Tracking environmental changes over the past 3000 years in the Region of Ria do Mamanguá, Rio de Janeiro, Southeastern Brazil using molecular organic markers

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Molecular organic markers (terrestrial *n*-alkanes and alkenones) and other geochemical tracers ($\delta^{13}C$, $\delta^{15}N$ and % Terr) were used to assess changes in rainfall patterns and in the sea surface temperature over the past 3000 years in the Region of Ria do Mamanguá, located on the southern coast of Rio de Janeiro, Brazil. It was possible to identify periods with distinctive contribution from terrestrial organic matter in the sediments cores. The wetter periods between 2733 and 2000 cal years BP and between 1100 and 200 cal years BP presented a higher contribution of terrestrial organic matter to the area. While the dryer period between 2000 and 1100 cal years BP showed a lower input. Furthermore, it was possible to identify the presence of the Little Ice Age event, that was characterized as a period of wetter conditions and with relatively low SST in the Region of Ria do Mamanguá, corroborating with other paleoclimate records in South America. A possible reduction in the termohaline circulation during these cold events may have contributed to the increase in the latitudinal temperature gradient. A lower sea surface temperature in the North Atlantic could have contributed to a displacement in the atmospheric system of the South Hemisphere through a change in the latitudinal position of the Intertropical Convergence Zone (ITCZ). The ITCZ acts as the main source of moisture to the region where the South American Summer Monsoon is formed and consequently the South Atlantic Convergence Zone (SACZ). The SACZ is one of the main features responsible for most of the rain in the Region of Ria do Mamanguá.

The global record of local iron geochemical data from Proterozoic through Paleozoic basins

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Iron-based redox proxies represent one of the most mature tools available to sedimentary geochemists. These techniques, which benefit from decades of refinement, are based on the fact that rocks deposited under anoxic conditions tend to be enriched in highly-reactive iron. However, there are myriad local controls on the development of anoxia, and no local section is an exemplar for the global ocean. The global signal must thus be determined using techniques like those developed to solve an analogous problem in paleobiology: the inference of global diversity patterns through time from faunas seen in local stratigraphic sections. Here we analyze a dataset of over 4000 iron speciation measurements (including over 600 de novo analyses) to better understand redox changes from the Proterozoic through the Paleozoic Era. As with paleobiological diversity curves, it is expected that a number of biases affect such a dataset, including both spatial and temporal sampling bias and stochastic error.

Preliminary database analyses yield interesting observations. We find that although anoxic water columns in the middle Proterozoic were dominantly ferruginous, there was a statistical tendency towards euxinia not seen in early Neoproterozoic or Ediacaran data. Also, we find that in the Neoproterozoic oceans, oxic depositional environments–the likely home for early animals-have exceptionally low pyrite contents, and by inference low levels of porewater sulfide. This runs contrary to notions of sulfide stress on early metazoans. Finally, the current database of iron speciation data does not support an Ediacaran or Cambrian oxygenation event. This conclusion is of course only as sharp as the ability of the Fe-proxy database to track dissolved oxygen and does not rule out the possibility of a small-magnitude change in oxygen. It does suggest, however, that if changing pO_2 facilitated animal diversification it did so by a limited rise past critical ecological thresholds, such as seen in the modern Oxygen Minimum Zones benthos. Oxygen increase to modern levels thus becomes a Paleozoic problem, and one in need of better sampling if a database approach is to be employed.

www.minersoc.org
DOI:10.1180/minmag.2013.077.5.19