Comment on “Origin of the Superflock of Cichlid Fishes from Lake Victoria, East Africa”

Verheyen et al. (1) presented an interpretation of East African cichlid fish origins that is incompatible with the geological context. Hindcasting paleoenvironmental history from haplo-type analyses calibrated by molecular clocks from extant haplochromines, they concluded that Lake Victoria (LV) did not dry out during the late Pleistocene, despite much stronger sedimentary evidence to the contrary.

Dated paleosols in midlake cores indicate complete drying of LV between 16,000 and 14,000 years ago (around 12,400 14C years before present), and possibly 18,000 to 17,000 years ago as well (2, 3). The paleosols are clearly revealed in seismic-reflection images crossing the lake’s deepest regions, and similar data suggest that major lowstands also occurred simultaneously in Lake Albert (4).

There is no evidence of paleo–river channels in the LV seismic records, and the Rwandan headwaters of LV’s geological tributary, the Kagera, likewise experienced severe late Pleistocene aridity (5), which made rivers unlikely feeders of residual lake refugia within the desiccated lake basin (although reduced rivers or ponds may have persisted at higher elevations).

Even if refugia did exist within the dry LV basin, they would have been too small and shallow to harbor more than a few, if any, species endemic to the parent lake. Isotopes and diatom assemblages associated with the paleosols indicate that lowstand waters were at least as chemically concentrated as in today’s Lake Turkana (6, 7). In addition, shallowness may also have contributed to greater turbidity by facilitating the mobilization of benthic sediments, algal nutrients, or both into the water column, which in turn would have inhibited the evolution of specializations involving visually based behavioral choice—that is, mating and diet preferences. These factors would have allowed only a very few haplochromines to co-exist through niche partitioning and reproductive isolation (8, 9). It is thus unlikely that a diverse, lake-adapted species flock survived desiccation within the LV basin.

Verheyen et al. (1) implied that lake-adapted Lake Kivu cichlids swam directly to LV via the Kagera River, although the existence of a continuous river corridor between those lakes is highly speculative. Rwanda highland river systems were linked with the Kagera some time around the Pleistocene-Holocene boundary (10), possibly seeding LV with highland riverine taxa, but this probably occurred after regional tectonism severed the older intermediate river links to Kivu. The fish that recolonized LV after desiccation would be more accurately described as riverine than as lacustrine emigrants from Kivu. Perhaps Kivu’s cichlids themselves also originated from those same Rwandan riverine populations.

Reconstruction of a regional environmental history based largely upon a molecular analysis of extant Kivu fauna must be treated with caution, because paleolimnological evidence indicates that catastrophic volcanic gas and hydrothermal inputs occurred in Kivu within the last 5000 years (11). This is consistent with that lake’s current low species diversity and suggests that it houses a decimated, incomplete faunal assemblage. Rather than showing that LV’s species did not arise within the last 16,000 to 14,000 years, the haploptype data of Verheyen et al. (1) may instead show that a similarly rapid colonization and radiation event is now occurring in Kivu, in which high haploptype diversity and low species diversity could simply reflect recent colonization by widely divergent taxa from various river refugia rather than a great age for the current faunal assemblage.

We suggest that the inconsistency of the results of Verheyen et al. (1) with the geological record, as well as with earlier biochemical work on cichlid origins that is more compatible with a late Pleistocene desiccation of LV (12), may arise primarily from inaccuracies in the calibration of the molecular clocks used in their study.
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