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Jean Gueux

Retrograde Evolution During Major Extinction Crises

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To Catherine, Suzanne, and Raphael

Abstract Most of the evolutionary trends described in the following pages concern more or less gradual geometrical and ornamental transformations occurring over long periods of ecologically stable periods. Such trends are discussed in Chapter 1 of this study.

By contrast, major evolutionary jumps in several invertebrate groups occur during massive extinction periods, which are characterised by the appearance of primitive forms resembling remote ancestors of their immediate progenitors. These forms are defined as atavistic. Homeomorphic species generated during sublethal environmental stress can be separated from the ancestral group by several millions of years. In this paper we present a new theoretical model of retrograde evolutionary changes during sublethal environmental stress and analyse the evolutionary patterns of some planktonic foraminifera, radiolarians, nautiloids, conodonts, corals and ammonoids during major extinction periods. In ecologically stable periods, the transformations of the skeletons are characterised by an increase of shell curvature, corresponding to an increase in the apparent geometrical complexity. During periods of sublethal environmental stress, rapid retrograde evolution occurs in many invertebrates. The evolution of silicoflagellids is discussed as an example of application of artificial stress to modern organisms.

