

## **Major bioevents, extinction of land vertebrates, Cretaceous-Tertiary and other major boundaries in Indo-Pakistan subcontinent (South Asia)**

**M. Aslam Buzdar<sup>1</sup> and M. Sadiq Malkani<sup>2</sup>**

<sup>1</sup>*Faculty of Marine Sciences, Lasbela University of Agriculture, Water and Marine Sciences, Uthal, Lasbela, Balochistan, Pakistan*

<sup>2</sup>*Geological Survey of Pakistan, Muzaffarabad, Azad Kashmir, Pakistan  
drmaslam@hotmail.com*

### **Abstract**

The four major bioevents and extinction of terrestrial vertebrates are found in Indo-Pakistan subcontinent. The first major bioevent occurred at the Permo-Triassic boundary from where the land vertebrates initiated (It was the time when the area was occupied by marine to transitional marine condition). After the Permo-Triassic boundary the dinosaurs-largest land animals along with mesoeucrocodyles and pterosaur-the flying reptiles were occurred during the Mesozoic of Indo-Pakistan. The Triassic-Jurassic and Jurassic-Cretaceous boundaries both marine and terrestrial are well exposed in Indo-Pakistan especially in Indus Basin of Pakistan. The second bioevent is found at the Cretaceous-Tertiary boundary where these dinosaurs, mesoeucrocodyles and pterosaur became extinct and the mammals (also birds) became dominant. Cretaceous-Tertiary boundary terrestrial sections are rare in the world and only well exposed in the western North America, Mongolia, India and Pakistan. In India and Pakistan the dinosaurs are found on and close to Cretaceous-Tertiary boundary which show abrupt extinctions. After the Cretaceous-Tertiary boundary disaster the Baluchitheria-largest land mammals were found on the Sulaiman/middle Indus Basin (the eastern flank of Western Indus Suture), and Kakar-Khorasan/Katawaz/northern Balochistan basin (western flank of Western Indus Suture). These Baluchitheria originated and migrated from Indo-Pakistan subcontinent to Eurasia via western Indus Suture. The third bioevent occurred at the Oligocene-Miocene boundary from where the Baluchitheria became extinct. After this third bioevents the rhinocerotoids, anthracotherids, proboscideans, carnivores, chalicotheres, deinotheres, bovids, suids, Creodonta, ruminantia, amynodontiae, and crocodilians were found in the Indo-Pakistan subcontinent. The fourth bioevent is found on the Pleistocene-Holocene boundary from where the man civilization evolved.