EXTRATERRESTRIAL IMPACTS ON EARTH AND EXTINCTION OF LIFE IN THE HIMALAYA

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Abstract. The comets, meteorites and asteroids have collided with the Earth throughout geological history. The mass extinction at Permian-Triassic boundary and Cretaceous-Tertiary boundary is strongly supported by the extraterrestrial asteroidal impact theory in the Indian Himalayan sequences well exposed at Spiti in Western Himalaya and Um Sohryngkew section in Meghalaya, northeastern Himalaya. The carbon isotopic and palaeobiological events suggest extraterrestrial impacts at P/T and K/T boundaries all over the world. The early evolution of life, its diversification, carbon isotope chemostratigraphy, amino stratigraphy and extinction events have been discussed from the Indian Himalaya.

1. Introduction

The end of the Cretaceous period is named as K/T boundary and this boundary is marked by a catastrophic impact in the Yucatan Peninsula, Mexico. The Chicxulub impact crater is a possible trigger for the mass extinction that occured at K/T bondary about 65 million years ago in which the dinosaurs perished. The high concentration of platinum group elements particularly iridium at the K/T boundary in the Gubbio section of Italy strongly supports an extraterrestrial impact (Alvarez *et al.*, 1980). The platinum group elements have a rich concentration in extraterrestrial materials like meteorite, asteroid or comet and a very low concentration in the terrestrial volcanic eruptions for example Deccan basalt in India (Bhandari, 1991). The K/T boundary section at Um Sohryngkew River section (Figure 1) in Meghalaya, eastern lesser Himalaya, India contains a strong narrow peak of iridium (12.1 ng g). The iridium is enriched by a factor of about 10 in the broad band and by a factor of about 500 in the sharp peak above the Cretaceous Shales (Ir = 0.02 ng g, Bhandari, 1991). The K/T boundary sections at Padriciano, Trieste in North Italy and Slovenia has been established on the basis of palaentological extinction, sedimentological facies changes, carbon isotopic variations, iridium anomaly and micro tektites of extraterrestrial origin (Pugliese and Drobne 1995; Drobne *et al.*, 1996; Hansen 1995; Ogorelec *et al.*, 1995; Gregoric *et al.*, 1998 and Pugliese and Tewari, 2003). The iridium anomaly in Meghalaya of India is identical to that found globally and is extraterr-estrial. The Permo-Triassic boundary represents the major mass extinction on Earth. During the Permian period Siberia collided with the other landmasses and the largest super continent Pangea

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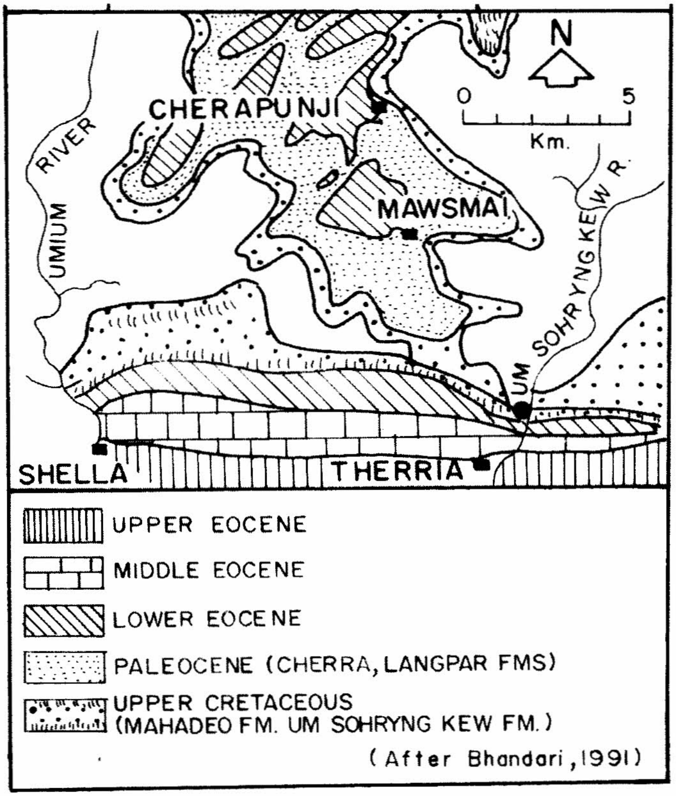

Figure 1. Geological and location map of the K/T boundary section, Meghalaya, NE Lesser Himalaya, India.

was created. The southern continent Gondwana started to drift away to the north creating new microcontinents. The Permo-Triassic boundary is characterized by Siberian volcanism, palaeoclimatic changes, oceanic anoxia events and extraterrestrial impacts. The recent carbon isotopic excursions from the P/T boundary sections of the Spiti valley in Tethys Himalaya of India has supported the impact hypothesis (Ghosh *et al.* 2002). In the present paper the major extinction events of life since the origin of life on Earth has been discussed.

2. Origins of Life from Amino Acids in Meteorites to Stromatolites

According to the recent research (Oro *et al.* 1971; Tewari, 2001a, 2002 a,b) comets and meteorites may have been a source of organic compounds on the early Earth. The Murchison meteorite found in Australia contains amino acids glycine, alanine, valine, proline, aspartic acid and glutamic acid (Oro *et al.* 1971). The discovery of amino acids phenylalanine, tyrosine and tryptophan by Laser Raman Spectroscopy from 4.5 billion year old Didwana-Rajod meteorite from Rajasthan, India (Tewari, 2002 a, b) confirms that life might have originated in space before being introduced to Earth by meteorites. The most convincing evidence for the extraterrestrial delivery of amino acids (alpha amino isobutyric acid and racemic isovaline) comes from the Cretaceous-Tertiary boundary section of the Stevens Klint in Denmark. The oldest sedimentary rocks on Earth are 3.9 billion years old Isua meta-Quartzite in Greenland but no convincing microfossils have been reported from these rocks. The oldest record of life on Earth, in the form of bacterial microfossils and stromatolites, is reported from the Apex chert of Western Australia (Schopf, 1993). The early evolution and diversification of life on Earth with special reference to the Himalaya has been discussed by Tewari (2001a, 2003 in press).

3. Discussion and Conclusion Major Extinction Events of Life on Earth

The stromatolites of Mesoproterozoic age (large Conophytons and other columnar forms) declined around 650 Ma. in Neoproterozoic period before the Ediacaran explosion of metazoans and metaphytes. The Ediacaran explosion of metazoan and metaphyte multicellular life took place after Neoproterozoic palaeoclimatic change from snow ball Earth to global warming (Tewari, 2001b). A major global decline of Mesoproterozoic stromatolites and planktonic acritarchs has been recorded on Earth related to Neoproterozoic/Varangian/Blainian glacial event. Explosive radiation of new acanthomorphic acritarchs, sponge spicules, multicellular brown sheet algae Vendotaenids and Ediacaran metazoans were recorded from Australia, Krol Group of the Uttaranchal Lesser Himalaya, India, China, Siberia, Canada and Namibia in South Africa (Tewari, 2001, 2003). During the Vendian 650 Ma. ago the dominant Precambrian flora and fauna perished in the first great extinction and has been correlated with a large glaciaton event. The Cambrian period is marked as an important turning point in the history of evolution of life on Earth. This is the time when most of the major groups of animals first appeared in the fossil record. This event is called the Cambrian Explosion of life on Earth. During the Cambrian, the trilobite Olenellids and archaeocyathids (reef building organisms) perished. Palaeobiological records also suggest that climate during Permocarboniferous was cool in Gondwanaland. The Cretaceous period about 65 Ma. ago suffered an asteroid impact and caused global cooling on Earth and extinction of dinosaurs from the planet. The organic compounds such as amino acids of extraterrestrial origin have been found in Martian (SNC) and other meteorites landing on Earth from the asteroid belt between Mars and Jupiter strongly suggests that the meteorites braught life to the Earth and can cause its extinction. Astrobiology in future may give us important clues regarding extraterrestrial origin of life on Earth and other planets of the universe (Tewari, 1998).

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