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# Paleoenvironmental changes associated with the Deccan Volcansim, new insights from the intertrappean sediments from the Nagpur area, India

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The cause(s) of the Cretaceous/Tertiary boundary (KTB), which corresponds to one of the five major mass extinctions of the Phanerozoic, remain (s) still controversial. Since the 80's, the connection between the onset of the Deccan Traps in India and the KT events has been established by numerous authors.The biotic evolution is well understood in marine environments but only few data are available concerning the response of the terrestrial biota. Deccan Traps exhibit three major phases and associated sediments were deposited during periods of quiescence of the volcanic activity mainly in alluvial-limnic to lacustrine environments. These sedimentary beds (infra- and inter-trappeans) are located in the eastern part (Madhya Pradesh and Maharashtra States) of the Traps, in the Nagpur, Chandrapur and Chhindwara districts, India. A sedimentological, mineralogical and geochemical approach has been achieved to evaluate the changes triggered by the Deccan volcanism in central part of India. The results have been compared with the existing palynological data. Bulk rock, the clay minerals, phosphorus, organic matter and major/trace elements analyses indicate that the inter-trappean sediments deposited during the Deccan volcanism do not reflect the same characteristics than the infra-trappean sediments preceding the volcanic eruptions. Sedimentological and mineralogical observations indicate alluvial-limnic environment under arid climate for the deposition of the infra-trappean sediments. Moreover, palynoflora are dominated by gymnosperms and angiosperms with a rich canopy of gymnosperms (Conifers and Podocarpaceae) and an understory of palms and herbs. The low content in organic matter could be related to excessive desiccation and/or oxidation under arid conditions. The eruption of Deccan volcanic flows severely affected the environemt. Inter-trappean sediments associated with volcanic phase-1 and phase-2 were deposited in terrestrial to lacustrine environments under arid seasonal climate alternating long dry and short humid cycles. Moreover, clay minerals indicate a predominance of smectites resulting from the basalts alteration. Dinoflagellates, diatoms and ostracods blooms in the sediments preceding phase-2 could be related to increased micronutrients availability. Organic matter is well preserved in the sediments deposited before the onset of the main volcanism phase and consists of a mixed source with low oxidized lacustrine organic matter and terrestrial inputs. Trace elements (Ba, Cu, Ni, Zn, U and V) revealed a high productivity under low oxygenated conditions. A strong floral response is observed with the onset of the main volcanism phase leading to dominance by angiosperms and pteridophytes at the expense of gymnosperms. In subsequent inter-trappean sediments a sharp decrease in pollen and spores coupled with the appearance of fungi mark increasing stress conditions apparently as a direct result of intensified volcanic activity. The organic matter analyses indicate a strong degradation suggesting that the biomass was oxidized because of strong volcanic activity and resulting acidic conditions. The chemical index of alteration (CIA) shows a gradual increase culminating within the main phase of volcanism reflecting increased acid rains. Ti/Al and K/(Fe+Mg) ratios are high and close to Deccan average basalt values indicating a strong influence from the basalts. Mineralogical and geochemical observations indicate more contrasted sources for the sediments deposited after the main phase of volcanism and palynological observations indicate a floral recovery.