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Project Title: Taphonomy of fish fossils and calibration of sediment cores using fish remains.

Introduction

Lake Tanganyika, an ancient, deep lake in the western part of the East African Rift Valley, is known for its large number of endemic fish, especially those within the family Cichlidae. Presently there is no fossil record for fish of Lake Tanganyika. In the absence of this record, there is a dearth of information involving the history of biodiversity, abundance, and paleoecology of the fish within the lake. For the greater part of a year, I have been working on this problem using sediment cores. I have gathered fish remains, including teeth, scales and various bones including vertebrae. However, there are some problems with this type of collection, particularly since no one has attempted to construct a fossil record using fragmentary fish remains. The identification of the fossils to even family level is presently difficult; there is no understanding of taphonomy or preservation patterns, nor is there any calibration for the fish remains found in the cores.

In the three week independent study session of the Nyanza project, I have attempted to correct this problem by gathering multiple surficial samples along depth gradients as well as collecting fish for an osteological collection. I intend to use these samples plus the 1998 multi-core tops to solve at least some of the problems mentioned above. Ideally, this includes: 1) the identification of the remains to the highest resolution possible, preferably to genus level, in an attempt to quantify biodiversity, 2) the generation of abundance numbers from the remains, and 3) the calibration of the sites and sediment cores for paleobiological and paleolimnological understanding.

Materials and Methods

I have collected 5 transects, each consisting of a depth gradient sampled at 2 m, 5 m, 10 m, 15 m, and 30 m. The sites are located in two main areas: the Kigoma Bay area and in the vicinity of Gombe National Park. Within Gombe, two undisturbed sites were selected, Nyasanga and Kahama. Nyasanga was a fortuitous collection due to Sarah Pittiglio’s use of the site, while Kahama was used due to its proximity to a multi-core site. North of Gombe, a disturbed site near the village of Mwamgongo was used, also partly chosen due to its proximity to a multi-core site. In the Kigoma Bay area, two sites were chosen: an area just inside Kigoma Bay designated as disturbed, and Bongwe, a supposedly undisturbed site. “Disturbed” versus “undisturbed” is based upon the presence or absence of human habitation, and hence deforestation and disturbance of the watershed. The reason these types of sites were chosen is that it is more likely to see patterns in preservation, sedimentation, abundance and biodiversity in such sites. Other samples are from around the Luiche delta area. Data replication will be achieved by repeated sampling of the 5 original transects, and also across different sites. Many of these sites and samples are being used in conjunction with Sarah Pittiglio’s, Mark Woodworth’s and Kirsten Bannister’s projects. For further information on these sites, please refer to those papers.

In the period of allotted during the Nyanza Project, only two sites were examined, Nyasanga and Mwamgongo. A fraction of the samples was wet sieved to separate the fish remains for ease of extraction as well as to determine grain size, mineralogy and texture of the sediment. Sample fractions were >4mm, >2mm, >1mm, >0.5mm, >250mm, >125mm, >63mm, and <63mm (-2 to 4 phi). The latter two sample fractions were not examined for fish remains. The samples were then dried, and then picked through using small paintbrushes to avoid damaging the specimens.

In addition to sediment fractions, I have also collected approximately 30 fish species. The fish will be digested by trypsin to isolate the bones, teeth and scales.

Data

Raw data concerning masses of fractions and samples are provided in the report by Sarah Pittiglio’s Excel file. Other data are presented in the form of three figures (see attached Fig. 1, 2 and 3). Mineralogy and sediment texture is yet to be examined.

Results and Discussion

In the period of two weeks, I have only managed to pick through two sites: Mwamgongo and Nyasanga. No statistical analyses have been conducted yet. Though it is difficult to make any conclusions from such a small sample size, there are some speculations that may be proven or disproven later. Mwamgongo, in general, has a finer grain size than Nyasanga (see grain size figure in S. Pittiglio’s paper). General observations of the samples show that Mwamgongo has a lesser degree of quartz grains than Nyasanga, and has a much higher abundance of charcoal and ostracods. All Nyasanga sediment fractions consisted primarily of subangular quartz grains. It also appears that Nyasanga has a higher diversity though lower abundance of ostracods. The reason why noting ostracod abundance is relevant is because of a pattern noticed in the dissection of two cores, 86-DG-32 and 86-DG-14. In these cores, there appeared to be an inverse relationship between ostracod and fish remains abundance. This pattern does not hold in these samples. The type and abundance of fish remains in the samples differed dramatically (see Figs. 1 and 2). Mwamgongo had much higher abundance, and also...
had many more scales and bones than Nyasanga. Nyasanga’s abundance was lower, and fish remains recovered consisted primarily of teeth. There appears to be a general trend of increased abundance with depth (see Fig. 3). The reason for these patterns is presently unknown. It appears to be counter-intuitive, as it was expected that there would be a higher abundance of remains in the undisturbed site. This may be a result of a preservation/taphonomic difference, which could be the result of pulverization by quartz grains in a high energy environment. A higher influx of finer sediment in Mwamgongo may improve the preservation of fish remains. An influx of terrestrial sediment and/or higher fish abundance by depth may be responsible for the trend of increased fish remains abundance by depth. It is presently unknown if overall fish abundance is higher at one site than the other.

**Conclusion**

Much work remains to be done on this project, which will be conducted for the next two years. All of the samples need to be worked on, and many samples need to be replicated for statistical comparison. Objectives outlined in the introduction remain to be realized.