GEOGRAPHIC TRENDS IN NORTH AMERICAN FRESHWATER FISH FROM THE CRETACEOUS TO THE PLIOCENE

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The age – latitude relationships for 54 taxa within 37 families of freshwater fish were examined from over 150 fossil localities from the late Cretaceous to the Pliocene in North America. Within the data, 16 southerly linear trends were detected for which regression analyses indicate significant relationships. The results suggest that a common process might link the patterns. Processes that could account for trends on a scale of millions of years include those associated with evolution, plate tectonics and climate change. For any taxonomic grouping, a trend might have an evolutionary cause. However, it is improbable that evolution would result in geographically similar trends between several distantly related groups. Southerly trends could also result from transport of fossils by movement of the North American plate. However, the rates of movement measured from the trends are too high to be accounted for by plate tectonics. Also, the fossil trends are multidirectional, and not unidirectional as would be expected if they resulted from plate movement. To examine the long-term effects of climate, we compared the changes in latitudinal data with changes in paleotemperatures based on the oxygen isotope analyses of benthic foraminifera by Miller et al. (1987). We assumed that during warming and cooling trends fish populations would shift to the north and south, respectively. A non-parametric t-test indicates that in a significant number of cases (i.e., 65%), the latitude distribution data was inversely correlated with trends in the paleotemperature curve. This relationship suggests that many of the patterns in long-term fish dispersal can be explained by fish populations shifting in response to changing thermal conditions. The southward component in the trends for the 16 fish taxa analyzed can be accounted for by the response of those taxa to the climatic cooling of the Cenozoic Era.