Oceans stem the tide of evolution

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(PhysOrg.com) -- Toxic seas may have been responsible for delaying the evolution of life on Earth by 1 billion years, experts at Newcastle University have revealed.

The study, published online today in Nature Geoscience, reveals for the first time a chemical 'layering' of the ocean which may have delayed the evolution of our earliest animal ancestors.

Using novel geochemical techniques developed by Newcastle University's Dr Simon Poulton, the team found that beneath oxygenated surface waters, mid-depth oceanic waters were rich in sulphide about 1.8 billion years ago, conditions that may have persisted until oxygenation of the deep ocean more than1 billion years later.

These widespread sulphidic conditions close to the continents, coupled with deeper waters that remained oxygen-free and iron-rich, would have

placed major restrictions on both the timing and pace of biological evolution.

Dr Poulton, who led the research, explained: “It has traditionally been assumed that the first rise in atmospheric oxygen eventually led to oxygenation of the deep ocean around 1.8 billion years ago.

“This assumption has been called into question over recent years, and here we show that the ocean remained oxygen-free but became rich in toxic hydrogen-sulphide over an area that extended more than 100 km from the continents. It took a second major rise in atmospheric oxygen around 580 million years ago to oxygenate the deep ocean.

“This has major implications as it would have potentially restricted the evolution of higher life forms that require oxygen, explaining why animals appear so suddenly, relatively late in the geological record.”

Between 2.4-1.8 billion years ago, the Earth underwent a major upheaval, sparked by the first great rise in atmospheric oxygen 2.4 billion years ago when atmospheric oxygen rose from nothing to around 5 per cent of present levels.

What has remained unclear, however, is the response of ocean chemistry to rising atmospheric oxygen - a vital piece of the evolutionary jigsaw because it is here that early life evolved.

Dr Poulton adds: “What we have done with this study, is to provide the first detailed evaluation of changes in ocean chemistry with water depth in the global ocean at this critical time.

“Earth scientists will need to consider the consequences of this oceanic structure when trying to piece together the co-evolution of life and the environment.”

Provided by Newcastle University