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doi:10.1038/nature02912

The Proterozoic aeon (2.5 to 0.54 billion years (Gyr) ago) marks the time between the largely anoxic world of the Archean (> 2.5 Gyr ago) and the dominantly oxic world of the Phanerozoic (< 0.54 Gyr ago). The course of ocean chemistry through the Proterozoic has traditionally been explained by progressive oxygenation of the deep ocean in response to an increase in atmospheric oxygen around 2.3 Gyr ago. This postulated rise in the oxygen content of the ocean is in turn thought to have led to the oxidation of dissolved iron, Fe(II), thus ending the deposition of banded iron formations (BIF) around 1.8 Gyr ago. An alternative interpretation suggests that the increasing atmospheric oxygen levels enhanced sulphide weathering on land and the flux of sulphate to the oceans. This increased rates of sulphate reduction, resulting in Fe(II) removal in the form of pyrite as the oceans became sulphidic. Here we investigate sediments from the 1.8-Gyr-old Animikie group, Canada, which were deposited during the final stages of the main global period of BIF deposition. This allows us to evaluate the two competing hypotheses for the termination of BIF deposition. We use iron–sulphur–carbon (Fe–S–C) systematics to demonstrate continued ocean anoxia after the final global deposition of BIF and show that a transition to sulphidic bottom waters was ultimately responsible for the termination of BIF deposition. Sulphidic conditions may have persisted until a second major rise in oxygen between 0.8 to 0.58 Gyr ago, possibly reducing global rates of primary production and arresting the pace of algal evolution.

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The influence of sulfur and iron on dissolved arsenic concentrations in the shallow subsurface under changing redox conditions Peggy A. O'Day, Dimitri Vlassopoulos, Robert Root, and Nelson Rivera Proc. Natl. Acad. Sci. USA published 8 September 2004, 10.1073/pnas.0402775101 http://www.pnas.org/cgi/content/abstract/0402775101v1?ct

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Biological Effects of Wood Ash Application to Forest and Aquatic Ecosystems K. Andreas Aronsson and Nils G. A. Ekelund J. Environ. Qual. 2004; 33(5): p. 1595-1605 http://jeq.scijournals.org/cgi/content/abstract/33/5/1595?ct

The Evolution of the Upper Mantle beneath the Canary Islands: Information from Trace Elements and Sr isotope Ratios in Minerals in Mantle Xenoliths ELSE-RAGNHILD NEUMANN, WILLIAM LINDSEY GRIFFIN, NORMAN J. PEARSON, and SUZANNE YVONNE O'REILLY J. Petrology published 9 September 2004, 10.1093/petrology/egh063 http://petrology.oupjournals.org/cgi/content/abstract/egh063v1?ct

High-pressure Partial Melting of Mafic Lithologies in the Mantle T. KOGISO, M. M. HIRSCHMANN, and M. PERTERMANN J. Petrology published 9 September 2004, 10.1093/petrology/egh057
http://petrology.oupjournals.org/cgi/content/abstract/egh057v1?ct
We review experimental phase equilibria associated with partial melting of mafic lithologies (pyroxenites) at high pressures to reveal systematic relationships between bulk compositions of pyroxenite and their melting relations. An important aspect of pyroxenite phase equilibria is the existence of the garnet-pyroxene thermal divide, defined by the enstatite-Ca-Tschermaks pyroxene-diopside plane in CaO-MgO-Al2O3-SiO2 projections. This divide appears at pressures above 2 GPa in the natural system

where garnet and pyroxenes are the principal residual phases in pyroxenites. Bulk compositions that reside on either side of the divide have distinct phase assemblages from subsolidus to liquidus and produce distinct types of partial melt ranging from strongly nepheline-normative to quartz-normative compositions. Solidus and liquidus locations are little affected by the location of natural pyroxenite compositions relative to the thermal divide and are instead controlled chiefly by bulk alkali contents and Mg-numbers. Changes in phase volumes of residual minerals also influence partial melt compositions. If olivine is absent during partial melting, expansion of the phase volume of garnet relative to clinopyroxene with increasing pressure produces liquids with high Ca/Al and low MgO compared with garnet peridotite-derived partial melts.
Keywords: experimental petrology; mantle heterogeneity; partial melting; phase equilibrium; pyroxenite.

Magma Generation at a Large, Hyperactive Silicic Volcano (Taupo, New Zealand) Revealed by U-Th and U-Pb Systematics in Zircons B. L. A. CHARLIER, C. J. N. WILSON, J. B. LOWENSTERN, S. BLAKE, P. W. VAN CALSTEREN, and J. P. DAVIDSON J. Petrology published 9 September 2004, 10.1093/petrology/egh060 http://petrology.oupjournals.org/cgi/content/abstract/egh060v1?ct

The Solubility of Sulphur in Hydrous Rhyolitic Melts BEATRICE CLEMENTE, BRUNO SCAILLET, and MICHEL PICHAVANT J. Petrology published 9 September 2004, 10.1093/petrology/egh052
http://petrology.oupjournals.org/cgi/content/abstract/egh052v1?ct
Experiments performed at 2 kbar, in the temperature range 800-1000°C, with fO2 between NNO-2·3 and NNO+2·9 (where NNO is the nickel-nickel oxide buffer), and varying amounts of sulphur added to hydrous metaluminous rhyolite bulk compositions, were used to constrain the solubility of sulphur in rhyolite melts. The results show that fS2 exerts a dominant control on the sulphur solubility in hydrous silicate melts and that, depending on fO2, a rhyolitic melt can reach sulphur contents close to 1000 ppm at high fS2. At fO2 below NNO+1, the addition of iron to a sulphur-bearing rhyolite magma produces massive crystallization of pyrrhotite and does not enhance the sulphur solubility of the melt. For a given fO2, the melt-sulphur-content increases with fS2. For fixed fO2 and fS2, temperature exerts a positive control on sulphur solubilities, at least for fO2 below NNO+1. The mole fraction of dissolved sulphur exhibits essentially linear dependence on fH2S at low fO2 and, although the experimental evidence is less clear, on fSO2 at high fO2. The minimum in sulphur solubility corresponds to the redox range where both fH2S and fSO2 are approximately equal. A thermodynamic model of sulphur solubility in hydrous rhyolite melts is derived assuming that total dissolved sulphur results from the additive effects of H2S and SO2 dissolution reactions. The model reproduces well the minimum of sulphur solubility at around NNO+1, in addition to the variation of the sulphide to sulphate ratio with fO2. A simple empirical model of sulphur solubility in rhyolitic melts is derived, and shows good correspondence between model and observations for high-silica rhyolites.
Keywords: sulphur; solubility; rhyolite; thermodynamics; fO2; fS2.

A Globin Gene of Ancient Evolutionary Origin in Lower Vertebrates: Evidence for Two Distinct Globin Families in Animals Anja Roesner, Christine Fuchs, Thomas Hankeln, and Thorsten Burmester Mol. Biol. Evol. published 8 September 2004, 10.1093/molbev/msh258 http://mbe.oupjournals.org/cgi/content/abstract/msh258v1?ct

Structural and Evolutionary Analyses of the Ty3/gypsy Group of LTR Retrotransposons in the Genome of Anopheles gambiae Jose Manuel C. Tubio, Horacio Naveira, and Javier Costas Mol. Biol. Evol. published 8 September 2004, 10.1093/molbev/msh251 http://mbe.oupjournals.org/cgi/content/abstract/msh251v1?ct

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BLUE LIGHT STIMULATED LUMINESCENCE IN CALCIUM FLUORIDE, ITS CHARACTERISTICS AND IMPLICATIONS IN RADIATION DOSIMETRY M. P. Chougaonkar and B. C. Bhatt Radiat. Prot. Dosimetry published 7 September 2004, 10.1093/rpd/nch398 http://rpd.oupjournals.org/cgi/content/abstract/nch398v1?ct

- **IAPC**

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