Archaeofauna 13 (2004): 145-154

Revisting the Senga 5a Fish Fauna, Upper Semliki River, Democratic Republic of Congo

KATHLYN M. STEWART
Canadian Museum Of Nature, P.O. Box 3443, Stn. D, Ottawa, Canada
Tel. 613-364-4051; Fax 613-364-4027; e-mail: kstewart@mus-nature.ca

ABSTRACT: In the mid-1980s, excavations were conducted at the archaeological site of Senga 5a, located along the Semliki River in the eastern Democratic Republic of Congo (formerly Zaire). The site had attracted interest after initial survey and excavation because of its Oldowan-appearing lithics and Plio-Pleistocene-aged fauna. In the final season of the Senga 5a excavations, the site geologists concluded that Senga 5a was not formed *in situ* in the Pliocene, but had been redeposited by the Holocene-aged Semliki River. However, conflicting with this interpretation was a large vertebrate fauna, primarily fish, in the eastern section of the site, which appeared to be a coherent Pliocene-aged fauna, associated with Pliocene artifacts. In this paper, the author compares the taxonomic composition of the Senga 5a fauna with that of other fish faunas from the Upper Semliki River and Lake Edward, ranging in age from Pliocene to Holocene. The resulting analysis indicates the Senga 5a fish fauna is a cohesive Middle to Late Pliocene-aged fauna, with no later intrusive fish. Further investigation of the geology and the invertebrate and vertebrate faunas as well as the artifacts is needed to develop a site formation history of Senga 5a that is consistent with all of the evidence.

KEYWORDS: FOSSIL FISH, EARLY HOMINIDS, WESTERN RIFT VALLEY, LATE CENOZOIC, AFRICAN ARCHAEOLOGY

RESUMEN: A mediados de la década de 1980 se realizaron excavaciones en el yacimiento arqueológico de Senga 5a, ubicado a orillas del Río Semliki, en la parte este de la Republica Democrática del Congo (antiguo Zaire). El yacimiento llamó la atención después de que en un sondeo y excavación preliminares aparecieran líticas con apariencia Oldowaense y restos faunísticos de época Plio-Pleistocénica. En la campaña final de excavaciones, los geólogos concluyeron que Senga 5a no se formó *in situ* durante el Pleistoceno, sino que fue el resultado de una redeposición del río Semliki surgido en el Holoceno. Tal interpretación fue posteriormente cuestionada por la presencia de grandes vértebras, principalmente de peces, en la sección este del yacimiento, aparentemente pliocénica y asociada con artefactos de dicha época. En este trabajo se compara la ictiofauna de Senga 5a con la de otras faunas de peces recuperadas en el tramo superior del río Semliki y en el lago Edward que abarcan desde el Plioceno hasta el Holoceno. El resultado de estos análisis indica que la fauna de peces encontrada en Senga 5a corresponde a una asociación depositada entre el Plioceno Medio y el Tardío, sin que se detecten restos intrusivos posteriores. En cualquier caso, se concluye destacando la necesidad de realizar más investigaciones sobre la geología, las faunas de vertebrados e invertebrados, así como sobre los artefactos del yacimiento para reconstruir una historia geomorfológica que sea consistente con toda la evidencia actualmente disponible.

PALABRAS CLAVE: PECES FÓSILES, PRIMEROS HOMÍNIDOS, VALLE OCCIDENTAL DEL RIFT, CENOZOICO TARDÍO, ARQUEOLOGÍA AFRICANA

INTRODUCTION

In the mid-1980s excavations were conducted at the Senga 5a site, located along the Semliki River (Figure 1) in the eastern Democratic Republic of Congo (DRC) (formerly Zaire), by a team led by Dr. J.W.K. Harris, Rutgers University. Senga 5a was one of several Plio-Pleistocene sites surveyed and/or excavated in 1985, 1986, 1988, and 1990 by a multinational team led by Dr. Harris, Dr. A. Brooks (George Washington University), and Dr. N. Boaz (Virginia Museum of Natural History) (Boaz, 1990). The site was first excavated in 1985, and the recovery of Oldowan-appearing artifacts and Plio-Pleistocene-aged fauna led the team to return in 1986 for further excavation. Senga 5a attracted much interest, as it was at the time the earliest reported early hominid site with tools. It was also unusual because of its location in the African Western Rift Valley - a wetter, more vegetated, and therefore less explored area than the better known and drier, less vegetated Eastern Rift Valley, where well-known sites such as Olduvai Gorge were located. Bordering the tropical Ituri forest, the Western Rift Miocene-Pleistocene deposits contain evidence of both extreme pluviality and dessication, as well as drastic tectonic movements, which repeatedly altered the landscape, subsequently followed by Holocene volcanic eruptions. As a result of these events, the formation of the Senga 5a site was complex, and geological reconstruction is problematic, with consequent conflicting interpretations of the site formation history.

By the end of the 1986 excavations, 435 artifacts and 4,400 faunal elements were recovered. In 1988 the excavations continued, but were halted when the site geologists concluded, on the basis of a variety of geomorphological evidence, that Senga 5a was not formed *in situ* in a Pliocene ironstone bed, but had been redeposited by a much younger Semliki River. The age of the artifacts and fauna was therefore thrown into question. However, researchers noted at the time that the vertebrate fossils from the eastern section of the site, in particular the numerous fish elements, seemed to be a

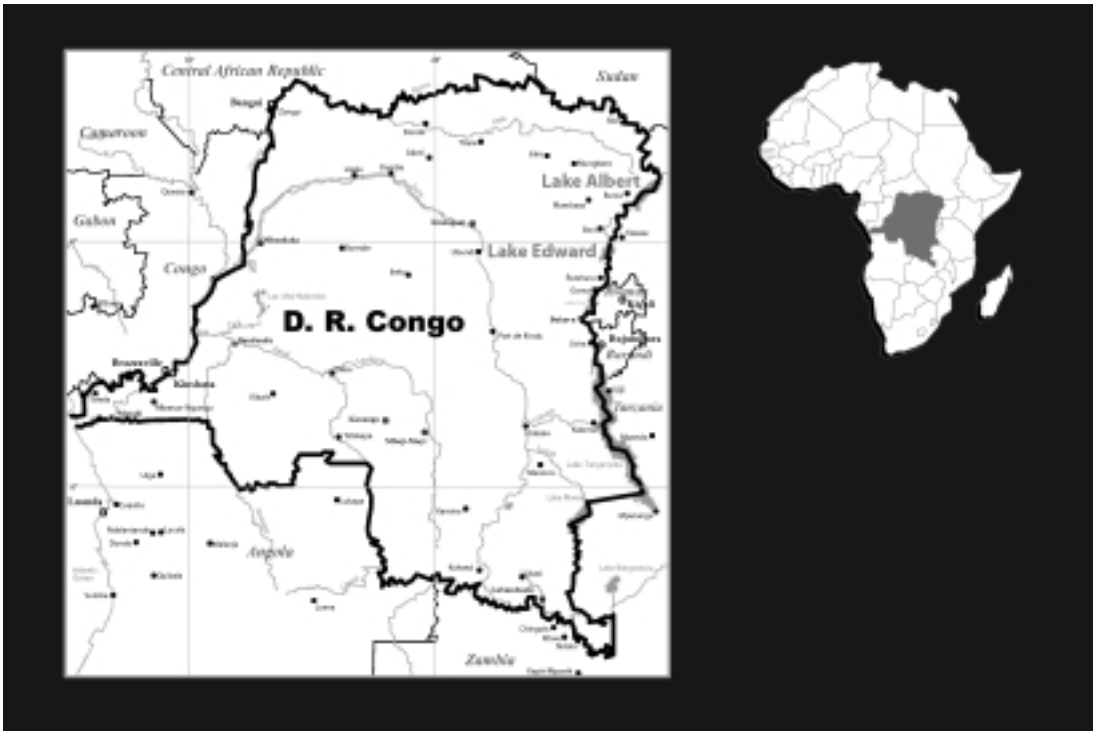

FIGURE 1

Map of northeastern Zaire, with Lakes Edward and Albert at the right; Semliki River is shown as a thin line from Lake Edward to Lake Albert.

coherent assemblage in terms of both age (Pliocene) and preservation. Subsequent reports on Senga 5a have stated that the site was redeposited in the Holocene (Boaz *et al.*, 1992; de Heinzelin & Verniers, 1996), and the latest report (de Heinzelin & Verniers, 1996) has questioned the Pliocene age of even the fauna and artifacts.

In this paper I reexamine the fossil fish fauna, which was by far the largest component of the fossil assemblage from the Senga 5a site, in comparison with other Plio-Holocene Upper Semliki River and Lake Edward fish assemblages that have been excavated and/or analyzed since the Senga 5a field seasons. My findings here strongly reinforce the Pliocene age and cohesiveness of the extensive Senga 5a fish fauna; further, there is no evidence of later intrusives. These conclusions suggest that the late derivation of Senga 5a is not so clearcut as reported in the geological reports, and that the site context needs to be reinvestigated.

As well as examining the context of Senga 5a, this study indicates that in tropical or near-tropical regions, where climatic and environmental variables result in complex site formation, faunal assemblages can be useful in reconstruction. In this paper, fossil fish assemblages are used as chronostratigraphic markers to make interpretations about the formation of the Senga 5a site.

GEOLOGICAL CONTEXT OF THE WESTERN RIFT VALLEY

Senga 5a is one of several Plio-Holocene sites located in the Western Rift Valley, along the Upper Semliki River, as it flows north from present-day Lake Edward (Figure 1). The Western Rift Valley is the western margin of the African Rift, and is a mountainous region in central Africa, bordered to the west by the tropical Ituri Forest, to the east by four of the African Great Lakes, and to the south by a large zone of tropical deciduous and bush vegetation. The Western Rift deposits date from the Miocene to Holocene, and these have been explored by several geological and paleontological teams in the 20th century (e.g., Wayland, 1926, 1934; Fuchs, 1936; Damas, 1940; Lepersonne, 1949; de Heinzelin, 1957, 1961; Bishop, 1969; Boaz, 1990); work has focused primarily on the Upper Semliki River and the northwestern Lake Edward shores, the Lower Semliki valley and the Lake Albert area. The data gleaned from these expeditions document an area with considerable tectonic movements and climate change throughout the Plio-Pleistocene, with parallel events often occurring in both the Lake Albert and Lake Edward regions. Numerous fossil and some archaeological sites have been documented in this whole Albert-Edward region.

Field work was conducted by the Harris-Brooks-Boaz team, or some subset thereof, in the Lake Edward and Upper Semliki River regions in 1985, 1986, 1988, and 1990, with the intention of better documenting the geology, paleontology, and archaeology of the region (e.g., Boaz 1990; Brooks *et al.*, 1995). Work was primarily focused on the Pliocene-aged Lusso Formation sites, the Pleistocene-aged Katanda Formation sites, and the Late Pleistocene-aged Ishango sites.

LUSSO FORMATION SITES

The Lusso Formation sites are scattered along the Semliki River and the Lake Edward margin; though direct dating is not possible, the Lusso Formation probably spans most of the Pliocene (de Heinzelin & Verniers, 1996). The Formation deposits were initially intensively studied in the 1950s by the late Jean de Heinzelin (1955) and again in the 1980s by Jacques Verniers and de Heinzelin (Harris *et al.*, 1987; Boaz *et al.*, 1992; de Heinzelin & Verniers, 1996; Verniers & de Heinzelin, 2000). Lusso Point, also known as Cape Lusso, on the shores of Lake Edward, is the type locality for the Lusso Formation. Lusso Formation sediments there are at least 60 m thick, representing a lower clay facies and an upper sand and silt facies. These facies are lacustrine, deposited under mainly permanently aerobic littoral conditions. The Lusso 1 site, at Lusso Point on Lake Edward, dates to the Middle Pliocene and contained over 4,000 fossil fish teeth. Its sediments represent deeper lake deposition, while the Upper Lusso Formation sites along the Semliki River represent near-shore deposition (de Heinzelin & Verniers, 1996).

There are several ironstone beds throughout the Lusso Formation sequence, interpreted as regressive events. These ironstone beds are distinctive and can be traced for kilometers along the Semliki River and Lake Edward; two distinctive marker beds are the Middle Pliocene Senga 1 marker bed and the Late Pliocene “Three Meter Ironstone” marker bed. The formation of the ironstone beds

has been attributed either to climatic extremes (severe aridification and lake level regression) and/or tectonic events (with lake level regression). What is clear is that these events occurred cyclically and, from the thousands of vertebrate and invertebrate fossils found in and around these ironstone beds, must have caused massive die-offs of aquatic faunas, primarily fish. Artifacts are also known from the Lusso Formation deposits, including the quartz/quartzite assemblage from Senga 5a, stone flakes from the Kanyatsi site, and occasional other artifacts observed during surveys in these deposits.

Collection of fossil fish elements at Lusso Formation sites involved two methods: the Lusso 1 site elements were recovered from wet-screening through a minimum 0.8 mm mesh, while at most other sites, surface collections were made, with only limited screening undertaken (Senga 5a is discussed below). There is some chance of admixture from later deposits in the surface collections, but field observation and later laboratory analysis confirmed the temporal integrity of the taxa. The difference in collection techniques resulted in different sizes of fish elements represented: Lusso 1 is represented mainly by teeth, and fewer bone elements, while the other Upper Lusso Formation sites are mainly represented by bone elements, with fewer teeth. Numerous mammalian and reptilian elements were also recovered from all sites.

The Lusso 1 fish fauna (Appendix 1) is noteworthy for the number of extinct taxa (four of the 12 identified) and for the large size of the fish themselves (compared with modern representatives). All four extinct taxa are remarkable for their large flattish or rounded teeth, presumably for crushing molluscs (which are abundant in the deposits); these teeth were distinctive and the most abundant of all the fish remains. Two other taxa - *Gymnarchus* and *Alestes* - were probably also at least partial molluscivores. Three of the other taxa - tigerfish (*Hydrocynus* sp.), *Synodontis*, and the Nile perch (*Lates niloticus)* - were large, voracious piscivores, and were probably dominant predators on the mollusc-eating fish. The remaining three taxa were either omnivorous or herbivorous. This trophic composition is most unusual compared with modern African freshwater faunas, where fish with flattish, molariform teeth are rare, as are molluscivores. Molluscs themselves are a very large component of the Lusso Formation faunas (e.g., Williamson, 1990); some ironstone beds contain densely packed units consisting of thousands of shells, many of them large and armored.

The Upper Lusso Formation sites (Late Pliocene in age) contain a fish fauna similar in taxonomic composition to that of the Lusso 1 site (Appendix 1). Three of the extinct taxa are represented, although the previously common extinct taxon *Gen* et *sp nov A* was not found. The large, extinct Lusso 1 molluscivore ?*Hyperopisus* is still well represented, and the extinct *Sindacharax* sp. is also common. Large piscivores are also still dominant, in particular the Nile perch. Two cyprinids appear for the first time, *Labeo* and *Barbus*, which are generally bottom-dwelling omnivores; their elements are however rare.

SEMLIKI FORMATION

Considerable tectonic activity occurred at the onset of the Pleistocene-aged Semliki Formation deposition (de Heinzelin & Verniers, 1996). Although the Lusso Formation sediments were deposited under lacustrine conditions, the Semliki Formation deposits are fluvially derived, from the proto-Semliki. Three confirmed facies are recorded: the first has coarse sands, which move up into clayey sands and then into humic clays; the second is fluvial with cross-bedded sands; and the third is clay with medium sand grains. The proto-Semliki was a powerful river, partly because of the contribution of a large eastern river system, and partly because of the absence of a large body of water, i.e., Lake Edward (de Heinzelin & Verniers, 1996). Few fossils are known from the Semliki Formation period, although fossils were recovered from the Katanda 2 site, dug by a team headed by A. Brooks and dated at about 500,000 BP (Brooks *et al.*, 1995; Yellen *et al.*, 1995). Two fish taxa are known (Appendix 1), one of which is present throughout all Plio-Pleistocene deposits (*Synodontis* sp.), while the other first appears at this time (*Clarias* sp.). *Clarias* is a catfish with very robust cranial elements; these preserve well and are abundant at sites where *Clarias* was present. Absence of these plates in the previous Lusso Formation sites almost certainly indicates that *Clarias* was not yet in this section of the Western Rift.

KATANDA FORMATION SITES

Between the deposition of the Semliki Formation and the Katanda Formation beds, drastic tectonic

and geomorphological changes again occurred in the Western Rift, in particular the upheaval of the Ruwenzori Mountains, the formation of Lake Edward, and the establishment of the Semliki as a permanent river flowing south (de Heinzelin & Verniers, 1996). Not surprisingly, the taxonomic composition of the fish faunas from the Katanda Formation (Late Pleistocene) shows considerable change from the Lusso Formation faunas. Fossil fish are known from the Katanda 9 and 16 sites, dating to early Late Pleistocene and middle Late Pleistocene, respectively. Both sites were excavated in 1990, and sediments dry-screened for fauna (Brooks *et al*., 1995; Yellen *et al*., 1995).

The Katanda 9 and 16 site faunas document that 9 of the 15 fish taxa previously recorded in the Lusso Formation have disappeared, including all of the extinct taxa (Appendix 1). In the Katanda 16 site, five new taxa appear, previously unknown in Upper Semliki sites. These include two archaic, piscivorous species (*Protopterus* or lungfish and *Polypterus*), a mormyroid (*Hyperopisus*, which is extant, and distinct from the extinct *?Hyperopisus*) and two catfish, *Clarias* and *Bagrus*, both large omnivores. *Barbus*, a cyprinid that was very rare in the Late Lusso deposits, is now common. The trophic composition of the fauna has completely changed, with the disappearance of most molluscivores and a drastic reduction or disappearance of the large piscivores, such as the Nile perch and tigerfish. More herbivores and/or omnivores are represented, and the overall length of the individual fish has decreased. Considering the enormous changes to the landscape and hydrological systems during the Middle and Late Pleistocene, the drastic change in fish fauna is not surprising. Specialized trophic niches were eliminated, causing the disappearance and/or extinction of fish that could not adapt to new habitats; new hydrological inflows introduced "new" taxa.

ISHANGO 11 AND THE KATWE VOLCANO ERUPTIONS

The Ishango 11 fauna demonstrates taxonomic continuity with the fauna of the previous Katanda sites, particularly Katanda 9. While Ishango 11 is located on the bank of Lake Edward, not the Upper Semliki River as in the previous sites, the two bodies of water are contiguous and faunas were probably largely similar, as with today's fauna. Ishango 11 is a well-reported, stratified site, which spans the Late Pleistocene to the Early Holocene (de Heinzelin, 1961; Brooks & Smith, 1987). In its earlier cultural levels (NFP), it contained an abundant fish and mammal fauna, as well as numerous barbed bone points and numerous other artifacts. The fish fauna has been described in detail (Greenwood, 1959; Stewart, 1990), and contains numerous large-sized fish including *Barbus*, Nile perch, and the catfish *Clarias* (Appendix 1). Four of the taxa recovered from the Katanda sites are absent from the Ishango site - *Polypterus*, *Hyperopisus*, *Gymnarchus*, and *Clarotes*; it is not known if these absences are due to human selection at Ishango or are a real absence from Lake Edward and Semliki River.

A drastic change to the composition of the Ishango fish fauna came with the eruption of the Katwe volcano in the Late Pleistocene or Early Holocene (for a discussion of the date of the Katwe eruptions, see Brooks & Smith, 1987; de Heinzelin & Verniers, 1996). Thick volcanic ash covered much of the Lake Edward and Upper Semliki River deposits; in some areas the ash is over 6 m thick. At Ishango 11, evidence of the volcanic ash is seen in layers above the rich cultural layers. Of the seven taxa reported from the early, richly fossiliferous, Ishango 11 deposits, two genera (*Lates* and *Synodontis*) as well as several species (including the large-sized *Barbus bynni*) had disappeared from the later Ishango 11 layers. It is assumed that during the eruption thick ash blanketed the lake and river surfaces, causing the disappearance of fish that were intolerant of deoxygenated waters (e.g., Greenwood, 1959). Further evidence of the enormity of the destruction of the fish fauna is seen in the composition of the modern Lake Edward fauna, which is described as "depauperate" (Beadle, 1981). The modern lake fauna, as well as that of the Upper Semliki River, now lacks polypterids, distichodontids, characids, mochokids, and latids, all of which were present in earlier times in the lake, and are common members of the Nilotic freshwater fauna in other modern lakes and rivers.

SENGA 5a SITE

The above summary of the geological context of the Plio-Holocene Semliki River and Lake Edward sites provides a background to the deriva-

tion of the Senga 5a site and its faunas. Faunal material at Senga 5a was recovered both in the excavation and from dry and wet screening. Because of its potential significance as an early hominid site, Senga 5a was intensively geologically surveyed in 1985 and 1986, with a detailed report published (with other findings) in 1987 (Harris *et al*., 1987). In this report the first indications appeared of inconsistencies in Senga 5a's sedimentary context. The site was described as being located in a "prominent limonitic sandstone" (termed the Senga 5a limonite), which can be traced almost continuously for about 3 km along the Semliki River (Harris *et al.,* 1987). However, while the northern and southern exposures of the Senga 5 limonite contain three or four similar subunits, the section in the middle, which includes the Senga 5a site, comprises only one unit consisting of a medium to coarse sand layer (Harris *et al.,* 1987). From this limonitic unit came the numerous artifacts and faunal elements of apparent Pliocene age. Other fauna and artifacts, of later age, were recovered from the layer above the limonitic one, and were described as being "easily distinguished from the 'limonitic' fossils" (Harris *et al.*, 1987). In fact the diagnostic mammal elements recovered from the 1986 Senga 5a excavations were identified by experts as being broadly equivalent to Members F or G of the Shungura Formation (from the Omo River deposits), that is, dating between 2 and 2.35 ma (Harris *et al.*, 1987). However, in contrast to the fish fossils, which were fresh in appearance, the mammal fossils showed evidence of rounding, suggesting that they had been transported and rolled.

In 1988 new excavations of Senga 5a began in the hitherto unexcavated western part of the site, divided from the eastern section of the site by "a recent north-south trending gully" (Harris *et al.,* 1990). The 1988 excavations uncovered a matrix that contained mixed subfossil and fossil bones and other material inconsistent with the interpretation of Senga 5a as an *in situ* site in the limonitic layer. Further investigation indicated that the western and eastern sections of the site had somewhat different lithologies (Harris *et al*., 1990). The western sediments were therefore deemed to belong primarily to the Lower Terrace complex of the Semliki River, making them late Quaternary in age. Further geological examination and testing of the whole site context and its surroundings were conducted through the 1988 season, including tests for perovskite (a tracer mineral of the early Holocene Katwe volcanic ash), dips of the basal contact of the eastern section of the site, and petrographic and granulometric comparison of ironstones from the two site units. From the results of these tests and other variables, the consensus arose among the site geologists that all of Senga 5a was a "re-deposited unit in a much later deposit, the Semliki Lower Terrace of Late Pleistocene age." (For a thorough discussion of these tests, and arguments for recent redeposition of Senga 5a, see de Heinzelin & Verniers, 1996: 25-32; Boaz *et al.,* 1992: 247-253.) The latest published geological discussion of the Senga 5a site stated that the site's contents were of "late Mesolithic or still younger occupations," in other words, only a few millennia old (de Heinzelin & Verniers, 1996). As mentioned above, the paradox of the different faunas and artifacts from the western and eastern sections of the site - the west a mixture of ages, and the east all Pliocene-aged - was left unresolved.

A final report on the geology of the Upper Semliki River and its sites (de Heinzelin & Verniers, 1996), states that the Senga 5a site consists of Lower Terrace gravels deposited in the Holocene, with bones mixed in, some of which were eroding from the Senga 5 limonite. However the authors now separate the derivation of the artifacts from that of the fauna, and suggest the artifacts derive from Late Holocene archaeological sites along the Semliki shores; the fauna is still suggested to be reworked in the Lower Terrace sediments.

SENGA 5A FISH FAUNA AND COMPARISON WITH OTHER ASSEMBLAGES

The 1996 geological report was the last word on the geology of Senga 5a, and the site has received little attention since. However, the derivation and interpretation of the fauna and artifacts from the eastern part of the site still remain in question. Therefore, in order to put the Senga 5a fish fauna in better context, I compared the eastern section fauna with other fish faunas excavated from Pliocene to Holocene sites along the Upper Semliki River and Lake Edward (Appendix 1). As described above, the Plio-Holocene fish taxa in the Western Rift have biostratigraphic significance, in that several apparent extinction events - caused by the drastic tectonic and later volcanic events through the later Cenozoic - have resulted in several fish faunas with different and distinctive com-

positions from the Middle to Late Pliocene to the Holocene (see Appendix 1). Therefore, comparison of the taxonomic composition of the Senga 5a fauna with the other Plio-Pleistocene fish faunas should make it clear where the taxonomic composition of the Senga 5a fauna is a "best fit," and whether it shows intrusives from later faunas.

One caveat is that several of the sites used for comparison contained archaeological levels, in particular the Katanda sites and Ishango 11, meaning that some levels had artifacts associated with fish elements, while some levels contained fish and no artifacts. It is not possible to know if the fish were causally associated with the artifacts (there are no cultural modifications on the bone), but in any case, the possibility of cultural bias exists in the fish represented in these sites. Therefore, because these sites were stratified with abundant fish faunas from levels both with and without artifacts, I collapsed the levels together for each site. In this way, any cultural bias inherent in the taxa from the archaeological levels would be minimized. Ishango 11 is an exception in that it contained few, if any, non-archaeological levels; therefore there may be some cultural bias in the Ishango 11 taxa listed in Appendix 1. In fact, however, any cultural bias in the Katanda and Ishango sites appears minimal, as the fish taxa present in the modern Semliki River are nearly identical to those from the Katanda and Ishango sites (and completely different from the Pliocene faunas) (Appendix 1), with the exception of those taxa eliminated after the Katwe eruptions. This suggests overall taxonomic consistency through the Pleistocene and Holocene to the present day.

Comparison of the Senga 5a fish taxa with the other Upper Semliki River and Lake Edward fossil faunas indicates that the Senga 5a composition is very similar to that of the Pliocene faunas, particularly Lusso 1, but is extremely dissimilar to the Late Pleistocene and Holocene faunas (Appendix 1). All but one of the ten Senga 5a taxa are also present in the Lusso 1 site, although Lusso 1 has three additional taxa. These three additional taxa include *Alestes* and Characidae *Gen nov a*, both extremely rare in the Lusso 1 deposits; the third taxon - the extinct *Gen* et *sp nov a* - was common at Lusso 1 but represented only by teeth. It is particularly interesting that, not only is the taxonomic composition highly similar between the Senga 5a and Lusso 1 sites, but also, the proportional abundances of elements of the taxa recovered from the Senga 5a site are almost identical to those from Lusso 1.

The other Lusso Formation site faunas, late Pliocene in age, contain the same ten taxa found at Senga 5a, plus four additional taxa. Two of the four taxa not at Senga 5a are the same rare *Alestes* and Characidae G*en nov a* found at Lusso 1, as well as *Barbus* and *Labeo*, also very rare in the Upper Lusso Formation faunas.

In contrast to the Pliocene-aged faunas, the Late Pleistocene and Holocene site faunas are extremely dissimilar to that of Senga 5a (Appendix 1) (the Middle Pleistocene Katanda 2 fauna is too small for useful comparisons). The Late Pleistocene Katanda 9 site contains seven taxa, only three of which are shared with Senga 5a. Even more dissimilar is the Late Pleistocene Katanda 16 site fauna, which contains ten taxa, only four of which are found at Senga 5a. The Late Pleistocene/Holocene Ishango 11 site shares three of the Senga 5a taxa and has four additional. The modern Upper Semliki River fauna is the most dissimilar, containing only one of the ten Senga 5a taxa. While very different from that at Senga 5a, these four faunas, including the modern river, show considerable taxonomic similarity and consistency. In particular, the taxa *Barbus*, *Clarias*, and *Bagrus* are very common in all four faunas, and can be considered "markers" of this time period, up to the present day.

To summarize, the dominant Pliocene taxa, including three extinct taxa and large tigerfish and Nile perch, are, with one exception, all present at Senga 5a, in similar proportions as at Lusso 1. The dominant taxa of the Late Pleistocene and Holocene - *Barbus*, *Bagrus*, *Clarias*, and the cichlids - are absent at Senga 5a, or in the case of the cichlids, rare.

This clear alignment of the Senga 5a fauna with the Pliocene faunas, and the lack of any Late Pleistocene or Holocene intrusives, makes it difficult to hypothesize a late Quaternary reworking and redeposition of this fauna. Such redeposition would certainly include intrusive elements from later faunas, including elements from the fauna living in the river at that time. Two of the taxa characteristic of the later sites - *Clarias* and *Barbus* - have very robust elements (cranial plates and pharyngeal teeth, respectively) which are always clear evidence of their presence in sites. At Katanda 16, for example, which is an extensive, stratified site with a considerable fish fauna, there were several records of intrusive fish elements. These intrusive elements were rolled and clearly redeposited from

earlier levels (personal observation). Similarly, a study of naturally deposited fish elements along a lakeshore (Lake Turkana, Kenya) indicated a mix of elements from a variety of late Cenozoic deposits (Stewart, 1991). In fact, the western deposits of Senga 5a, with their mixture of subfossil and fossil fish, fit in with a redeposition scenario; the chronologically coherent faunas of the eastern deposits, however, do not.

DISCUSSION AND CONCLUSIONS

What therefore is the derivation of the eastern section of the Senga 5a site? From a palaeontological perspective, the integrity of the Senga 5a fish fauna and its overwhelming taxonomic similarity with the Pliocene-aged fauna - particularly Lusso 1 fauna - with no intrusives, signifies a homogeneous Middle to Late Pliocene-aged fauna. The lack of more recent faunal elements would be highly unusual in a reworked assemblage redeposited into a much younger context. Further, examination of the fauna itself suggests that the redeposition hypothesis is flawed, in that the Senga 5a fish elements comprise a variety of shapes and sizes - including large elements from Nile perch as well as numerous small to medium-sized teeth. Such disparity in element size and density contradicts taphonomic wisdom that in fluvial-created assemblages, sizes sort together (e.g., Voorhies, 1969; Behrensmeyer, 1975). Similarly, the lack of any younger artifacts in the eastern section deposits is highly unusual, as late Pleistocene and Holocene sites along the Semliki are very artifact-rich, with lithics, barbed bone points, pottery, etc. (e.g., Brooks & Smith, 1987; Kanimba, 1990).

In this paper, I have not discussed the other vertebrate or the invertebrate faunas, or the artifacts recovered in association with the fish fauna at Senga 5a. While analysis of these data primarily supports, or at the least does not refute, a Pliocene date for the Senga 5a site, some contradictory evidence, including rounding of some mammalian elements (indicating transport) must be further studied. Nor have I discussed in detail the geological arguments concerning the so-called redeposition of the Senga 5a site. The purpose of this paper is to present a sound paleontological argument for the *in situ* derivation of the abundant fish fauna at Senga 5a, based on comparisons from the other rich fish faunas in the Upper Semliki River and Lake Edward regions. This paper shows unequivocally that the Senga 5a fish fauna (from the eastern section of the site) is a coherent Pliocene assemblage, with no intrusives or similarity with later faunas from the Semliki River, least of all with the Holocene faunas. These findings indicate that the goal in future must be to reexamine the other associated evidence in order to form a hypothesis on the Senga 5a site formation that is consistent with all the known evidence.

This paper also demonstrates that analysis of fossil faunal assemblages, particularly fish, can make a valid contribution to reconstructing site formation in an area where geological processes are complex. Such is often the case in tropical or near-tropical regions, where series of climatic, tectonic, and volcanic events can create a confusing sequence of data, and biological evidence is needed to aid in reconstructing a coherent history of events.

ACKNOWLEDGMENTS

I would like to thank the editors of the special issue of Archaeofauna - Kitty Emery and Wendy Teeter - for inviting me to contribute a paper. I would also like to thank the original organizers of the Upper Semliki Expedition - Noel Boaz, Alison Brooks and Jack Harris - for inviting me to participate in that expedition. Thanks to Donna Naughton for providing the map. This paper benefited from recent discussions and/or suggestions from Jack Harris, Paul Morris, Martha Tappen, and Wendy Teeter, although of course responsibility for the paper rests with me.

REFERENCES

BEADLE, L. C. 1981: *The Inland Waters of tropical Africa*. Longman, London.

BEHRENSMEYER, A. K. 1975: The taphonomy and paleoecology of Plio-Pleistocene assemblages east of Lake Rudolf, Kenya. *Bulletin of the Museum of Comparative Zoology* 145: 473-578.

BISHOP, W. W. 1969: Pleistocene stratigraphy in Uganda. *Geological Survey of Uganda, Memoir 10.*

BOAZ, N. T. 1990: Evolution of Environments and Hominidae in the African Western Rift Valley. *Virginia Museum of Natural History, Memoir 1.*

BOAZ, N. T.; BERNOR, R. L.; BROOKS, A. S.; COOKE, H. B. S.; DE HEINZELIN, J.; DECHAMPS, R.; DELSON, E.; GENTRY, A. W.; HARRIS, J. W. K.; MEYLAN, P.; PAVLAKIS, P. P.; SANDERS, W. J.; STEWART, K. M.; VERNIERS, J.; WILLIAMSON, P. G. & WINKLER, A. J. 1992: A new evaluation of the significance of the Late Neogene Lusso Beds, Upper SemlikiValley, Zaire. *Journal of Human Evolution* 22: 505-517.

BROOKS, A. S. & SMITH, C. C. 1987: Ishango revisited: new age determinations and cultural interpretations. *African Archaeological Review* 5: 65-78.

BROOKS, A. S.; CRAMER, J. S.; FRANKLIN, A.; DE HEINZELIN, J.; HELGREN, D. M.; HORNYAK, W.; KEATING, J. M.; KLEIN, R. G.; RINK, W. J.; SCHWARCZ, H.; SMITH, J. N. L.; STEWART, K. M.; TODD, N.; VERNIERS, J. & YELLEN, J. E. 1995: Dating and context of three middle stone age sites with bone points in the upper Semliki valley, Zaire. *Science* 268: 548-553.

DAMAS, H. 1940: Observations sure des couches fossilifères bordant la Semliki. *Revue de zoologie et botanique africaine* 33: 265-272.

DE HEINZELIN, J. 1955: Le fossé tectonique sous le parallèle d'Ishango. *Explorations du parc national Albert, Mission Jean de Heinzelin de Braucourt (1950),1.*

DE HEINZELIN, J. 1957: Les fouilles d'Ishango. *Explorations du parc national Albert, Mission Jean de Heinzelin de Braucourt (1950), 2 (1957).*

DE HEINZELIN, J. 1961: Ishango. *Scientific American* 26: 105-116.

DE HEINZELIN, J. & VERNIERS, J. 1996: Realm of the Upper Semliki (Eastern Zaire). An Essay on Historical Geology. *Musée Royal de l'Afrique Centrale, Annales-Sciences Géologiques*, volume 102.

FUCHS, V.E. 1936: Extinct Pleistocene Mollusca from Lake Eward, Uganda, and their bearing on the Tanganyika problem. *Journal of the Linnaean Society* 269: 93-106.

GREENWOOD, P. H. 1959: Quaternary Fish Fossils. *Explorations du parc national Albert, Mission Jean de Heinzelin de Braucourt* 1950, Fasc.4.

HARRIS, J. W. K.; WILLIAMSON, P. G.; VERNIERS, J.; TAPPEN, M. J.; STEWART, K.M.; HELGREN, D.; DE HEINZELIN, J.; BOAZ, N. T. & BELLOMO, R. V. 1987: Late Pliocene hominid occupation in Central Africa: the setting, context, and character of the Senga 5A site, Zaire. *Journal of Human Evolution* 16(7/8): 701-729.

HARRIS, J. W. K.; WILLIAMSON, P. G.; MORRIS, P. J.; DE HEINZELIN, J.; VERNIERS, J.; HELGREN, D.; BELLOMO, R. V.; LADEN, G.; SPANG, T. W.; STEWART, K. M. & TAPPEN, M. J. 1990: Archaeology of the Lusso Beds. In: Boaz, N. T. (Ed.): *Evolution of Environments and Hominidae in the African Western Rift Valley*: 237-273. Virginia Museum of Natural History Memoirs 1.

KANIMBA, M. 1990: Archaeological Research on the Age of Metals in the Semliki Area, Zaire. In: Boaz, N.T. (ed.): *Evolution of Environments and Hominidae in the African Western Rift Valley*: 301-316. Virginia Museum of Natural History Memoirs 1.

LEPERSONNE, J. 1949: Le fossé tectonique du Lac Albert-Semliki-Lac Edward. *Annales de la Société Géologique de la Belgique* 72: 1-92.

STEWART, K. M. 1989: Fishing Sites of North and East Africa in the Late Pleistocene and Holocene. Cambridge Monographs in African Archaeology 34. B.A.R. (International Series) 521. Oxford.

STEWART, K. M. 1990: Fossil Fish Remains from the Lusso Formation. In: Boaz, N.T. (ed.): *Evolution of Environments and Hominidae in the African Western Rift Valley*: 141-163. Virginia Museum of Natural History Memoirs 1.

STEWART, K. M. 1991: Modern Fishbone Assemblages at Lake Turkana, Kenya: a methodology to aid in recognition of hominid fish utilisation. *Journal of Archaeological Science* 18(5): 579-603.

VERNIERS, J. & DE HEINZELIN, J. 2000: Stratigraphy and Geological History of the Upper Semliki: A Preliminary Report. In: Boaz, N.T. (ed.): *Evolution of Environments and Hominidae in the African Western Rift Valley*: 17-41. Virginia Museum of Natural History Memoirs 1.

VOORHIES, M. R. 1969: Taphonomy and population dynamics of an early Pliocene fauna, Knox County, Nebraska. *Contributions to Geology, Special Paper No. 1*, Laramie, Wyoming.

WAYLAND, J. E. 1926: The geology and paleontology of the Kaiso Bone Beds. *Geological Survey of Uganda, Occasional Paper No. 2*, Entebbe.

WAYLAND, J. E. 1934: Rifts, rivers, rains and early man in Uganda. *Royal Anthroplogical Institute Journal* 6 (64).

WILLIAMSON, P. G. 1990: Late Cenozoic Mollusc faunas from the North Western African Rift (Uganda-Zaire). In: Boaz, N.T. (ed.): *Evolution of Environments and Hominidae in the African Western Rift Valley*: 125-141. Virginia Museum of Natural History Memoirs 1.

YELLEN, J. E.; BROOKS, A. S.; CORNELISSEN, E; MEHLMAN, M. J. & STEWART, K. 1995: A Middle Stone Age Worked Bone Industry form Katanda, Upper Semliki Valley, Zaire. *Science* 268: 553-556.

Taxa:	**Senga 5a**	Lusso 1	Upper Lusso Formation sites	Katanda 2	Katanda 9	Katanda 16	Ishango 11 – NFP	Modern Upper Semliki River
Protopterus sp. (Lungfish)					P	P	P	P
Polypterus sp.						P		
Hyperopisus sp.						P		
?Hyperopisus sp.+	**P**	P	P					
Gymnarchus sp.	**P**	P	P			P		
Labeo sp.			P					P
Barbus sp.			P		P	P	P	P
Distichodus sp.	**P**	P	P					
Hydrocynus sp. (tigerfish)	**P**	P	P					
Alestes sp.		P	P					
Sindacharax sp. + Characidae	**P**	P	P					
Gen nov a+		P	P					
Bagrus sp.					P	P	P	P
Clarotes sp.	**P**		P					
Clarias sp.				P	P	P	P	P
Synodontis sp.	**P**	P	P	P	P	P	P	
*Lates niloticus (*Nile perch)	**P**	P	P		P	P	P	
Lates sp.	**P**	P	P					
Cichlidae	**P**	P	P		P	P	P	P
Gen and sp nov a +		P						
# of taxa shared with Senga 5a		9	10	1	3	4	3	1
# of taxa not present at Senga 5a		3	4	1	4	6	4	5
Number of fish specimens Identified	1233	4740	1983	87	2008	4270	2324	Un-known
	??	**Middle to Late Pliocene**	**Late Pliocene**	**Middle Pleisto-Cene**	**early-Late Pleisto-cene**	**mid-Late Pleisto-cene**	**late-Late Pleisto-cene to Early Holocene**	**Modern**

APPENDIX 1

List of fish taxa recovered from Middle Pliocene to Holocene sites located on the Upper Semliki River ad Lake Edward shoes. Data taken in part from Brooks *et al.* (1995), Stewart (1989, 1990), Yellen *et al.* (1995). P=Present.