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Short Communication

New light on the paleobiogeography of the labyrinth fishes

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Abstract - The labyrinth fishes (Anabantoidei/Anabantiformes) have an African-Asian disjunctive distribution; however, their biogeographical history remains elusive due to the scarcity of their fossil records, especially for the Anabantidae itself, the only anabantoid family with a disjunctive biogeography. A time-calibrated anabantoid phylogeny incorporating both fossil and extant taxa and a likelihood dispersal extinction and cladogenesis (EDC) model in the software package of LAGRANGE were used to infer the ancestral areas of main lineages of the anabantoid fishes. The results suggest that" before "the split of the Asian and African anabantids is a recent event The split of the Asian-African anabantid is a recent event. The traditional drift vicariance hypothesis and the late Cretaceous or early Tertiary dispersal hypotheses are now called into question for the interpretation of the anabantid biogeographical pattern.

Keywords: †Eoanabas, paleobiogeography, labyrinth fishes

1. Introductiuon

The labyrinth fishes (Anabantoidei/Anabantiformes) have an African-Asian disjunct distribution; however, their biogeographical history remains elusive due to the scarcity of their fossil records, especially for the Anabantidae itself, the only anabantoid family with a disjunctive biogeography (Murray *et al*., 2015; Rüber *et al*., 2006). Previously, hypotheses of Gondwanan continental drift vicariance or late Mesozoic to early or middle Cenozoic dispersals from Asia to Africa, or *vice versa*, were proposed to interpret their current distribution pattern (Liem, 1963; Skelton, 1980; Rüber *et al*., 2006). Recently, we discovered a fossil climbing perch, †*Eoanabas thibetana*, from the upper Oligocene of the central Tibetan Plateau, which has a mosaic character combination of African and Asian anabantids and represents the oldest and most primitive lineage to date of the Anabantidae and also the only fossil labyrinth fish with well-constrained age (Murray *et al*., 2015; Wu *et al*., 2017). Motivated by this discovery, we attempt to explore the biogeography history of the labyrinth fishes and test the validity of former relevant hypotheses.

2. Materials and methods

A time-calibrated anabantoid phylogeny incorporating both fossil and extant taxa and a likelihood dispersal extinction and cladogenesis (EDC) model in the software package of LAGRANGE (Ree and Smith, 2008) were used to infer the ancestral areas of main lineages of the anabantoid fishes. The divergence times were estimated by using an uncorrelated model of molecular evolutionary rate heterogeneity that assumes a lognormal distribution of molecular rates (UCLN) implemented in the computer program BEAST version 1.7.5 (Drummond and Rambaut, 2007).

3. Results

The results of our analyses echoed the placement of †*Eoanabas* as a stem anabantid and the reciprocal monophyly of African and Asian anabantids (Wu *et al*., 2017). The divergence of the African and Asian anabantids was estimated to occur at the middle Miocene, and hence 20 to 74 Myr younger than estimated by previous molecular analyses (Rüber *et al*., 2006) and even younger than the age (165-121 Ma) of the geological split between India and Africa continents (Storey, 1995).

4. Discussion and conclusion

The split of the Asian-African anabantid is a recent event. The traditional drift vicariance hypothesis and the late Cretaceous or early Tertiary dispersal hypotheses are now called into question for the interpretation of the anabantid biogeographical pattern. Our analyses inferred that the anabantid fishes probably had originated in southeast Asian during the middle Paleogene and subsequently dispersed to Africa in middle Miocene via the land bridge created by

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the connection of Eurasia and Arabo-Africa in the early Miocene (Rögl, 1999).

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