Abstract

The late Neoproterozoic or Ediacaran period, (635 to ~543 Ma) is a primordial time in the Earth history corresponding to the beginning of animal life and the most extreme ice ages on Earth. In this dissertation, palaeoenvironmental conditions were reconstructed for Ediacaran, post-Gaskiers shelf deposits in SW-Gondwana and their changes were evaluated according to the diversity of organisms. The present study addresses the question of interactions between biodiversity and environmental change by using the elemental and isotopic geochemistry of sedimentary rocks and associated organic matter, as well as the distribution of hydrocarbon biomarkers. The studied sedimentary sequences are from a large basin extended from the Paraguay belt to the Rio de la Plata craton, including the Corumbá Group in SW-Brazil (Paraguay belt), the Arroyo del Soldado Group in Uruguay and the Sierras Bayas Group in Argentina (both in the Río de la Plata craton).

Several geochemical signatures of the sediments from Corumbá and Sierras Bayas groups provides evidence for an euxinic setting in the Ediacaran Ocean: 1) The occurrence of syngenetic pyrite in the Corumbá Group together with hydrocarbon biomarkers of an anoxic microbial consortium including traces of gammacerane, a distribution of hopanes with maxima at C_{29} as well as a low pristane/phytane (Pr/Ph) ratio; 2) the occurrence of ^{34}S enrichments within sulfides of the Sierras Bayas Group exceeding the sulfur isotopic composition of coeval carbonate-associated sulfate. In the Arroyo del Soldado Group, an event of reducing conditions was revealed by higher concentrations of redox-sensitive trace elements and negative $\delta^{13}C_{car}$ shifts in all sections. This event is extended to the whole unit in the deepest section and is restricted to tempestites in the two other shallow sections. The persistent negative. $\delta^{13}C_{car}$ values recorded at the basinal setting implies strong isotopic gradient between shallow and deep water environments and therefore, a locus of deposition below the redox chemocline.

In all studied sections, the $\delta^{13}C_{car}$ excursions, the strong enrichment of authigenic trace-elements, the occurrence of longer chain *n*-alkanes, gammacerane and low Pr/Ph and Ph/*n*-C_{18} ratios, combined with the previous sedimentological and paleontological observations indicate that the chemistry of the ocean was strongly controlled by the oxygen availability; waters being moderately oxic at the surface and anoxic at depth for much of the Neoproterozoic. This water column stratification was favourable to the storage of large amounts of nutrients in the deep ocean. During upwelling periods, the export of these nutrient-rich waters may have triggered an important bioproductivity in surface waters. Drops in $\Delta^{13}C_{car\text{-}ker}$ and positive $\delta^{13}C_{car}$ excursions highlight the increase in primary productivity. Preservation of organic carbon was ensured by reducing conditions at the bottom. The $\Delta^{13}C_{car\text{-}ker}$ excursions could also reflect changes in the composition of the primary biomass.

New geochemical evidence from SW-Gondwana sections supports a stratified Ediacaran ocean, outside restricted or hypersaline environments, in the aftermath of glaciations. The association of ocean stratification and the appearance of metazoans support the model that the evolution of eukaryotic life was related to the increase of oxygen levels in surface environments due to an efficient recycling of nutrients in the anoxic deep ocean.