OSTARIOPHYSI

SILUROIDEA

Fam. CHARACIDAE.

Clarias cf. **C. lazera** and **Clarias** cf. **C. mossambicus.**

The tentative specific identification is based on the surface sculpturing of the bones.

Clarias lazera. — One prefrontal (from a fish about 75 cm standard length); two ? post-temporals (from a fish of about 75 cm S.L.); *Clarias mossambicus* : two unidentifiable neurocranial bones.

Clarias sp. indet. — A fragment of parasphenoid.

Fam. MOCHOCIDAE.

Synodontis cf. **S. frontosus.**

Pectoral girdle. — The specific identification of the fish from which this bone was derived is based on the restored outline of the left humeral process and on the sculpturing visible on part of the process.

Two incomplete but well preserved pectoral spines are also referred to this genus.

PERCOMORPHI

Fam. CENTROPOMIDAE.

Lates sp.

Parasphenoid. — One large fragment.

Entopterygoid. — A small fragment from the posterior end of the bone.

Preoperculum. — Two specimens. One is a fragment from the angle of the bone. The other is more complete, but lacks the horizontal anterior limb and the proximal part of the vertical limb.

Dentary. — One damaged specimen.

Vertebra. — A specimen of the second vertebra, well preserved and lacking only the neural arch.

Except for the fragment of entopterygoid, all these bones were derived from fishes about 75 cm standard length. The entopterygoid is from a larger individual, probably about 85 cm standard length.

Fam. CICHLIDAE.

Tilapia sp.

Part of the operculum (the upper anterior angle and articular facet) estimated as being derived from a fish about 28 cm standard lenght.

SITE IX

Ishango, source of the Semliki; the principal fossiliferous beds (N.F.PR.) of Makalian (Epi-Pleistocene) age; (p. 65).

DIPNOI

Fam. LEPIDOSIRENIDAE.

Protopterus cf. **P. aethiopicus.**

Sixteen palatopterygoid tooth-plates are referred to *Protopterus aethiopicus*. There is, however, some variability which, although worthy of note, is still within the limits of individual variation as observed in living fishes.

Greatest departure from modal *Protopterus aethiopicus* tooth morphology is shown by the form of the ridge or hump which lies at the confluence of the second and third lateral tooth-ridges. In the extant material examined (six specimens) and in six of the fossils, this point is either a broad plateau or a short, broadly rounded ridge lying almost antero-posteriorly and at an obtuse angle to the second lateral ridge. In the remaining fossils it appears as a prominent, somewhat elongate peak almost equalling in size the first lateral tooth-ridge. Since hypertrophy of this inner ridge only

occurs in larger specimens its development is probably a function of overall body size, and its manifestation probably related to diet. Evidence for the latter supposition is provided by the teeth of *P. aethiopicus* from Lake Victoria. In this lake, the species feeds mainly on Mollusca and the tooth plates of large fishes show greater signs of attrition than are evident in the teeth of comparable sized or even larger fossil individuals.

The third, or posterior, lateral ridge exhibits great variation in its outline, which, although basically rhomboidal, may vary from an elongate to a short rhombus. This variation is not obviously correlated with size. In all the extant material examined the third ridge is clearly elongate, in fact, more so than in any fossil.

As in the young of living fishes, the cutting edge of the teeth in smaller specimens is serrated.

The splenial tooth plate is represented by nine incomplete specimens. None shows any marked departure from that of *Protopterus aethiopicus*. In addition there is a small fragment presumed to be derived from a splenial tooth.

The material represents fishes from *ca.* 50 to *ca.* 150 cm total length.

OSTARIOPHYSI

SILUROIDEA

Fam. CLARIIDAE.

Clarias cf. **C. lazera** and **Clarias** cf. **C. mossambicus.**

Nearly all the *Clarias* material from this site may be referred to species closely resembling *C. lazera* and *C. mossambicus*. The remaining specimens are without obvious diagnostic characters.

Comparison of the neurocrania of *Clarias lazera* and *C. mossambicus* shows that although most elements do not differ in their outline or spatial relationships, some may be differentiated specifically on the basis of their superficial ornamentation. Other slight but specifically constant differences were noted in the form of the sutural surfaces uniting the frontals.

The neurocranial elements preserved are :

Dermethmoid. — Thirty specimens with *Clarias lazera*-like ornamentation (tubercles more numerous, higher and more pointed), ten being almost entire and twenty from the anterior portion of the bone.

One, almost complete specimen is referred to *Clarias mossambicus*.

Prefrontals. — *Clarias lazera* (more highly ornamentated, with finer, more numerous and discrete tubercles), left 57, right 17 specimens.

One prefrontal is tentatively referred to *Clarias mossambicus* and six others are considered specifically unidentifiable.

Frontals. — One character was determined for distinguishing between the frontals of *Clarias lazera* and *C. mossambicus*, namely the ornamentation (tubercles more numerous and discrete in *C. lazera*).

On the basis of this character the material is divided as follows :

Clarias lazera : 44 specimens (19 left, 24 right and one paired);

Clarias mossambicus : 2 specimens (left and right);

Clarias sp. indet. : 15 fragments.

None of these specimens is entire and the areas of the frontal represented by them are varied.

Supraorbital. — Only *Clarias lazera* is represented; the material comprises twenty-one fragments (15 left, 6 right), of which four are almost entire, thirteen are of the anterior third or less and four are from the middle third.

Three further fragments are tentatively identified as supraorbitals.

Jugal. — *Clarias* sp.; three fairly complete bones (1 left, 2 right).

Supraorbital. — Two entire (right) and two almost entire bones (left and right) are assigned to *Clarias lazera* on the basis of their sculpturing.

Sphenotic. — *Clarias* sp.; seven fragments only one of which is almost entire. Four other specimens are identified provisionally as pieces of *Clarias* sphenotic.

Dermosphenotic. — One nearly complete bone can be referred to *Clarias lazera*. The dermosphenotic in this species has its tubercles arranged in centrifugally radiate striae, whereas in *C. mossambicus* the tubercles are distributed more irregularly.

Supraoccipital. — Twenty-two incomplete specimens; the majority from that part of the bone anterior to the fontanelle. The ornamentation is considered to be nearer that of *Clarias lazera* than *C. mossambicus*.

One fairly complete specimen is referred to *Clarias mossambicus*.

Pterotic. — Eight fragments of pterotic are assigned to *Clarias lazera* because of their numerous, acute and densely arranged tubercles.

Post-temporal. — Three fragments, which cannot be identified specifically. Two other fragments are though to be derived from the post-temporal of *Clarias*.

In addition to these identifiable neurocranial roofing bones, there are ninety-two fragments too small for accurate identification. Judging from the ornamentation of these bones, both *Clarias lazera* and *C. mossambicus* are represented, the former species predominating.

Two of the fragments represent a fish, or, fishes considerably larger than those from which the other fragments or more complete bones were derived. Both in their thickness and in possessing coarse, blunt tubercles, the exceptional fragments closely resemble Clariid neurocranial fragments found in lower gravel G. INF. at site VIII *a* (vide p. 27) and may be derived from older deposits.

Parasphenoid. — The twenty-one fragments of parasphenoid can be divided into two groups of ten and eleven specimens each, representing the anterior and posterior halves of the bone respectively. No specific characters can be determined.

Basioccipital. — Eight, almost entire bones.

Vomerine tooth-band. — A single fragment from the median part of the band, together with a splinter of the vomer itself.

The following elements of the branchiocranium were identified :

Palatine. — Seven specimens (four entire and three less than half complete).

Hyomandibula. — Two fragments; derived from the postero-ventral aspect of the bone.

Operculum. — Eight specimens, all more or less entire.

Ventral elements of the hyoid arch. — It should be noted that any apparent differences which may exist between these elements in *Clarias mossambicus* and *C. lazera* are outweighed by intra-specific growth changes.

Left.

(i) Epihyal only : twenty specimens; the majority are broken at the epi-ceratohyal suture.

(ii) Ceratohyal only : twelve specimens, fractured as above.

(iii) Epihyal and ceratohyal : seven entire specimens.

(iv) Ceratohyal and hypohyal : one specimen.

Right.

(i) Epihyal only : nineteen specimens, mostly fractured as above.

(ii) Ceratohyal only : seven specimens, mostly fractured as above.

(iii) Epihyal and ceratohyal : one entire specimen.

Urohyal. — Sixty-three specimens; with two exceptions all these bones are well preserved.

Quadrate. — Thirty-four specimens (15 left, 19 right), none entire. Fracture lines are variable and no common breakage pattern can be detected.

Articular. — Sixty-five specimens (28 left, 37 right). The majority is virtually entire, lacking only the most anterior projection. In only one case is there a fragment of the dentary still closely applied by its lateral sutural union. Although there appear to be at least two species represented, it is obvious from a study of extant material that changes in form associated with growth are as great as the differences observed in the fossils.

Dentary. — Fairly reliable characters for differentiating the dentary of *Clarias mossambicus* from that of *C. lazera* were determined from a study of the skeletons of these species. But, the criteria cannot be applied to the fossil material with any certainty.

There are ninety-five specimens in all, comprising forty-two left and fifty-three right rami. Two points of fracture are most frequent : (i) at or slightly behind the point where the dentigerous surface narrows laterally; (ii) immediately behind the most posterior extension of the dentigerous surface.

Pectoral girdle. — Cleithrum.

(i) Median ventral portion : represented by forty-four fragments of various sizes (19 left, 17 right and 8 indeterminable). The marked striae and rugosities preserved in the fossils are nearer the ornamentation of *Clarias lazera* than of *C. mossambicus*.

(ii) Lateral portion (especially the enlarged area accommodating the articular fossae for the pectoral spine) : twenty-two specimens (13 left, 9 right). No trenchant diagnostic characters are preserved.

(iii) Scapula and coracoid : four large fragments of both elements in which the trochlea and glenoid facets are preserved, and three specimens comprising only the coracoid with part of the glenoid facet.

Pectoral spine. — Twenty specimens (10 left, 10 right), eight of which are practically undamaged; the remainder comprise the proximal half to third of the spine. In all, the articular head is present and only slightly damaged.

Vertebral column.

Anterior fused vertebral mass. — Ten fragmentary specimens.

In general it is impossible to differentiate *Clarias lazera* from *C. mossambicus* on vertebral morphology.

1st Vertebra : seven.
2nd Vertebra : six.
3rd Vertebra : twelve.
4th Vertebra : seven.
5th-9th Vertebra : eighteen.

It is remarkable that amongst the great number of fish vertebrae recovered from this site, none can be unequivocally recognized as caudal vertebrae of *Clarias*.

Ribs. — Thirteen small, hamate bones are identified as pleural ribs of *Clarias*.

Size range and number of individuals.

The estimated size range of *Clarias lazera* from this deposit is 45-100 cm, with a modal range of 75-80 cm; few fishes less than 60 cm are represented. The minimum number of individuals present is estimated at 63 (the number of urohyal bones preserved).

? Heterobranchus sp.

With the exception of the vomerine tooth band and the dentary, the tentative generic identification of the specimens described below is based solely on characters of ornamentation.

In *Heterobranchus* the tuberculate ornamentation characteristic of many *Clarias* species is, to a large extent, replaced by radiating striae. This is particularly marked on the frontals, prefrontals and dermethmoid. When present, tubercles are of a type intermediate between those of *Clarias lazera* and *C. mossambicus*.

Frontal. — 8 fragments (5 left, 3 right).

Mesethmoid. — One fragment.

Lateral ethmoid. — Two fragments.

Sphenotic. — One fragment.

Post-temporal. — One fragment.

Supraoccipital. — A single fragment from the anterior end.

One unidentifiable fragment of roofing bone.

All these bones were derived from fishes of about 60 cm total length.

Dentary. — A fragment from the posterior part of the bone.

Vomerine tooth-band. — A small segment from the median part of the band, together with a splinter of vomer, is referred to *Heterobranchus* on the basis of its shape and the small dental alveoli, which indicate that the teeth were slender. It was derived from a fish longer than 60 cm total length.

Fam. MOCHOCIDAE.

Synodontis spp.

The genus *Synodontis* does not occur in the present fish-fauna of Lake Edward and it is therefore of considerable importance to determine what species were present when the Epi-Pleistocene beds were laid down.

To this end, the fossils were compared with *Synodontis frontosus*, *S. schall*, *S. nigrita*, *S. victoriae* and *S. afro-fischeri*. These species were selected on the grounds of their present distribution as those most likely to have occured within the Lake Edward basin, assuming of course, that the species were already evolved at that time.

Sculpturing and ornamentation of neurocranial bones provide the most readily determined specific characters for fossil material which is often fragmentary. Additional criteria are provided by the shape and ornamentation of the humeral process, and, the morphology of the dorsal fin-spine.

These admittedly few and not altogether satisfactory characters suggest that most of the fossils may be referred to *Synodontis frontosus*, a species at present found in Lake Albert, the Nile, Lake Rudolf and Lake No. A few bones are apparently attributable to *S. schall*, whose present distribution is Lake Albert, the Nile and the Niger.

Although, in the characters examined, correspondence between fossils and extant fishes may not be exact, there is no reason to suppose that on morphological grounds the Ishango fishes represent an undescribed and presumably extinct species. The differences observed are matched by the observed intra-specific variability of living *Synodontis frontosus*.

The following bones were identified :

Dermethmoid. — Twenty-five specimens, of which twenty-one are almost entire.

Prefrontal. — Ten specimens (4 left, 6 right); all are entire or almost so.

Frontal. — One hundred and forty-five specimens (59 left, 86 right), all referred to *Synodontis frontosus*; the majority is entire, or, virtually so. Most specimens exhibit a cancellous pattern underlying the superficial

tuberculate ornamentation. This deep pattern is considered to be an artifact resulting from partial decay and weathering of the bone before fossilization; it is present in most other *Synodontis* neurocranial bones from this site. Similar cancellous patterns were observed in the bones of extant *Synodontis* picked up as skeletons on the shore of Lake Rudolf, but are absent in skeletons prepared from fresh or preserved material.

Sphenotic. — Nineteen specimens, mostly entire.

Supraoccipital. — Sixty-two specimens.

Post-temporal. — Thirteen specimens (8 left, 5 right).

Occipito-nuchal plate :

(i) Anterior unpaired plate : one almost entire bone and sixteen fragments (11 left, 5 right) of various sizes; all have ornamentation of the *Synodontis frontosus*-type

Two small fragments are tentatively identified as anterior nuchal plates.

(ii) Postero-lateral paired plates : three specimens (2 left, 1 right) are also referred to *Synodontis frontosus*.

Forty-eight skull bones (neurocranial and probably some nuchal-plate elements) cannot be identified. All have ornamentation approximating to that of *Synodontis frontosus*.

Basioccipital. — Four entire specimens, three of which compare closely with the basioccipital in *Synodontis frontosus;* and the fourth (derived from a large fish) is more like that of *S. schall.*

Pectoral girdle.

Cleithrum and humeral process. — On hundred and fifteen specimens (58 left, 57 right); with few exceptions, the lateral, dome-like expansion of the cleithrum and the greater part of the ascending limb are preserved. A large area of the humeral process is present in many specimens.

The ornamentation of these bones is similar to that of *Synodontis frontosus* Further, in many specimens the humeral process is almost complete, or it is sufficiently complete to allow the reconstruction of its posterior outline. In this character too, the fossils resemble *S. frontosus*, in which the length/depth ratio of the humeral process is approximately unity.

One hundred and fifty (62 left, 88 right) fragments, mostly of the lateral dome or the ascending cleithral limb, cannot be specifically identified.

Only two specimens (one left and one right but from different individuals) are tentatively referred to *Synodontis schall.* In these two bones the lower margin of the humeral process has a predominantly striate pattern and an approximate reconstruction of their outline indicates that the humeral process was longer than deep.

Coracoid. — Four fragments (1 left, 3 right) and in addition, a large fragment from the horizontal, median expansion of the bone.

Pectoral spine. — No trenchant specific characters were observed in the pectoral spines of the extant species examined; the fossils are therefore considered as specifically indeterminable.

Right spine. — Sixty-seven specimens, of which thirty-three are entire, or, two-thirds entire, nine have at least the proximal third intact and twenty-four have less than the proximal third preserved. One specimen has only the distal two-thirds preserved. The articular head is preserved in all but five spines.

Left spine. — Eighty-one specimens, comprising thirty-three complete, or, two-thirds complete, twenty-eight with at least the proximal third present and twenty with less than the proximal third intact. With one exception the articular head is present in each specimen.

Dorsal fin-spines.

(i) Pungent spine : Some slight but certainly diagnostic characters serve to distinguish spines of *Synodontis frontosus*, *S. victoriae* and *S. schall*. The small adult size of *S. afro-fischeri* precludes its comparison with the other species.

The spines of *Synodontis victoriae* and *S. frontosus* differ from those of *S. schall* in having a rounded as opposed to a laterally compressed cross-section. The spine of *S. frontosus* may be distinguished from that of *S. victoriae* by its having a low and not a high keel on the anterior face, by its stronger curvature and thirdly, by the longer and more numerous distal serrations on the posterior face.

There are enough complete spines amongst the ninety-six specimens to assign the fossils to *Synodontis frontosus* with reasonable certainty.

(ii) Second dorsal ray : This small, chevron-shaped bone which lies anterior to the pungent spine, is represented by nine almost undamaged specimens.

Vertebrae.

Only six anterior precaudal vertebrae were identified. This paucity of vertebrae is remarkable, especially when compared with the large number of cranial bones preserved. A similarly disproportionate ratio of cranial to axial skeletal parts was noted in the *Clarias* specimens from the same deposit.

It is estimated that the size range of *Synodontis* from this deposit is between 20 and 40 cm standard length; the modal size is about 35 cm.

The minimum number of individuals in the collection (based on the number of frontals preserved) is eighty-six, although the number of dorsal spines indicates a somewhat higher figure.

CYPRINIODEA

Fam. CYPRINIDAE.

Barbus cf. **B. bynni** and **Barbus** cf. **B. altianalis.**

The majority of fish-fossils from Site IX is referable to this genus, which also provides the highest estimated number of individuals.

The fossils consist mainly of branchiocranial elements, particularly lower phararyngeal bones and dissociated pharyngeal teeth; the neurocranium is very poorly represented.

Two fairly clear-cut differences were found in the morphology of the pharyngeal bones and teeth of *Barbus bynni* (FORSK.) and *B. altianalis* (BOULENGER), the species thought most likely to occur in these deposits. On the basis of these characters, I consider that fishes resembling *B. bynni* and *B. altianalis* were present in Lake Edward during the Epi-Pleistocene. Since most of the pharyngeal bones and teeth resemble those of *B. bynni* it seems likely that this was the predominant species, or at least, morphological type (see below).

Neurocranium. — Represented only by the basioccipital, of which there are thirty-four rather fragmentary specimens.

Branchiocranium.

Hyomandibula. — Ninety specimens (31 left, 59 right) most of which are almost entire and lack only the slender, distal limb.

Operculum. — Thirty-three specimens (14 left, 19 right), none entire.

Preoperculum. — Thirty-three fragmentary specimens (17 left, 15 right and 1 indeterminable).

? Interoperculum. — A single bone is tentatively identified as an interoperculum.

Urohyal. — Two specimens.

Ceratohyal. — Three (2 left, 1 right).

Epihyal. — One.

? Metapterygoid. — One almost entire bone has the general appearance of this element.

Quadrate. — The anterior outline of the articular surface differs slightly in *Barbus bynni* and *B. altianalis*, being almost square in the latter.

On this character, three bones (all left) may be assigned to *Barbus altianalis* and fifty-one (22 left, 29 right) to *B. bynni*. None of these specimens is entire.

Articular. — Thirty-one fragmentary specimens (15 left, 16 right). The point of fracture is remarkably constant, and occurs slightly anterior to the facet.

Palatine. — Ten almost entire bones (7 left, 3 right).

Jaws.

Dentary. — One hundred and ninety-one specimens (112 left, 79 right). There is some variation in the gross morphology of the fossil dentaries, particularly in the stoutness of the horizontal limb. This variability is, however, within intraspecific limits as determined from the skeletons of present-day fishes. It is impossible to determine the specific identity of the fossils.

Maxilla. — Seventy-three specimens (25 left, 48 right) showing various forms of breakage. The maxillae of *Barbus bynni* and *B. altianalis* differ in the nature of the process to which the palato-maxillary ligament is attached. In *B. altianalis* there is a low boss at the point of insertion, whereas in *B. bynni* the ligament is attached to a shelf-like projection. Fossils in which this character can be checked are clearly of the « *bynni* » type.

Premaxilla. — Two fairly complete specimens (left and right) from fishes of markedly different sizes.

Pharyngeal bones and teeth.

It is difficult to select trenchant criteria which may be used to separate the pharyngeal bones and teeth of *Barbus bynni* from those of *B. altianalis*. Two characters have been chosen, however, which although showing slight interspecific overlap, prove reliable when large series are available.

One of the characters is the form of the major pharyngeal tooth. The crown of this tooth is globose in *Barbus bynni*, but in *B. altianalis* it is more compressed and mammiform. If the teeth of small specimens are compared, a clearly defined difference is seen in the nature of the cusp. In *B. altianalis* the cusp rises smoothly from the crown, whereas in *B. bynni* it has the appearancee of a slight median protuberance from the otherwise convex occlusal surface. It is in the pattern of cusp attrition that the two species show greatest divergence. The low cusp of *B. bynni* is usually worn and only slightly evident even in small individuals; large fishes have the occlusal

surface worn into a definite and extensive pit, so that the originally globose crown becomes distinctly molariform.

Attrition of this type is rarely encountered in *Barbus altianalis*. In this species, wear is slight and restricted to the cusp which retains its mammiform appearance even in large individuals (80 cm standard length).

Such differences in attritional pattern, although modified by the form of the unworn tooth, are probably related to differences in the food of the two species and to the functional relationships of the pharyngeal bones with the horny pad against which they occlude.

The second « specific » character is less readily determined. It is the ratio of the distance between the major pharyngeal tooth and the apex of the angle in the lower limb of the bone, to the length of the lower limb below the apex. In *Barbus bynni* the ventral limb is longer (as much as 1 ½ times) than the distance from apex to major tooth, but in *B. altianalis* it is equal to, or, very slightly shorter than, this distance.

These two characters (used in combination wherever possible) show that most pharyngeal bones and isolated teeth can be assigned to *Barbus bynni*. In fact, only seven bones (3 left, 4 right) are definitely referred to *Barbus altianalis*.

Since they are unit characters, the pharyngeal bones provide a suitable means for estimating the minimum number of fishes represented in the collection. In order to facilitate this calculation the material is divided first, into left and right bones and secondly, into six fracture groups. No group is absolute and there is slight overlap between the various categories.

Left bone :

(i) Ventral limb and the major tooth or its « alveolus », with occasionally the succeeding one or two rows of teeth. Tooth present : 93. Tooth absent : 37 (all *Barbus* cf. *B. bynni*).

(ii) The major tooth (or its « alveolus ») together with the bone immediately surrounding it : Tooth present : 37 (*Barbus* cf. *B. bynni*). Tooth absent : 4 (sp. indet).

(iii) The entire or greater part of the dentigerous area; in some specimens either the ventral or dorsal limb is present. Major tooth present : 15. Major tooth absent : 6 (Both groups *Barbus* cf. *B. bynni*). Species indeterminable : 16.

(iv) The dorsal limb and part of the dentigerous surface : 19 specimens, all specifically indeterminable.

(v) Dorsal limb only : 23 specimens, all specifically indeterminable.

(vi) The entire bone : Major tooth present : 11. Major tooth absent :1 (all *Barbus* cf.*B. bynni*). Species indeterminable : 5 (tooth absent, lower limb damaged).

Right bone. — The same breakage groups, as defined above, are used.

(i) Major tooth present : 62. Major tooth absent : 44 (all *Barbus* cf. *B. bynni*). Species indeterminable : 2.

(ii) Tooth present : 37 (*Barbus* cf. *B. bynni*). Tooth absent : 13 (sp. indet.).

(iii) Tooth present : 4 (*Barbus* cf. *B. bynni*). Tooth absent : 8 (sp. indet.).

(iv) Tooth present : 2 (*Barbus* cf. *B. bynni*). Tooth absent : 20 (sp. indet.).

(v) 32 specimens, all specifically indeterminable.

(vi) Tooth present : 6 (*Barbus* cf. *B. bynni*). Tooth absent : 4 (*Barbus* cf. *B. bynni*). Specifically undeterminable : 4.

Barbus altianalis.

Left bone. — 4 [three of breakage group (i) and one of group (iii)].

Right bone. — 5 [all of group (ii)], each with the major tooth preserved.

In addition, two isolated major pharyngeal teeth are assigned to *B. altianalis*.

Besides the material described above, there are fourteen small fragments of pharyngeal bones which cannot be identified further.

Isolated pharyngeal teeth :

(i) Major pharyngeal tooth : *Barbus* cf. *B. bynni*. One hundred and sixty-four teeth are referred to this species. The teeth represent a wide size-range of fishes, with the majority derived from large individuals and very few from small fishes. Attrition pattern is variable and apparently without correlation between tooth size and the degree of wear; most teeth show considerable wear and are of the molariform type. In a few specimens almost the entire crown is reduced to a low, flattened surface.

One additional tooth, without pronounced wear, is morphologically intermediate between the major teeth of *Barbus bynni* and *B. altianalis*. It is considered as specifically indeterminable.

Forty-eight fragments are identified as being derived from the major pharyngeal teeth of *Barbus* cf. *B. bynni*.

(ii) Other pharyngeal teeth of *Barbus* sp. or spp. : Sixty-eight teeth; their size-range is similar to that of the major teeth.

As mentioned above, the pharyngeal bones may be used for calculating the minimum number of individuals present in the sample. In this instance the major pharyngeal tooth in association with its bone, or, the alveolus of this tooth, has been used. As many specimens cannot be specifically identified, three estimates of minimal number of individuals must be given : *viz.* for *Barbus* cf. *B. bynni*; for *B. altianalis*; and for *Barbus* spp.

The estimates are : *Barbus* cf. *B. bynni* 200 fishes; *B. altianalis* 5 fishes; and for *Barbus* spp. 227 fishes.

In the calculations no account was taken of the one hundred and sixty-four isolated major pharyngeal teeth since these could not be assigned to left or right bones. Considering total *Barbus*, it will be seen that the number of bones from either side lacking major teeth is almost equal. (66 left and 81 right). Thus, it would seem reasonable to consider the isolated teeth as being divisible equally into two groups representing those dislodged from left and right bones (the size ranges of isolated teeth and edentulous bones are similar). If one hundred and forty-seven of the teeth are refered to those bones which lack major teeth, then the total minimum number of all *Barbus* is only increased by six individuals.

Axial skeleton.

Vertebrae. — The vertebrae, especially the abdominal elements, of present-day *Barbus bynni* are stouter than those of fishes in the *B. altianalis* sub-species complex. In lateral view, the longitudinal strut of the centrum is seen to be thicker in *B. bynni* than in *B. altianalis* vertebrae. This difference also affects the outline of the centrum when viewed from above : in *B. altianalis* the centrum has a distinct transverse constriction, whereas in *B. bynni* it is only slightly narrowed. Neither of these characters are, however, absolute, particularly when considering large individuals of *B. altianalis*; the validity of their use in the specific identification of this material is doubtful and will be discussed below.

Precaudal vertebrae.

1st Vertebra. — Forty-eight specimens. The centrum shows considerable variation in outline, but in the majority of specimens it is oval, thus differing from the almost circular first vertebra of *Barbus bynni* and *B. altianalis*.

2nd Vertebra. — Fifty-five specimens. Most of the fossils approach the form of the second vertebra in *Barbus bynni* rather more closely than that of *B. altianalis*. In many specimens the centrum is obliquely broken along a dorso-ventral line. This type of fracture is very similar to that resulting from a knife-cut into and through the centrum; it has not been observed in skeletons found in Nature and cannot easily be replicated by manual pressure alone. Judging from the nature of the exposed surface, the damage occurred before fossilization.

Other precaudal vertebrae. — Two hundred and thirty-three well-preserved but specifically unidentifiable specimens. There are approximately equal numbers of anterior and posterior elements.

Neural spines. — Four isolated neural spines are identified as those of the fourth vertebra.

Ribs. — The highly characteristic third rib is represented by eighteen specimens (10 left, 8 right). In general appearance these ribs are nearer those of *Barbus bynni* than *B. altianalis*. One other specimen is tentatively identified as a third rib.

Nine fragments of pleural ribs (proximal parts) cannot be further identified.

Caudal vertebrae. — The majority of these specimens is intermediate in form between the caudal vertebrae of extant *Barbus altianalis* and those of *B. bynni*. They are somewhat coarser than the vertebrae of *B. altianalis* but are less compact and stout than those of *B. bynni*; a few specimens are strictly comparable with similar vertebrae of *B. altianalis*.

Thus it appears that the predominant species in this upper Pleistocene population of *Barbus* combined certain osteological characters (notably the pharyngeal bones and teeth) of present-day *B. bynni* with a vertebral form more nearly akin to that of extant *B. altianalis*.

In general, the three hundred and eight caudal vertebrae are well preserved, but most lack neural and haemal spines. With few exceptions, the centrum is intact.

Terminal vertebrae. — Five damaged specimens.

Hypurals. — Five specimens.

Fin skeleton.

First interneural pterygiophore. — Except for its more robust form in *Barbus bynni*, this bone is similar in both *B. altianalis* and *B. bynni*. The forty-two fossils show varied breakage patterns; none is entire.

Second interneural. — Several characters serve to distinguish the second interneural of *Barbus bynni* from that of *B. altianalis*. The characters most frequently preserved in the fossils are :

(i) The distal articular surface is almost horizontal in *Barbus bynni*, but is curved and inclined forwards in *B. altianalis*; laterally and below these facets there is an elongate and well-defined fossa in *B. bynni*, but in *B. altianalis* this fossa is barely, if at all, perceptible.

(ii) In *Barbus bynni* the posterior face of the bone is clearly concave, with the sides sloping steeply towards the median spine; in *B. altianalis* this face is only weakly concave and gives the appearance of a gently curved surface divided by the spine. Furthermore, in *B. bynni* the lateral bound-

aries of the concavity turn sharply inwards to join a median, posteriorly directed projection from the anterior surface, whereas in *B. altianalis* the boundaries pass almost imperceptibly into a lateral thickening at the base of the posterior projection.

It was found that although the lateral fossa is generally more definite in specimens designated by other characters as *Barbus* cf. *B. bynni*, intermediates between the « *bynni* » and « *altianalis* » types occurred in specimens assigned to *Barbus* cf. *B. bynni* or to *B.* cf. *altianalis*.

Breakage patterns vary, with the majority of specimens representing the distal third or two thirds of the bone.

Ninety-three specimens are identified as second interneural pterygiophores; of these, eighty-four are referred to *Barbus* cf. *B. bynni* and nine to *B.* cf. *altianalis*.

Third interneural. — The more concave posterior face of this element in extant *Barbus bynni* and differences in the shape of the articular surface, permit fairly certain specific identification.

All the fossils are incomplete, the distal third to two-thirds of the bone being most frequently preserved. Of seventeen specimens, sixteen are assigned to *Barbus* cf. *B. bynni* and one to *B.* cf. *altianalis*.

Fourth interneural. — One specimen (specifically indeterminable).

Three fragmentary specimens are tentatively identified as first (f 2) and second interneural pterygiophores.

Interhaemal pterygiophores. — Three fragmentary specimens are identified as second, third and fourth interhaemals.

Pectoral and Pelvic girdles. — Are each represented by a single, fragmentary specimen.

Third (enlarged) dorsal fin-ray. — There are thirty-one fragments (21 left and 10 right halves) mostly from the proximal fifth to third of this spine-like ray. On the basis of their slight curvature and their massiveness, the specimens are referred to *Barbus* cf. *B. bynni*. Two other specimens should probably be identified as fragments of this ray.

Branched dorsal and anal rays. — It seems probable that most of the two hundred and seventy-nine halves of fin rays recovered from this deposit should be referred to *Barbus*.

Size range and number of individuals. — The size range of individuals present in this sample is estimated to be from 25 to 75 cm. standard length, with a distinct mode between 45 and 60 cm.

The probable minimum number of individuals of both species is two hundred and twenty-seven.

PERCOMORPHI

Fam. CENTROPOMIDAE.

Lates cf. L. niloticus.

No well-defined osteological characters have been found which will enable *Lates niloticus* to be distinguished from the species and sub-species of *Lates* occurring in Lakes Rudolf and Albert. The fossil bones are identical with comparable elements from species of this complex and are considered as representing *L. niloticus*.

Neurocranium. — The few neurocranial bones present are identified as follows :

Vomer. — The dentigerous surface is preserved in all nine specimens, and the posterior ventral limb in seven. There is some variation in the shape of the toothed area. Basically, this surface is cardiform in outline, but in seven specimens the posterior median margin is produced as either a narrow, or, a broad tongue. Two other specimens have the posterior margin smoothly convex. Some intraspecific variability in this character was observed amongst the extant species and sub-species examined; in these, the posterior outline is usually either somewhat concave or convex. Since so few fossils are available and because this character is known to be inconstant in living fishes, it must be considered of little taxonomic importance. (See also WHITE, 1927).

Parasphenoid. — Represented by six fragments, one of which is almost entire; the remainder are from the middle third of the bone.

Basioccipital. — In all fourteen specimens fracturing has occurred along almost identical lines. The facet and lateral walls immediately anterior to it are preserved, but, as the break runs obliquely ventrad, the anterior part of the bone is represented only by its ventral and ventro-lateral walls.

Exoccipital. — Three, fairly complete specimens.

Supraoccipital. — Three fragments, two from the middle third of the bone and one in which the anterior two thirds are preserved.

Branchiocranium.

Palatine. — Two imperfect specimens (left and right) from fishes of manifestly different sizes.

Hypohyal. — A single specimen, wanting the dorsal third.

Ceratohyal. — Five specimens (4 left, 1 right), all more or less entire.

Hyomandibula. — Three imperfect specimens (1 left, 2 right).

Quadrate. — Sixty specimens (31 left, 29 right) exhibiting various degrees of completeness, from virtually entire to some in which only the articular surface and ventral limb are present.

Articular. — Thirty-six specimens (13 left, 23 right) of which only two are almost entire. With few exceptions, the remainder show a rather constant fracture point anterior to the facet; in some, breakage has occurred immediately anterior to the facet.

Dentary. — Seventy-two specimens (6 left, 66 right), none entire. The line of fracture is remarkably constant, occurring most frequently somewhat anterior to the point at which the dentary forks into ascending and horizontal rami.

Premaxilla. — Twenty-three (12 left, 11 right); breakage is varied and only two bones are entire.

Maxilla. — Twenty-five specimens (9 left, 16 right), none entire; most specimens are derived from the anterior and antero-lateral portions of the bone.

Preoperculum. — Twenty fragmentary specimens (11 left, 9 right), mostly derived from the region between the ascending and horizontal limbs, although the ascending limb is present, albeit incomplete, in five specimens.

Branchiostegal rays. — Two specimens, one about two-thirds complete and the other about one-third complete.

Gill-rakers. — Five well-preserved specimens, all from the first gill-arch (four from the epibranchial and one from the epi-ceratobranchial angle).

Fin skeleton.

Pectoral girdle. Post-temporal. — Six fragmentary specimens.

Cleithrum. — Seventeen specimens (6 left, 11 right), all incomplete: the majority is from the region between the ascending and horizontal limbs, but short lengths of both limbs are usually present.

Scapula. — Two incomplete specimens from the ventrolateral portion of this bone, including the trochlea facet.

Pelvic girdle. — Five fragmentary specimens (4 left, 1 right) of the posterior transverse face and part of the median longitudinal limb.

Interneural pterygiophores.

First interneural. — Two incomplete specimens.

Third interneural. — This very characteristic pterygiophore is represented by twenty, variously fragmented specimens.

Fourth interneural. — Two incomplete specimens.

One fragmentary and serially indeterminable interneural is tentatively referred to *Lates*.

Interhaemal pterygiophores.

First interhaemal. — Twenty-six well-preserved specimens. A badly damaged fragment, probably from the distal third of this interhaemal, is provisionally referred to *Lates*.

Dorsal and anal fin-spines. — Forty-two spines are tentatively identified as those of *Lates*, although the possibility that some were derived from large individuals of *Tilapia* cannot be overruled. In addition there are two anal spines and two rays which were preserved in their serial arrangement, but which were dislodged during cleaning and development.

Pectoral spines. — Thirty-three (25 left, 8 right) spines may be referred to *Lates*.

Vertebrae.

In general, the vertebrae are well-preserved, although most have their neural and haemal arches broken or missing entirely. There is no indication of rolling or weathering and the finest details of sculpturing and pattern are preserved.

Precaudal vertebrae. — 1st : eleven specimens; 2nd : seven specimens; 3rd : twenty-three specimens; 4th : nine specimens.

Excepting the twelfth vertebra, which is easily recognised by the transverse strut connecting the parapophyses, none of the more posterior precaudal vertebrae was individually identified. There are sixty-three such elements and three twelfth vertebrae.

Caudal vertebrae. — Sixty-one specimens.
Thirty-one fragmentary vertebrae are readily identifiable as those of *Lates*, but they cannot be serially placed.

Ribs. — One specimen, the head of an anterior abdominal rib.

Size range and number of individuals.

From the vertebrae and certain syncranial bones, the size range of individuals represented in this sample is estimated to be from 30-100 cm

standard length, with distinct modes at *ca.* 40 and *ca.* 65 cm. Thus, it is obvious that *Lates* from this deposit were considerably smaller than those from Kaiso beds and beds of the Semliki series in the Lake Edward area.

The estimated minimum number of individuals represented is sixty-six (derived from the dentary).

Fam. CICHLIDAE.

Tilapia sp. indet.

The *Tilapia* remains are interesting because of the disproportionately high number of first interhaemal pterygiophores preserved. Reasons for this disparity may possibly be associated with human activity; it is difficult to imagine any natural sorting process which could produce similar results, particularly since the phenomenon is apparently restricted to one species.

The specific determination of the *Tilapia* fossils has proved impossible.

Branchiocranium.

Hyomandibula. — Four incomplete specimens (all left).

Quadrate. — Three fragmentary and similarly fractured specimens.

Articular. — Ten specimens (5 left, 5 right), of which five are almost entire.

Dentary. — Two incomplete specimens.

Premaxilla. — Six incomplete bones (5 left, 1 right) comprising the anterior third of the horizontal ramus and the major part of the ascending process. It is clear from the alveolar surface that at least five inner series of teeth were present.

Urohyal. — One, almost entire specimen.

Operculum. — Thirty-eight fragmentary specimens (17 left, 21 right).

Suboperculum. — One fairly complete bone.

Fin skeleton.

Post-temporal. — One, almost entire bone.

Pelvic girdle. — Characters serving to distinguish the pelvic girdle of *Lates* and *Tilapia* are neither numerous nor well represented in the fossils; thus, some fragments thought to be from *Tilapia* may be derived from the girdles of small *Lates*.

Ten specimens (4 left, 6 right) are tentatively referred to *Tilapia*; all are very fragmentary.

First interhaemal pterygiophore. — The first interhaemal is the predominant *Tilapia* fossil, being represented by one hundred and ninety-three specimens. Of these, seventeen are virtually entire, with only the attenuated proximal spine broken near its tip; thirty-nine others have at least two-thirds of the bone preserved. The remaining specimens are more fragmentary, but include one in which the first anal spine is still articulated by its delicate double-ring joint. Only a few other bones have the pterygiophore joint intact.

It is impossible to divide this material into well-defined breakage groups since inter-grading fracture types are common.

Fin-spines.

Dorsal fin. — On the basis of their curvature and the inclination of the proximal face, one hundred and forty-seven spines are assigned to *Tilapia*. The material is variously broken and only a few spines are entire; the majority is of the proximal half or less.

Anal fin. — Fifty-one specimens, comprising eighteen first and thirty-three second and third spines. Unlike the dorsal spines, many anal spines are entire, or, almost entire.

Pelvic spine. — Thirty-two (10 left, 22 right).

Vertebrae.

Precaudal vertebrae. — 1st : twenty-six specimens; 2nd twenty-three specimens; 3rd : thirteen specimens.

In addition there are one hundred and thirty-nine precaudal vertebrae of indeterminable position in the column.

Caudal vertebrae. — One hundred and sixty-one specimens, all of indeterminable position.

All vertebrae are well preserved and although many are without neural and haemal spines there is a high proportion of specimens with these delicate structures intact.

Size range and number of individuals.

The modal size of these *Tilapia* is estimated at *ca.* 35 cm standard length, and the size range from *ca.* 30-40 cm. The minimum number of individuals (based on the number of first interhaemal pterygiophores) is one hundred and ninety-three.

PALAEOPTERYGII

Fam. POLYPTERIDAE.

Polypterus sp.

The only specimen from this genus is an almost entire abdominal vertebra. *Polypterus* does not occur in the present fauna of Lake Edward and neither was it found in earlier deposits.

Vertebral form in this family is very characteristic and I have no doubt as to the identity of the specimen.

In appearance and mineralization the *Polypterus* vertebra compares very closely with other specimens from this deposit; thus, there seems little reason to doubt the contemporaneity of *Polypterus* with the other species of the N. F. P. R. Since the fish fauna of the period was so typically Nilotic the presence of *Polypterus* is not unexpected. It is, of course, impossible to give a certain specific identification from one vertebra, but it can be said that the bone compares more closely with the corresponding vertebrae of *P. senegalus* than with those of *P. enderlichi* or *P. bichir*.

The paucity of *Polypterus* remains may reflect the relative scarcity of these fishes in the Epi-Pleistocene lake. Certainly, in present-day Lake Albert, *P. senegalus* is not often or easily captured.

GENERICALLY UNIDENTIFIABLE *PERCOMORPHI*.

(i) 2 fragmentary fin-spines (? *Lates* dorsal and anal spines).

(ii) 23 fin-rays and spines, in which only proximal ends are preserved.

(iii) 5 pectoral spines.

GENERICALLY UNIDENTIFIABLE FRAGMENTS.

Quadrate. — Fourteen.

Vertebrae. — Four hundred and fifty-three fragments.

It seems likely that the greater number of these fragments should be assigned to *Barbus*. Identification cannot, however, be considered sufficiently certain to permit their inclusion with other material referred to this genus.

Hypural elements. — Thirteen.

Pterygiophores. — Eighty-eight; interneurals of the *Barbus* type predominate.

?Basioccipital. — Thirteen.

Unidentifiable bones. — Ninety-eight, of which seven are dentigerous.

SITE Xa

Ishango, at the source of the Semliki. Excavation in the post-emersion zone (Z.POST-EM.), trench N 43^{e} E, between 7 and 23 metres. Mesolithic; a kitchen midden.

DIPNOI

Fam. LEPIDOSIRENIDAE.

Protopterus sp.

A large fragment of upper tooth-plate.

OSTARIOPHYSI

SILUROIDEA

Fam. BAGRIDAE.

Bagrus sp.

The presence of *Bagrus* in this deposit is of particular interest. The only other unequivocal record of this genus in the Lake Edward basin is from deposits at Kanyatsi (Lower Kaiso age). The apparent absence of *Bagrus* from the generically rich site IX (N.F.PR.) is enigmatic and remains unexplained.

Neurocranium.

Frontal. — Eight specimens (4 left, 4 right) derived from the posterior part of the bone. All are well preserved, with the finest details of sculpturing intact; breakage is varied.

Supraoccipital. — Two specimens; one almost entire but lacking its posterior spine, the other rather extensively damaged.

Sphenotic. — A single, almost complete bone (left).

Parasphenoid. — Two fragments, from the middle third of the bone and with almost identical fracture lines in both the horizontal and vertical planes.

Basioccipital. — Four specimens, each comprising the facet and posterior third, or, quarter of the bone; the dorso-lateral face is broken in all.

Branchiocranium.

Hyomandibula. — Two specimens (left and right); the left is almost complete but the right comprises only its articular head.

Quadrate. — Two fragmentary specimens.

Articular. — Six specimens (4 right, 2 left).

Dentary. — Fifteen specimens (6 left, 9 right). With three exceptions, only the anterior (symphysial) portion is preserved; in the exceptional bones the greater part of the horizontal limb is present.

In addition, two fragments of dentigerous bone are thought to be derived from the dentary of *Bagrus*.

Vertebrae. — The centrum of the anterior fused vertebral mass is represented by twelve variously fragmented specimens. There is also a fragment from the anterior, median crest of this bone, and four well-preserved specimens of the centrum which lies between the compound vertebra and the basioccipital facet.

Precaudal vertebrae. — Forty-three specimens.

Caudal vertebrae. — Forty-six specimens.

Fin skeleton. — The pectoral girdle is represented by two fragments (left) which include the articular fossa and short portions of the ascending and horizontal limbs immediately adjacent to it. There are also two

fragmentary post-temporals (left and right, but from different individuals) and one incomplete scapulacoracoid.

Fin-spines.

Dorsal. — Three specimens (one almost complete and two from the proximal third and quarter). Three fragments from the distal part of the spine are tentatively assigned to this genus.

Pectoral spine. — Twelve (5 left, 7 right). None is entire, but the complex articular head is well-preserved in all. There is also a fragment which is probably from the distal portion of the spine.

Fam. CLARIIDAE.

Clarias sp.

One fragment of neurocranial roofing bone (possibly the post-frontal) and four vertebrae (3 precaudal and 1 caudal, from at least two individuals) are the sole remains of *Clarias* in this collection. A fragment of parasphenoid may be derived from a *Clarias*.

CYPRINOIDEA

Fam. CYPRINIDAE.

Barbus sp. (probably **B. bynni**).

Dentary. — Two rami (left and right) from different fishes.

Articular. — One rather fragmentary specimen (left).

Pharyngeal bones and teeth. — Two incomplete right bones, comprising the lower limb, major pharyngeal tooth and part of the dentigerous area. In addition there is the crown of a very large major pharyngeal tooth whose gross morphology is similar to that of the unworn tooth in *B. bynni*.

Vertebrae. — Nine precaudal and twenty-one caudal elements.

Apart from the large pharyngeal tooth, apparently only two fishes (with estimated standard lengths of 30 and 50 cm) are represented by this material.

PERCOMORPHI

Fam. CICHLIDAE.

Tilapia sp.

Tilapia are poorly represented by the following fragments :

Articular. — One, almost complete specimen.

Vertebrae. — Two precaudal (possibly second vertebra) and eleven caudal vertebrae.

Fin-spines.

Pectoral. — One almost complete right spine. The proximal two-thirds of another spine, lacking the diagnostic articular head, is tentatively identified as *Tilapia*.

Dorsal fin. — Twenty spines (about equal numbers of anterior and posterior spines) are tentatively referred to this genus.

Anal fin. — Two spines.

Size range. — These few specimens were derived from fishes between *ca.* 35 and 45 cm standard length.

GENERICALLY UNIDENTIFIABLE MATERIAL.

Vertebrae and fragments of vertebrae. — Twenty-one.

Fin-rays and spines. — Two.

Unidentifiable fragments. — Two.

Fam. CENTROPOMIDAE.

Lates sp.

Vertebrae. — Two abdominal and one caudal vertebrae. The abdominal elements have the same appearance as other specimens from this deposit, whereas the caudal vertebra is lighter in colour and has an adherent matrix similar to that of fossils from the N.F.PR.

Dentary. — The anterior two thirds, from a small fish. The specimen is relatively well-mineralized.

SITE X*b*

As for Xa, but trench N 143^{G} E, between 15 and 19 metres.

OSTARIOPHYSI

SILUROIDEA

Fam. BAGRIDAE.

Bagrus sp.

Dentary. — Two specimens (left and right rami, from different individuals) in which only the dentigerous surface is preserved.

Pectoral girdle.

Cleithrum. — Two fragmentary specimens, one of the ventral margin of the ascending limb, the other from the median aspect of the cleithrum near its point of union with the mesocoracoid.

Pectoral fin-spines. — Two almost entire spines (left and right). Slight size differences suggest that they are from different individuals.

Vertebrae.

Anterior fused vertebral mass. — Three specimens, all derived from the antero-ventral aspect of this structure, together with three specimens of the vertebra which lies between the compound vertebra and the skull.

Precaudal vertebrae. — Thirteen.

Caudal vertebrae. — Twenty-seven.

The estimated size range of the fishes represented by these bones is *ca.* 45-80 cm standard length, with a mode at *ca.* 65 cm.

Fam. MOCHOCIDAE.

Synodontis cf. **S. frontosus.**

Frontal. — Two incomplete fragments (left and right) probably from different individuals. The ornamentation is nearest that of *Synodontis frontosus*.

In addition, there is a small and unidentifiable fragment of neurocranium.

Pectoral fin-spines. — Six specimens (4 left, 2 right) from the proximal end, and two from the distal end of the spine.

Fam. CLARIIDAE.

Clarias cf. **C. lazera** and probobly also **C. mossambicus.**

The species are identified on the basis of neurocranial ornamentation; those specimens tentatively referred to *Clarias mossambicus* are clearly in the minority.

Neurocranium.

Dermethmoid. — Ten (five from the anterior portion, including the lateral horn, and five from the posterior quarter to half). The indentation between the horns is more acute than that observed in living *Clarias lazera* and *C. mossambicus*.

Prefrontal. — Two, both incomplete.

Pterotic. — Two large fragments, one right, the other probably left.

Frontal. — Five small fragments.

Supraorbital. — Two fragments.

Post-temporal. — Two (left and right, from different fishes), both incomplete.

Unidentifiable neurocranial fragments. — Twenty-six, of which three may be tentatively assigned to *Clarias mossambicus*.

Hyoid arch.

Ceratohyal : one (right); epihyal : two (both right) and one fragment (left).

Quadrate. — One; almost entire.

Articular. — Eight almost perfect specimens (6 left, 2 right).

Pectoral fin-spines. — Four specimens from the proximal part of the spine, and three from the middle section.

Vertebrae. — Twelve precaudal and twelve caudal elements.

Size range. — The size-range of individuals represented by these bones is estimated at between 55 and 75 cm standard length, with a mode at *ca.* 60 cm.

CYPRINOIDEA

Fam. CYPRINIDAE.

Barbus sp.

Barbus is represented only by five vertebrae (2 precaudal and 3 caudal) from fishes of *ca.* 30 and 35 cm standard length.

PERCOMORPHI

Fam. CICHLIDAE.

Tilapia sp.

Vertebrae.

Precaudal. — Thirty-seven, of which nine are identified as first vertebrae.

Caudal. — Nineteen specimens.

Interneural pterygiophores.

Two first interneurals; one almost complete, the other comprising the articular surface only.

Fin-spines.

One pectoral spine and fifteen dorsal spines. The latter can only be tentatively identified as *Tilapia*, since few characters are preserved which will enable them to be differentiated from similar spines of small *Lates*.

The estimated size range of the fishes represented by this material is from 30-45 cm standard length.

Fam. CENTROPOMIDAE.

Lates sp.

Vertebrae. — Two specimens, one of which is poorly preserved and has an adherent matrix unlike that of other specimens from this level. The second specimen (an abdominal element) is markedly well-mineralized and appears to be somewhat rolled. It seems very probably that both specimens were derived from older deposits.

GENERICALLY UNIDENTIFIABLE MATERIAL.

(i) A fragment of siluroid pectoral spine.

(ii) Four fragments from the proximal ends of soft fin-rays.

(iii) A small fragment of parasphenoid.

(iv) Fourteen vertebrae.

SITE Xc

As for site Xa and b, but trench N 43° E, between 0-9 metres.

OSTARIOPHYSI

SILUROIDEA

Fam. BAGRIDAE.

Bagrus sp.

Neurocranium.

Supraoccipital. — Four specimens, variously fragmented and none entire.

Sphenotic. — One almost entire (right).

Frontal. — One small fragment.

Basioccipital. — Five specimens, all virtually entire.

Branchiocranium.

Quadrate. — One; fragmentary.

Articular. — One; almost entire.

Epihyal. — One; slightly damaged.

Ceratohyal. — Three specimens (1 left, 2 right), all incomplete, together with a small fragment which includes the epi-ceratohyal suture.

Hypohyal. — Three specimens (right); two of these are almost entire and one is a fragment from the postero-dorsal margin.

Dentary. — Nine (3 left, 6 right); none entire.

Vertebrae.

Anterior fused vertebral mass. — Sixteen specimens; none entire. The centrum of this compound vertebra is the only portion represented, except for a fragment from the anterior aspect of the flanged and curved « neural spine ».

Five specimens are identified as the small, flattened first vertebra.

Precaudal vertebrae. — Fifty specimens; the majority being of the first three vertebrae.

Caudal vertebrae. — Forty-two specimens.

Pectoral girdle.

Post-temporal. — Five specimens, four of which are rather fragmentary and one almost entire.

Cleithrum. — Eight fragments, of which six are derived from the area including and surrounding the articular fossa for the pectoral spine.

Coracoid. — Almost the entire posterior part; including the articular surfaces.

Fin-spines.

Pectoral spines. — Seven incomplete spines (2 left, 5 right) together with a fragment from the head of an eighth specimen.

Dorsal spine. — Four specimens from the proximal part of the dorsal spine, and a fifth fragment from the middle section.

Size range. — The estimated size-range of the fishes represented by these various bones is 30-70 cm standard length; most individuals are in the 60-70 cm class.

Fam. CLARIIDAE.

Clarias cf. **C. lazera** and **Clarias** cf. **C. mossambicus.**

As with specimens from other deposits, the specific identification of this material is based on the ornamentation of neurocranial bones. Again, *Clarias mossambicus* is poorly represented.

Neurocranium.

Dermethmoid. — Six variously fragmented specimens, of which three are almost entire.

Prefrontal. — Four incomplete bones (2 left, 2 right) and probably a small fragment of prefrontal.

Supraorbital. — One specimen, from the anterior part of the bone.

Frontal. — Thirteen fragments (5 left, 7 right and one indeterminable), ten of which are derived from the area including, or, immediately surrounding the fontanelle, and three are from the anterolaterally expanded portion of the bone. Wherever the post-fontanelle sutural surfaces are preserved, they are, with one exception, of the *Clarias lazera* type (see p. 34), as is the surface ornamentation. The exceptional specimen compares closely with *C. mossambicus* in both these characters.

Supraoccipital. — Five; all incomplete.

Post-temporal. — Five, rather fragmentary specimens, of which two are definitely and three are tentatively identified as post-temporals.

Unidentifiable fragments of neurocranium. — Twenty-two.

Branchiocranium.

Palatine. — Two; one entire the other slightly damaged.

Epihyal. — Two (left and right); almost complete.

Urohyal. — One specimen.

Articular. — Three (2 left, 1 right); all well-preserved.

Dentary. — One specimen, lacking the posterior part.

Vertebrae. — Seven posterior precaudal vertebrae.

Fin girdles.

Pectoral girdle. — Represented by : (i) an almost complete right cleithrum; (ii) a fragment of left cleithrum; (iii) a small fragment from the clavicle.

Fin-spines.

Pectoral spines. — Six spines (4 left, 2 right) showing various lines of fracture. In none is the articular head without some slight damage.

Size range.

The estimated size-range of fishes represented by this sample is from 40-75 cm standard length.

Fam. MOCHOCIDAE.

Synodontis sp.

No characters permitting specific differentiation are preserved in this material, which comprises :

(i) An almost entire dorsal fin-spine.

(ii) Two pectoral spines (left and right) and a fragment of pectoral spine.

GENERICALLY UNIDENTIFIABLE SILUROID REMAINS.

Seven fin-spine fragments.

CYPRINOIDEA

Fam. CYPRINIDAE.

Barbus sp.

Vertebrae. — Five caudal vertebrae.

Weberian ossicles. — One fragmentary tripus.