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Mass Extinctions, Impacts, Volcanism, Cosmic Rays and others

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Abstract content

The history of life in our planet has not always been a process of gradual evolution. In fact, the study of fossils throughout the different geological eras has revealed that occasionally numerous species disappear abruptly.

In five of the extinctions that have been identified in the last 550 million years more than half of the species disappeared in a short time. The last of these mass extinctions, the one at the Cretaceous-Tertiary boundary (KT) (65 million years ago) has been well documented. The impact of an asteroid (or a comet) on what is now the Yucatan Peninsula, produced a tremendous global devastation: fires, tsunamis, acid rain, and a year-long night that killed more than two thirds of the living species. The Chicxulub crater is an unquestionable proof of the giant impact.

For the four remaining mass extinctions there is no clear evidence that an impact was the culprit. In this lecture I will examine a number of alternative geophysical and astronomical catastrophes that have been considered to explain these mass extinctions. Among these phenomena: massive volcanic eruptions, supernova explosions, cosmic rays and gamma rays bursts are of particular interest.

Monstrous volcanic eruptions like that of the Deccan Traps in India and the Siberian Traps have been considered to produce global poisoning of the biosphere; the Siberian Traps have been associated to the mass extinction at the Permian-Triassic Boundary 250 million years ago.

The primary cosmic radiation has not been constant in the past. An increase in its intensity may be associated with mutations which, in general, are deadly. Most primary cosmic rays are produced in supernova explosions; although these events are infrequent, there is evidence that in the past the Solar System has been exposed to cosmic radiation trapped in supernova remnants. These encounters with increased cosmic rays flux may last thousands of years; during these long periods their deadly effects are experienced not only as mutations, but also through the effects on the climate, as well as through the destruction of the ozone layer and the associated exposure to solar UV radiation. The relevance of gamma ray bursts and the impact of solar activity on the climate will also be considered.

If this paper is presented for a collaboration, please specify the collaboration

Summary

Reference

Primary author(s) : Prof. POVEDA, Arcadio (Institute of Astronomy UNAM)

Presenter(s) : Prof. POVEDA, Arcadio (Institute of Astronomy UNAM)

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