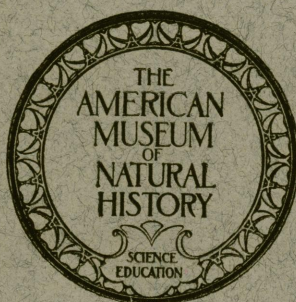


RESULTS OF THE VERNAY-LANG KALAHARI EXPEDITION. LARGER MAMMALS OF BECHUANALAND PROTECTORATE

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BULLETIN
OF
THE AMERICAN MUSEUM OF NATURAL HISTORY

VOL. LXXIX, ART. V, pp. 367-390

New York

Issued July 7, 1942

**Article V.—SCIENTIFIC RESULTS OF THE VERNAY-LANG
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BECHUANALAND PROTECTORATE**

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PLATES XXXVI TO XLIII; 1 MAP, TABLES I TO IX

Twenty papers have appeared describing the splendid collections of this expedition, which was led and financed by Mr. Arthur S. Vernay in 1930. Detailed accounts of the expedition are given by Vernay (1931) and Roberts (1935), and an annotated list of the smaller mammals, several of which were described as new, appeared in the latter account.

The Vernay Expedition made an extremely important biological exploration of the Kalahari and Ngamiland, collecting large series of the various invertebrate animals in addition to fishes, reptiles, birds and mammals. Anthropological measurements and photographs of great ethnological importance were secured and studies made of the plant life and the geology. Such an inclusive and extensive expedition had not been undertaken in these regions and only rarely anywhere. The elaborate equipment permitted stops for collecting that could not have been made otherwise, and the trucks transported large specimens that would have been left or only partly saved. For instance, at one locality ten giraffes were shot, and the skins, with complete skeletons of the adults, were preserved. (It was necessary to secure such series of large mammals because the collection was to be divided between four museums, and it was important to have enough individuals to determine variation within a population.)

Official assistance was an important factor in the success of the expedition. The Earl of Athlone, then Governor General of South Africa; Captain B. H. E. Clifford, then Imperial Secretary and British Representative of the South African High Commission and leader of the first British expedition across the Kalahari; and Lieutenant Colonel C. F. Rey, then Resident High Commissioner of Bechuanaland

Protectorate, were most helpful in connection with the necessary permits and in extending privileges to the expedition.

Mr. Vernay, in addition to organizing and leading the expedition, collected most of the large game. He was accompanied by an aide, Mr. Joseph Aebischer. Mr. Herbert Lang assisted Mr. Vernay in organizing the expedition, and he arranged with the Transvaal Museum, Pretoria, for four members of the scientific staff of this institution, Messrs. Austin Roberts, V. FitzSimons, G. van Son and F. O. Noomé, to form part of the expedition. (In consideration of this the Transvaal Museum was to receive a share of the collections.) Dr. A. W. Rogers, Director of the Union Geological Survey of South Africa, was invited by Mr. Vernay to accompany him, and he was able to make an important survey of the geology of the Kalahari. Captain Beeching of the Bechuanaland Police, with three native troopers, formed a valuable addition to the party. Mr. Dowthwaite, who had been over the route the expedition was to follow, was secured to prepare and have charge of the equipment and trucks; under his direction were four driver mechanics, two of whom were familiar with the country to be traversed. The Transvaal Museum lent the services of five experienced native preparators; nine other natives were hired and trained before starting. The expedition thus consisted of fourteen white members of the staff and seventeen native assistants.

Collecting was begun in the Kalahari at Gaberones, near the Transvaal border. The route followed from there to Ghanzi ran almost northwest, and camps were made at intervals of from fifteen to forty miles to secure collections. At Ghanzi, trucks were sent to Gobabis, South West Africa, for supplies sent there by rail, while

called, a desert but is rather a sandy, arid, grassy plain. Numerous acacia trees are found in many places, and the tall grass, chiefly of "bunch" habit, is abundant, at least in normal years. Most of the camps were made at "pans," ponds of water after rains although dry and bare during dry spells. Vegetation was somewhat more abundant around these pans. The soil of the Kalahari is almost exclusively sand, in places more than a hundred feet in thickness, but no active dunes were encountered nor true desert conditions. No rivers are found in the Kalahari, but several old, almost obliterated channels indicate former water courses of considerable size. What rain falls now is absorbed by the sand and held in a zone of moisture several feet below the surface, or collects in the pans.

The Kalahari is subject to periods of severe drought. Game is scarce and the native population sparse on this account. These periodic droughts may be one reason that few strictly endemic species have developed in this area and may explain the lack of differentiation in the larger mammals. These latter probably migrate to less barren places, and the smaller forms may be exterminated during prolonged droughts. Afterward the animals might re-invade the Kalahari from adjacent areas. This is at least a possibility and has been suggested by authors.

The mammalian fauna of the Kalahari, like the birds, is mostly a selection of arenicolous species of the Southwestern Arid District (compare Chapin, 1932), the smaller mammals generally represented by endemic races of pale coloration.

Ngamiland, the northern part of the Bechuanaland Protectorate, is not sharply separable from the Kalahari, physiographically or faunally, but the soil contains stones and silt, there are kopjes (hills), and much of the northwestern section is permanently or periodically inundated by the waters of the Okovango (Cubango) River. Baobab and other large trees were encountered near Mabeleapudi and from there on. Ngami Flats and Mababe Flats were not flooded in 1930, but the moisture

from previous years or perhaps from underground seepage made good pasturage for game and the herds of native stock. The rivers connecting with these flats, whether dry or carrying water, were lined with green trees. Forests of mopane extend back from the rivers for some distance. Dense swamps are present in the delta of the Okovango, but these could not be investigated by this expedition. Makarikari Lake or Depression, in the extreme southeastern part of Ngamiland, is much like the central Kalahari but with more luxuriant vegetation and much more abundant game.

The fauna of Ngamiland shows a mixture of affinities. Many mammals are the same as in the Kalahari and the southwestern fauna, but others, often more dependent on water, are either the same as Angolan and Northern Rhodesian forms, or very similar, and belong to the Rhodesian Highland fauna (Chapin, 1932). A few mammals are represented in Ngamiland by endemic races, where the species have more extensive ranges.

Only part of the collection has been examined by me. The material was divided between the Field, the American, the Transvaal, and the British Museums of Natural History, most of the larger mammals going to the first two institutions. The specimens in the Field Museum have been examined and are included in this account.

Acknowledgments are due to Dr. H. E. Anthony, Curator of Mammals, The American Museum of Natural History, for helpful advice and criticism; to Dr. Karl P. Schmidt, Dr. Wilfred H. Osgood and Mr. Colin C. Sanborn of the Field Museum of Natural History, Chicago, for the friendly assistance rendered while studying the part of the collection in their charge, and to Mr. T. Donald Carter of the American Museum for assistance with much of the preliminary identification.

Mr. A. S. Vernay, who financed the expedition, also generously supplied the funds for my study of the material in the Field Museum of Natural History.

LOCALITIES OF THE VERNAY-LANG KALAHARI EXPEDITION, WITH LISTS OF LARGE MAMMALS TAKEN

• THE KALAHARI:

Gaberones (24°40' S., 25°55' E.), March 15 to March 20.

Steenbok, 4.

Kuke Pan (23°20' S., 24°25' E.), March 21 to March 25.

Warthog, 1; blue wildebeest, 3; red hartebeest, 7; duikerbok, 2; steenbok, 1; impala, 1; gemsbok, 1.

Matapa Pan (23°10' S., 24°35' E.), March 26 to March 29.

Lion, 1; wildebeest, 1; hartebeest, 3; steenbok, 3; springbok, 5; impala, 1 (skull only); gemsbok, 3.

Gomodimo Pan (22°30' S., 23°45' E.), April 4.

Lion, 1.

Kaotwe Pan (22°30' S., 23°15' E.), April 7 to April 10.

Wildebeest, 2; hartebeest, 3; duikerbok, 2; steenbok, 3; gemsbok, 2; koodoo, 1.

Damara Pan (22°5' S., 22°30' E.), April 18 to April 21.

Brown hyaena, 4; wildebeest, 2; hartebeest, 1 (skull only); steenbok, 1; gemsbok, 7; eland, 3.

Van Zyl's Cutting (21°45' S., 22°10' E.), April 4.

Steenbok, 4.

[Gobabis, South West Africa (22°30' S., 19° E.), May 1.]

Springbok, 1.

Sunnyside (21°35' S., 22° E.)

Gemsbok Pan (21°40' S., 21°35' E.), May 3.

Steenbok, 1.

Ghanzi (Khanzi) (21°30' S., 21°45' E.), May 4 or 5.

Leopard, 1 (skull only).

NGAMILAND:

Mabeleapudi (20°58' S., 22°28' E.).

Tololamoro (20°25' S., 22°40' E.), May 15.

Springbok, 1.

Maun (20° S., 23°30' E.), June 18.

Baboon, 3; duikerbok, 1.

Shorobe (19°45' S., 23°45' E.).

Aardvark, 1.

Kwaai (19°10' S., 23°40' E.), May 6 to May 28.

Spotted hyaena, 1; lion, 5; warthog, 7; giraffe, 1; tsessebe, 12; reedbuck, 3; lechwe, 10; sable antelope, 2; impala, 17; buffalo, 1; zebra, 5.

Kudumane or Mochaba River, near Kwaai, May 16.

Warthog, 1.

Mababe Flats (about 19° S., 24°10' E.), May 28 to June 29.

Spotted hyaena, 3; serval, 1; leopard, 1; lion, 9; warthog, 3; giraffe, 10; wildebeest, 10; tsessebe, 11; steenbok, 6; reedbuck, 1; lechwe, 2; roan antelope, 7; sable antelope, 3; gemsbok, 1; koodoo, 10; eland, 3; impala, 10; zebra, 9.

Shaleshanto (19°10' S., 24° E.), July 14.

Eland, 1.

Tsotsoroga Pan (18°40' S., 24°25' E.), June 17 to July 20.

Spotted hyaena, 1; serval, 2; lion, 6; warthog, 3; giraffe, 6; wildebeest, 1; tsessebe, 3; steenbok, 1; roan antelope, 2; sable antelope, 2; koodoo, 3; eland, 7; buffalo, 2.

Kavimba (18°5' S., 24°35' E.).

Lion, 1.

Kabulabula (17°45' S., 24°55' E.), July 17 to July 20.

Baboon, 17; civet, 1; leopard, 1; warthog, 1; duikerbok, 3; puku, 4; sable antelope, 2; bushbuck, 2; impala, 2.

Kasane (17°45' S., 25°10' E.), June 5 to July 20.

Baboon, 1; hunting dog, 2; warthog, 1; eland, 1.

Legge's Island, Chobe River, near Kasane, July 27.

Puku, 1.

Chobe River, near Kazungula, July 29.

Duikerbok, 1.

N'Kate and vicinity (20° S., 26°15' E.), August 6 to August 21.

Brown hyaena, 2; lion, 1; wildebeest, 5; hartebeest, 22; steenbok, 5; springbok, 34; gemsbok, 31.

Near mouth of Nata River, Makarikari Lake Flats (20°20' S., 26°10' E.), August 26 to August 27.

Wildebeest, 1; duikerbok, 1; springbok, 7.

Tsessebe (20°40' S., 27°30' E.), December 11, 1929.

Steenbok, 1.

NORTHERN RHODESIA:

Kazungula (17°45' S., 25°15' E.), July 25.

Puku, 2; sable, 1; bushbuck, 1.

The large mammals of Africa have been killed in great numbers by white men for more than a hundred years, but, while the species are for the most part adequately characterized, few of the geographical races have been substantially established. Large size makes transportation, storage, handling and comparing of specimens difficult and expensive. All the scientific collections combined often do not have adequate numbers of these animals to distinguish individual variation from geographic.

Large mammals may not show close ties with locality. Individuals and herds frequently range widely, and barriers, insurmountable to smaller forms, may not prove obstructions to larger species. However, it seems probable that in many cases the significant geographic-climatic areas can be correlated with characters displayed by mammals and it may be best to accept the more plausible forms until they are confirmed or invalidated by adequate material.

I have used the following terms to indicate age groups:

Juvenile, with some or all of the deciduous dentition.

Adult, with complete permanent dentition, M¹ little worn.

Mature, with all permanent teeth showing wear, M¹ with the pattern more or less obliterated in most mammals, most or all of the cranial sutures fused.

Senile, with all teeth showing severe wear, usually without pattern.

Colors are those of Ridgway (1912), when in capitals.

Measurements are in millimeters. Under 150 mm. these were taken with dial caliper reading in tenths of a millimeter; over 150 mm. measurements were taken by means of outside calipers and steel tape.

The synonymy and references to original descriptions of the mammals discussed are given by Allen (1939, Checklist of African Mammals), and it was not thought necessary to repeat them here.

ORDER PRIMATES

Cercopithecidae

Papio comatus ngamiensis Roberts

Baboon

Thirteen specimens examined: Maun, 1 (AMNH); Kabulabula, 5 (AMNH), 6 (FM); Kasane, 1 (FM).

Roberts (1932, p. 18) named two races of baboon from Ngamiland from four adult specimens. Our specimen from Maun, topotype of *P. p. ngamiensis* Roberts, agrees closely with the series from Kabulabula, topotypes of *P. p. chobiensis* Roberts, and I consider the latter name a synonym. Cranially, I am unable to distinguish Ngamiland baboons from the typical chacma of South Africa. While not so yellowish as Roberts indicated, our specimens are decidedly more yellowish than the chacma, and the feet are gray rather than black. The amount of black and blackish on the feet varies, increasing

with age, and there is more on the forefeet than on the hind feet.

MEASUREMENTS.—See Table I.

There are lesser differences between the currently accepted species of the genus *Papio*, in the restricted sense, than between several forms usually treated as races of a single species in other genera of primates. Forms like *Papio comatus griseipes*, *P. c. ngamiensis*, *P. c. rhodesiae* and *P. jubilaeus* tend to bridge the color differences between *Papio c. comatus* and *P. cynocephalus*. Both of these latter baboons, however, maintain considerable uniformity over large areas, and they may be distinguished cranially in all specimens known to me.

In Northern Rhodesia, across the Zambezi from Kabulabula, a yellowish, small-toothed, short-faced baboon occurs, probably *Papio kindae*. It may possibly intergrade to the east with *P. cynocephalus*, with which it agrees in color, but it is quite distinct from the Ngamiland baboon.

ORDER CARNIVORA

Canidae

Lycaon pictus Temminck

Hunting Dog

Two specimens in the Field Museum from Kasane.

The splendid series of hunting dogs in the Berlin Museum, which formed the basis for Matschie's (1915) twenty-six species, was examined by me in 1937, while studying under a grant of the Carnegie Corporation of New York. Variation is extreme in *Lycaon* in pattern and coloration, but it is not correlated with geography. Furthermore, no good cranial characters were found to divide the hunting dogs.

The two examples from Ngamiland are predominantly pale ochraceous in color, with extensive Fuscous and white blotches. The markings are nearly symmetrical. There is a blackish facial blaze; a blackish nuchal stripe from occiput to shoulder; the tail is tricolor, ochraceous at the base, then blackish, the tip white, the colors nearly equal. In the Berlin Museum collection one specimen from South West Africa, the type of *L. mitchelli* from Togo, and the type of *L. styxi* from Mpwapa, Tanganyika, are similar to these in coloration, although not in pattern. The type of *L. gobabis* from Gobabis, South West Africa, and the type of *L. windhorni* from the Rustenburg, Transvaal, are paler yellowish, with very little blackish and only a few flecks of white. On the other hand, the third specimen from South West Africa and the type of *L. fuchsi* from near Benguela, Angola, are dark, predominantly Fuscous with ochraceous spottings and with little white, except on the tail.

MEASUREMENTS.—See Table II.

Hyaenidae

Hyaena brunnea Thunberg

Brown Hyaena

Five specimens examined: N'Kate, 1 (AMNH), 1 (FM); Damara Pan, 2 (AMNH), 1 (FM).

Two specimens from the Kalihari (Da-

mara Pan) are much paler on the head, neck and shoulders than the third and one from N'Kate, the neck except in the mid-dorsal region being almost white. There seem to be more paler gray hairs mixed with the blackish brown of the body. The other two specimens are about two-thirds brown (FM 34586, ♀, near Natal Brown; FM 34585, ♀, near Fuscous or Fuscous Black). The amount of blackish on the limbs varies somewhat, one specimen having only a row of dark spots, others have heavier markings. One N'Kate specimen is like the latter in this respect. A specimen in the Museum from the Transvaal is duller in color with more grayish; legs and feet pale; forelegs with transverse stripes; hind legs with stripes blurred into a dark band, which tapers off near the ankle. The variation is such as to render the validity of *H. b. melampus* Pocock doubtful.

The mammae in two specimens are 0-2 = 4.

MEASUREMENTS.—See Table II for skull measurements. Male (female in parentheses): head and body, 1,103 (1,010); tail, 280 (280); hind foot, 210 (210); ear, 155 (152).

Crocota crocuta Erxleben

Spotted Hyaena

Four specimens examined: Mababe Flats, 2 (AMNH); Tsotsoroga Pan, 1 (FM); Kwaai, 1 (FM).

In one of the hyaenas from Mababe Flats the spots on the body are dark, almost black, and the ground color near Tilleul Buff; the hind feet are blackish; the underparts are near Clove Brown overlaid by the long white guard hairs. In the other the body spots are much paler, near Snuff or Sayal Brown; on the thighs the spots are nearly black; the ground color is near dilute Cinnamon-Buff; the feet are only slightly darker than the sides; the belly has only a little dilute Fuscous underlay.

Matthews (1939) shows that the cranial characters and the coloration vary so greatly in a single locality that all the

supposed races of spotted hyaena would be included in his large series. In view of these findings the recognition of subspecies in this mammal seems unwarranted.

MEASUREMENTS.—See Table II.

Felidae

Panthera pardus shortridgei Pocock

Leopard

Three specimens in the Field Museum: Mababe Flats, 1; Kabulabula, 1; Ghanzi, 1 (skull only).

The ground color of both skins is near Cinnamon-Buffer, gradually passing into nearly white on the belly. The centers of the spots in the middorsal area are about the same as the ground color, but they retain their Cinnamon-Buffer color well down on the sides. The area between the eyes is unspotted. The face is paler, grayer than Pinkish Buffer. This is somewhat different from the coloration of *shortridgei* as given in the original description ("pale greyish or pallidly olivaceous buff with no bright yellowish or orange tint," Pocock, 1932).

The pelage is short and smooth; this also is unlike the original description of *shortridgei*. The specimens are referred to this race on geographic grounds and with some uncertainty. They agree quite

closely with Angola specimens, from the other side of the type locality, and may be more normally colored and furred than the type was.

MEASUREMENTS.—See Table III.

Panthera leo bleyenberghi Lönnberg

Lion

Nineteen specimens examined (5 juveniles, 5 skulls only): Matapa Pan, 1 (AMNH); Gomodimo Pan, 1 (FM); Kwaai, 5 (AMNH); Mababe Flats, 1 (AMNH), 7 (FM); Tsotsoroga Pan, 1 (AMNH); N'Kate, 1 (AMNH), 1 (FM).

The large amount of variation, both cranial and in external characters and coloration, put in question many proposed races of the lion; they have usually been based on insignificant differences of size, and far too few specimens have been used. Cranially the specimens listed above are not significantly different from lions from East Africa, Angola and the Transvaal in our collections.

In coloration some individuals are Clay Color or Cinnamon-Buffer mixed with blackish; others (most of the males) are near Tilleul Buffer and blackish, the general effect near Pale Olive-Buffer.

MEASUREMENTS.—See Table III for skull measurements. FM 35743, ♀ adult: head and body, 1,510; tail, 890; hind foot, 330; ear, 105.

ORDER TUBULIDENTATA

Orycteropodidae

Orycteropus afer albicaudus Rothschild

Aardvark or Antbear

One specimen in the Field Museum, from Shorobe, female adult.

The underparts, perineal region, end of muzzle and distal half of the tail are whitish. The skull resembles that of *O. e. faradjius* figured by Hatt (1934, Fig. 2b), but the zygoma and the basiscranial axis are more nearly in line with the alveolar

axis, being less deflected dorsally. The lower jaw, unfortunately, is missing.

MEASUREMENTS.—Skull: greatest length, 218.5; basal length, 194.5; palatal length, 136.5; length of nasals at suture, 140.3; breadth nasals, 46.2; zygomatic breadth, 84.6; interorbital breadth, 53.9; breadth across postorbital processes, 60.1; temporal constriction, 44.6; mastoid breadth, 64.9; depth of premaxilla at suture, 24.2; depth rostrum at nasofrontal suture, 36.1; depth zygomatic (jugal), 21.5; facial part of lacrimal, length \times depth, 26.2 \times 19.2; M¹, length \times breadth, 11.0 \times 7.2.

ORDER ARTIODACTYLA

Suidae

Phacochoerus aethiopicus Pallas

Warthog

Twelve specimens examined: Kuke Pan, 1 (FM); Kwaai, 5 (AMNH), 1 (FM); Mababe Flats, 2 (AMNH); Tsotsoroga Pan, 2 (FM); Kabulabula, 1 (FM).

St. Leger (1932) refers specimens of this collection from Mababe Flats to *P. a. shortridgei*, described in the same paper. The characters given for this and most of the various races of warthog are included in the series from East Africa and north-eastern Belgian Congo in our collections. A specimen from Zululand and one from the Transvaal compare closely with the Ngamiland warthogs. All of the adults examined have the medial upper incisors.

CRANIAL MEASUREMENTS.—See Table IV.

regions are Cinnamon or paler. Both have the entire front of the face near Fuscous-Black. The three skulls have well-developed anterior horns, like that figured by Lydekker and Blaine (1914, III, p. 247, Fig. 43). This is also unlike the description of *angolensis*. Shortridge (1934, II, p. 268) says that some individuals in the Kaokoveld have darker spots than others.

The young animals in this collection are much paler than adults of both sexes. One has the dorsal blotches near Orange-Cinnamon, the interspaces near Tilleul Buff, the latter becoming whitish on the sides and belly. Another calf has the dorsal blotches near Tawny-Olive, the interspaces whitish mixed with black.

CRANIAL MEASUREMENTS.—See Table IV.

Giraffidae

Giraffa camelopardalis angolensis

Lydekker

Giraffe

Twelve specimens examined: Kwaai, 1 (FM); Mababe Flats and Tsotsoroga Pan, 4 (AMNH), 7 (FM). Of these 3 are adult males (1 skull only) and 5 adult females.

The females agree fairly well with the description of *G. c. angolensis*, the interspaces being pale, near Pale Olive-Buff, and between one-half and one inch wide. The almost quadrangular spots on the upperparts are dark, near Fuscous or Fuscous-Black, mixed with pale buffy of the bases of the hairs; the underparts spotted; the spots under the eye indistinct. The skull of the adult female resembles that of *G. c. capensis* figured by de Winton (1897, p. 277).

The males resemble the females until adult. The two skins of young adults show the blotches almost black in color, mixed with Warm Sepia, the interspaces mixed Cartridge Buff and blackish. The legs below the hocks in one specimen are black, except for a small pale stripe and a pale area, four inches deep, above the hoof. In the other, the lower legs and metapodial

Bovidae

The arrangement of the Bovidae follows Pilgrim (1939).

Raphicerus campestris campestris

Thunberg

Steenbok

Eighteen specimens examined: Gaberones, 2 (AMNH); Matapa Pan, 3 (AMNH), 1 (FM); Damara Pan, 1 (FM); Gemsbok Pan, 1 (FM); Van Zyl's Cutting, 3 (FM); Mababe Flats, 1 (AMNH), 1 (FM); Tsotsoroga Pan, 1 (AMNH); N'Kate, 1 (FM); Tsessebe, 1 (AMNH); near Bulawayo (S. Rhodesia), 1 (AMNH); without data, 1 (AMNH).

Most specimens are near lightly frosted Vinaceous-Tawny in general color, but some have a more orange hue. Only two have a dark coronal marking. The underparts are whitish from between the forelimbs to the perineum in most specimens, but three have the color of the upperparts gradually passing into that of the underparts, and these are pure white only in the inguinal region. In specimens with the underparts white, the lower jaw region and part of the throat is also white; in the others these are washed with ochraceous. Kalahari and Ngamiland examples do not show any significant differences, the extremes in coloration occurring in the same or adjacent localities. The specimen from

Bulawayo does not differ in color from others of the collection. All are paler than the Angolan steenboks in the American Museum and appear to be less richly colored than the typical form, judging from the description in Lydekker and Blaine (1914, II, p. 149). The only specimens available for comparison from South Africa is a frosted Russet in coloration and may represent *R. c. natalensis* Rothschild.

The horns of adult males are small, 70.5 to 88.5 mm. in length (average, 79 mm.). External measurements of two males and one female are: head and body, 910, 875, 860, respectively; tail, 68, 76, 60; hind foot, 276, 275, 274; ear, 119, 121, 116.

CRANIAL MEASUREMENTS.—See Table V.

Antidorcas marsupialis marsupialis

Zimmermann

Springbok

Thirty-two specimens: Mataba Pan, 2 (AMNH), 2 (FM); Tololamoro, 1 (AMNH); N'Kate, 6 (AMNH), 11 (FM); Makarikari Lake Flats, 2 (AMNH), 3 (FM); Gobabis (South West Africa), 1 (AMNH). Five specimens (AMNH), near Kroonstad, Orange Free State, collected by the expedition, and eight from this locality collected by Herbert Lang, Vernay Angola Expedition, were used for comparison.

Kalahari and Ngamiland springbok are slightly paler, general color near Pinkish Buff, than those from the Orange Free State, representing "*centralis*." In both series, the frontal area is about the color of the back of the neck; the extent of this area is variable, but in none is it bordered with darker brown as described in *A. m. angolensis* Blaine; it passes gradually into the white of the face. The chestnut marking through the eye and reaching almost to the upper lip varies in width from that of a pencil to about an inch; it is paler in some specimens than Verona Brown, although usually near Chestnut-Brown. The lateral band varies similarly in color, and the darker bands are more extensive in some specimens than in others. In some the underparts are pure white, while in others there is an overlay of Maize Yellow or even Sulphur Color.

About one-third of the specimens ex-

amined have three upper premolars; one had three on one side, two on the other. The size of the first upper premolar varies from minute (1.5×2.3) to well developed (7.5×5.5). In one specimen the last upper premolar was greatly reduced and excluded from the grinding surface. The lower premolars are constantly two. In ten males the horns average 320 mm. in length (taken on the front curve) and 208 in greatest spread. The largest horns collected on this expedition were 356 mm. long (Dollman and Burlace, 1935, p. 193). The record horns from the Kalahari in this work are 483 mm. (19 inches). Horns of females are slender but may be nearly as long as those of males. External measurements of a series from N'Kate: Males: head and body, 1,200 to 1,250 mm.; tail, 220 to 325 mm.; hind foot, 403 to 432 mm.; ear, 158 to 173 mm.; height at shoulder, 780 to 820 mm. Females: head and body, 1,210 to 1,270 mm.; tail, 232 to 290 mm.; hind foot, 390 to 419 mm.; ear, 154 to 185 mm.; height at shoulder, 770 to 795 mm.

CRANIAL MEASUREMENTS.—See Table V.

Aepyceros melampus melampus

Lichtenstein

Impala or Pala

Twenty specimens examined: Matapa Pan, 1 (AMNH); Kwaai, 6 (AMNH), 7 (FM); Mababe Flats, 3 (AMNH), 3 (FM).

The dorsal coloration in these specimens is near Mikado Brown; the lower sides and underparts are slightly darker than Pinkish Buff. The distal two inches of the ear is black (this may be less extensive in some individuals). The coronal marking is dark brown or blackish. There is a white spot above and in front of the eye; the groin, narrow perineal band, chin and small throat patch, white. Seven specimens have a dark, dull and indistinct blaze on the muzzle, agreeing in this with several Angolan specimens. Two have a small blackish marking in front of the eye, and five have a small blackish stripe at the posterodorsal angle of the eye. The general coloration is not appreciably different from that of specimens from southwestern Angola, *A. petersi* Bocage, and the treatment of that

form as a race of *A. melampus* seems fully justified on the basis of the Ngamiland series. The one Kalahari impala is not significantly different from the Ngamiland specimens.

The horns of adult males in the collection vary from 520 to 572 mm. in length (average 534 mm.) and from 340 to 412 in spread (average 361). The longest horn from Bechuanaland reported by Dollman and Burlace (1935, p. 145) is 628.5 mm.

CRANIAL MEASUREMENTS.—See Table V.

Alcelaphus caama G. Cuvier

Cape Hartebeest

Twenty-three specimens examined: Kuke Pan, 2 (AMNH); 1 (FM); Matapa Pan, 1 (AMNH); Kaotwe, 2 (AMNH), 1 (FM); N'Kate, 7 (AMNH), 9 (FM).

The series collected by the expedition shows sufficient variation in coloration, not correlated with geography, to put in question the several races named and recognized at present. The skins have the appearance of watered silk and cannot be matched with any of Ridgway's colors. Some individuals are near Vinaceous-Brown on the back; others are much more buffy and nearer Testaceous. The facial blaze may be blackish Warm Sepia or blackish Mars Brown, and it may continue to the blackish area between the ears or end in front of the eyes. In some the pale rump patch is Pale Pinkish Buff to white; in others it is appreciably darker. The black leg-markings vary in extent and intensity and may be obsolete on the forelegs, except at the hocks.

The horns vary sufficiently to include the characters of Monard's *A. c. evalensis* and the typical form in the same series. The longest horns in the collection, a skull picked up at Kaotwe Pan, are 575 mm. long (measured on curve) and 348 mm. in spread. The smallest horns of an adult male measured 405 mm. in length, 285 mm. in spread. A female skull had horns 463 mm. long, 313 mm. in spread. Dollman and Burlace (1935, p. 56) list horns from Ngamiland 654.5 mm. long (25 $\frac{3}{4}$ inches).

CRANIAL MEASUREMENTS.—See Table VI.

Damaliscus lunatus Burchell

Sassaby or Tsessebe

Nineteen specimens examined: Kwaai, 5 (AMNH), 4 (FM); Mababe Flats, 3 (AMNH), 5 (FM); Tsotsoroga Pan, 2 (FM).

These specimens agree in general with the description of Selater and Thomas (1894-1900, I, p. 86). The general coloration is "watered" Cameo Brown. The facial blaze, from muffle to between ears, is blackish mixed with a few white hairs. The blackish shoulder markings begin near the hocks, gradually fading out on the shoulder and sides. The sides have a wash of blackish. There is a blackish marking on the hind limb from the hock, gradually fading out about the level of the knee. In several specimens the facial blaze is interrupted. In most of the individuals in the American Museum and in five in the Field Museum, there is a blackish stripe down the front of the cannon bone to the hoof on the forefeet. This varies from well marked to barely discernible; it is not correlated with geography in our collections.

The horns in adult males vary from 337 to 412.5 mm. in length and from 354 to 410 mm. in spread. The largest listed by Dollman and Burlace (1935, p. 70) from Ngamiland is 420 mm. long (16 $\frac{1}{2}$ inches). In females the horns are from 322 to 364 mm. long and spread from 345 to 362 mm.

CRANIAL MEASUREMENTS.—See Table VI.

Connochaetes taurinus taurinus Burchell

Blue Wildebeest or Brindled Gnu

Seventeen specimens examined: Kuke Pan, 2 (AMNH); Kaotwe Pan, 1 (FM); Damara Pan, 1 (FM); Mababe Flats, 4 (AMNH), 3 (FM); N'Kate, 1 (AMNH), 4 (FM); Makarikari Lake Flats, 1 (AMNH).

The adult specimens vary in color from an animal with brindling and lower parts almost black, with black forehead and mane, to one with the markings dull Chocolate, underparts near Orange-Cinnamon and forehead dull Clay Color. The lower parts of the limbs vary in color from near Army Brown to Cinnamon-Buff. One animal has the mane and beard mixed with

gray. Immature wildebeest are more brownish and paler than the adults.

The two darkest specimens come from Kuke Pan and Kaotwe Pan, but one from Kuke Pan shows the most reddish hue. Examples from Ngamiland are on the average more grayish, as are specimens from Angola, but the range of individual variation is such as to make the recognition of *C. t. mottosi* Blaine appear unwarranted.

The horns vary in males from 387 to 520.5 mm. long (average of five, 442.9), with spread of from 562 to 718 mm. (average, 620.9). In a female the horns measure 354 mm. long, with a spread of 465 mm.

CRANIAL MEASUREMENTS.—See Table VI.

Hippotragus equinus cottoni Dollman and Burlace

Roan Antelope

Eight specimens examined: Mababe Flats and Tsotsoroga Pan, 4 (AMNH), 4 (FM).

The examples from Ngamiland are slightly paler than those from Angola but resemble the latter more than they do the descriptions of the typical form. *Cottoni* may not be distinct from *H. e. langheldi* Matschie from Tabora, Tanganyika; specimens of the former agree closely with descriptions of the East African race.

General color of upperparts near Cinnamon-Rufous; tips of hairs on the back near Liver Brown overlying Cartridge Buff. Underparts white, including insides of hind legs almost to the hocks. A black facial marking may extend to base of horns or may end in front of the eyes. A black marking on the forelegs extends from near the wrist to the shoulder, and one may be present on the front of the cannon bone. These markings may be diffuse, and the underparts may be stained with buffy. The tail may be black or dark brown.

A calf is pale Cinnamon in general color, without Russet overlay, except along the back. The face is brownish.

Three specimens (FM) from the Pungwe River, Portuguese East Africa, are slightly paler and duller in color than the Ngamiland specimens but otherwise much the same.

The horns of three adult males measured 702, 712 and 722 mm. in length, with a spread of 331, 294 and 525, respectively. Those of females varied from 516 to 603 mm. in length, 215 to 282 mm. in spread.

CRANIAL MEASUREMENTS.—See Table VII.

Hippotragus niger niger Harris

Sable Antelope

Eight specimens examined: Kwaai, 2 (FM); Mababe Flats, 1 (AMNH); Tsotsoroga Pan, 1 (AMNH), 1 (FM); Kabulabula, 2 (FM); Kasungula (N. Rhodesia), 1 (AMNH).

The sable antelope of Ngamiland agree with the typical race in the blackish brown color of the females. Adult females of this color were seen by T. Donald Carter in 1938 (personal communication) north to about 16° S. near the Zambezi River. *H. n. kaufmanni* Matschie and *H. n. kirkii* Gray are based on slight individual differences and may well be synonymized with the typical race.

The adult male from Kabulabula is almost pure black above. The white stripe from eye to muzzle is stained with Olive-Buff and is almost broken by the color of the cheeks in one place. Young males agree in color with the females.

The horns of three adult males measured 967, 1,123 and 1,220 mm. in length, with a spread of 305, 588 and 810 mm., respectively. Those of the females varied from 701 to 772 mm. in length, 200 to 320 mm. in spread.

CRANIAL MEASUREMENTS.—See Table VII.

Oryx gazella Linnaeus

Gemsbok

Thirty-one specimens examined: No locality, 1 (AMNH); Kuke Pan, 1 (AMNH); Matapa Pan, 1 (AMNH), 1 (FM); Damara Pan, 4 (AMNH), 2 (FM); Mababe Flats, 1 (AMNH); N'Kate, 10 (AMNH), 10 (FM). Five of these are mounted in the Akeley African Hall, The American Museum of Natural History.

The series is not altogether uniform in coloration: the upperparts vary from near Light Vinaceous-Fawn to near Drab-Gray. The dorsal dark stripe, near Dark Umber in color, may be interrupted or complete and broad. The dark girdle around the

muzzle may be extremely narrow at a point between eye and muffle. The throat stripe is constantly present. On the lower metapodial segments of fore and hind feet there is a blackish spot; on the hind feet it may be indistinct or a well-marked stripe reaching to the ankle joint.

The longest horn (the record) from Bechuanaland given by Dollman and Bur-lace (1935, p. 206) is 1,229 mm. (48 inches). The longest secured by the Vernay-Lang Expedition was 1,090 mm., that of a female. The longest horn of a male collected was 1,035 mm. The average length of horn in eleven adult males collected by the expedition was 911 mm.; in ten females the horns averaged 984 mm.

CRANIAL MEASUREMENTS.—See Table VIII.

Redunca arundinum arundinum

Boddaert

Reedbuck

Four specimens examined: Kwaai, 1 (AMNH), 2 (FM); Mababe Flats, 1 (AMNH).

No examples of reedbuck from the Cape of Good Hope were available for comparison, but the specimens examined agree with descriptions. The back is variously near Avellaneus or near Tawny-Olive; the sides paler and more grayish; underparts white, including the insides of the legs to the hocks. Forehead near Bister. Stripes on foreleg to elbow and on cannon bone of hind foot, Clove Brown, but in the brightest specimen these were broken and faint.

Horns of a picked up frontlet from Mababe Flats measure 313 mm. in length and have a spread of 292.5.

CRANIAL MEASUREMENTS.—See Table VIII.

Onotragus leche leche Gray

Lechwe

Nine specimens examined: Kwaai, 4 (AMNH), 5 (FM).

These specimens were taken near the type locality (Zongo Valley, near Lake Ngami). The dorsal coloration in most specimens is near Tawny, but one is much paler, near Cinnamon. The face is paler, the white area around eyes nearly a circle.

The chin, throat, chest and abdomen, insides of legs almost to false hoofs, perineal region and under side of tail are white. The front of the forelegs below the elbow to the hoofs and the hind legs from below the hocks are blackish, except for a narrow white marking above the hoofs and around the false hoofs. The tail has a blackish tuft. The hind legs are distinctly paler than the upperparts, although the sides are lighter than the back.

The horns in five adult males vary from 477 to 648 mm. in length (average 561 mm.) and from 302 to 447 mm. in spread (average 380 mm.).

CRANIAL MEASUREMENTS.—See Table VIII.

Adenota vardonii vardonii Livingstone

Puku

Five specimens in the Field Museum: Kabulabula, 4; Legge's Island, Chobe River, 1. (Also two from Kazungula, N. Rhodesia.)

The coloration of the dorsal region varies from near Tawny to near Russet, gradually becoming paler on the sides and limbs. The lips, throat (but not under side of the lower neck), belly, under side of tail, insides of forelegs to the wrist and insides of hind legs to about four inches above the hocks are white. The ears are tipped with blackish.

The darker adult has much more black on the ears and forehead, a character supposed to be characteristic of *A. v. senganus* Slater and Thomas.

Horns in two adult males were 317 and 353 mm. in length, with a spread of 210 and 190.5 mm., respectively.

CRANIAL MEASUREMENTS.—See Table VIII.

Sylvicapra grimmia vernayi

Hill

Kalahari Common Duiker

Five specimens examined: Kuke Pan, 2 (FM); Kaotwe, 2 (AMNH, one the type); Makarikari Lake Flats, 1 (AMNH).

These were described as new (Hill, 1942). The upperparts are near Pinkish Buff, mixed with Hair Brown; the chest and inside of the tarsus are colored like the upperparts, without the Hair Brown tips and in

some specimens with a mixture of white hairs. The white of the underparts is restricted to the lower jaw, insides of the forelegs, abdomen and groin, and insides of hind legs above the hock. (One specimen from Kuke Pan has some white on the tarsus.) In some specimens the white is even more restricted on the legs. The facial blaze is near Hair Brown, as are the dark markings of the forelegs above the hoofs. The horns of the single adult male were 77.5 mm. long, measured in a straight line.

The Makarikari Lake Flats are some distance from the other two localities, but the fauna is apparently similar.

CRANIAL MEASUREMENTS.—See Table IX.

Sylvicapra grimmia splendidula Gray

Angola Common Duiker or Duikerbok

Three specimens examined: Kabulabula, 1 (AMNH), 1 (FM); Chobe River, near Kazungula, 1 (FM).

These agree with the series from Angola in the American Museum in coloration: the upperparts near ochraceous (16' h) mixed with blackish; the facial blaze black; the frontal tuft partly black; the front of the leg black, the underparts white, including chest and insides of legs to the false hoofs (one has the white near the hind hocks interrupted by buffy). The Ngamiland examples are paler than the average from Angola but within the range of variation shown by that series. One has the black facial blaze extending to meet the frontal tuft.

Horns of a single adult male (FM) were 77.3 mm. in length. A specimen from Ngamiland listed by Dollman and Burlace (1935, p. 80) measured 127 mm. (5 inches).

CRANIAL MEASUREMENTS.—See Table IX.

Across the Zambezi River from Kabulabula, *S. g. flavescens* Lorenz occurs. It is poorly characterized in the description. Examples from Northern Rhodesia are more yellowish in color than the Ngamiland and Angolan race, with less admixture of blackish and with a brownish facial blaze.

Flavescens is much paler and more yellowish than the South African duiker and appears to be a valid race allied to *S. g. splendidula*.

Tragelaphus scriptus ornatus Pocock

Bushbuck

Two specimens in the Field Museum from Kabulabula, only a short distance from the type locality, Linyanti. Also a skull from Kazungula, N. Rhodesia (FM).

The adult, a female, is near Tawny in general coloration; dorsal crest white, except over the shoulders; six white transverse stripes; Bister markings on the forelegs extend from near the false hoofs to the elbow region, and on the hind legs there are similar markings near the false hoofs. The color is brighter and striping more distinct than in a specimen of the same age and sex from South Africa.

CRANIAL MEASUREMENTS.—See Table IX.

Strepsiceros strepsiceros strepsiceros Pallas

Koodoo or Kudu

Ten specimens examined: Mababe Flats, 2 (AMNH), 5 (FM); Tsotsoroga Pan, 2 (AMNH), 1 (FM).

The characters on which the several supposed races of koodoo are distinguished are not constant. The Ngamiland specimens are Light Cinnamon-Drab to Drab-Gray in general color; the dark markings around the hoofs are indistinct in the old males. These have short hair, especially on the cheeks, neck and shoulder, which may be almost bare. Young animals are richer in color than adults and have longer pelage, as do the females. The number of stripes varies from seven to ten (five specimens have eight stripes); in one old male only five stripes are distinct, although eight can be made out.

The horns of specimens in the American Museum collection are small, the longest being 1,242 mm., measured along the spiral, and the largest spread, 860 mm.

CRANIAL MEASUREMENTS.—See Table IX.

Taurotragus oryx livingstonii
Sclater

Eland

Thirteen specimens examined: Damara Pan, 1 (AMNH), 2 (FM); Shaleshanto, 1 (AMNH); Mababe Flats, 1 (AMNH); Tsotsoroga Pan, 3 (AMNH), 4 (FM); Kasane, 1 (FM).

The general coloration varies between a grayish Sayal Brown and bright Cinnamon. An old male has blackish skin, the general color darkened thereby. The mane is only slightly darker than the neck in some individuals, in others it is almost Fuscous; the Fuscous dorsal stripe between the shoulders and base of tail is narrow; it may be broken (in one animal in two pieces, each about a foot in length). The frontal tuft is usually more grayish than the dorsal color. In adults, the neck is grayish, and in this area the hairs are short and few. Five adults and one young (FM) appear to have no stripes; two adults have a single visible stripe behind the foreleg; one has two faint stripes; one has four stripes and one, five (these are faint). A fetus has six stripes. Two animals have the face colored like the back; four have a small blaze of Fuscous; one (old male) has a large blaze of Fuscous-Black; still others have a wash of Fuscous on the front of the face and on the cheeks. All have dark markings, although these may be small, on fore and hind feet near the hoofs. Three specimens have faint blackish markings on the back of the forearm near the elbow; four others have a well-marked blackish semicircle here. Two have a distinct white mark in front of the eye, as in the koodoo and in the East African race.

In all but the highly variable striping, they agree fairly well with the description of *T. o. livingstonii*.

The horns are not large in the specimens in the American Museum. In a mature male the longest measured 589 mm., and the spread was 348 mm. Two females are in the class listed by Dollman and Burlace (1935, p. 245), 797 and 764 mm. in length, 595 and 270 in spread. The largest horns from this area in the Records of Big Game, those of a female, are 820 mm. in length.

CRANIAL MEASUREMENTS.—See Table IX.

Syncerus caffer caffer Sparrman

Cape Buffalo

Three specimens in Field Museum: Kwaai, 1; Mababe Flats, 2.

The animals are females, near Bone Brown in general coloration. In a region where, at the turn of the century, a herd of about a thousand buffalo could be seen (Selous, in Bryden, 1899, p. 106), only these three were secured by the expedition. Rinderpest is probably chiefly responsible for the decrease in this area.

The largest recorded horns from Bechuanaland (Dollman and Burlace, 1935, p. 299) have a spread of 1,279.5 mm. (50 inches), and the length on the anterior curve may be estimated at about 900 mm. The horns of the females examined were 742 and 772 mm. in spread, and 622 and 545 mm. in length along the anterior curve.

CRANIAL MEASUREMENTS.—See Table IX.

ORDER PERISSODACTYLA

Equidae

Equus (Quagga) burchellii antiquorum
H. Smith

Common Zebra

Ten specimens examined: Kwaai, 2 (AMNH), 2 (FM); Mababe Flats, 5 (AMNH), 1 (FM).

The common zebra of Ngamiland agrees with specimens from western Angola, the

type locality of this race (cf. Cabrera, 1936). The shadow stripes are less evident than those in Cabrera's figure 10, but the stripes on the legs are similar in most specimens. In two specimens the stripes extend to the hoofs but are slender and broken below the knee. The stripes on the lower forelegs are weaker than those on the hind legs.

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TABLE I

	Sex	Skull Greatest length	Basilar length	Palatilar length	Length orbit to prosthion ¹	Zygomatic breadth	Temporal constriction	Mastoid breadth	Maxillary breadth across M ¹ -M ²	Length maxillary alveoli	Length M ¹	Length M ²
<i>Papio comatus ngamiensis</i>												
Kabulabula. AMNH 83594	♂ ad.	223.0	158.0	97.3	128.5	119.8	58.8	92.3	60.2	69.8	11.5	13.8
" " AMNH 83595	♂ mat.	224.5	157.8	100.5	126.0	122.2	61.3	93.2	58.9	68.3	11.1	14.2
" " FM 34579	♂ ad.	218.0	155.0	96.1	119.3	119.0	60.0	88.9	59.0	71.6	10.9	13.4
" " FM 34581	♂ y. ad.	214.0	144.5	90.5	115.3	120.1	56.9	85.6	57.9	72.4	11.9	14.5
Kasane. FM 34580	♂ ad.	213.5	149.0	91.5	120.1	117.1	57.5	90.4	59.1	72.0	12.5	14.3
Type <i>Papio c. ngamiensis</i> ²												
Maun. Transv. Mus. 6614	♂ y. ad.	217.0	155.0	94.0		118.5		92.0	54.0 ³	72.0	15.0	14.3
Type <i>Papio c. chobiensis</i> ²												
Kabulabula. Transv. Mus. 6615	♂ mat.	230.0	163.0	105.0		116.0		88.0	60.5 ³	76.5	14.5	14.1

¹ Prosthion, the most anterior point of the premaxillae in midline.² Roberts, 1935, Ann. Transv. Mus., XVI, p. 248.³ Breadth across M¹-M².

TABLE II

	Sex	Skull Greatest length	Basilar length	Palatilar length	Length nasals near midline	Zygomatic breadth	Interorbital breadth	Mastoid breadth	Temporal constriction	Length orbit to prosthion	Breadth maxilla P ₄ -P ₄	Length maxillary alveoli	Length P ₄
<i>Lycan pictus</i>													
Kasane. FM 34587	♂ ad.	209.0	187.0	94.7	61.5	129.4	45.3	76.2	42.5	91.2	76.5	83.5	21.5
" FM 34588	♂ ad.	211.0	187.5	95.3	60.4	132.2	45.6	74.7	43.3	92.8	78.8	83.8	21.8
<i>Hyaena brunnea</i>													
N'Kate. AMNH 83589	♂ mat.	246.2	213.0	113.9	47.0	164.4	57.8	89.0	43.7	96.5	91.2	100.2	27.0
" FM 34586	♀ ad.	252.0	205.0	112.5	48.4	161.0	54.3	89.3	42.4			92.4	33.1
Damara Pan. AMNH 83590	? ad.	247.0	208.9	113.0	48.0	160.5	53.4	87.2	40.9	96.4	92.1	97.0	32.5
" " AMNH 83588	♀ y. ad.	222.4	196.9	100.7	42.0	153.4	50.2	83.0	40.0	89.0	90.8	89.6	31.9
<i>Crocuta crocuta</i>													
Kwaai. FM 34582	♂ ad.	276.0	234.0	127.0	40.3	164.0	61.5	100.0	48.5			103.6	37.3
Mababe Flats. AMNH 83591	♂ ad.	270.8	227.5	126.0	41.5	165.5	61.7	99.5	48.1	103.3	105.5	102.8	37.5
" " AMNH 83593	? mat.	280.3	230.8	128.6	39.0	169.6	57.5	99.9	49.9	104.6	110.0	105.7	38.3
Tsotsoroga Pan. FM 34583	♂ ad.	280.0	227.0	126.9	36.5	178.0	59.9	98.5	47.0			102.6	37.5

TABLE III

	Sex	Skull Greatest length	Basilar length	Palatilar length	Length nasals	Zygomatic breadth	Interorbital breadth	Mastoid breadth	Temporal constriction	Length orbit to presthion	Breadth maxillary P ₄ -P ₄	Length maxillary alveoli (C ₁ -P ₄)	Length P ₄
<i>Panthera p. shortridgei</i>													
Mababe Flats, FM 34591	♂ ad.	221.0	192.0	96.7	58.5	148.0	43.1	92.7	45.9			75.6	25.9
<i>Panthera l. bleyenberghi</i>													
Mababe Flats, FM 35741	♂ ad.	394.0	316.0	165.1	93.8	243.0	78.3	139.5	61.8			115.0	37.0
" " FM 41406 ?													
(Field No. 150)													
Matapa Pan. AMNH 83616	♂ ad.	371.0	311.0	157.0	91.5	231.5	75.8	138.7	66.4			120.5	39.1
Mababe Flats, AMNH 83617	♂ mat.	355.0	290.0	152.0	93.3	248.0	68.5	145.0	59.6	138.1	149.9	108.8	39.4
Tsotsoroga Pan. AMNH 83619	♂ ad.	355.0	296.0	153.0	86.3	213.0	67.7	133.0	64.6	138.8	133.5	115.4	37.0
Mababe Flats, FM 41405	♂ ad.	357.0	287.0	153.0	91.5	235.0	68.9	131.0	61.5	136.3	138.4	110.7	37.9
Gonodimo Pan. FM 35739	♂ y. ad.	354.0	291.0	144.5	88.5	240.5	71.1	137.1	65.3			113.7	40.8
N'Kate, AMNH 83620	♀ mat.	302.0	253.0	134.0	72.6	205.0	60.7	117.0	58.9	125.0	127.5	99.9	34.9
" FM 35743	♀ ad.	303.0	248.5	127.5	70.5	198.5	60.7	117.1	60.4			92.6	33.7
Mababe Flats, FM 35742	♀ ad.	295.5	243.5	127.3	73.9	191.0	58.1	108.3	57.6			92.5	36.9

TABLE IV

	Sex	Skull Greatest length	Basal length	Palatal length	Length nasals	Zygomatic breadth	Interorbital breadth	Mastoid breadth	Least breadth post- orbital flat area	Greatest length post- orbital flat area	Breath occiput	Length maxillary alveoli	Length crown of M ¹
<i>Phacochoerus aethiopicus</i>													
Kwaai. AMNH 83586	♂ ad.	406	295.0	210	252	214.0	128.0		33.8	52.0	92.0	77.0	41.0
Mababe Flats. AMNH 83587	♂ ad.	397	304.0	220	238	208.0	120.8		34.5	51.5	84.6	81.8	40.0
Kwaai. FM 34504	♂ ad.	399		226		227.5	133.0		36.8	49.0	89.3	82.7	46.0
						circ.							
Tsotsoroga Pan. FM 34500	♂ ad.	389	301.0	220	238	202.0	121.9	140.0	33.0	49.1	86.9	69.5	39.6
Kuke Pan. FM 34501	♀ ad.	315	265.5	187	197	161.0	92.8	107.1	27.4	41.0	56.2	83.8	38.1
	Sex	Skull Greatest length	Basal length	Palatal length	Palatal length	Orbit to prethion	Zygomatic breadth	Temporal constriction	Mastoid breadth	Breath rostrum (premaxillary)	Length maxillary alveoli	Length M ¹	
<i>Giraffa c. angolensis</i>													
Mababe Flats. FM 34422	♂ ad.	720	662	399	399	416	261	140	172	117	159.1	31.2	
" " FM 34426	♂ y. ad.	693	628	381	397	397	259	137	175	107	153.0	28.6	
Kwaai. FM 34425	♂ y. ad.	701	635	391	391	418	253	149	164	110	151.3	30.0	
Mababe Flats. FM 34424	♀ ad.	605	547	332	332	354	238	124	148	83	147.5	30.8	
" " FM 34427	♀ y. ad.	620	558	337	337	398	240	122	149	80	154.0	32.3	
" " AMNH 83458	♀ y. ad.						245	117	142		137.2	30.8	

TABLE V

	Sex	Skull Greatest length	Basal length	Palatal length	Length nasals	Zygomatic breadth	Temporal constriction	Mastoid breadth	Orbit to prosthion	Breadth rostrum (premaxillary swelling)	Length maxillary alveoli	Length M ¹
<i>Raphicerus c. campestris</i>												
Bechuanaland Protectorate												
Average 5	♂	143.7	127.8	73.9	41.3	65.4	44.8	43.2	69.2	18.7	47.4	9.0
Maximum	♂	150.5	133.0	77.2	45.7	69.3	48.5	47.1	72.5	19.2	49.5	9.6
Minimum	♂	138.3	122.9	71.8	36.8	63.1	43.0	40.7	67.6	18.1	45.6	8.7
Average 4	♀	144.9	129.0	74.5	40.5	64.8	44.9	44.3	70.2	19.6	46.3	8.7
Maximum	♀	147.6	130.8	77.0	42.5	65.6	48.8	45.0	72.4	21.2	48.3	9.3
Minimum	♀	142.5	127.1	72.3	37.0	63.1	43.2	43.4	68.6	16.7	44.0	8.3
<i>Antidorcas m. marsupialis</i>												
Bechuanaland Protectorate												
Average 5	♂	235.7	215.8	122.3	83.5	95.8	62.8	83.9	130.6	36.6	65.6	14.2
Maximum	♂	247.5	228.0	124.5	89.0	103.5	67.6	91.9	136.2	41.2	69.4	14.6
Minimum	♂	221.0	206.0	120.2	75.0	89.1	58.5	77.3	126.9	34.3	63.7	13.6
Average 5	♀	230.9	210.0 ¹	118.6	77.4	93.2	60.0	79.0 ¹	128.0	33.7	64.7	13.9
Maximum	♀	242.0	216.0	125.7	85.7	96.5	61.5	82.9	138.6	39.0	67.3	16.9
Minimum	♀	213.0	205.0	107.4	70.9	89.1	56.3	75.6	115.0	27.1	61.8	11.4
<i>Aepyceros m. melampus</i>												
Kwaai and Tsotsoroga Pan												
Average 4	♂	265.1	245.2	140.8	84.0	103.7	70.4	84.7	160.0	43.5	76.9	15.1
Maximum	♂	288.0	261.0	153.0	88.7	108.8	73.1	88.6	171.0	47.6	78.4	16.9
Minimum	♂	252.5	226.0	127.0	81.0	97.4	68.0	80.2	153.0	39.0	73.6	13.5
Kwaai and Mababe Flats												
Average 4	♀	257.0	233.0	137.6	72.4	97.4 ²	66.4	76.1	155.3	39.9	73.4	13.3
Maximum	♀	261.5	239.5	143.7	81.8	98.0	68.5	78.9	160.5	40.9	76.2	15.7
Minimum	♀	250.0	226.0	132.0	65.8	96.3	64.5	74.7	147.6	39.3	68.3	11.5

¹ Four specimens.

² Three specimens.

TABLE VI

	Sex	Skull Greatest length	Basal length	Palatal length	Length nasals (greatest)	Zygomatic breadth	Temporal constriction	Mastoid breadth	Orbit to prosthion	Breadth rostrum (premaxillary swelling)	Length maxillary alveoli	Length M ¹
<i>Alcelaphus caama</i>												
N'Kate. AMNH 83513	♂ mat.	434.0	388.0	228	206.0	135.9	86.0	124.6	294.0	60.1	96.5	19.4
Matapa Pan. AMNH 83516	♂ ad.	425.0	383.0	227	203.0	130.4	83.8	129.7	287.0	59.8	108.6	23.2
N'Kate. AMNH 83520	♂ mat.	434.0	387.0	231	233.0	132.8	81.0	125.1	299.0	63.9		18.9
Kuke Pan. AMNH 83514	♀ ad.	399.5	352.0	215	183.0	128.0	78.5	119.8	280.5	56.2	104.9	21.2
<i>Damaliscus lunatus</i>												
Kwaai. AMNH 83529	♂ ad.	401.0	364.0	220	171.0	138.1	90.0	133.0	258.0	57.6	95.6	19.1
Mababe Flats. AMNH 83525	♂ mat.	401.2	365.0	222	165.0	137.0	87.2	127.8	257.0	55.5	87.2	14.2
" " AMNH 83524	♂ ad.	391.8	354.0	213	161.0	139.8	88.5	126.5	254.0	56.2	98.9	19.3
Kwaai. AMNH 83528	♀ mat.	407.0	370.0	226	157.0	135.0	86.2	121.5	263.5	61.1	95.8	17.0
" " AMNH 83523	♀ mat.	407.0	372.0	223	163.0	141.0	85.2	122.5	269.0	59.5	89.4	14.8
Mababe Flats. AMNH 83526	♀ ad.	394.0	365.0	220	155.0	136.5	87.0	124.7	258.2	55.5	92.5	18.0
<i>Connochaetes l. taurinus</i>												
Mababe Flats. AMNH 83508	♂ mat.	464.5	418.0	242	213.0	174.5	99.5	167.0	294.0	73.7	101.0	17.6
Kuke Pan. AMNH 83506	♂ mat.	478.0	424.0	248	232.0	178.0	93.0	173.0	310.0	73.5	108.5	17.6
" " AMNH 83507	♂ ad.	487.0	438.5	255	211.0	172.0	101.0	177.5	311.0	78.0	112.9	22.3
Makarikari Lake Flats.												
AMNH 83505	♂ ad.	504.5	450.0	253	244.5	179.0	102.5	184.0	319.0	79.1	104.8	18.6
Mababe Flats. AMNH 83503	♀ mat.	436.0	393.0	215	178.0	168.0	97.5	154.0	272.5	76.3	100.5	17.3

TABLE VII

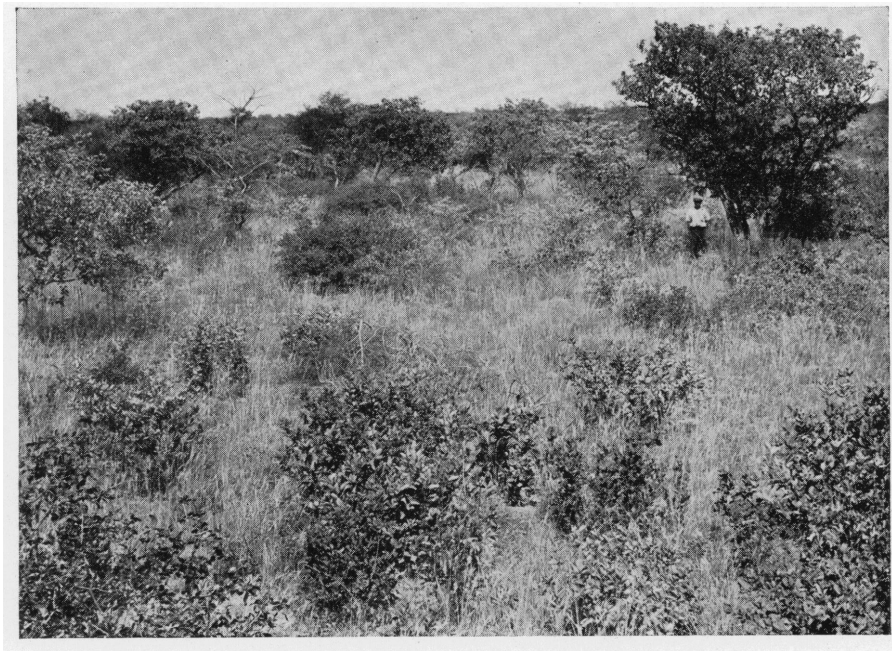
	Sex	Skull Greatest length	Basal length	Palatal length	Length nasals near midline	Zygomatic breadth	Temporal constriction	Mastoid breadth	Length orbit to prosthion	Breadth rostrum (premaxillary swelling)	Length maxillary alveoli	Length M1
<i>Hippodragus e. coltoni</i>												
Mababe Flats. FM 34604 (skull only)	♂ sen.	454.0	419.5	257.5	175.0	175.0	97.0	134.4	264.0	69.8	116.0	
Tsotsoroga Pan. FM 34594	♂ ad.	461.0	420.5	259.0	173.0	187.0	99.0	130.6	265.5	68.5	129.1	23.9
" " AMNH 83474	♂ ad.	459.0	414.0	258.0	175.0	171.5	94.2	130.9	271.0	69.5	123.5	21.7
Mababe Flats. FM 34520	♀	479.5	439.0	283.0	194.0	178.0	99.0	130.4	290.0	70.1	129.7	23.1
Tsotsoroga Pan. AMNH 83475	♀ ad.	472.5	438.0	282.0	190.0	182.0	93.7	133.3	284.0	64.9	132.1	25.8
Mababe Flats. AMNH 83473	♀ ad.	461.5	424.0	272.0	177.5	171.0	84.7	132.1	277.0	64.5	128.3	23.2
<i>Hippodragus n. niger</i>												
Kabulabula. FM 34515	♂ ad.	440.0	387.5	230.5	191.5	156.5	94.9	125.5	263.0	65.5	112.0	20.6
" " FM 34605 (skull only)	♂ ad.	439.5	387.5	231.0	169.5	157.5	95.5	121.7	241.0	66.9	101.8	18.2
Mababe Flats. AMNH 83470	♂ sen.	415.0	378.0	209.0	164.7	164.7	108.0	119.5	227.5	69.8	119.5	19.4
Tsotsoroga Pan. FM 34518	♀ ad.	420.0	377.0	236.5	166.0	156.0	88.0	114.8	253.5	59.1	117.9	21.1
Kwaai. FM 34517	♀ ad.	424.0	377.0	232.0	170.0	155.0	95.0	114.6	261.0	58.5	105.8	17.8
Mababe Flats. AMNH 83477	♀ mat.	419.5	377.5	229.0	158.0	156.0	80.0	118.1	255.0	60.4	112.0	19.3
Tsotsoroga Pan. AMNH 83476	♀ mat.	413.5	373.5	234.0	158.0	147.5	89.0	109.7	251.0	55.6	101.8	18.0

TABLE VIII

	Sex	Skull Greatest length	Basal length	Palatal length	Length nasals	Zygomatic breadth	Temporal constriction	Mastoid breadth	Orbit to prosthion	Breadth rostrum (premaxillary)	Length maxillary alveoli	Length M ¹
<i>Oryz gazella</i>												
N Kate.	♂ ad.	438.0	394.0	255.0	179.5	161.0	97.1	144.2	276.5	69.2	122.6	23.5
"	♂ ad.	429.0	389.0	243.0	185.0	162.5	94.5	143.6	272.5	64.2	112.7	20.7
"	♂ mat.	427.0	372.0	234.0	171.0	161.0	94.0	134.9	255.0	63.8	118.2	20.1
"	♀ mat.	438.0	398.5	253.0	177.0	171.0	95.0	138.3	273.5	65.1	111.2	18.9
"	♀ mat.	444.0	400.0	249.0	173.5	162.0	99.2	143.5	275.5	66.7	118.2	20.5
Damara Pan. AMNH 83485	♀ mat.	424.5	386.5	237.0	171.0	161.0	93.0	137.5	259.0	57.7	102.7	21.1
<i>Redunca a. arundinum</i>												
Kwaai. FM 34570	♀ ad.	263.5	244.5	151.2	99.4	103.2	60.6	77.3	157.5	32.5	72.2	14.5
<i>Onotragus l. leche</i>												
Kwaai. Average 5	♂	292.4	270.9	156.6	107.7	123.9	74.8	112.2	156.8	39.8	75.8	15.4
Maximum	♂	302.5	281.5	161.0	112.0	130.5	77.5	121.3	163.0	45.0	76.3	16.4
Minimum	♂	281.0	253.0	148.0	101.1	118.0	71.5	106.8	149.0	37.1	74.7	14.3
Kwaai. FM 34471	♀ ad.	266.5	245.0	145.2	94.7	116.2	69.4	96.2	151.0	37.2	71.9	14.1
<i>Adenota v. vardonii</i>												
Kabulabula. FM 34465	♂ ad.	293.0	273.0	159.5	102.8	106.3	60.2	84.0	173.0	41.4	66.0	12.5
Kazungula. FM 38165	♂ ad.	292.0	271.0	160.0	114.7	116.3	67.1	89.4	173.5	43.0	74.2	13.7
Kabulabula. FM 34464	♀ juv.	271.0	247.5	152.5		102.8	67.2	78.1	162.5	34.5	77.5	14.8

TABLE IX

Sex	Skull Greatest length	Basal length	Palatal length	Length nasals	Zygomatic breadth	Temporal constriction	Mastoid breadth	Length orbit to presthion	Breadth rostrum (premaxillary swelling)	Length maxillary alveoli	Length M
<i>Sylvicapra g. vernayi</i>											
♂ ad.	186.5	165.5			circ. 80.0	54.9	58.3	99.0	22.6	57.6	11.0
Type. Kaotwe Pan. AMNH 83576											
<i>Sylvicapra g. splendidula</i>											
♂ ad.	195.0	171.0	95.8	70.4	83.3	59.3	63.2	98.2	26.3	53.9	9.2
♀ mat.	191.0	169.0	96.3	65.1	79.2	54.5	59.4	101.6	27.1	58.8	10.0
♀ ad.	181.5	157.5	89.7	57.9	78.8	54.9	56.2	92.9	24.5	53.6	10.3
Kabulabula. AMNH 83578 FM 34539											
<i>Tragelaphus s. ornatus</i>											
♂ sen.	252.0	229.0	125.0	91.0	104.0	71.9	89.1	123.2	36.9	67.6	10.7
Kazungula, FM 38162											
<i>Strepsiceros s. strepsiceros</i>											
♂ y. ad.	439.0	339.0	220.0	184.0	165.0	119.0	152.0	236.0	63.0	130.6	22.9
♂ ad.	410.5	378.0	202.0	154.0	163.5	111.0	146.8	228.0	64.5	116.5	19.6
♂ sen.	415.0	378.0	209.0		164.5	108.0	149.5	228.0	69.8	119.5	19.4
" " AMNH 83470											
<i>Taurotragus o. livingstonii</i>											
♂ mat.	492.5	437.0	228.0	164.0	215.0	134.0	222.5	289.5	82.5	149.4	24.8
♀ ad.	474.5	427.0	225.0	200.0	182.0	111.5	162.5	290.0	66.5	145.1	27.1
♀ mat.	486.0	438.0	237.0		193.0	107.0	171.5	298.0	68.5	155.5	30.8
♀ mat.	474.0	423.0	223.0	172.0	200.0	115.0	177.5	295.0	70.2	147.2	25.0
Shaleshonta. AMNH 83466											
<i>Synecerus c. caffer</i>											
♀ y. ad.	525.0	490.0	310.0	196.0	217.5		258.5	295.5	107.1	146.5	26.7
♀ y. ad.	513.0	471.0	311.0	223.0	219.0		244.0	283.0	102.3	147.5	29.9
Kwaai. FM 34566 Mababe Flats. FM 34547											



1



2

Fig. 1.—Typical bush near Molepolole, southern Kalahari.

Fig. 2.—Low bush and grass country near Gomodimo Pan.

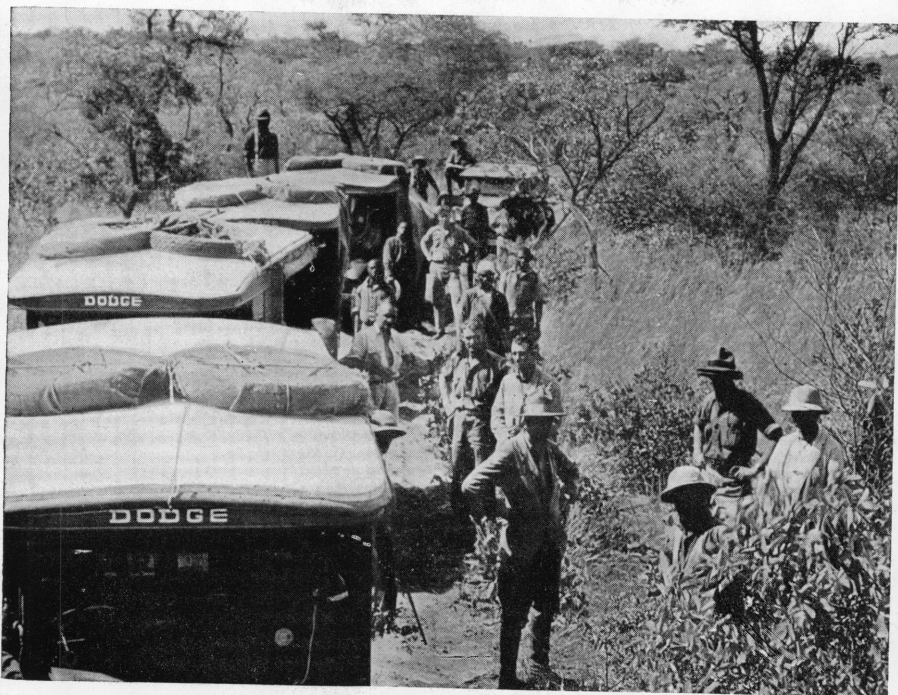
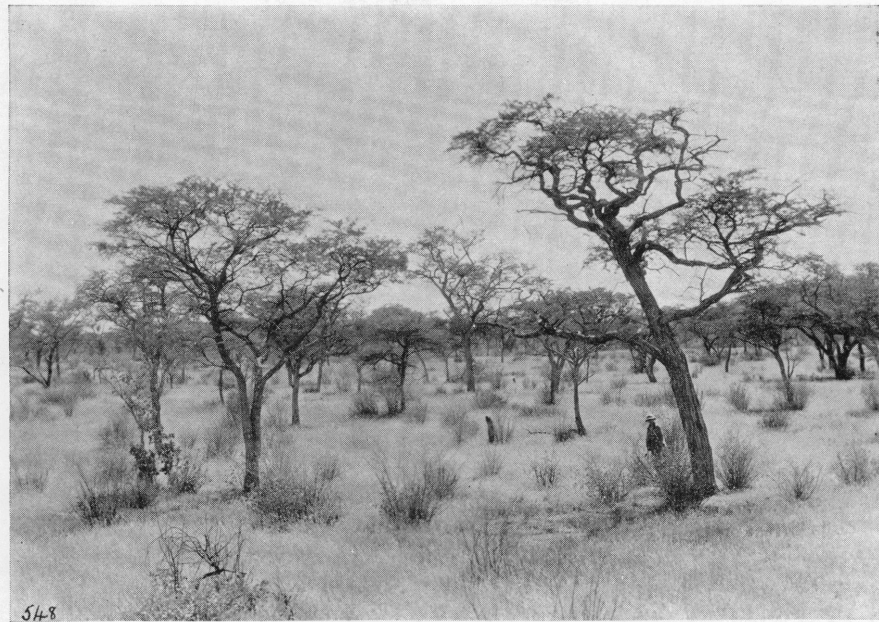
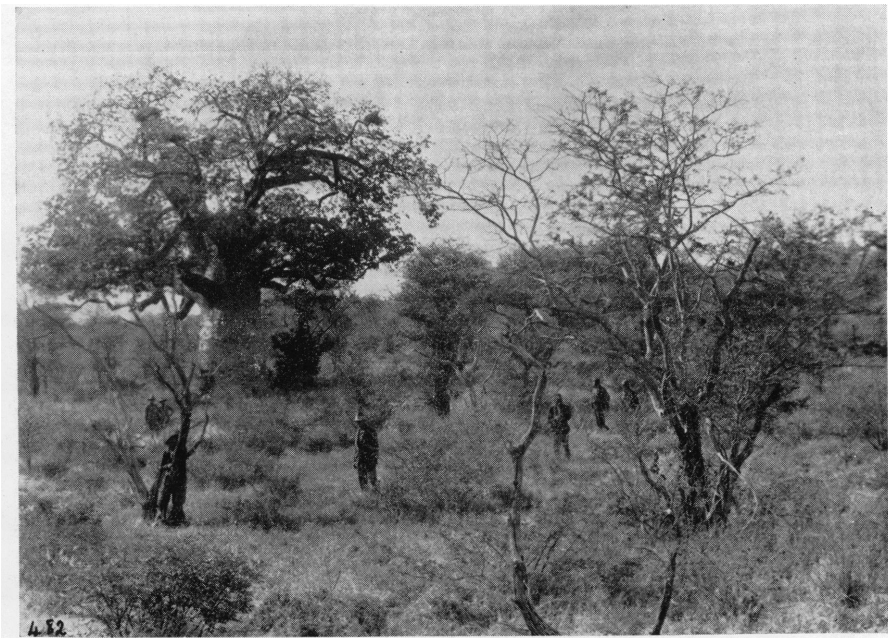


Fig. 1.—Kalahari, near Gomodimo Pan, expedition en route.
Fig. 2.—Grassy plain near Okwa River, central Kalahari.

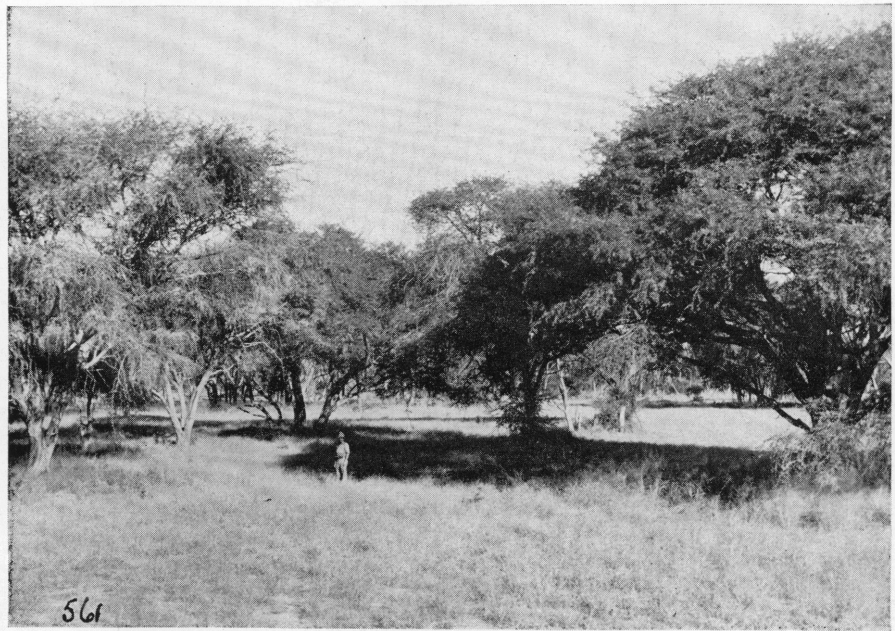


1



2

Fig. 1.—Park-like country near Damara Pan.
Fig. 2.—Baobab tree (with swollen trunk) and bush near Mabeleapudi.



1

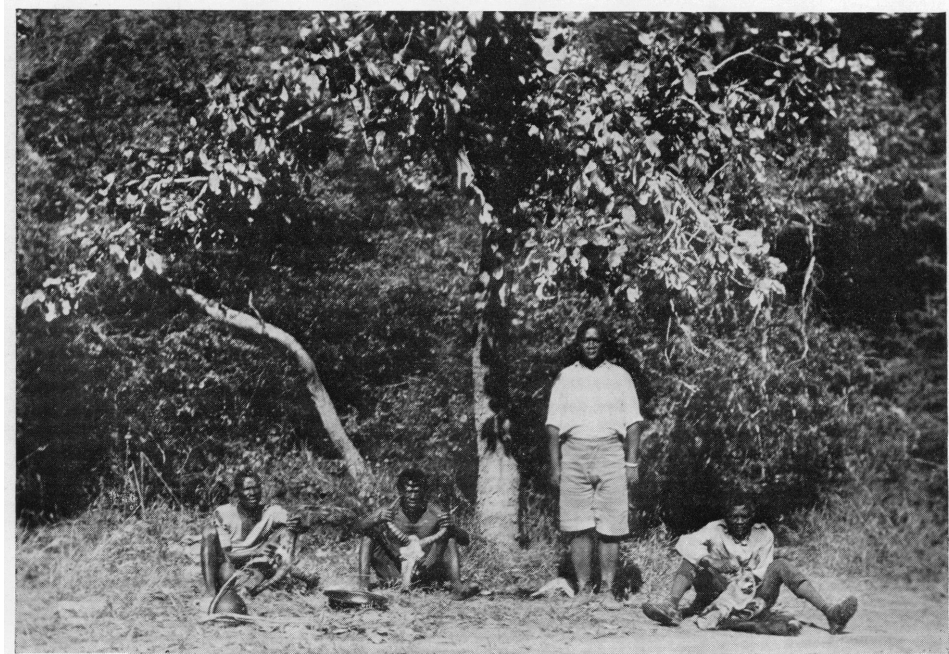


2

Fig. 1.—Trees on south side of Ngami Flats.
Fig. 2.—One of the flood channels near Ngami Flats.



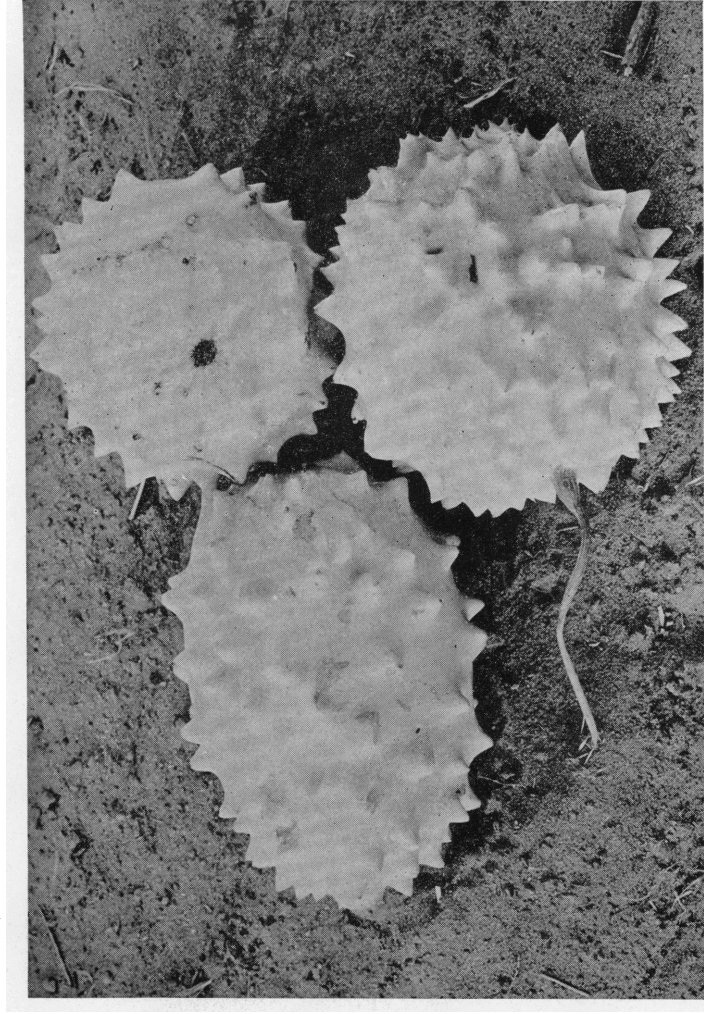
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2

Fig. 1.—Thamalakane River at Maun.

Fig. 2.—Headman at Kwaai, with gallery forest of Kudamane River.



Gemsbok cucumber, an important source of water.



1



2

Fig. 1.—Clump of tall grass, N'Kate.
Fig. 2.—“Bunch-grass,” N'Kate.



1



2

Fig. 1.—Mopane savanna, N'Kate. Trees in leaf and shrub in right foreground, *Copaifera mopane*; bushy tree in center foreground, leadwood, *Copaifera imberbe* (?); large tree at right, *Burkea africana*.

Fig. 2.—Hyphaene palms and large termite hill, N'Kate.

