SIMILARITIES AND CONTRASTS BETWEEN THE PATTERNS OF SURVIVAL AND RECOVERY FOLLOWING THE CENOMANIAN-TURONIAN (UPPER CRETACEOUS) AND THE CRETACEOUS-TERTIARY MASS EXTINCTIONS

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Mass extinctions have played a significant role in the Phanerozoic evolutionary history. Not only have they resulted in the relatively rapid loss of numerous, ecologically and genetically diverse taxa, but, in most cases, they have culminated in the radiation of new lineages, communities and ecological structure based not only on the evolution of new taxa, but also on changes in dominance of surviving taxa. The hypothesis that these biotic crises may be periodic and caused by similar forcing mechanisms has generated the need to compare mass extinction survival and recovery intervals. The ultimate test of this hypothesis lies in the fossil record. For this study, the Cenomanian-Turonian (C-T) and Cretaceous-Tertiary (K-T) boundary intervals are analyzed. These boundaries are interesting for a number of reasons: 1) they both are well-studied at a high level of resolution at a number of localities; 2) the K-T event follows the C-T event by approximately 26 My reflecting the proposed extinction periodicity; 3) they represent two different levels of extinction intensity with the K-T affecting a far greater percentage of taxa; and 4) they occurred under very different environmental conditions. Initial analyses of generic and species range data for epifaunal and infaunal bivalves, ammonites, brachiopods, benthic and planktic foraminifers, ostracodes, and nannoplankton suggest that the basic patterns of survival and recovery are similar for C-T and K-T extinctions. Both extinction events show an initial survival interval in most groups, during which most of the species present represent survivors (including "Lazarus taxa") or new species within surviving lineages. This gives way to a recovery interval characterized by an increasing number of new species within new lineages. Based on the rapidity with which new species evolve, these repopulation intervals suggest that the degree of survivorship among diverse groups must be far greater than generally believed, because the evolutionary rates appear to be too rapid to be accounted for by rapid radiation solely from generalist stocks. Although the general patterns appear to be quite similar between these two extinction-repopulation intervals, there are significant differences. The C-T mass extinction affected primarily epifaunal bivalves, benthic foraminifers, and ammonite taxa severely, while the K-T event resulted in a pronounced extinction among planktic foraminifers and infaunal bivalves. This suggests that at least the proximate causes of extinction for the two intervals were substantially different. Despite the greater overall magnitude of the K-T extinctions, the repopulation occurred more rapidly following this event. This suggests that the degree of vacated niches was greater and/or the environmental conditions returned to more favorable levels more rapidly. The C-T repopulation may have been delayed due to the deleterious background conditions which existed throughout much of the mid-Cretaceous. Finally, the K-T extinctions resulted in the disappearance of significant elements of the pre-extinction faunas and communities, such as the ammonites, inoceramids, and rudists, whereas the C-T event resulted in the temporary reduction in abundance and diversity in these groups, but they rapidly reobtained their dominance.