warthog	5	-	-	4	-	-	-	-	9
	Giraffe (*Giraffa camelopardalis*)	1(1)	-	2	1	-	2	40(2)	29(3)	81
	Commom bush duiker (*Sylvicapra grimmia*)	-	-	-	1	-	-	-	-	1
	Oribi (*Ourebia ourebi*)	11(1)	-	1	8(3)	-	-	-	-	24
	Small antelopes	45(15)	4	5(2)	41(10)	-	3	-	-	125
	Gazelle, mainly red-fronted gazelle (*Gazella rufifrons*)	-	-	-	-	2	18	43(3)	13(1)	80
	Medium antelopes	6	-	2(1)	6	1	12	28	4	60
	Greater kudu (*Tragelaphus strepsiceros*)	-	-	-	15	-	-	-	-	15
	Roan antelope (*Hippotragus equinus*)	3	-	1	-	-	-	-	-	4
	Topi and/or hartebeest (*Damaliscus lunatus*/*Alcelaphus buselaphus*)	11	1	-	2	-	-	-	-	14
	Large antelopes	32(4)	1	1	24(4)	1	2(1)	9(1)	1	81
DOMESTIC MAMMALS	Domestic donkey (*Equus africanus* f. asinus)	-	-	-	-	-	-	-	1	1
	Sheep (*Ovis ammon* f. aries)	-	-	-	-	-	-	1	-	1
	Goat (*Capra aegagrus* f. hircus)	-	-	-	1	-	-	-	-	1
	Small livestock (sheep and/or goat)	-	-	-	-	-	-	2	3	5
	Cattle (*Bos primigenius* f. taurus)	-	-	-	-	-	(1)	4	-	5
WILD OR DOMESTIC MAMMALS	Jackal and/or dog (*Canis* sp.)	-	-	-	2(1)	-	6	11(1)	4	25
	Small bovids	-	-	-	-	-	4(2)	10	4	20
	Large bovids	-	-	-	-	-	-	5(2)	2(1)	10
TOTAL NUMBER OF IDENTIFIABLE BONE FRAGMENTS		163	22	37	286	6	81	294	82	964

Numbers between brackets indicate bone fragments derived from subadult (or in a few cases juvenile) animals. Symbols used to describe the molluscan assemblage: P = Present (very few specimens); R = Rare (a few specimens); F = Frequent (< 50); FF = Very frequent (> 50).

TABLE 10-2

Mammalian Skeletal Elements per Group or Species Encountered in Site S21

SITE	S21															
MAMMALIAN GROUP/ SPECIES / SKELETAL ELEMENT	North African porcupine (*Hystrix cristata*)	Cane rat (*Thryonomys* sp.)	Medium viverrid	(African) wild cat (*Felis silvestris*)	Small carnivore	African elephant (*Loxodonta africana*)	Warthog (*Phacochoerus aethiopicus*)	Suid(s)	Giraffe (*Giraffa camelopardalis*)	Oribi (*Ourebia ourebi*)	Small antelope(s)	Medium antelope(s)	Roan antelope (*Hippotragus equinus*)	Topi and/or hartebeest (*Damaliscus lunatus*/*Alcelaphus buselaphus*)	Large antelope(s)	TOTALS
Proc. cornualis	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
Cranium	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
Maxilla	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	2
Mandibula	1	-	-	-	-	-	-	-	-	1	1	-	-	-	3	6
Dentes	2	-	1	-	-	3	1	-	-	1	-	-	-	2	-	10
Atlas	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	3
Axis	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
Other vertebrae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sternum	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
Scapula	-	-	-	1	-	-	-	-	-	-	1	1	-	-	-	3
Clavicula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Humerus	-	-	-	-	1	-	-	-	-	-	2	-	-	-	1	4
Radius	1	-	-	-	-	-	-	-	-	-	3	1	-	-	1	6
Ulna	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	4
Carpalia	-	-	-	-	-	-	-	-	1	-	-	-	2	7	2	12
Metacarpalia	-	-	-	-	-	-	-	-	-	-	(2)	-	1	-	1	4
Os coxae	-	1	-	-	-	-	-	-	-	-	5	1	-	1	1	9
Os femoris	-	-	-	1(1)	-	-	-	-	-	-	(1)	2	-	-	-	5
Patella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tibia	-	-	-	-	-	-	-	1	-	-	(1)	-	-	-	-	2
Fibula/Os malleolare	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Talus	-	-	-	1	-	-	-	-	-	-	5	-	-	-	4	10
Calcaneus	-	1	-	-	-	-	-	-	-	-	2	-	-	-	(1)	4
Other tarsalia	-	-	-	-	-	-	-	-	-	2	2(1)	-	-	-	2	7
Metatarsalia	-	-	-	-	-	-	-	-	-	-	1	1	-	-	3(1)	6
Metapodalia	-	-	-	-	-	-	-	2	-	-	7(8)	-	-	-	2(2)	21
F. proximales	-	-	-	-	-	1	-	1	-	2(1)	2(1)	-	-	-	6	14
P. mediae	-	-	-	-	-	-	-	1	(1)	3	2(1)	-	-	-	3	11
P. distales	-	-	-	-	-	-	-	-	-	1	1	-	-	1	-	3
Ossa sesamoidea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3
TOTAL NUMBER OF IDENTIFIED MAMMALIAN FRAGMENTS	4	2	1	5	1	4	1	5	2	12	60	6	3	11	36	153

Numbers between brackets indicate bone fragments derived from subadult (or in a few cases juvenile) animals.

TABLE 10-3

Mammalian Skeletal Elements per Group or Species Encountered in Site S1-B

SITE	S1-B													
MAMMALIAN GROUP/ SPECIES / SKELETAL ELEMENT	Bats (Chiroptera indet.)	Small cercopithecid	Hare (Lepus sp.)	Striped ground squirrel (Euxerus erythropus)	Nile (grass) rat (Arvicanthis niloticus)	Large gerbil (Tatera sp.)	North African porcupine (Hystrix cristata)	Small rodents	Medium rodents	Honey badger (Mellivora capensis)	Slender mongoose (Herpestes sanguineus)	Genet (Genetta sp.)	Medium viverrids	Medium felids
Proc. cornualis	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cranium	-	-	-	-	-	(1)	-	-	-	-	-	1	-	-
Maxilla	-	-	-	-	-	1	-	-	-	-	1	-	-	-
Mandibula	-	-	-	1	1	-	-	-	-	-	1	1	-	-
Dentes	-	1	-	-	-	-	11	-	-	-	-	-	-	-
Atlas	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Axis	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other vertebrae	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sternum	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scapula	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Clavicula	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Humerus	-	-	-	-	-	-	1	2	-	-	-	-	-	-
Radius	-	-	-	-	-	-	2	1	1	-	-	1	1	-
Ulna	-	-	-	-	-	-	1	-	-	1	-	-	-	-
Carpalia	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Metacarpalia	-	-	-	-	-	-	3	-	-	-	-	-	-	1
Os coxae	1	-	1	-	-	-	-	2	-	-	-	-	-	-
Os femoris	-	-	-	-	-	-	-	1(1)	1	-	-	-	-	-
Patella	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tibia	-	-	-	-	-	-	-	1(1)	-	-	-	-	-	-
Fibula/Os malleolare	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Talus	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Calcaneus	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other tarsalia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metatarsalia	-	-	-	-	-	-	4	-	-	-	-	-	1	1
Metapodalia	-	-	-	-	-	-	-	-	(1)	-	-	-	-	1
P. proximales	-	-	-	-	-	-	6	-	-	-	-	-	1	-
P. mediae	-	-	-	-	-	-	1	-	-	-	-	-	-	1
P. distales	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ossa sesamoidea	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL NUMBER OF IDENTIFIED MAMMALIAN FRAGMENTS	2	2	1	1	1	2	30	9	3	1	2	3	4	4

Numbers between brackets indicate bone fragments from subadult (or in a few cases juvenile) animals.

S1-B

Small carnivores	Medium carnivores	Warthog (Phacochoerus aethiopicus)	Suid(s)	Giraffe (Giraffa camelopardalis)	Commom bush duiker (Sylvicapra grimmia)	Oribi (Ourebia ourebi)	Small antelopes	Gazelle (mainly Gazella rufifrons)	Medium antelopes	Greater kudu (Tragelaphus strepsiceros)	Roan antelope (Hippotragus equinus)	Topi and/or hartebeest (Damaliscus lunatus/Alcelaphus buselaphus)	Large antelopes	Goat (Capra aegagrus f. hircus)	Jackal and/or dog (Canis sp.)	TOTALS
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	1	-	-	-	-	-	1	1	-	-	-	-	1	-	-	6
-	-	-	-	-	-	(1)	-	-	-	-	-	-	-	-	-	3
-	-	-	-	-	-	1(2)	2	-	-	-	-	-	-	-	-	9
-	-	2	1	2	-	2	-	-	-	3	-	2	4	-	-	28
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	3
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
-	-	-	-	-	-	-	4	-	1	-	-	-	1	-	-	9
1	-	-	-	-	-	-	1	-	1	-	-	-	2(2)	1	-	14
-	-	-	-	-	-	-	(1)	-	-	-	-	-	2	-	(1)	6
-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	-	5
-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	6
-	-	-	-	-	-	-	3	-	1	-	-	-	3	-	-	11
1	-	-	-	-	-	-	3(2)	-	-	-	-	-	1	-	-	10
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	1	-	-	-	2(1)	-	1	-	-	-	-	-	-	7
-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	2
-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	4
-	-	-	-	-	-	-	2(1)	-	1	-	-	-	2	-	-	6
-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2
-	-	-	-	-	-	-	3	-	-	-	-	-	1	-	-	10
-	1	-	1	-	-	-	8(6)	-	1(1)	1	-	-	1	-	1	23
-	-	-	-	-	-	1	9	-	1	-	-	-	5	-	-	23
-	-	-	-	1	1	3	1(1)	-	1	5	-	-	2(2)	-	-	19
-	-	-	1	-	-	2	2	1	-	3	1	-	-	-	-	10
-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
2	2	2	4	3	1	12	62	2	10	15	1	3	31	1	3	219

TABLE 10-4

Mammalian Skeletal Elements per Group or Species Encountered in Site S1-A

SITE	S1-A										
MAMMALIAN GROUP/ SPECIES / SKELETAL ELEMENT	Hare (Lepus sp.)	Striped ground squirrel (Euxerus erythropus)	North African porcupine (Hystrix cristata)	Small rodent(s)	Medium rodent(s)	Genet (Genetta sp.)	Medium viverrid	Striped hyaena (Hyaena hyaena)	(African) wild cat (Felis silvestris)	Small carnivore(s)	Aardvark (Orycteropus afer)
Proc. cornualis	-	-	-	-	-	-	-	-	-	-	-
Cranium	-	-	-	-	-	-	-	-	-	-	-
Maxilla	-	1	-	-	-	-	-	-	-	-	-
Mandibula	-	-	5	-	-	1	-	1	-	1	-
Dentes	2	-	17	-	-	-	-	1	-	-	-
Atlas	-	-	-	-	-	-	-	-	-	-	-
Axis	-	-	-	-	-	-	-	-	-	-	-
Other vertebrae	-	-	-	-	-	-	-	-	-	-	-
Sternum	-	-	-	-	-	-	-	-	-	-	-
Scapula	1	-	1	-	-	-	-	1	-	-	-
Clavicula	-	-	-	-	-	-	-	-	-	-	-
Humerus	1	-	1	1	1	-	-	-	-	-	-
Radius	1	-	1	-	-	-	-	-	1	-	1
Ulna	-	-	-	-	-	-	1	-	-	1	-
Carpalia	-	-	-	-	-	-	-	-	-	-	1
Metacarpalia	1	-	-	-	-	-	-	-	-	-	-
Os coxae	-	-	-	-	-	-	-	1	-	-	1
Os femoris	1	-	-	(3)	-	-	-	-	-	-	-
Patella	-	-	-	-	-	-	-	-	-	-	-
Tibia	2	-	1	-	1	-	-	-	-	-	1
Fibula/Os malleolare	-	-	-	-	-	-	-	-	-	-	-
Talus	-	-	-	-	-	-	-	-	-	-	-
Calcaneus	1	-	-	-	-	-	-	-	-	-	1
Other tarsalia	-	-	-	-	-	-	-	-	-	-	-
Metatarsalia	2	-	2	-	-	-	-	-	1	-	-
Metapodalia	-	-	(1)	-	-	-	-	1	-	-	2
P. proximales	-	-	-	-	-	-	-	-	-	-	-
P. mediae	-	-	-	-	-	-	-	-	-	-	-
P. distales	-	-	1	-	-	-	-	-	-	-	-
Ossa sesamoidea	-	-	-	-	-	-	-	-	-	-	-
TOTAL NUMBER OF IDENTIFIED MAMMALIAN FRAGMENTS	12	1	30	4	2	1	1	5	2	2	7

Numbers between brackets indicate bone fragments derived from subadult (or in a few cases juvenile) animals.

S1-A

Warthog (Phacochoerus aethiopicus)	Giraffe (Giraffa camelopardalis)	Small antelope(s)	Gazelle (mainly Gazella rufifrons)	Medium antelope(s)	Large antelope(s)	Domestic ass (Equus africanus f. asinus)	Sheep (Ovis ammon f. aries)	Small livestock (sheep and/or goat)	Cattle (Bos primigenius f. taurus)	Jackal and/or dog (Canis sp.)	Small to medium antelopes and/or small livestock	Large to very large antelopes and/or cattle	TOTALS
-	-	1	4	2	-	-	1	-	-	-	1	-	9
-	-	-	5	2	-	-	-	-	-	-	1	-	8
-	-	-	2	-	-	-	-	-	-	-	1	-	4
-	(1)	1	3(1)	2	-	-	-	-	-	4	2	(1)	23
1	19	-	7	-	5	-	-	4	2	-	4	4	66
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	1	-	-	-	-	-	-	-	-	1	-	-	2
-	-	-	-	-	-	-	-	-	-	(1)	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	4	3	-	-	-	-	-	-	-	-	10
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	4	-	3	3	1	-	-	-	-	-	-	1(1)	17
-	5(1)	-	3(1)	2	1	-	-	-	-	1	1	(1)	20
-	1	1	-	2	1(1)	-	-	-	-	-	-	-	8
-	7	-	3	-	-	-	-	1	2	-	-	-	14
-	1	-	2	2	-	-	-	-	-	3	1	-	10
-	3	-	1	3	-	-	-	-	-	1	-	-	10
-	3(1)	-	-	2	-	-	-	-	-	-	-	-	10
-	-	-	1	1	-	-	-	-	-	-	-	-	2
-	2	-	6	5	1	-	-	-	-	-	-	1	20
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	1	-	6	1	-	-	-	-	-	1	-	-	9
-	2	-	2(1)	-	-	-	-	-	-	2	-	-	9
-	3	-	-	1	-	1	-	-	-	-	-	-	5
-	-	-	7	5	-	-	-	-	-	2	4	-	23
-	4	-	6(1)	4	-	-	-	-	-	2	(2)	1	24
-	5(1)	-	5(1)	1	3(1)	-	-	-	-	4	3	-	24
-	3	-	2	3	-	-	-	-	-	-	-	-	8
-	3(1)	-	1	-	-	-	-	-	1	-	-	-	7
-	4	-	-	-	-	-	-	-	-	-	-	-	4
1	76	3	78	44	14	1	1	5	5	22	20	10	347

of *P. ovata,* but accepted *P. wernei* as a valid Sudanese species. Tothill (1948b) described *Ampullaria (Pila) wernei* as the only Sudanese species, including in it *A. (P.) kordofana.* Bell (1966), however, studying *Pila* from the central Sudan, concluded that a lot of transitional forms linked *P. ovata* to *P. wernei;* hence he decided that *P. ovata* was the only Sudanese species. From the foregoing, we can conclude that the morphology of the shell cannot be used for specific identification. In his work on the freshwater snails of Africa, however, Brown (1980:45-47, fig. 25) shows two morphologically clearly different opercula, assigned to *P. ovata* and *P. wernei,* concluding that, on the basis of this criterion, two species occur in the Sudan. This view is accepted by Van Damme (1984) in his review of North African freshwater mollusks. Gautier (1983a) found that the extensive *Pila opercula* collection from Saggai (central Sudan, Early Holocene) exhibited all the diagnostic features (growthline details, proportions) of *Pila wernei;* this suggested to him that perhaps the shell polymorphism is not much reflected in the morphology of the operculum, which, for the moment, may be the only external diagnostic feature separating *P. wernei* and *P. ovata.* Unfortunately, only a few complete opercula were found in S21; these could be assiged to *P. wernei.*

Pila wernei is found today in southern Somalia, southern Sudan, westward to the Niger river in Mali, in northern Kenya, and in the Malagarasi Swamp in Tanzania. *P. ovata* occurs from Lower Egypt to northern Mozambique, preferring temporary water bodies, papyrus swamps, and even the stony beaches of Lake Victoria (Brown 1980:45). *P. wernei* probably has comparable ecological requirements, but precise information on minor ecological differences is lacking. Both species estivate, burrowed in the mud, if their environment dries out (Beadle 1974). At Jebel Moya, opercula of *P. wernei* appear to have been used as pendants (Addison 1949:137, pl. 40).

Cleopatra bulimoides: one shell of this small freshwater gastropod was found in the midden (S1-B/III). Its present day distribution includes the Nile Basin and adjacent regions up to Lake Tana, Ethiopia. It is essentially a creature of larger water bodies, preferring stagnant or slowly flowing waters with sandy or clayish substrata (Brown 1980). Since such waters do not seem to have occurred in the immediate vicinity of Shaqadud during the period considered here, this find may point to connections with the Nile. Addison (1949:37) described the use of *Cleopatra* shells as beads at Jebel Moya.

Freshwater Bivalves

Aspatharia sp.: this large bivalve is represented by approximately 15 specimens from the midden. This small collection contains both robust suboval and smaller elongate forms, probably attributable to two distinct *Aspatharia* species: *A. rubens* and *A. wahlbergi.* Recently, Mandahl-Barth (1983) raised the subgenus *Spathopsis* to the rank of genus, but this change may cause much debate; therefore, we prefer to use the older names.

According to Van Damme (1984), *Aspatharia* is a typical genus of large rivers; on floodplains these clams are able to survive low river stands by burying themselves in the mud. Their presence at Shaqadud may point to unspecified contacts with the Nile, for this river is, in a broad sense, the nearest suitable habitat where *Aspatharia* could be collected. Whether the clams were used for the manufacture of tools (cf. "potters' tools" of Shaheinab, Arkell 1953:66) or other purposes (e.g., spoons) could not be established.

Large bivalves: a considerable number of undiagnostic shell fragments from large bivalves were recovered. On the basis of the composition of the Shaqadud assemblages (table 10-1), we can assume that most of these fragments belong to *Aspatharia* specimens. However, other large bivalves, such as *Mutela dubia* (=*M. nilotica,* cf. Van Damme 1984) or even *Etheria elliptica* (Nile oyster) may have contributed to the sample.

Caelatura aegyptiaca: an incomplete valve from S1-B/III could be assigned to this freshwater bivalve on the basis of the morphology of its hingeplate. It occurs only sporadically in prehistoric central Sudanese sites (cf. Arkell 1953:10). The ecological requirements of this species are to a certain extent comparable to those of *Aspatharia,* i.e., large water bodies. Again, unspecified contacts with the Nile can be invoked to explain this find.

Corbicula consobrina: the bottom of the cave (S1-A/I) yielded a complete valve which can be ascribed to *Corbicula consobrina* on the basis of its morphology. This species is a typical inhabitant of flowing water, which clearly did not exist at Shaqadud at the time the cave sediments were deposited. This shell, therefore, could be reworked from older deposits of which, however, the existence has not yet been established. It could also point to some form of contact with the Nile.

Land Snails

Zootecus insularis: this tiny landsnail has been found in considerable numbers in the various sites at Shaqadud (table 10-1). The identification is based on its small size and typical morphology (Thiele 1931:554, fig. 637).

Zootecus insularis nowadays occurs in the semi-arid regions of India, Arabia, Eritrea, Egypt, Sudan, Senegal, and the Cape Verde Islands, but its present distribution is said to be artificial and a product of human activity (Verdcourt 1960). In Africa, the distribution in prehistoric times of this species includes, for the moment, Nubia (Martin 1968), the Western Desert (Gautier 1980), the Acacus Massif (Gautier and Van Neer 1982), and central Sudan (see, for example, Bate 1949; Tigani el Mahi 1982; Gautier 1983a). *Zootecus insularis* has not yet been recorded alive, and data on its ecological requirements are therefore not available. No doubt it is a burrowing species; this, together with its small size, makes collecting of living individuals extremely difficult.

Limicolaria cailliaudi: this medium-sized achatinid is well represented in the Shaqadud deposits. The bulk of the material consists of very fragmented shells, although a few complete adult, subadult, and juvenile specimens are preserved. Its present-day distribution extends from eastern Sudan to Ethiopia and southward to Tanzaniya (Crowley and Pain 1970). The exact requirements of this species are not well known but it seems that *L. cailliaudi* has a considerable tolerance with respect to annual precipitation. Williams and Adamson (1980) describe it as typical of the acacia tall grass plains, bounded by the 500–800 mm. isohyets. According to Tothill (1948b), *L. flammata* (=*L. cailliaudi*, cf. Crowley and Pain 1970) occurs in well-drained areas with tall grass and in clay-pans, characterized by an annual precipitation between 400 and 800 mm. However, members of the French Section of the Sudan Antiquities Service recently transmitted to Dr. Gautier specimens, collected shortly after death, along the Nile near Shendi (Gautier, pers. comm.); in this area, the average rainfall is about 136 mm. (Wickens 1982:32, table 3.2).

Zonitarion sp., probably *Z. cailliaudi:* the midden yielded a number of shell fragments as well as some adult immature specimens at various stages of development, which were attributed to *Zonitarion* cf. *cailliaudi* by Mr. T. Pain (in litt.) Neither the present distribution of this snail nor its ecological requirements are well known. However, Mr. Pain informs me that moist habitats are necessary. This is in agreement with the fact that these snail shells have greatly reduced in size and can no longer contain the animal. The presence of the snail in the midden deposits cannot be the result of human gathering activities. Most likely, its presence was linked with the small residual pool which existed in front of the cave during the formation of the midden. The snails disappeared with the drying out of the pool.

Amphibians

Bone fragments of amphibians are restricted to the midden. On the basis of certain osteomorphological characteristics found in Rage (1974) and Glastra (1980), our specimens can be assigned to the group of frogs and toads, i.e., the Anura. As good comparative material of the postcranial skeleton of African anurans is lacking in the available collections, none of the specimens could be identified as to genus or species. On the basis of their relative size, however, at least two species are present in the collection.

In the sample studied, complete limb bones, as well as fragments of the pelvic girdle, clearly predominate. Since the muscles attached to these skeletal elements provide most of the meat, these bones would be destroyed when consumed, so we assume that these animals did not form a usual item in the diet of the Shaqadud inhabitants. Their presence at Shaqadud, therefore, is linked with the pool in front of the cave.

Reptiles

Remains of several turtles, a monitor, and at least one kind of snake were found at Shaqadud (table 10-1). Dr. de Broin (Paris) kindly provided preliminary identifications of the turtle fragments. The other identifications are based on Grasse (1970) and Mertens (1942). Data on actual zoogeographical ranges, food requirements, and preferential habitats of reptiles are available in Brehm (1930), Loveridge and Williams (1957), Villiers (1958), Mylnarski (1973), Mylnarski and Wermuth (1973), and Neugebauer (1973). The order in which the reptiles are described follows Grzimek (1976).

Terrapin (*Pelusios* sp.). A terrapin has been found in the cave deposits, but may also occur in the lower unit of the midden (table 10-1). At least one species, probably Adanson's terrapin (*Pelusios adansonii*) is present. Today this species is more or less confined to the Sudano-Sahelian belt sensu Zonneveld (1980). It generally lives in seasonally flooded areas and buries itself to estivate during the dry season.

Hinged Tortoise (*Kinixys sp.*, probably *K. belliana*). A hinged tortoise is represented by only three fragments in the midden. According to Dr. de Broin (in litt.), *Kinixys* spp. generally inhabit the wooded areas of Africa, except for Bell's eastern hinged tortoise, *Kinixys belliana,* which is also found in drier, more open environments. Most likely our material is therefore attributable to this species; Villiers (1958:146) noted that its activity is restricted to the wet season.

African Spurred Tortoise (*Geochelone sulcata*). The cave assemblage yielded over 70 specimens which could be assigned to the African spurred tortoise, *Geochelone sulcata,* by Dr. de Broin (fig. 10-1, 4). This true tortoise is a typical inhabitant of the Sahelian and Sudano-Sahelian belt, where it is able to survive very dry conditions for long periods by feeding on succulent plants. *G. sulcata* estivates during the dry season, buried at depths of up to 3.5 m. The northern limit of its present day distribution reaches as far north as Dongola.

African Spurred Tortoise (*Geochelone sp.*, probably *G. sulcata*). Seventeen fragments found on the lower and upper cave units can for the moment only be ascribed to *Geochelone sp.* As the reptilian assemblage from the cave is dominated by the African spurred tortoise (cf. previous section), we assume that most of these fragments can be attributed to this species.

True Tortoise (Testudinidae indet.). S1-A/II yielded one fragment of a true tortoise which could not be identified as to genus or species.

Cape Monitor (*Varanus exanthematicus*). Monitors are represented by approximately 25 vertebrae, some skull fragments, and a few incomplete limb bones, derived from animals of varying size. Three monitor species are known from the Sudan: the Nile monitor (*Varanus niloticus*), the Cape monitor (*V. exanthematicus*), and the desert monitor (*V. griseus*). The latter, however, distributed from the Western Sahara to western Pakistan, is adapted to desertic conditions (Neugebauer 1973) and, therefore, can be excluded as a possible identification. Both Nile and Cape monitor are today confined to Africa south of the Sahara, but occupy different habitats. The Nile monitor prefers riverine environments with considerable cover, while the Cape monitor lives in drier habitats with open vegetation, sometimes at a considerable distance from water. Thus, circumstantial evidence favors an identification as Cape monitor. Today, monitors are hunted for their skins, but their meat is known to be excellent. In prehistoric times, monitors may also have been hunted for both purposes.

Unidentified Snake(s). S21 and the lower midden units (S1-B/I-II) yielded a few vertebrae, attributable to snakes on the basis of morphology (fig. 10-1, 5). No precise identification could be made because good comparative material was not available to us.

Birds

Preliminary identifications of the bird remains were kindly provided by Mrs. D. Matthiesen (Gainesville). This assemblage, although small, is dominated by helmeted guineafowl (*Numida meleagris*) (table 10-1). Information concerning the present-day distribution and the ecological requirements of the avian forms concerned were gleaned from Cave and MacDonald (1955), Heim de Balsac and Mayaud (1962), Williams (1963), Etchecopar and Hue (1967), Goodwin (1967), Steinbacher (1973), Wolters (1973), and Serle et al. (1980). The order of description follows Grzimek (1976). Although most of the bone remains should be considered kitchen offal, the occupants of Shaqadud apparently were not particularly interested in fowling.

Pelican (*Pelecanus sp.*). S1-B/III yielded an incomplete phalanx, ascribed to a pelican. Most likely, two species have to be taken into account: the pink-backed or gray pelican (*Pelecanus rufescens*) and the larger (eastern) white pelican (*Pelecanus onocrotalus*). The first is a resident species, fairly widespread south of latitude 20° N, preferring rivers, marshes, floodplains, lakes, and lagoons; but, according to Cave and MacDonald (1955:54), the gray pelican has also been seen far from open water. The second pelican form is a fairly common Palaearctic visitor from October to April, frequenting rivers and lakes. If the Shaqadud specimen can be attributed to the latter, then at least part of the occupation took place during the dry season.

Clapperton's *Francolin* (*Francolinus clappertoni*). A right coracoid from the midden (S1-B/III) could be assigned to Clapperton's francolin. This phasianid inhabits the semiarid belt near the desert, and is today a common resident from Darfur, Kordofan, Dinder River, and southward.

Helmeted Guineafowl (*Numida meleagris*). As already noted, the helmeted (or tufted) guineafowl clearly dominates the avian collection. It is a common resident in acacia forest and the various savannah types. Cave and MacDonald (1955:116) stated that this bird still occurred as far as 50 miles north of Kassala in the early fifties.

Dove (*Streptopelia sp.*). S1-B/III yielded a right ulna attributable to a dove. The specimen could represent any one of the following resident species: the turtle dove (*S. turtur*), the African collared dove (*S. roseogrisea*), the mourning collared dove (*S. decipiens*), the vinaceous dove (*S. vinacea*), etc. All these doves are found in arid country, with thorn scrub, acacia, or other trees, sometimes far away from any known surface water.

Owl (Strigidae indet.). An incomplete left coracoid can for the moment only be identified to the family level due to the lack of typical osteomorphological features and because of the incompleteness of the available comparative collections.

Crow (*Corvus sp.*). The genus *Corvus* is represented by a premaxilla in the cave deposits (S1-A/III). This specimen can be derived from the pied crow (*Corvus albus*), the brown-necked raven (*C. ruficollis*), or even the fan-tailed raven (*C. rhipidurus*). These birds are adapted to a wide range of habitats from tree savannah to subdesert.

Birds (Aves indet.). A few fragments from the midden and the cave could not be identified as to genus or species for the moment.

Ostrich (*Struthio camelus*). To the foregoing osseous assemblage, we should add the ostrich, represented by egg shell fragments (table 10-1) and beads.

Mammals: Introduction

Mammals form the major part of the vertebrate fauna at Shaqadud. Within this assemblage, remains of antelopes clearly dominate. Due to the pronounced fragmentation of the bones and the fact that a considerable number of antelope species may have contributed to the sample, it was not possible to give a specific identification for each bone fragment. (The term "antelope" is used here for all wild members of the Bovidae family.) Instead of lumping these remains under the heading "Bovidae indet.," we grouped them according to their relative size. Our classification is quite different from the one proposed by Brain (1974). This author grouped 34 antelope species into 4 antelope classes on the basis of their live-weights. We believe this parameter is too variable because minimum and maximum values sometimes differ very widely. Except for the extinct red gazelle (*Gazella rufina*) and the water buffalo (*Bubalus bubalis*), our classification (table 10-5) includes the other 79 antelopes listed in Meester and Setzer (1971–78, part 15 and 15.1). This classification is based on the shoulder height of the antelopes, which in our opinion reflects better the relative size of the postcranial skeleton. Furthermore, the terminology used by Brain (1974), antelope class I, II, III, and IV can better be changed into small, medium, large, and very large antelopes as these labels are much more self-explanatory. A further subdivision of the small antelope class has been proposed by Van Neer (1981) for central African archaeozoological samples. Bone fragments of certain small duikers such as the red-flanked duiker (*Cephalophus rufilatus*) or the blue duiker (*C. monticola*) could be easily separated from those more robustly built, e.g., the common duiker (*Sylvicapra grimmia*) and the oribi (*Ourebia ourebi*). Our final classification, therefore, comprises five groups: very small, small, medium, large, and very large antelopes (table 10-5).

When, besides antelopes, livestock is also present, further subdivisions have to be made. The domesticated bovids are divided into two size classes. The first comprises sheep (*Ovis ammon* f. aries) and goat (*Capra aegagrus* f. hircus), while the second includes cattle (*Bos primigenius* f. taurus). The analysis of mixed bone assemblages, therefore, involves four steps:

(1) The sorting of all bone specimens attributable to bovids.

(2) The classification of these remains according to their size into very small, small, medium, large, and very large bovids.

(3) The distinction between the remains of small to medium antelopes and small livestock (sheep/goat) on the one hand and large to very large antelopes (for example, buffalo) versus cattle on the other, based on osteomorphological and osteometrical differences (Peters, in preparation). The residue contains bone fragments which cannot be attributed definitely to either wild or domesticated bovids; they are grouped into two categories, "small bovid" and "large bovid."

(4) If possible, identifications as to genus or species are made. Remains that are listed as small livestock include bone pieces of either sheep or goat which cannot be separated on an osteomorphological basis (Boessneck et al. 1964).

TABLE 10-5

Classification of Antelopes Based on Shoulder Height

VERY SMALL ANTELOPES

LIST	SH	W
CEPHALOPHINAE		
Cephalophus monticola (Blue duiker)	35-41	3.5-10
Cephalophus maxwelli (Maxwell's duiker)	32-40	4 - 9
Cephalophus rufilatus (Red-flanked duiker)	30-38	9 -14
Cephalophus adersi (Ader's duiker)	30-32	6.5-12
ANTILOPINAE		
Madoqua swaynei (Swayne's dik-dik)	30-33	2 - 2.5
Madoqua saltiana (Salt's dik-dik)	33-40	2.5- 4
Madoqua phillipsi (Phillip's dik-dik)	33-38	2.5- 3.6
Madoqua guentheri (Günther's dik-dik)	34-40	3.5- 5.5
Madoqua kirki (Kirk's dik-dik)	35-45	2.5- 6.5
Neotragus pygmaeus (Royal antelope)	25	1.5- 2.5
Neotragus batesi (Bates' dwarf antelope)	24-33	2 - 3
Neotragus moschatus (Suni)	30-41	4 - 9

SMALL ANTELOPES

LIST	SH	W
CEPHALOPHINAE		
Cephalophus nigrifrons (Black-fronted duiker)	45-55	15 -18
Cephalophus zebra (Banded duiker)	40-50	15 -20
Cephalophus niger (Black duiker)	45-50	15 -20
Cephalophus natalensis (Red forest duiker)	35-45	11 -14
Cephalophus callipygus (Peter's duiker)	45-60	12 -23
Cephalophus dorsalis (Bay duiker)	40-56	14.5-22
Cephalophus leucogaster (White-belled duiker)	42-51	15 -20
Cephalophus ogilbyi (Ogilby's duiker)	±55	14 -20
Sylvicapra grimmia (Common duiker)	45-70	10 -25.5
ANTILOPINAE		
Gazella dorcas (Dorcas gazelle)	55-65	15 -38
Gazella spekei (Dero)	50-60	15 -30
Gazella thomsoni (Thomson's gazelle)	55-65	15 -30
Oreotragus oreotragus (Klipspringer)	43-60	8 -18
Dorcatragus megalotis (Beira antelope)	50-60	9 -11.5
Ourebia ourebi (Oribi)	50-67	12 -22
Raphicerus campestris (Steenbok)	45-60	7 -16
Raphicerus melanotis (Grysbok)	45-55	8 -13
Raphicerus sharpei (Sharpe's grysbok)	45-60	7 -11.5

MEDIUM ANTELOPES

LIST	SH	W
BOVINAE		
Tragelaphus spekei (Sitatunga)	75-125	40-125
Tragelaphus angasi (Nyala)	80-120	55-140
Tragelaphus scriptus (Bushbuck)	61-100	25- 80
Tragelaphus imberbis (Lesser kudu)	90-110	56-108
CEPHALOPHINAE		
Cephalophus spadix (Abbott's duiker)	50- 74	50- 60
Cephalophus jentinki (Jentink's duiker)	75- 85	64- 70
Cephalophus sylvicultor (Yellow-backed duiker)	65- 87	45- 80
REDUNCINAE		
Redunca arundinum (Reedbuck)	65-105	40- 95
Redunca redunca (Bohor reedbuck)	65- 90	35- 65
Redunca fulvorufula (Mountain reedbuck)	60- 80	20- 37
Kobus megaceros (Nile lechwe)	80-105	60-120
Kobus leche (Lechwe)	85-110	60-130
Kobus kob (Kob)	70-105	50-120
Kobus vardoni (Puku)	77-100	48- 91
HIPPOTRAGINAE		
Addax nasomaculatus (Addax)	95-115	60-125
ALCELAPHINAE		
Damaliscus hunteri (Hunter's hartebeest)	100-120	73- 80
Damaliscus dorcas (Bontebok)	85-100	55- 80
AEPICEROTINAE		
Aepyceros melampus (Impala)	70- 95	40- 80
ANTILOPINAE		
Antidorcas marsupialis (Springbok)	70- 90	20- 45
Litocranius walleri (Gerenuk)	80-105	28- 51
Gazella dama (Addra gazelle)	90-120	40- 75
Gazella soemmerringi (Soemmerring's gazelle)	81- 92	35- 46
Gazella granti (Grant's gazelle)	75- 95	35- 80
Gazella cuvieri (Edmi gazelle)	60- 80	15- 35
Gazella leptoceros (Rhim)	65- 72	20- 30
Gazella rufifrons (Red-fronted gazelle)	65- 82	20- 35
Ammodorcas clarkei (Dibatag)	80- 88	22- 35
PELEINAE		
Pelea capreolus (Grey ribbok)	70- 80	18- 30
CAPRINAE		
Capra ibex (Ibex)	65- 90	50- 80
Capra walie (Walia ibex)	90-110	80-125
Capra lervia (Barbary sheep)	75-100	40-140

The classification used in this table follows Meester and Setzer (1971-78). The listed values (SH = shoulder height; W = weight) are based on Grzimek (1969), Dorst and Dandelot (1972), Haltenorth and Diller (1979), and Kingdon (1982).

LARGE ANTELOPES		
LIST	SH	W
BOVINAE		
Tragelaphus euryceros (Bongo)	110-130	210- 405
Tragelaphus buxtoni (Mountain nyala)	90-135	150- 300
Tragelaphus strepsiceros (Greater kudu)	100-160	120- 320
REDUNCINAE		
Kobus ellipsiprymnus (Waterbuck)	100-130	150- 300
HIPPOTRAGINAE		
Hippotragus leucophaeus (Blue buck)	102-116	150- 170
Hippotragus equinus (Roan antelope)	125-160	225- 300
Hippotragus niger (Sable antelope)	117-143	190- 270
Oryx dammah (Scimitar oryx)	110-125	180- 200
Oryx gazella (Gemsbok)	85-140	155- 225
ALCELAPHINAE		
Connochaetes taurinus (Blue wildebeest)	115-140	120- 290
Connochaetes gnou (Black wildebeest)	95-120	160- 180
Alcelaphus lichtensteini (Lichtenstein's hartebeest)	119-136	120- 204
Alcelaphus buselaphus (Hartebeest)	107-150	116- 218
Damaliscus lunatus (Topi, Tiang)	100-134	75- 160

VERY LARGE ANTELOPES		
LIST	SH	W
BOVINAE		
Bos primigenius (Aurochs)	150-185	±400-1.000
Syncerus caffer (African buffalo)	100-170	250- 850
Taurotragus oryx (Eland)	125-180	300- 900
Taurotragus derbianus (Giant eland)	150-176	440- 950

The classification used in this table follows MEESTER & SETZER (1971-78).

A similar problem arises with the identification of African carnivores, again because many species may have contributed to the sample. All African carnivores, therefore, were classified on the basis of their size into three classes, small, medium, and large carnivores (table 10-6). If a specimen can be attributed to a certain carnivore family, but no further identification is possible, another system is used: small canid, medium felid, etc.

Osteometric and osteomorphologic data on African and other mammals are available among others in Hue (1907), Setzer (1956), Rosevear (1969, 1974), Pales and Lambert (1971), Osborn and Helmy (1980), Van Neer (1981), and Gautier (1983a). Data on actual zoogeographic ranges of recent African mammals, their food requirements, and preferential habitats can be obtained from Brehm (1930), Verheyen (1951), Mackenzie (1954), Stevenson-Hamilton (1957), Rosevear (1969, 1974), Kingdon (1971–82), Meester and Setzer (1971–78), Dorst and Dandelot (1972), Grzimek (1976), Delany and Happold (1979), and Haltenorth and Diller (1979). The sequence in which the mammals are described follows Anderson and Jones (1967). The nomenclature used for the domesticated animals is according to Bohlken (1961). These references are not repeated in the following descriptions, unless necessary.

Wild Mammals

Unidentified Bat(s) (*Chiroptera* indet.). Bats are represented by two postcranial fragments from the midden deposits. It is for the moment impossible to give a more specific identification because diagnostic morphologic features are lacking.

Small Cercopithecid (*Cercopithecus sp.*). An upper premolar and an incomplete talus from the midden deposits can be assigned to a small cercopithecid. On the basis of their relative size, two species may be present, i.e. the grivet monkey (*Cercopithecus aethiops*) and the patas (*C. patas*). Both cercopithecids occur in several types of savannah, and are consequently widely distributed in Subsaharan Africa.

Hare (*Lepus sp.*). Remains of hare are restricted to the cave deposits, except for one fragment from the midden. Three hares still occur in the present-day Sudan: Cape hare (*Lepus capensis*), Whyte's or Crawshay's hare (*Lepus whytei* sensu Haltenorth and Diller 1979:149), and Uganda grass hare (*Poelagus marjorita*). The latter can be excluded on the basis of circumstantial evidence. The bone material, however, is too fragmented to allow a more specific identification.

Both *Lepus capensis* and *L. whytei* are common throughout the northern and southern savannah (sensu Delany and Happold 1979:70) and, although the first predominates in the more open, less humid environments, it is known that both species are sympatric in considerable parts of their geographic ranges.

Striped Ground Squirrel (*Euxerus erythropus*). Two cranial fragments can definitely be attributed to the striped ground squirrel on the basis of their size and the relative position of the tooth alveoles (fig. 10-1, 8). Another Sudanese squirrel of comparable size, the African giant (forest) squirrel (*Protoxerus stangeri*), can be excluded, for its habitat was certainly not present in the area around Shaqadud.

The ground squirrel is a burrowing rodent adapted to various habitats, but lives mainly in the Sudano-Sahelian belt sensu Zonneveld (1980). Its diet consists of roots, leaves, shoots, and acacia pods, sometimes supplemented by insects, reptiles, young birds, and eggs.

Kingdon (1974:441) stated that East African natives hunt these squirrels, but Malbrant (1952:166) noted that its meat is of mediocre quality, while the bite of this animal would provoke septicemia.

Nile (Grass) Rat (*Arvicanthis niloticus*). A lower jaw from S1-B/III with M1-M3, OL 6.4, exhibiting a typical murine molar pattern can definitely be assigned to the Nile rat (*Arvicanthis niloticus*). Other genera such as *Acomys, Lemniscomys, Praomys, Dasymys, Mylomys,* etc., can be excluded on the basis of their osteomorphology and relative size (Setzer 1956; Misonne 1969; Osborn and Helmy 1980). This rodent is a common inhabitant of the northern savannah, although it occasionally invades more arid areas if suitable habitats are present, e.g., the cultivated banks of the Nile in the Khartoum Province (Happold 1967).

Gerbil (*Gerbillus sp.* or *Dipodillus sp.*). The upper cave deposits contain a mandible with M1–M3, which could be attributed to a gerbil on the basis of its occlusal pattern. The length of this molar row (OL 4.3) indicates that we are dealing with a larger gerbil species. Two such gerbils are found today in the Sudan, i.e., *Dipodillus campestris* (*Gerbillus campestris*) and *Gerbillus pyramidum,* but the tooth wear is too heavy to allow a specific identification. Both species inhabit desertic and sub-desertic environments where they make elaborate burrows, but their exact requirements are not well known.

Large Gerbil (*Tatera sp.*). Remains of such a rodent are found in the midden. They include an incomplete

TABLE 10-6

Classification of African Carnivores by Size

	CANIDAE	MUSTELIDAE
SMALL CARNIVORES (SH<25; W<5 kg)	Small canids : Fennecus zerda (Fennec)	Small mustelids : Mustela nivalis (Weasel) Poecilogale albinucha (African striped weasel) Poecilictis lybica (Libyan striped weasel) Ictonyx striatus (Zorilla)
MEDIUM CARNIVORES (25<SH<50; W<20 kg)	Vulpes pallidus (Sand fox) Vulpes vulpes (Red fox) Vulpes chama (Cape fox) Vulpes rueppelli (Ruepell's fox) Medium canids : Otocyon megalotis (Bat-eared fox) Canis adustus (Side-striped jackal) Canis mesomelas (Black-backed jackal) Canis aureus (Golden jackal)	Medium mustelids : Mellivora capensis (Honey badger) Lutra maculicollis (Spotted-necked otter) Lutra lutra (European otter) Large mustelids : Aonyx capensis (Clawless otter) Aonyx congica (Congo clawless otter)
LARGE CARNIVORES (SH>50; W>20 kg)	Large canids : Canis simensis (Ethiopian wolf) Lycaon pictus (Hunting dog)	

	VIVERRIDAE (part)	HYAENIDAE	FELIDAE
SMALL CARNIVORES (SH<25; W<5 kg)	Small viverrids (part) : Herpestes sanguineus (Slender mongoose) Suricata suricatta (Suricate) Helogale parvula (Pygmy mongoose) Medium viverrids (part) : Genetta genetta (Common genet) Genetta tigrina (Pardine genet) Osbornictis piscivora (Aquatic civet) Nandinia binotata (Palm civet) Herpestes ichneumon (Ichneumon) Atilax paludinosus (Marsh mongoose) Mungos mungo (Banded mongoose) Ichneumia albicauda (White-tailed mongoose)		
MEDIUM CARNIVORES (25<SH<50; W<20 kg)	Large viverrids : Viverra civetta (African civet) Cryptoprocta ferox (Fossa)	Medium hyaenid : Proteles cristatus (Aardwolf)	Small felids : Felis margarita (Sand cat) Felis nigripes (Black-footed cat) Felis silvestris (Wild cat) Medium felids : Felis serval (Serval) Felis chaus (Swamp cat) Felis caracal (Caracal) Felis aurata (Golden cat)
LARGE CARNIVORES (SH>50; W>20 kg)		Large hyaenids : Hyaena brunnea (Brown hyaena) Hyaena hyaena (Striped hyaena) Crocuta crocuta (Spotted hyaena)	Large felids : Panthera pardus (Leopard) Acinonyx jubatus (Cheetah) Panthera leo (Lion)

The nomenclature used in this table follows Haltenorth and Diller (1979).

skull, associated with a mandible, a vertebra, and an immature humerus and radius, pertaining probably to one not fully grown large gerbil. A maxilla fragment represents a second individual. The occlusal molar patterns suggest an identification as *Tatera* and *Taterillus*, but the latter can be excluded because of its shorter jugal teeth row (Petter 1959). Two *Tatera* gerbils are said to occur in central and south Sudan the fringetailed gerbil, *Tatera robusta*, and the savannah gerbil, *T. vallida*, but no specific identification could be made because comparative material is lacking in the collections available to us. *Tatera* gerbils are burrowing creatures, preferring sandy soils in well-drained areas. They feed on a mixed diet including termites, locusts, grasses, seeds, and fruit and sometimes cause a lot of damage in cultivated areas.

North African Porcupine (*Hystrix cristata*). Porcupine is well represented in the Shaqadud assemblage, indicating that it frequently filled the hunters' bag. On the basis of the relative size of the fragments and biogeographical considerations, the finds can be attributed to *Hystrix cristata*, the North African porcupine (fig. 10-1, 7). Some measurements on the better-preserved specimens follow:

Mandible, L. P4-M3 (alveolar): 35.5
Radius, Bp: 11.4, 12.1, 12.2, 13.5
Metacarpal IV, GL: 25.5, 26.5, 27.5
Tibia, Bd: 16.3
Metatarsal II, GL: 25.0, 25.5
Metatarsal III, GL: 25.5, 29.5
Metatarsal IV, GL: 25.5
Metatarsal V, GL: 25.5
P. proximalis, GL: 11.5, 12.4, 12.7, 12.9, 13.1
P. media, GL: 7.8

The North African porcupine is well adapted to a wide range of habitats and occurs in southern Europe (introduced, cf. Haltenorth and Diller 1979:140), North Africa, the Sudano-Sahelian belt, the Middle East, and India (Prater 1971:216). In these regions, it is absent only in the true desert. Its diet includes roots, bulbs, shoots, fruits, and bark, but sometimes also worms and insects. Porcupines are known to transport, accumulate, and gnaw bones (Alexander 1956; Hendey and Singer 1965; Brain 1981:109–117).

Cane Rat (*Thryonomys* sp., probably *T. gregorianus*). S-21 yielded an incomplete pelvis and calcaneus which can be attributed to rats of the genus *Thryonomys* (fig. 10-1, 6). Two cane rats are living today in the Sudan: the marsh cane rat (*Thryonomys swinderianus*) and the lesser or savannah cane rat (*T. gregorianus*), which, as one of its names implies, is somewhat smaller in size. Both species show similar general osteomorphologic features, except for some minor differences in skull characteristics. As our sample only consisted of postcranial remains, osteomorphological criteria could not be used to assign the material to one of the species mentioned above.

Cane rats are endemic to Africa and confined to the northern and southern savannah and the rainforest. Both cane rats occur in areas where enough cover is provided, but occupy different econiches sensu Odum (1971:234). The marsh cane rat is a semiaquatic inhabitant of marshes, reeds, and well-developed vegetation on riverbanks and lake shores, while the savannah cane rat prefers a humid savannah with dense grass vegetation. Circumstantial evidence, therefore, suggests an identification of the Shaqadud remains as *T. gregorianus*.

Small and Medium Rodents. Eleven fragments of long bones and two pelvis fragments from small rodents were collected in the midden and the cave. These fragments cannot be identified more precisely as good comparative postcranial material is missing in the collections available to us. Small rodents which may have contributed to this sample include those already recorded (*Arvicanthis niloticus*, *Tatera* sp.), but also *Jaculus jaculus* (the lesser jerboa) and *Praomys* sp. (multimammate rat) The latter two have been recognized respectively at Kadero (Gautier, in preparation) and Esh Shaheinab (Bate 1949; Peters, in preparation).

Unknown medium-sized rodents are represented in our study material by five limb bones (table 10-1). To this sample, the striped ground squirrel (*Euxerus erythropus*) and other rodents of comparable size such as the giant rat (*Cricetomys gambianus*) may have contributed.

Honey Badger (*Mellivora capensis*). The honey badger or ratel has been recognized by an incomplete ulna from the midden on the basis of its relative size and morphology. It occurs from Africa to India and is adapted to a wide range of habitats. Its diet includes small rodents, birds, snakes, lizards, turtles, fish, insects, fruit, bulbs, roots, and, of course, honey.

Slender Mongoose (*Herpestes sanguineus*). S1-B/III yielded one upper and one lower jaw fragment of a small viverrid. Some measurements follow:

Maxilla, P4, CL: 6.2
Mandible, M1, CL: 5.7

Both specimens can be attributed to the slender mongoose (*Herpestes sanguineus*) on the basis of the morphology and relative size of the teeth (cf. Rosevear 1974:313, fig. 40, 320). The slender mongoose lives in

Subsaharan Africa and is well adapted to all kinds of habitats except desert.

Genet (*Genetta sp.*). A medium viverrid (fig. 10-1, 9) is represented by four bone fragments (table 10-1). The recent biogeographical distribution of African genets—as well as the relative size of our specimens—indicates that two species might be involved, i.e., the common genet (*Genetta genetta*) and the pardine genet (*Genetta tigrina*). However, the pardine genet requires rather humid environments, while the common genet generally inhabits dry savannahs and also may be found in the sub-desert. This animal often prefers rocky grounds and slopes (Kingdon 1978:144). The topography of the Shaqadud area, as well as circumstantial evidence, suggests an identification as common genet for our specimens.

Unidentified Medium Viverrids. All three sites contain osseous remains which could not be attributed definitely to either the genets mentioned or to mongooses of comparable size, such as the ichneumon (*Herpestes ichneumon*) or the white-tailed mongoose (*Ichneumia albicauda*). The absence of clear osteomorphological differences and the pronounced fragmentation of the bone material preclude a generic or specific identification.

Striped Hyena (*Hyaena hyaena*). The striped hyena is represented at Shaqadud by five bone fragments (fig. 10-1, 10) from the two upper cave units (table 10-4). They cannot be ascribed to the spotted hyena (*Crocuta crocuta*) because of their small relative size.

The striped hyena is widely distributed throughout southwestern Asia and part of the Mediterranean region. In Africa, it occurs around the fringes of the Sahara and ranges as far east as the Red Sea, and in East Africa southward to about the equator. It is essentially an inhabitant of arid zones, the sub-desert, and the Sahel-woodland (Rosevear 1974:345). Its food consists largely of carrion or carcasses abandoned by other carnivores such as lion, leopard, or African hunting dog (*Lycaon pictus*). Bones of all kinds and sizes are collected (Stromer 1902; Sutcliffe 1970; Shipman and Phillips-Conroy 1977) and eagerly eaten, sometimes even those which are already denuded of all flesh by vultures. Striped hyenas are also known to attack calves, small livestock, dogs, and even donkeys and horses (Rosevear 1974:349). Sometimes hyenas associate with man, functioning as a sanitation agent, cleaning away kitchen and other offal (Wendt 1973).

Bone material of striped hyenas at Shaqadud is limited to the cave deposits containing livestock. Today, hyenas are not often hunted for food by Africans, except locally (cf. Wendt 1973) or during famine periods (Hillaby 1967 *fide* Kingdon 1978:279). During the Egyptian Dynastic Period, these animals were kept and stuffed with food for the specific purpose of fattening (Brothwell and Brothwell 1969:38). At Shaqadud, however, the striped hyena may have been killed to protect livestock. The presence of a worked distal metapodial in S1-A/II probably suggests that certain parts of the body held a particular symbolic or medical value; this is, for example, still the case for the nose, canines, eyebrows, hair, skin, and dung of spotted hyenas in East Africa (Kingdon 1978:227–278) and for the tongue of the striped hyena in India (Wendt 1973).

(African) Wild Cat (*Felis silvestris*). A small felid is represented in S21 and S1-A by an incomplete upper jaw (fig. 10-1, 11) and six postcranial bone fragments (tables 10-2 and 10-4). Some measurements follow:

Maxilla, CL P2-P4: 23.0
Maxilla, CL P4: 11.1
Scapula, GLP: 13.4
Radius, Bp: 7.3
Os femoris, Bp: 20.5
Mt III, Bp: 5.6

These measurements indicate animals comparable in size or somewhat larger than average housecats and, therefore, pertain to a small wild cat such as the sand cat (*Felis margarita*) or the (African) wild cat (*F. silvestris*). Biogeographical considerations and circumstantial evidence suggest an identification as wild cat, a widely distributed felid in Africa and Eurasia. Wild cats are well adapted to a wide range of habitats, avoiding the real desert and the closed rainforest. Its major prey animals include rodents, hares, fowl, lizards, turtles, and arthropods, but Guggisberg (1975:32) recorded that not fully grown dikdiks and duikers are also sometimes hunted.

Medium Felids. S1-B/III yielded a small number of metapodials and one second phalanx, attributable to a medium felid such as serval (*Felis serval*), caracal (*F. caracal*), or swamp cat (*F. chaus*). The latter can be excluded here because its actual biogeographical range is restricted to the Nile delta. For the moment, the bone material does not allow a distinction between serval and caracal, although the serval is said to be somewhat larger than the caracal (cf. Gautier 1983a).

Both serval and caracal are common inhabitants of the northern and southern African savannahs; the range of the caracal extends as far as India (Prater 1971:77). The serval generally prefers areas with much cover such as gallery forests and tall grass plains with scattered trees and shrubs, while the caracal mainly occurs in open grass savannah and acacia woodland. The latter would be better adapted to drier climatic conditions and is thought to be still present in the northern Sudan. The distribution of the serval in the Sudan is limited to the more humid southern part of the country.

Small and Medium Carnivores. Four fragments of long bones and one incomplete lower jaw from small carnivores (table 10-6) cannot be identified more precisely because of their fragmentation and the absence of good comparative material in the available collection. Carnivores which may have contributed to this sample include some of the already recorded ones (slender mongoose, genet), zorilla (*Ictonyx striatus*), Lybian striped weasel (*Poecilictis lybica*), ichneumon (*Herpestes ichneumon*), banded mongoose (*Mungos mungo*), white-tailed mongoose (*Ichneumia albicauda*), or even marsh mongoose (*Atilax paludinosus*).

Medium Carnivores (table 10-6). These are represented by two bone fragments from the lower midden deposits (table 10-1). To this sample, approximately fifteen species from several genera (*Canis, Mellivora, Viverra, Proteles, Felis*) may have contributed.

Aardvark (*Orycteropus afer*). The aardvark or antbear is represented by seven postcranial bone fragments collected in the two upper cave units (fig. 10-1, 12). The identification of these remains does not pose particular problems since the aardvark skeleton exhibits very typical osteomorphological features reflecting the burrowing habits of the animal (Frechkop 1937; Grasse 1967).

Aardvarks live in Africa south of the Sahara and are typical savannah dwellers, avoiding the true rainforest. Their diet consists mainly of termites; therefore, they generally occur in the vicinity of termitaria. During the wet season, they consume locusts and other insects, as well as ants. The aardvark is well adapted to a fossorial life and makes elaborate burrows, sometimes reaching a depth of over 6 m. Abandoned holes are colonized by porcupines, warthogs, honey badgers, jackals, and other vertebrates. Stevenson-Hamilton (1957:295) noted that aardvark meat is of good quality. In East Africa, local people attach a symbolic value to its teeth, hair, and claws (Kingdon 1971:385).

African Elephant (*Loxodonta africana*). S21 yielded three molar fragments and an incomplete first phalanx which can be attributed to *Loxodonta africana* because of their relative size and morphology (fig. 10-1, 13). Two subspecies are extant: *L. africana cyclotis* and *L. a. africana*. The first is somewhat smaller (shoulder height up to 3 m.) and confined to forested areas, while the second (up to 4 m.) is a typical savannah dweller. No doubt it is the second subspecies that roamed near Shaqadud.

African elephants inhabit the more humid areas of their home range sensu Odum (1971:219) such as gallery forests during the dry season, but migrate to the drier parts of it during the wet season, attracted by particular fruit-bearing plants. Elephants are known to be very destructive when their home ranges are reduced (Glover 1963, 1972).

Prehistoric hunters presumably killed elephants for their meat, but ivory may have been used as raw material. Ivory objects are known from prehistoric sites along the central Sudanese Nile, for example, at El Kadada (Gautier, 1986).

Warthog (*Phacochoerus aethiopicus*). The warthog is represented at Shaqadud by a few fragmentary jugal teeth, exhibiting the typical enamel pattern as shown in Peyer (1968:263). This animal still occurs in much of the northern and southern savannahs sensu Delany and Happold (1979:70). It would prefer open savannah with dispersed trees and shrubs, eventually in the vicinity of water. Warthogs are able to survive sahelian conditions. We saw this suid in the Parc National des Oiseaux du Djoudj (Senegal, 16° 30′NB, 17° 30′ WL) together with Dorcas gazelle (*Gazella dorcas*).

Suids (probably *Phacochoerus aethiopicus*). S21 and S1-B/III yielded some postcranial remains which, osteomorphologically, could not be attributed to warthog or the other suids occurring in the Sudan such as bush pig (*Potamochoerus porcus*) and giant forest hog (*Hylochoerus meinertzhageni*). The suspected palaeosynecological context, however, favors an identification as warthog, at least for the remains from the midden, because both bush pig and giant forest hog cannot survive in drier savannah conditions.

Giraffe (*Giraffa camelopardalis*). This remarkable artiodactyl is well represented in our collection (fig. 10-1, 14–15; fig. 10-2, 1), especially in the younger Shaqadud deposits (table 10-1 and 10-4). Some measurements on the better-preserved specimens follow:

Humerus, BT: 118
Radius, BD: 130
Os carpi ulnare, GL: 63, 66
Os carpale II+III, GB: 59
Os carpale II+III, GD: 67

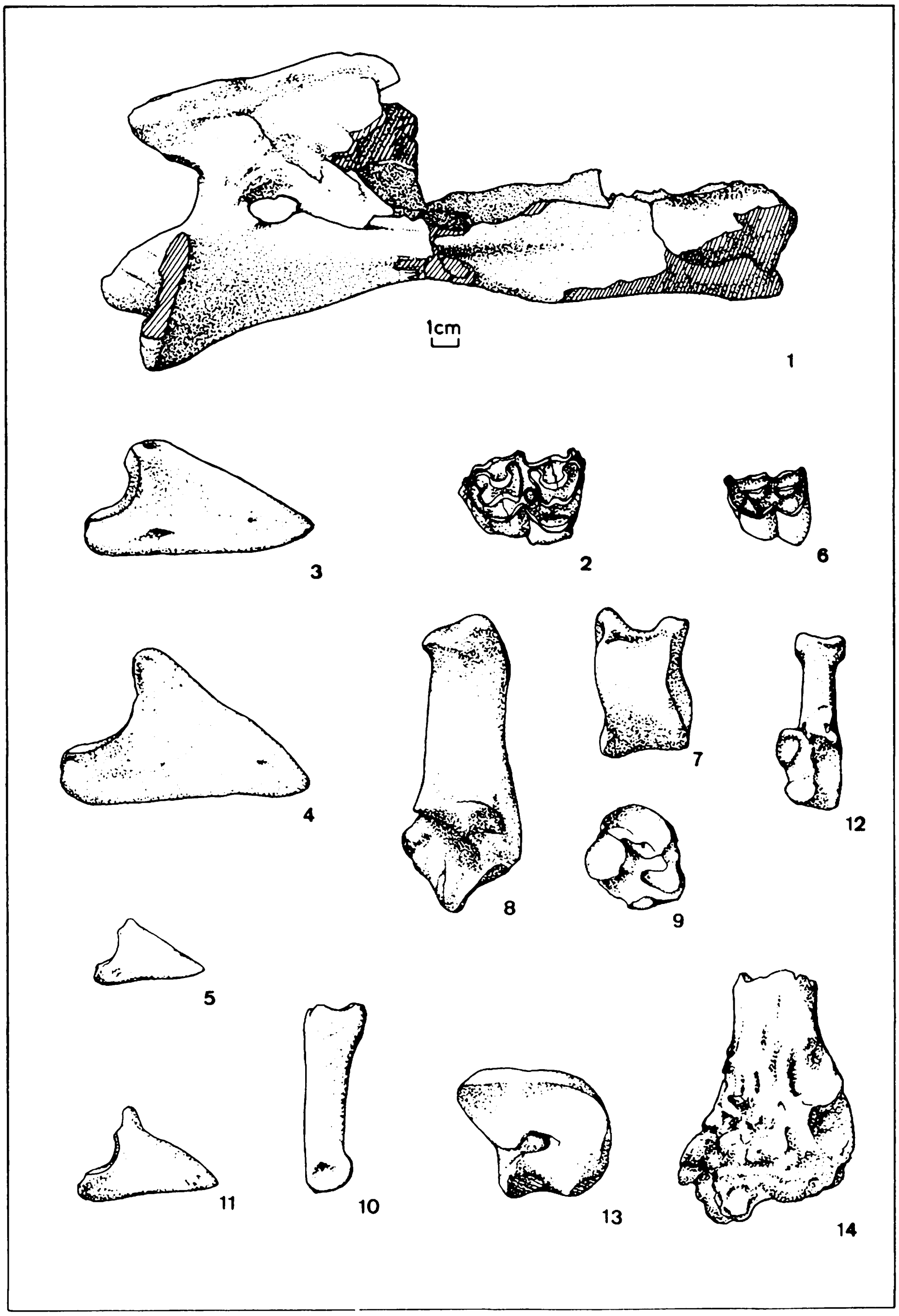

Figure 10-2. Key: 1, Giraffe (*Giraffa camelopardalis*), lateral view of an axis; 2, Topi or hartebeest (*Damaliscus lunatus* or *Alcelaphus buselaphus*), occlusal view of an upper third molar; 3, Topi or hartebeest (*Damaliscus lunatus* or *Alcelaphus buselaphus*), abaxial view of a third phalanx; 4, Greater kudu (*Tragelaphus strepsiceros*), abaxial view of a third phalanx; 5, Oribi (*Ourebia ourebi*), abaxial view of a third phalanx; 6, Red-fronted gazelle (*Gazella rufifrons*), occlusal view of an upper third molar; 7, Red-fronted gazelle (*Gazella rufifrons*), dorsal view of a talus; 8, Red-fronted gazelle (*Gazella rufifrons*), medial view of a calcaneus; 9, Red-fronted gazelle (*Gazella rufifrons*), proximal view of a metatarsus; 10, Red-fronted gazelle (*Gazella rufifrons*), abaxial view of a first phalanx; 11, Red-fronted gazelle (*Gazella rufifrons*), abaxial view of a third phalanx; 12, Jackal or domestic dog (*Canis sp.*), medial view of a calcaneus; 13, Donkey (*Equus africanus* f. asinus), proximal view of an os tarsi centrale; 14, Pathologic specimen, probably an *os femoris* of a small antelope. (All pictures are drawn on natural size by Jo Baetens, except indicated otherwise.)

Talus, GL1: 108
Talus, GLm: 96
Talus, BD: 75
P. media, GL: 56, 56
P. media, BP: 39.5, 46

The giraffe, endemic in the Ethiopian region, is confined to the northern and southern savannahs. Within this area, it is well adapted to different environments and occurs in open savannahs with scattered bushes and trees to dense tree savannahs or even gallery forest. In East Africa, this animal is most frequently met in *Acacia, Commiphora, Combretum,* and *Terminalia* woodland (Kingdon 1979:378). Its diet largely consists of leaves, buds, twigs, flowers, and fruits, with a preference for plants of the Mimosaceae family. Tall shrubs and trees which are regularly visited by giraffes show a browse line, and the frequent nibbling of growing shoots results in a dense, hedge-like structure of many shrubs (Delany and Happold 1979:121, fig. 6.8).

Giraffes are not only known to provide good-quality meat, but their leather is put to a variety of uses. Cunnison (1958) noted that the Humr, a Kordofta tribe, use the hide to make sandals, whips, containers for liquids such as the "tugzu" (a crescent-shaped container for liquid butter), and formerly also shields. The same author recorded the particular significance of the giraffe tail, which is cut off immediately after a successful kill. East Africans still use the hair of the tail to make talismans (bracelets, pendants, etc.; cf. Kingdon 1979:337).

Small antelopes, oribi (*Ourebia ourebi*) and common bush duiker (*Sylvicapra grimmia*). Remains of small antelopes are fairly abundant in the Shaqadud deposits, especially in S21 and S1-B (fig. 10-2, 5). The bulk of this material consists of various postcranial remains, but two incomplete horn cores, some small skull fragments, a few damaged upper and lower jaws, and several loose teeth are also present. These specimens can be ascribed to oribi or common bush duiker; other small antelopes such as the klipspringer (*Oreotragus oreotragus*), or members from the genera *Cephalophus, Gazella,* and *Raphicerus* can be excluded on the basis of their osteomorphology, their recent distribution, and the assumed palaeosynecological context. On the basis of the criteria established by Van Neer (1981:124–129), only one specimen could be definitely attributed to the common duiker, while oribi is represented by twenty-four fragments. This ratio clearly indicates that oribi dominates the small antelope collection. Some measurements on the best-preserved specimens follow. Except for the upper molars, the distal humerus and radius, and the tali all specimens have been assigned to oribi.

Maxilla, OL M2: 9.7
Maxilla, OL M3: 11.4
Upper molar, OL M1/2: 11.7, 11.9
Humerus, BT: 18.7, 20.5, 21.5
Radius, BD: 18.4, 19.9
Talus, GL1-el: 24.5, 26, 26.5, 26.5, 27.5
Talus, BD: 14.1, 15.3, 14.6, 14.8, 16.4
Os centroquartale, GB: 20, 20.5
P. proximalis, GLPe: 35.5, 36, 39.5
P. proximalis, BP: 10.1, 10.2, 8.9
P. media, GL: 18.7, 18.7, 18.9, 19.0, 19.5, 20
P. media, Bp: 6.9, 8.3, 8.0, 7.0, 7.8, 8.6
P. distalis, DLS: 20.5, 22, 22.5
P. distalis, Bp: 6.8, 7.4, 7.2
P. distalis, HP: 11.5, 13.2, 12.7

Both oribi and common duiker are inhabitants of the northern and southern savannahs, although the second has a wider distribution (Haltenorth and Diller 1979:37, 47). The common duiker generally occurs in wooded savannah and woodland, avoiding the open grass savannah (Verheyen 1951), while the oribi prefers grass plains and open savannah, except for the very dry ones, with scattered trees and shrubs. The two species have different food preferences. The common duiker feeds largely on leaves of trees and shrubs, in contrast to the oribi, which is a true grazer. The ratio of oribi to common duiker might indicate that the area around Shaqadud mainly consisted of open terrain, although hunting techniques, as well as the common duiker's hiding behavior, might account, at least partly, for the observed ratio.

Gazelle, Mainly Red-fronted Gazelle (*Gazella rufifrons*). The upper unit of the midden as well as all cave units yielded bone fragments (fig. 10-2, 6–11) which could be definitely ascribed to gazelle on osteomorphological criteria (Peters, in preparation). Some measurements follow:

Upper M3, OL: 16.7
Mandible, OL M3: 18.2, +20.5
Humerus, BT: 28, 28.5
Radius, Bp: 37.5
Os carpi radiale, GD: +17.5
Os carpi radiale, GH: 12.5
Pelvis, LA: 31
Talus, GL1: 30, 31, 31, 34
Talus, Bd: 17.2, 18.7, 19.3, 21.5

Calcaneus, GL: 63
Calcaneus, Bp: 14.2
Calcaneus, Bd: 26
Os metatarsale III IV, Bp: 20.5, 23
Os metatarsale III IV, Bd: 23
P. proximalis, Bp: 11.7
P. proximalis, Bd: 9.1, 10
P. media, GL: 25
P. media, Bp: 10.4
P. distalis, DLS: 25.5, 29.5
P. distalis, HP: 16.2, 18.6
P. distalis, BFp: 8.4, 9

According to Gentry (1964, 1971), six *Gazella* species still occur in the Sudan: Dorcas gazelle (*G. dorcas*), red-fronted gazelle (*G. rufifrons*), Soemmerring's gazelle (*G. soemmerringi*), dama (*G. dama*), Grant's gazelle (*G. granti*) and Thomson's gazelle (*G. thomsoni*). The latter two can be excluded on biogeographical considerations, while dama does not have to be taken into account because of its larger size (Lange 1971; Haltenorth and Diller 1979:83) and biogeographical distribution, which is restricted to the area west of the Nile (Brocklehurst 1931; Haltenorth 1963). Furthermore, our measurements indicate that the Shaqadud specimens can be assigned mainly to the red-fronted gazelle. Some of the remains, however, may have belonged to smaller female Soemmerring's gazelles or larger Dorcas gazelles, the latter because they are known to be of considerably larger size during the Late Quaternary compared to the present-day specimens (Hooijer 1961:46).

The red-fronted gazelle inhabits the Sudano-Sahelian belt between 9 and 16° N, from Mauretania to Eritrea. It prefers dry savannahs with grass and shrubs or the vegetated valleys between sand dunes, feeding on grasses, herbs, and leaves of shrubs, depending on the time of the year. Red-fronted gazelles are known to migrate northward during the wet season (Haltenorth and Diller 1979:85).

Medium antelopes. Specimens which cannot be attributed definitely to either red-fronted gazelle or other medium antelopes (cf. table 10-5) are brought together in this category. The suspected palaeosynecological context suggests that the remains from the older Shaqadud deposits (S21, S1-B) probably are derived from bushbuck (*Tragelaphus scriptus*) or bohor-reedbuck (*Redunca redunca*). For the cave deposits, it is likely that the larger part of the medium antelope remains pertain to the gazelle mentioned in the previous section, since other medium antelopes could not be recognized among them.

Greater Kudu (*Tragelaphus strepsiceros*). Several cranial and postcranial fragments indicate the presence of a large, slenderly built antelope in the midden deposits (fig. 10-2, 4). This is illustrated by the following measurements:

Upper P3, OL: 16.8
Os centroquartale, GB: 39.5
Os centroquartale, GD: 35
P. media, GL: 35, 38, 38, 39.5
P. media, Bp: 18.2, 20.5, 22, 22
P. distalis, DLS: 53, 55
P. distalis, HP: 33.5, 32.5
P. distalis, BFp: 14.5, 14.2

These specimens can be assigned to the greater kudu on the basis of their slender habitus and some osteomorphological characteristics. This animal today occurs in Subsaharan Africa, from Tchad to Ethiopia and Somalia and southward to South Africa and Angola. The greater kudu inhabits a wide range of habitats, from humid savannah to subdesert (Pienaar 1974). Haltenorth and Diller (1979:55), furthermore, noted that this tragelaphine prefers rather dense vegetated savannahs in hilly and mountainous country, while lowland inhabitants are mainly found in the acacia belt along rivers. Its diet consists largely of tree and shrub foliage, but grasses and herbs are also eaten.

Roan Antelope (*Hippotragus equinus*). A robustly built large antelope is represented by two carpals, one incomplete metacarpus, and a terminal phalanx from the older Shaqadud deposits (table 10-1). A few measurements are listed below:

Os carpale II+III, GB: 34.5
Os carpale II+III, GD: 35.5
Os carpale IV, Bp: +25
Os carpale IV, H: 22
P. distalis, DLS: 62
P. distalis, HP: +34
P. distalis, BFp: 19.8

Both relative size and osteomorphology indicate that we are dealing with the roan antelope. This hippotragine occurs in the northern and southern savannahs, in grass plains, woodland, gallery-forest, and tree savanna. Ninety percent of its diet is composed of grasses, supplemented by leaves of trees and shrubs, herbs, and acacia-pods. Kingdon (1982:571) noted the existence of food competition (grasses) between roan antelope and Burchell's zebra (*Equus burchelli*), with a predominance of the latter where both species occur.

Topi (*Damaliscus lunatus*) and/or Hartebeest (*Alcelaphus buselaphus*). A few incomplete jugal teeth and an upper premolar collected in S21 and S1-B can be assigned to an alcelaphine on the basis of the typical occlusal enamel pattern as figured in Gentry (1978). Some postcranial remains can also be attributed to alcelaphines because of certain osteomorphological characteristics (Van Neer 1981:146–150). Two alcelaphine species may have contributed to this sample, more precisely topi (*Damaliscus lunatus*) and hartebeest (*Alcelaphus buselaphus*). Some measurements follow:

Lower M1/2, OL: 23.5
Os carpi radiale, GD: 30.5, 33.5
Os carpi radiale, GH: 24, 22.5
Os carpi intermedium, GD: 33
Os carpi intermedium, GH: 23.5
Os carpi ulnare, GH: 30, 32
Os carpi ulnare, Bp: 12.2, 12.6
Os carpale II+III, GB: 25.5
Os carpale II+III, GD: 24.0
Os carpale IV, Bp: 16.8, 18.0
Os carpale IV, H: 16.4, 18.3
P. distalis, DLS: 51
P. distalis, HP: 25.5
P. distalis, BFp: 15.0

The mentioned alcelaphine species overlap considerably in size (Van Neer 1981). The Shaqadud specimens, being of medium size, therefore cannot be attributed specifically (fig. 10-2, 2–3).

Topi today occurs in the northern and southern savannah, while the present distribution of hartebeest is more or less restricted to the northern savannah, from Senegal to northwest Somalia, southward to northwest Tanzania. During historic times, however, hartebeests were also common in north Ethiopia, Egypt, and Palestine (Walther 1973). Hartebeests occur in dry grass to dense tree savannah, while the topi inhabits open grass savannah to woodland with a preference for swamp and alluvial plain grassland (cf. Gautier 1983a). Both antelopes mainly feed on grasses, although the hartebeest would be less particular about its grazing (Kingdon 1982:508). An identification of the midden remains as *A. buselaphus* seems most likely on the basis of circumstantial evidence.

Large Antelopes. A considerable amount of much-fragmented bone remains can be conveniently grouped in this size class. Several species may have contributed to the sample, including in the first place the large antelopes mentioned in the previous sections, as well as some other species, for example the waterbuck, *Kobus ellipsiprymnus*.

Domestic Mammals

Domestic Donkey (*Equus africanus* f. asinus). S1-A/III, the upper cave unit, yielded a tarsal of an equid, GB:35.5 (fig. 10-2, 13). An identification as zebra is excluded here because of the relatively small size of our specimen. As no African wild ass (*Equus africanus*) skeleton was available to us, the Shaqadud specimen was sent to Prof. Dr. Boessneck and Prof. Dr. von den Driesch (Munich), who confirmed our identification. We are not aware of comparable finds from other Sudanese sites with an approximate age of 3,600 B.P., but in Egypt domestic asses were known at the end of the Predynastic Period (Brunton and Caton-Thompson 1928:92–94), approximately 6,000 B.P. (Hassan 1980). Therefore, we find it not too surprising to encounter this animal at Shaqadud, taking into consideration the relations between Egypt and north Sudan.

Sheep (*Ovis ammon* f. aries) and goat (*Capra aegagrus* f. hircus). The midden (S1-B/III), as well as the two upper cave units, yielded seven specimens which undoubtedly represent small livestock because of certain osteomorphological features (Peters, in preparation). Of these, two specimens can be identified to the species level on the basis of osteomorphologic criteria (cf. Boessneck et al. 1964), more precisely a radius-ulna from S1-B/III representing a goat, and a horn core fragment (S1-A/II), attributable to sheep. No measurements could be obtained due to the poor state of preservation; however, it is clear that we are dealing with normal-sized breeds of sheep and goat.

S1-A/III also contained two intrusive cranial fragments; the preservation clearly indicates that they do not belong to the Shaqadud Cave assemblage. These specimens are not included in our fragment counts (table 10-1).

Cattle (*Bos primigenius* f. taurus). Cattle are represented in all cave units by two incomplete jugal teeth, two carpal bones, and a fragment of a third phalanx. These could be separated from African buffalo (*Syncerus caffer*) on the basis of their relative size and osteomorphological criteria established by the present author (Peters, in preparation). Some measurements follow:

Upper M1/2, OL: 22
Os carpi radiale, GD: +43
Os carpi radiale, GH: 30.5

Os carpi ulnare, GH: 44.5
Os carpi ulnare, Bp: 20.5

The scarcity of cattle remains does not allow us to make an estimation of the shoulder height of the Shaqadud cattle breed. Yet, it seems that we are dealing with a medium-sized breed, comparable, for example, with that from El Kadero (Gautier 1984a) and El Kadada (Gautier 1986).

Wild or Domestic Mammals

Domestic Dog and/or Jackal (*Canis sp.*). Canid remains are rather scarce in the midden deposits but are frequently met with in the cave (table 10-1). The size of these fragments indicates medium canids (fig. 10-2, 12). Four species can be taken into account: the side-striped jackal (*Canis adustus*), the black-backed jackal (*C. mesomelas*), the golden jackal (*C. aureus*), domestic dog (*Canis lupus* f. familiaris). A distinction between these four species cannot be made at the moment, for detailed comparative studies on their osteomorphological differences are lacking. Moreover, the bones are too fragmented. Several indications, however, such as their distribution (absent in S21, scarce in S1-B, fairly abundant in S1-A) perhaps linked with the presence of livestock (herding practices), their relative size, and the presence of regurgitated bone fragments point to the presence of domestic dogs at Shaqadud, at least during the occupation of the cave. If present, these dogs would be comparable in size to those from Esh Shaheinab (Peters 1986) and El Kadada (Gautier 1986).

Small Bovids. Approximately twenty bone specimens, collected from the cave deposits, cannot be attributed specifically to either small or medium antelopes or to small livestock. This is due to the pronounced fragmentation, as well as to the lack of diagnostic osteomorphological features.

Large Bovids. The two upper cave units contained about ten bone fragments which can not be assigned to large or very large antelopes or to cattle for the reasons stated under the previous heading.

Special Traces

Special traces on bone surfaces are definitely present at Shaqadud. As the bone material is generally coated by clastics, traces may have been masked and no doubt some of them may have been overlooked during the sorting.

Three kinds of traces could be recognized: regurgitated fragments, bone pathology, and bone pseudo-artifacts (or pseudo-tools). We also saw on two occasions some kind of gnawing marks; their exact origin could not be traced for the moment.

Regurgitated fragments, four bovine distal metapodials, two bovine carpals, and a proximal moiety of a first phalanx (*G. rufifrons*) are the result of carnivore activity and occur in one unit from the midden (S1-B/III) and in all the cave units. Five out of seven fragments are derived from immature animals. Traces left by carnivores can be regarded as indirect evidence for the presence of domestic dogs at the site.

One bone fragment from S21, presumably an incomplete femur shaft of a small antelope, clearly exhibits the formation of new bone (fig. 10-2, 14). This suggests that it has been fractured and healed before the animal was killed by prehistoric hunters.

Besides a few bone artifacts, we found at least seven bone flakes, one from the midden and six from the cave, exhibiting the typical aspect of bone pseudo-artifacts. Such objects have been described from Upper Pleistocene caves in Switzerland (Koby 1943) and from recent open-air sites in southwest Africa (Brain 1967). Koby described the mechanism responsible for the formation of these pseudo-artifacts as *charriage-à-sec,* the movement in the dry soil due to trampling by larger animals visiting the cave. A comparable mechanism is advocated for the recent African specimens formed in dry climate or in well-drained deposits as a result of bioturbation by people and their flocks. The same process can be invoked to explain the presence of such objects at Shaqadud. Their presence, as well as the pronounced fragmentation of the cave bone sample, indicates that this location has been used intensively.

Taphonomy

Archaeozoological Productivity and Site Formation

Table 10-7 summarizes the archaeozoological productivity, i.e., the amounts of animal bones found in the excavated volume at each site. The contrast between them is striking. This marked difference is due to various factors, including the location of the site, the occupational intensity, post-depositional processes, and the choice of the area excavated. Except for the latter, none of these factors can be measured

TABLE 10-7

The Archaeozoological "Productivity" at Jebel Shaqadud

Parameter	S21	S1-B	S1-A
Excavated volume (A)	± 2 m^3	± 20 m^3	± 33 m^3
Number of bone fragments (B)	± 2900	± 3300	± 14500
Number of identified specimens (C)	163	351	450
"Productivity rate" (B/A)	± 1450/m^3	± 165/m^3	± 440/m^3
Identification rate $\left(\frac{C \times 100}{B}\right)$	± 5.5%	± 10.5%	± 3.0%
Preservation	uniform	uniform	varied
Weathering stages	1 & 2	1 & 2	1 to 5

accurately. Yet, we can advance a few considerations which may account partially for the encountered differences.

At S21 and S1-B, the preservation of the bones is quite uniform, while the remains of the cave show varied weathering stages. From this, we can conclude that the remains from S21 and the midden underwent differential destruction, while the cave assemblage certainly has been influenced less by this phenomenon. Given the locality of S21, it appears that a low sedimentation rate and wind erosion were responsible for this. The continuous effect of the latter, furthermore, may have caused a concentration of bones—hence, the high archaeozoological productivity. For the midden, the destructive effect of slope wash erosion, combined with a high sedimentation rate, may account for the low archaeozoological productivity. For the cave, it appears that sedimentation was fairly high but erosion low. This, combined with the effect of trampling, is responsible for the considerable number of bones per cubic meter in our cave sample.

Taphonomic Groups

Before a palaeoecological and palaeoeconomical evaluation can be made, we should try to find out how these assemblages originated. Remains of animals with a comparable death-to-discovery history can be brought together in so-called taphonomic groups, a concept introduced by Gautier (1983b). In general, we can isolate two categories, namely, the remains which arrived at the site through human intervention and those for which man is not responsible, namely, the intrusive elements.

The anthropogenic accumulation includes wild and domestic animals (and their products, for example, ostrich eggs) brought to the site for various reasons, the most important being food supply. However, skins, quills, shells, and feathers were probably also used. We bring all these elements together, since in many cases we cannot decide whether the animal was hunted only for the meat, or for the skin, quills, etc. An illustration of this (cf. Gautier 1983b) may be seen in the bone material of snakes and monitors mainly consisting of vertebrae, of which articulated clusters occur in some sites. This could indicate that the carcasses were thrown away after skinning. At Shaqadud, a similar process probably explains the presence of approximately four articulated neck vertebrae of a canid (*Canis* sp.) in the cave deposits (S1-A). In S1-B, three articulated metatarsals of a felid (caracal or serval) suggest that only the skin was brought to the site with the terminal leg bones.

The foregoing taphonomic group contains, according to us, also the freshwater mollusk *Pila*, found in considerable numbers in the older sites (S21/S1-B). Originally, many investigators assumed that these snails were used as bait for fishing and attention was drawn to the fact that the Nuer in the southern Sudan use *Pila* shells, attached to sticks with which the water is struck, to attract fish so as to spear them (Evans-Pritchard 1940:71, fig. 10). However, Gautier (1983a) notes that large amounts of *Pila* also occur in sites where remains of fish are almost absent, as is the case in El Kadero; therefore, he suggests that these mollusks were consumed. Their abundance at Shaqadud, especially in the site on the plateau (S21), certainly indicates that they were gathered for consumption, since fish remains are completely absent from the collection.

Ethnographic parallels concerning the consumption of *Pila* snails in Sudan are not well known (cf. Tothill 1948a:272), but Pilsbry and Bequaert (1927:178–179) mentioned that *Pila congoensis* (*P. ovata*) is eaten in Zaire. In this context they referred to a description by the explorer H. Lang: "At certain seasons the natives collect them in great quantities for food purposes. But among all the tribes of the northeastern Congo only the older people partake in this dish, the younger ones being afraid of even using the utensil they have been boiled in. The snails are cooked in water with wood ashes, taken from the shell, cleaned, cut to pieces, stewed again, seasoned and served with palm oil." The animals can be harvested most easily during the dry season, when their habitats dry up. Arkell (1945c) noted that buried aestivating *Pila* were dug out by jackals; such a method is certainly within the range of human possibilities.

A second taphonomic group includes "exotics" and animals from outside the immediate vicinity. We include in it, aside from the marine mollusks such as *Cypraea* and *Strombus,* the bivalves *Aspatharia* and *Caelatura* and the freshwater snail *Cleopatra bulimoides.* We assume that these shells were traded (or gathered?) for decorative purposes (pendants, bracelets, tools, etc). As they were covered with kunkar, comparable to that on the bone fragments, we are certain that they pertain to the same occupation phase.

The marine shells point to contacts direct or indirect with the more coastal parts of the Sudan. The bivalves *Aspatharia* and *Caelatura,* as well as the gastropod *Cleopatra bulimoides,* are probably Nilotic in origin, for the Nile is the nearest suitable habitat where they may be found or collected. Thus, their presence suggests unspecified contacts with the Nile. Whether *Aspatharia* shells were used for the manufacturing of tools (cf. the "pottery tools" of Nilotic sites) could not be established, owing to the high degree of fragmentation.

A third taphonomic group comprises the intrusive faunal elements. These are derived from animals that either lived or perished at the site and have no direct connection with the human occupation. They may have been brought there by man, birds of prey or owls (pellets), porcupine (Hendey and Singer 1965), or spotted hyena (Sutcliffe 1970). Furthermore, we can recognize two categories of intrusives, pene-contemporaneous and later.

Pene-contemporaneous intrusives are generally animals that lived and perished at a site or arrived there through the action of some taphonomic agent at about the same time people were using the site. Among the vertebrates, bone fragments of anurans (frogs and/or toads), bats, and small rodents (*Arvicanthis niloticus, Tatera* sp.) can be placed in this group. These remains do not look different from those of our first taphonomic group as would be the case if they arrived much later in the deposits. We also classify the landsnails *Zootecus insularis, Limicolaria cailliaudi,* and *Zonitarion* cf. *cailliaudi* within this taphonomic unit. The large number of shell fragments of *Limicolaria cailliaudi* in many prehistoric sites along the Nile (cf. Saggai, Gautier 1983a) and Shaqadud (table 10-1) can be explained, according to Gautier (1983b), by assuming that snails are attracted by abandoned sites. Such areas generally are rapidly overgrown by lush vegetation because of their very fertile soil. In any case, juvenile as well as mature *Limicolaria cailliaudi,* sometimes with an epiphragm, were found in the Shaqadud deposits, suggesting that these snails apparently bred, lived, and aestivated on the site. Therefore, it is obvious that at least part of the remains do not represent discarded shells. *Zootecus insularis* is included here on the basis of its vertical distribution in the Shaqadud deposits (table 10-1) and its relative size, which makes it impractical for consumption. Both its distribution in former times and ecological requirements are not well known at the moment, which is probably due to its burrowing life style. Verdcourt (1960) supposes that its recent distribution is mainly the result of human activity.

The upper cave deposits, S1-A/III, yielded, besides a lower jaw of a gerbil (*Gerbillus* sp.), two cranial bone fragments of small livestock. A thorough comparison of these elements with other bone remains from the cave revealed that the first were less fossilized, suggesting that they arrived there much later. Consequently, we classify them as late intrusives.

The taphonomic status of some animals, more precisely the small freshwater bivalve *Corbicula consobrina* and the striped ground squirrel, (*Euxerus erythropus*) is not very clear. The oldest cave deposits (S1-A/I) contained one valve attributable to the abovementioned bivalve. On the basis of its poor condition, its stratigraphical position, and the ecological requirements of the animal, two origins can be considered. The valve may have arrived at Shaqadud from the Nile, the nearest suitable habitat, through human intervention or as an intrusive derived from older alluvial deposits. We do not know of such deposits in the immediate vicinity of the site, but their presence is not inconceivable. As to the striped ground squirrel, again two possibilities arise. On the one hand, we know that these animals are today still hunted by locals in East Africa (Kingdon 1978:441); therefore, these remains might represent kitchen offal. On the other hand, people in West Africa generally avoid this rodent because its bite is known to provoke septicemia (Malbrant 1952:166). As do other rodents, ground squirrels no doubt prefer to burrow their holes in loose sediments (cf. the cave) and that habit could make them into pene-contemporaneous intrusives.

Except for the later intrusives and *Corbicula consobrina,* all the other animals can be used to sketch the

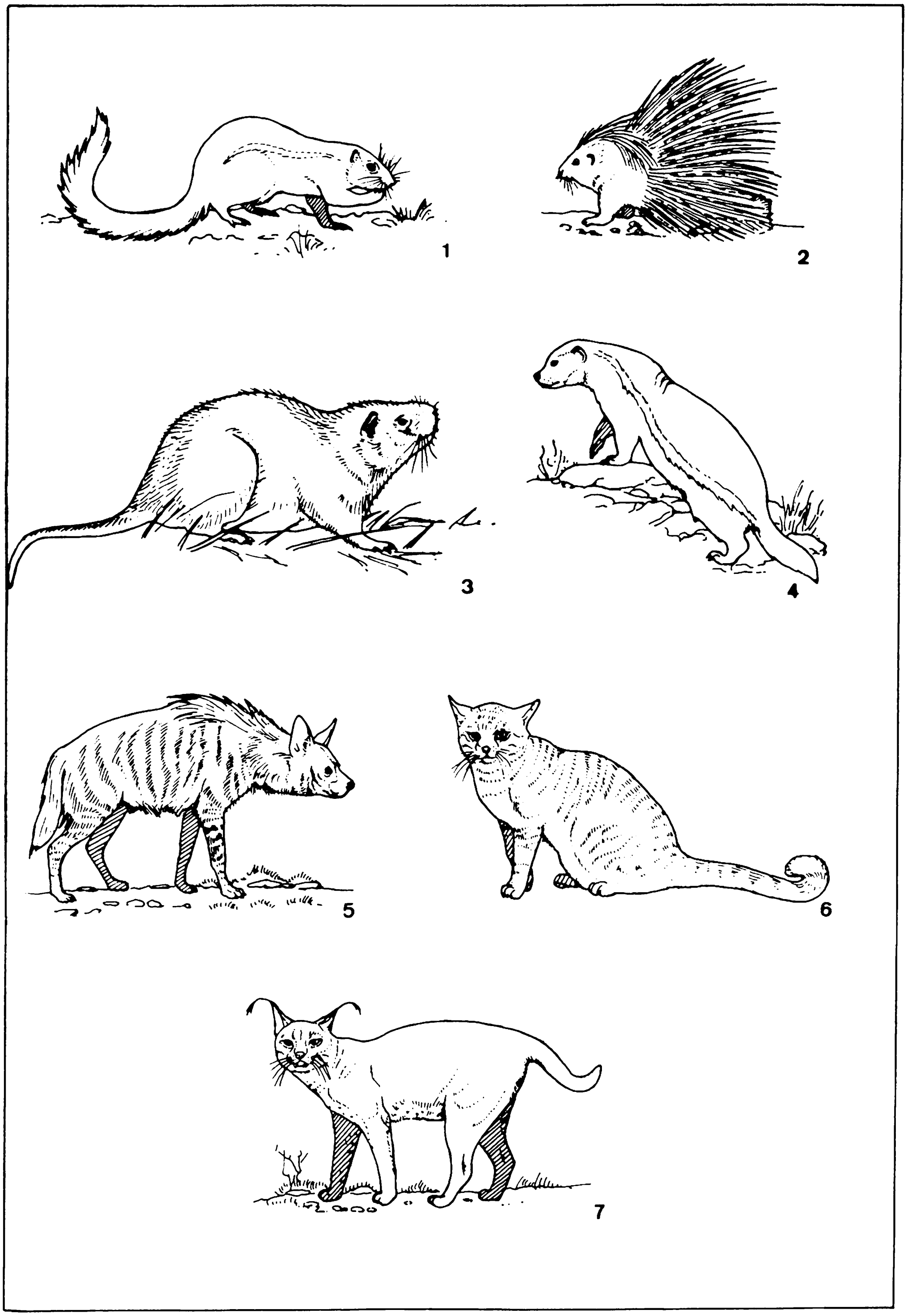

Figure 10-3. Key: 1, Striped ground squirrel (*Euxerus erythropus*); 2, North African porcupine (*Hystrix cristata*); 3, Marsh cane rat (*Thryonomys swinderianus*); 4, Ratel (*Mellivora capensis*); 5, Striped hyena (*Hyaena hyaena*); 6, (African) wild cat (*Felis silvestris*); 7, Caracal (*Felis caracal*). (All pictures are redrawn from Haltenorth and Diller (1979) by Jo Baetens.)

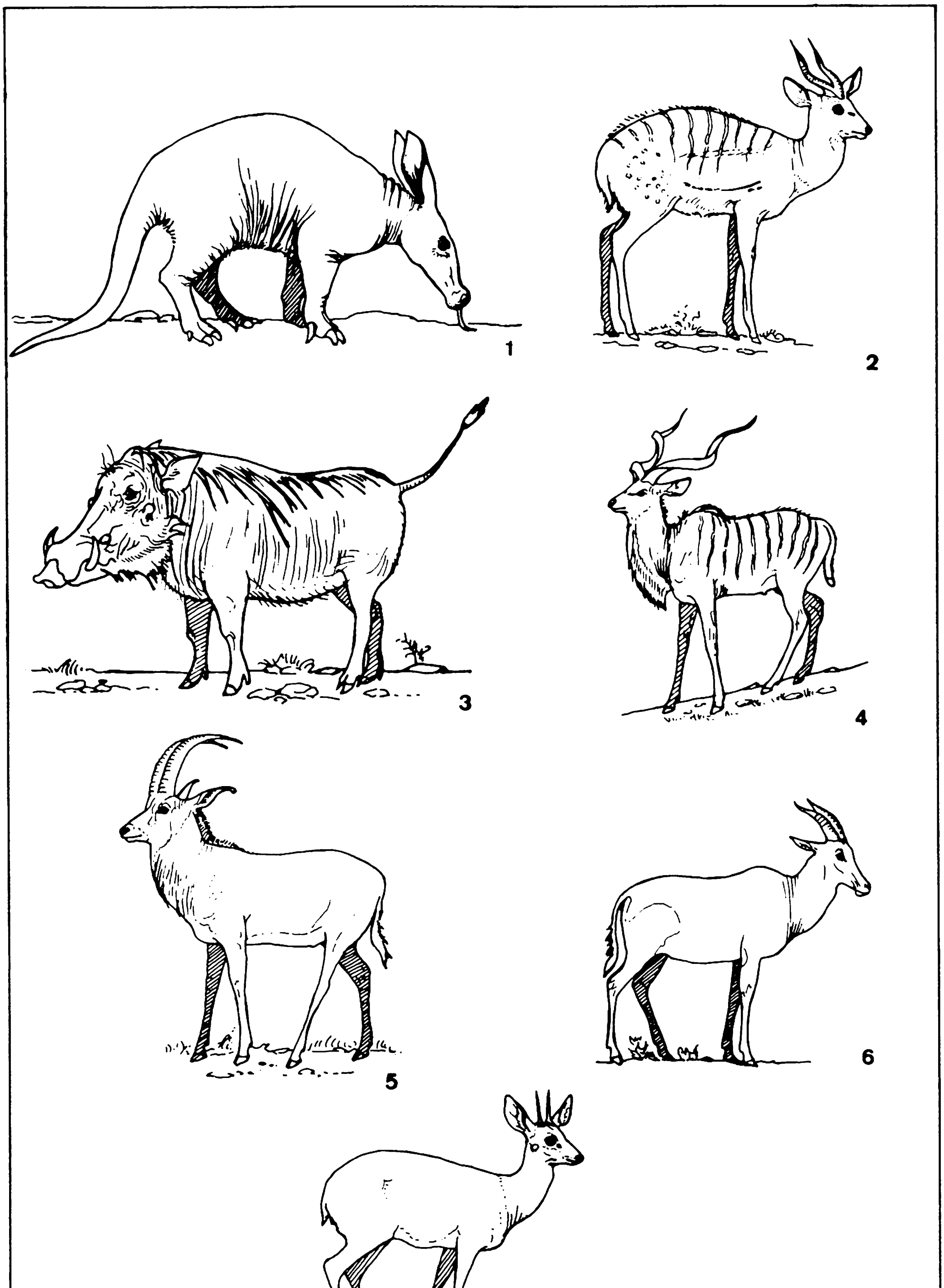

Figure 10-4. Key: 1, Aardvark (*Orycteropus afer*); 2, Bushbuck (*Tragelaphus scriptus*); 3, Warthog (*Phacochoerus aethiopicus*); 4, Greater kudu (*Tragelaphus strepsiceros*); 5, Roan antelope (*Hippotragus equinus*); 6, Topi (*Damaliscus lunatus*); 7, Oribi (*Ourebia ourebi*). (All pictures are redrawn from Haltenorth and Diller (1979) by Jo Baetens.)

bioenvironment (palaeoecology), while the remains resulting from human hunting and gathering give us an indication of how the Shaqadud people exploited this environment (figs. 10-3, 10-4).

Palaeoecology and Palaeoeconomy

Actual Climatological Conditions

Today Shaqadud lies within the Sudanese arid zone. Arid zones are chiefly characterized by an annual potential evapotranspiration which is at least twice as great as the annual rainfall, a very variable annual precipitation with long periods of drought, a rain which usually falls in a few showers, sometimes extremely localized, periodically flooding watercourses, marked seasonal and diurnal fluctuations in temperature, an insolation which is usually very high, and the development of saline soils (Delany and Happold 1979:140–146; Walter 1973: vol. 1:429–433). Shaqadud itself has a dry, relatively cold winter, followed by a hot summer with little precipitation. The average annual rainfall, about 145 mm. according to Wickens (1982:32, table 3.2), is restricted to April through September, with a peak during July and August. The rain usually falls in a few heavy showers with thunderstorms, caused by the influx of moist cool air from the Indian Ocean and the South Atlantic, where the Intertropical Covergence Zone (ITCZ) moves north to the Atbara region (Saeed 1976).

The present-day vegetation of the area can be described as semi-desert scrub and grassland with an average annual rainfall of 75–400 mm. (Harrison and Jackson 1958; Wickens 1975). The parent soil material, however, is of great importance for the distribution of plant species. Smith (1949) pointed out that species growing on sandy soils require a third less precipitation than their homologs on clay soils. For example, *Acacia senegal* needs some 400 mm. on sandy soils but requires 600 mm. rain on clay soils. Several tree species, furthermore, are adapted to a wide range of annual precipitations; *Acacia tortilis*, for example, needs 500 mm. to survive in gullies, 150 mm. on the Khartoum sandplain, 300 mm. in the Kassala district on clay soils, and 500 mm. on the drier parts of the Butana hills (Smith 1949).

Shaqadud is characterized by sandy soils (Andrew 1948) and, therefore, requires an average rainfall of 75 to 250 mm. to allow scrub vegetation up to 2 m. in height such as *Acacia tortilis, Leptadenia pyrotechnica, Salvadora persica,* and the dominant grasses, *Aristida* spp. (Wickens 1975). After the annual rains, grasses and herbs form a more or less continuous cover, while bushes and trees shoot new leaves (Delany and Happold 1979:141, fig. 7.1d).

Happold (1967) described the game of the present-day Khartoum province, distinguishing the mammals found along the Nile from those inhabiting the desert. Larger game animals include only the Dorcas gazelle (*Gazella dorcas*); smaller mammals such as hare (*Lepus capensis*), sand fox (*Vulpes pallidus*), striped ground squirrel (*Euxerus erythropus*), and rock hyrax (*Procavia ruficeps*) are probably still present in the area. Barbary sheep (*Ammotragus lervia*) have been introduced into the Sabaloka Game Reserve (Happold 1967). It should be mentioned that the dama gazelle (*G. dama*) is confined to the area west of the river Nile (Mackenzie 1954).

At Shaqadud a small resident population is engaged in rainfall farming and livestock herding (Marks et al. 1985). These people rely on deep wells for their water supply during most of the year. Local livestock include dromedaries, sheep, goats, and probably zebu cattle.

The present-day flora and fauna have been seriously degraded, especially during the last century (Wickens 1982). This is mainly the result of uncontrolled cutting and removal of woody species, i.e., trees (Rapp 1978), agriculture, overgrazing with the resulting destruction of perennial grasses (Walter 1973: vol. 1:124), as well as hunting practices involving bush fires.

INTERPRETATION OF THE SHAQADUD ASSEMBLAGE: QUALITATIVE AND QUANTITATIVE

Composition of the Faunal Assemblages

As mentioned above, our counts are based on specimen counts. The absolute frequencies of the various animal groups from Shaqadud are shown in table 10-1. The Shaqadud assemblage is very varied, but mammals predominate with the presence of at least thirty species.

A summary of the mammalian orders encountered, together with their absolute and relative frequencies, is given in table 10-8. This table indicates clearly that artiodactyls such as suids, giraffe, and bovids predominate in each analytic unit. In the older deposits (S21 and S1-B/III), however, small and large antelopes generally represent ±60% or more of the mammalian collection, while gazelle and giraffe predominate to a

TABLE 10-8

Absolute and Relative Frequencies of Mammalian Orders Encountered

SITE OR EXCAVATION UNIT / ANIMAL GROUPS	S21		S1-B I + II		S1-B III		S1-A I–III	
	n	%	n	%	n	%	n	%
REPTILES	5	3.1	7	18.4	36	16.8	96	21.7
BIRDS	5	3.1	2	5.3	10	4.7	7	1.6
MAMMALS	153	93.8	29	76.3	168	78.5	340	76.7
WILD MAMMALS	153	93.8	29	76.3	164	76.6	276	62.3
Primates	—	—	—	—	2	0.9	—	—
Lagomorpha	—	—	—	—	1	0.5	12	2.7
Rodentia	6	3.7	5	13.1	25	11.7	30	6.8
Carnivora	7	4.3	3	7.9	15	7.0	11	2.5
Tubulidentata	—	—	—	—	—	—	7	1.6
Proboscidea	4	2.4	—	—	—	—	—	—
Artiodactyla	136	83.4	21	55.3	121	56.5	216	48.7
Suids	6	3.7	—	—	6	2.8	1	0.2
Giraffe	2	1.2	2	5.3	1	0.5	76	17.1
Small antelopes	72	44.1	12	31.6	63	29.4	3	0.7
Medium antelopes	6	3.7	3	7.9	6	2.8	122	27.5
Large antelopes	50	30.7	4	10.5	45	21.0	14	3.2
DOMESTIC MAMMALS	—	—	—	—	1	0.5	12	2.7
Perissodactyla (donkey)	—	—	—	—	—	—	1	0.2
Artiodactyla	—	—	—	—	1	0.5	11	2.5
Small livestock	—	—	—	—	1	0.5	6	1.4
Cattle	—	—	—	—	—	—	5	1.1
WILD OR DOMESTIC MAMMALS	—	—	—	—	3	1.4	52	11.7
Carnivora (dog/jackal)	—	—	—	—	3	1.4	22	4.9
Artiodactyla	—	—	—	—	—	—	30	6.8
Small bovid	—	—	—	—	—	—	20	4.5
Large bovid	—	—	—	—	—	—	10	2.3
TOTALS	163	100.0	40	100.0	214	100.0	443	100.0

more or less comparable extent in the cave sediments (S1-A/I-III). Another striking difference between the old and younger sediments is the presence of cattle and small livestock in the cave deposits. They are absent in S21 and the midden, except for one incomplete long bone of a goat in S1-B/III. Taking into account these differences, we can divide the Shaqadud assemblages into two major stages: S21 and S1-B/I-III, on the one hand, and S1-A/I-III, on the other. The status of the upper midden unit (S1-B/IV) is somewhat uncertain, as explained below.

The first stage is characterized by typical hunting and gathering practices. Game animals mainly included small and large antelopes such as oribi, greater kudu, roan antelope, and topi and/or hartebeest, but medium antelopes, as well as porcupine, warthog, giraffe, and probably monitor and snake were also added to the hunting bag. Bone fragments of cane rat are limited to site S21. Since this animal is known to provide good meat, we assume that it disappeared in the Shaqadud region before the formation of S1-B/III; S1-B/I and II yielded too few remains to have representative samples and the absence of cane rat may be aleatory. Gathering activities certainly include the collecting of *Pila* and freshwater and land turtles.

The second stage, confined to the cave, illustrates a mixed economy, in which hunting and gathering as well as livestock herding were practiced. In the lower cave unit, *Gazella* remains are the most abundant, suggesting that this antelope provided most of the meat. The relative frequencies of bone fragments from giraffe in S1-A/II and III indicate an increasing importance of this animal. However, differential preservation might be invoked to explain partially the changed ratio of gazelle/giraffe, since giraffe bones are very bulky. Other mammals such as large antelopes, porcupine, hare, and aardvark were also added to the hunters' bag at this time. The absence of aardvark in the previous period poses a problem. On the basis of the palaeosynecological context there is no reason to assume that it was absent during the earlier period. It was probably not hunted at first and its presence in the later cave sediments may point toward deteriorated environmental conditions which forced people to adopt new food habits. This also might explain the increased number of turtles, as well as the need for the adoption (or further adoption?) of livestock.

We have evaluated the MNI-composition of the cave fauna. Besides a terrapin and at least one tortoise, all other bone remains can be attributed to mammals. Our comparison is restricted to the latter group, focusing on the species or groups involved in meat-supply. Table 10-9 summarizes mammalian specimen counts and Minimum Number of Individuals (MNI) counts, together with their relative frequencies. Live weights and absolute and relative quantity of meat based on MNI counts are also added. As only ca. 35% of the cave has been excavated, we will use a multiplication factor of three; hence fragment counts hypothetically produced 921, while MNI counts produced only 102 individuals. No correction has been made for the fact that the correlation between fragment and MNI counts has been said to be non-linear (cf. Poplin 1976; Gautier 1984b). If we compare the relative frequencies based on both counting methods, similar tendencies, although weakened with MNI, can be noted, such as the dominance of giraffe, gazelle, and medium antelopes. Specimens or groups represented by one or a few individuals gained importance. However, we would like to stress that MNI counts definitely do not reflect the number of mammals consumed. This is because we cannot imagine that a cave, inhabited for at least 500 years, would only yield the equivalent of ca. 8,500 kg. of meat, some 17 kg. of meat annually. (The amount of meat available to people is estimated at 50% of the total weight of the

TABLE 10-9

Absolute and Relative Frequencies Based on Specimen and MNI Counts, with an Estimation of the Meat Quantity Calculated with the Minimum Number of Individuals

	Specimen (fragment) counts		MNI counts				
Mammalian species/group	N	%	N	%	Weight*	N x Weight**	%
Hare	12	3.9	1	2.9	3	3	(0.05)
Porcupine	30	9.8	3	8.8	20	60	0.9
Aardvark	7	2.3	1	2.9	65	65	1.0
Warthog	1	0.3	1	2.9	75	75	1.2
Giraffe	76	24.8	4	11.8	950	3,800	59.6
Small antelopes	3	1.0	1	2.9	20	20	0.3
Gazelle	78	25.4	6	17.7	30	180	2.8
Medium antelopes	44	14.3	4	11.8	50	200	3.1
Large antelopes	14	4.6	2	5.9	200	400	6.3
Domestic doneky	1	0.3	1	2.9	200	200	3.1
Sheep and/or goat	6	1.9	3	8.8	25	75	1.2
Cattle	5	1.6	1	2.9	500	500	7.8
Small bovid	20	6.5	4	11.8	25	100	1.6
Large bovid	10	3.3	2	5.9	350	700	11.0
TOTALS	307	100%	34	100%	/	6,378	100%

*These mean values are based on data from Grzimek (1969), Dorst and Dandelot (1972), Haltenorth and Diller (1979), and Kingdon (1982).
**No correction has been made for the fact that in a few cases subadult individuals are also present.

animals.) Although specimen counts may produce a picture which may fit better quantitatively, both methods do have the weakness that neither can provide us with accurate information concerning the initial number of consumed animals. This, of course, is largely due to the loss of information caused by taphonomic processes sensu lato. Hence, it appears to us that, except for some particular cases (cf. Guilday 1970), MNI counts are quite useless; they provide similar acceptable general information on the economy of a site compared to specimen counts, the latter, however, being much easier to obtain.

As already stated, domestic animals are essentially restricted to the cave deposits. All cave units yielded remains of livestock, but the relative frequency within each unit is rather low. Even if all bone fragments assigned to small and large bovids pertained to livestock, the relative frequencies never exceed 15%. The presence of small livestock in the midden is rather unexpected. Two hypotheses can be put forward to explain this isolated find. First, the Shaqadud people may have had connections with pastoralists from whom they obtained a goat. Second, small livestock was already incorporated in the economy of the site, but limited in number and mainly kept for dairy products. Anyhow, at Shaqadud, the shift to economies with an emphasis on pastoralism is of a later date than in the central Sudanese Nile valley where cattle-dominated archeofaunas are typical for Esh Shaheinab and related sites (Tigani El Mahi 1982; Gautier 1984 and in preparation). The foregoing illustrates the diachronous character of the transition "Mesolithicum-Neolithicum."

The cause or causal complex for the introduction of livestock at Shaqadud cannot be deduced from the archaeozoological data. This introduction may have been preceded by a climatologic deterioration with a negative influence on the game biomass, forcing people to adopt a mixed economy. On the other hand, the adoption of pastoralism by other groups may have increased competition between livestock and game, finally causing a decrease of the latter, followed by the adoption by the Shaqadud people of a mixed economy. A third possibility is that during the second stage, after a break in the archaeological record, Shaqadud was occupied by a different human group adapted to a mixed economy.

The presence of domestic dog (*Canis lupus* f. familiaris) could not be established clearly, but the relative frequency and size of the canid remains, a few regurgitated fragments, and the presence of other domestic mammals suggest that dogs were present in the cave. Domestic ass (*Equus africanus* f. asinus) is present only in the upper cave unit, probably indicating that this animal was adopted much later.

The status of S1-B/IV is somewhat uncertain, since mixing was present. Domestic animals are lacking in this collection. The bone fragments are less fossilized than those from the older midden units and gazelle is definitely present. S1-B/IV could, therefore, represent a stage intermediate between the older and younger period at Shaqadud, but the sample is very restricted. Cultural materials indicate a mixture of at least two components: Khartoum Neolithic and 3rd millennium B.C. materials.

Site Catchment Analysis

The site catchment analysis is defined as the study of the relationship between technology and those natural resources lying within economic range of individual sites (Vita-Finzi and Higgs 1970). This range is assumed to have a radius of approximately 10 km. for hunter-gatherers and 5 km. for primitive agriculturists. Such an analysis will inform us about the provenance of the animal contents of a site. However, one should consider that, besides man, other taphonomic agents such as carnivores, birds of prey, and rodents may have contributed to the faunal sample.

As to the Shaqadud sites, their site catchments certainly included the adjacent sandstone outcrops, a part of the western Butana plain, and the wadi system, which is separated from the Nile by low undulating hills. The predominance of grazing and grazing and browsing herbivores in the faunal assemblages indicates that both this wadi system, today still lined with *Acacia*, and the plain were the preferred hunting grounds. The absence of fish, typical Nilotic freshwater turtles (e.g., *Trionyx*), crocodile, hippopotamus, and antelopes inhabiting riverine and seasonally flooded alluvial environments, such as kob (*Kobus kob*) and sitatunga (*Tragelaphus spekei*), clearly indicates that the Nile was not included in the site catchment. This fits the assumption of a limited radius for prehistoric hunter-gatherers, since the shortest distance between Shaqadud and the Nile is about 50 km. (cf. Whiteman 1971:113, fig. 48).

Paleoecology and Paleoclimate

As pointed out above, the composition of the fauna underwent considerable changes over the course of time. These changes suggest modifying environmental conditions, probably due to deteriorating climatological circumstances.

In the available collections, only part of the excavated units yielded sufficient archaeozoological data to make a tentative reconstruction of the environment. This certainly is the case for S21, S1-B/III, and S1-A/II; the other cave units eventually can be used for this purpose, as well. The reconstruction is based on the actual ecological requirements of the animals encountered. However, data concerning these requirements should be treated with care. First of all, the animals involved, especially the larger game animals, actually today have restricted distribution and are only surviving in protected areas. Ecological studies on such limited populations may present an inadequate picture of the animals' adaptability to changing conditions. The second problem concerns the terminology used to describe species' habitats. Some authors use their own terms without defining them, as for example "open" savannah which, as far as we understand, may designate anything from a savannah with "dispersed" treestands to an almost treeless savannah with disjunct ground cover.

Another problem is the definition of the types of savannah. For example, Muller (1974:97) distinguished in his classification a moist (1,200 mm.), a dry (500–1,200 mm.), and a thorn bush savannah (200–700 mm.), while Delany and Happold (1979:109) only described a moist (greater than 900 mm.) and a dry savannah (less than 900 mm.). Besides, some authors use the term "Sahel," i.e., the transition zone between Sahara and savannah sensu lato. Rodier (1975) noted for this area 300–750 mm. of rainfall; Maley (1977) placed it between the 100–500 mm. isohyets, while Talbot (1980) used the conclusions of both authors and gave an average annual rainfall of 100–750 mm. for the Sahel zone! In this study, we use the typical Sudanese vegetation units proposed by Harrison and Jackson (1958), as modified by Wickens (1975, 1982).

Most of the animals found at S21, especially the mammals, are actually living today in the southern Sudan, mostly within and south of thorn savannah and scrub sensu Wickens (1975). This belt is characterized by an average rainfall of 280–450 mm. on sandy soils and 400–800 mm. on clay soils. Most of the encountered mammals, however, are only present in the southern part of this belt (Mackenzie 1954; Setzer 1956). The foregoing points to a fairly humid palaeoenvironment around S21. The presence of a cane rat, probably savannah cane rat, today apparently confined to humid savannahs in the Sudan, suggests that we are probably dealing with the wetter thorn savannah and scrub. Therefore, in the 8th millennium B.P., Shaqadud with its sandy soil (Andrew 1948) may have received an annual precipitation of approximately 450–500 mm.

The faunal assemblage of S1-B/III, dating from the 6th millennium B.P., is comparable to that at site S21. The absence, however, of cane rat points to drier climatic conditions, perhaps with an annual rainfall of 400–450 mm. The cave deposits, with an abundance of gazelle (*G. rufifrons*) and giraffe remains, suggest further deterioration of living conditions. Both species still occurred in the northern part of the thorn savannah and scrub in the fifties (Mackenzie 1954). Antelopes such as the common duiker, oribi, greater kudu, and roan antelope were presumably not present in the area during the late 4th millennium B.P. We may assume, therefore, an average precipitation of 350 mm. during that period, provided that the deterioration was not caused by man and his flocks.

The suggested annual precipitation quantities illustrate that, between the 8th and 4th millenium B.P., the environment shifted from a rather humid grass savannah with scattered trees and shrubs toward a dry savannah, the latter being somewhat comparable in fauna to the Sahelian savannah near Fete-Ole, Senegal (cf. Delany and Happold 1979:116).

If we compare our estimates with the mean rainfall at certain stations in the Sudan (cf. Ireland 1948; Wickens 1982), it becomes clear that the humid thorn savannah and scrub of site S21 would correspond to a northerly shift in the present-day vegetation of approximately 300 km. In his hypothetical reconstruction of the Sudanese early Holocene vegetation zones, Wickens (1975, 1982) estimated a shift of some 400 km. for the wet period between 12,000 and 7,000 B.P.

The annual precipitation at Shaqadud in the 6th millennium B.P. (S1-B/III) points to a southward shift of some 250 km. of the vegetation zones, while the estimated annual rainfall during the formation of the cave deposits indicates a continued southward shift of the vegetation zones of approximately 200 km.

Resources, Scheduling, Seasonality, Exploitation Models

Antelopes and giraffes provided the largest part of the animal protein for the Shaqadud people, but porcupines, as well as warthogs, gallinaceous birds, turtles, and monitors were added; in later times, livestock was also sometimes used as a meat resource. The latter, however, was, in our opinion, mainly kept for dairy resources which are known from Asia and Africa as early as in the 4th millennium B.C. (Simoons 1971). Among the reptiles encountered, turtles can be considered the most important supply of meat. The large quantities of *Pila* shells in the S21 deposits suggest that this ampullarid was consumed frequently at that time. We agree with Gautier (1983b) that, although their quantitative importance is difficult to assess, we may not overestimate their significance. Snail eaters generally leave impressive testimonies of their activity behind because the non-edible remains constitute the largest part of the animal (cf. Lubell et al. 1975, 1976). Furthermore, it has to be mentioned that vegetable food generally represents a very important food resource (cf. Lee 1968). Nevertheless, traces of particular food plants are rather scarce at Shaqadud except in the cave (see chapter 9), but Lee noted (1968) that recently abandoned Bushman camp sites also show an absence of vegetable remains, although it has been shown that plant foods comprise over 60% of their actual diet!

It is clear that the bio-environment provided varied resources enabling people to adopt a diffuse economy sensu Cleland (1976). Such strategies only appear in areas with high ecological diversity and are generally characterized by a careful scheduling in time and space to maximize the exploitation of the available resources. For the moment, however, little evidence has been found to document resource scheduling by the Shaqadud people.

Some non-mammalian fauna may point to dry-season activities. *Pila,* as well as some turtles (*Pelusios*), are most easily harvested when their habitats become better accessible to people. The mammalian assemblage, at first sight, does not present evidence for seasonal activities. However, certain antelopes (oribi, greater kudu, gazelle) and giraffe tend to concentrate near waterholes at the end of the dry season. If the annual rain pattern in the period considered was essentially comparable to the present one, snail and turtle collecting, as well as the hunting of the aforementioned artiodactyls, could have taken place from January to March.

As noted by Marks et al. (1985), this one location appears unusual in the Butana and, therefore, may reflect the advantageous spatial co-association among good-quality sandstone for grinding stones, quartz and quartzite for chipped stone tools, a sheltered setting, and, most importantly, a source of predictable surface water. This, however, does not necessarily imply that Shaqadud was permanently occupied in prehistoric times. A first hypothesis sees Shaqadud as a dry-season camp, reoccupied over a long period. For the older deposits (S21, S1-B) *Pila* and, perhaps, turtle gathering might then represent dry-season activities, while game hunting might have been rewarding especially toward the end of the dry season, as already pointed out above. Besides, the presence of intrusives such as *Limicolaria cailliaudi, Zonitarion* cf. *cailliaudi,* anurans, and, perhaps, *Euxerus erythropus* could indicate that the site was abandoned from time to time. Comparable arguments apply for the cave deposits, but *Pila* has virtually disappeared, while turtle becomes much more important (cf. table 10-1). The presence of livestock could provide an additional argument for seasonal occupation. If livestock herding would be practiced all year round at Shaqadud, the grazing pressure on the vegetation may easily have exceeded its capacity for regeneration, resulting in overgrazing. Prehistoric herdsmen probably avoided such ecological disturbance by dispersing during the wet season and returning to places where the presence of water is predictable during the dry season; the latter is necessary to keep livestock in good health. Such an exploitation model suggests the involvement of a Butana-based group rather than a Nilotic group, especially since the latter, perhaps, were moving away from the Nile during the wet season (cf. Gautier 1983a).

A second model interpretes Shaqadud as a wet-season camp in which much of the *Pila* and turtle gathering might have taken place at the beginning of the rainy season. Rainfall, moreover, certainly resulted in a rich grass cover and a lot of flowering plants and trees, being attractive to hunter-gatherers, as well as pastoralists. If this hypothesis is accepted, either Nilotic or Butana-based groups could be involved.

A third alternative sees Shaqadud as a site that regularly was re-used for prolonged periods unrelated to the seasonal cycle. The large size of the sites, the thickness of the deposits, and the considerable number of potsherds and lithics could be adduced to defend this view. Moreover, as noted by Gautier (1983a), site permanence does not exclude resource scheduling in the site catchment itself or by smaller groups abandoning the settlement at certain periods for activities at appreciable distance from it. However, things may have been more complicated and periods of occupation may have changed in the course of time, with, for example, wet-season occupation or site permanence during the first stage, and dry-season occupation during the second one. More detailed knowledge of the ecological requirements, habits, and life cycles of the various potential biological resources as well as careful research on other prehistoric sites along the Nile and in the Butana plain are needed to establish which of the proposed exploitation models or combinations is to be preferred.

Comparison with Prehistoric Faunas from the Central Sudanese Nile Valley

Despite the fact that much more work has been done on central Sudanese Nilotic sites, compared to the hinterlands, it still remains impossible to draw a comprehensive picture of the history, sensu lato, of the central Nile region. The comparison between the archaeofaunas from the central Sudanese Nile Valley and Jebel Shaqadud consequently is not too enlightening, but some tendencies can be noted.

Up to now, some ten faunal assemblages are known from the mentioned area: Khartoum Hospital (Bate 1949; Peters 1986), Saggai (Gautier 1983a), Umm Marrahi (Gautier, in preparation), Shaheinab (Bate 1953; Tigani el Mahi 1982; Peters 1986), Geili (Gautier 1983a), Kadero (Sobocinski 1977; Gautier 1984a), Nofalab, Umm Direiwa, and Zakiab (Tigani El Mahi 1982), and Kadada (Gautier 1986).

These assemblages indicate that, compared to Shaqadud, the Nile environment provided more varied resources because of its higher ecological diversity. Animals of the river and its alluvial plain, including bivalves (*Mutela, Etheria*), various fish (*Clarias, Synodontis, Lates, Polypterus*, etc.), reptiles (*Trionyx, Cyclanorbis, Crocodylus*), birds (*Plectropterus gambensis*—spurr-winged winged goose), and mammals (*Tragelaphus spekei*—sitatunga; *Kobus kob*—kob; *Kobus ellipsiprymnus*—waterbuck) were available to people along the Nile.

The second striking difference is the quantitative importance of domestic animals in both areas as early as the 6th millennium B.P. According to several authors, some 50 to 90% of the mammalian fauna from the central Sudanese Neolithic sites would pertain to livestock (Tigani el Mahi 1982; Gautier 1984a, 1986). As already pointed out, livestock remains are restricted in the Shaqadud sequence and make their appearance much later than along the Nile. If the people occupying Shaqadud were not coming from the Nile, the foregoing implies that pastoralism was adopted later and to a lesser degree than along the Nile. If they were coming from the Nile, we can assume, as already argued, that occupation was in the wet season and that the pastoralists relied primarily if not almost completely on hunting and gathering.

SUMMARY AND CONCLUSIONS

The present study deals with the faunal remains obtained from three occupations at Jebel Shaqadud (central Sudan). This collection consists primarily of mammalian bone fragments. Most of these remains can be considered kitchen offal and were obtained from the Shaqadud area. The site catchment included neither the Nile nor its alluvial plain. Two faunal stages can be recognized, i.e., an older one with typical hunting and gathering practices (including both the Khartoum Mesolithic and Neolithic occupations), and a younger one dated to the 4th millennium B.P., with a mixed economy combining hunting and gathering with pastoralism (cattle, small livestock). The faunal sequence furthermore suggests a shift of the environment from a rather humid (450–500 mm. precipitation) to a dry savannah (350 mm.) between approximately ±7,400 and about ±3,600 B.P. Scheduling in time and space might have taken place, but further investigations on other prehistoric sites along the Nile and in the Butana plain are needed to establish which of the several proposed exploitation models, or combinations thereof, is to be preferred. The Nile environment in central Sudan provided at that time decidedly more varied resources compared to Shaqadud. Despite this, livestock acquired a much greater importance to Nilotic peoples in the 6th to 4th millennium B.P. than to those in the Butana.

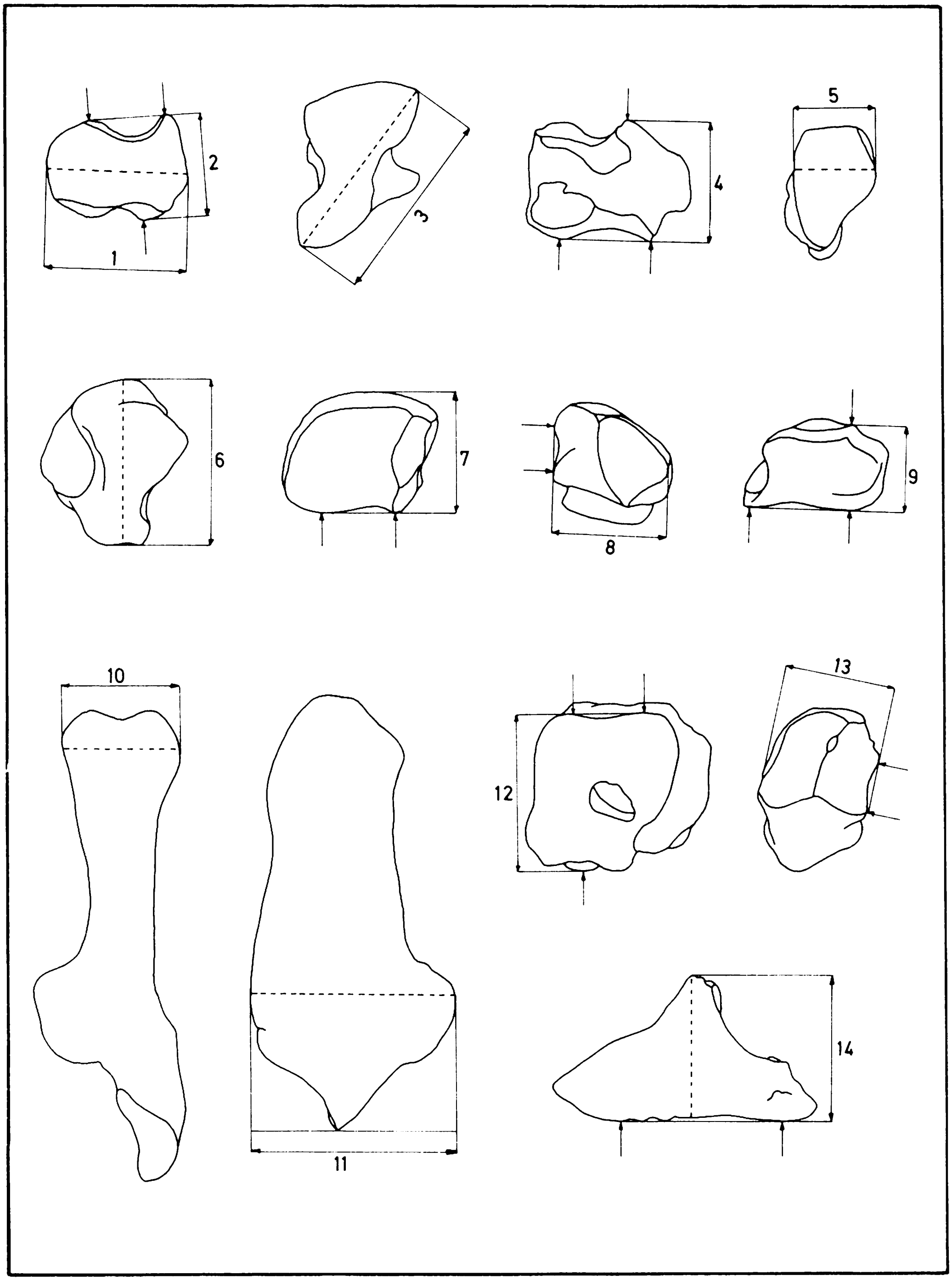

Figure 10-5. Key: 1, Os carpi radiale, medial view, greatest depth (GD); 2, Os carpi radiale, medial view, greatest height (GH); 3, Os carpi intermedium, proximal view, greatest depth (GD); 4, Os carpi intermedium, lateral view, greatest height (GH); 5, Os carpi ulnare, proximal view, (greatest) breadth of the proximal end (Bp); 6, Os carpi ulnare, lateral view, greatest length (GL); 7, Os carpal II+III, proximal view, greatest depth (GD); 8, Os carpale IV, proximal view, (greatest) breadth of the proximal end (Bp); 9, Os carpale IV, lateral view, greatest height (GH); 10, Calcaneus, plantar view, (greatest) breadth of the proximal end (Bp); 11, Calcaneus, lateral view, (greatest) breadth of the distal end (Bd); 12, Os centroquartale, proximal view, greatest depth (GD); 13, Phalanx distalis, proximal view (greatest) breadth of the *Facies articularis proximalis* (= proximal articular surface) (BFp); 14, Phalanx distalis, abaxial view, (greatest) height at the *Processus entensorius* (extensor process) (HP).