Permissive environments or biological innovation? Fresh insights into the Cambrian explosion

Locations	Palaeo Lab - Aston Webb Building G21
Date(s)	Monday 28th January 2013 (17:00-18:00)
Contact	For further details/information contact: Jon Clatworthy Curator of the Lapworth Museum of Geology Tel: 0121 414 7294 Email: **J.C.Clatworthy@bham.ac.uk (mailto:J.C.Clatworthy@bham.ac.uk)**
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Part of the Lapworth Lecture Series

Speaker: Dr Graham Shields, University College London

Abstract:

The late Neoproterozoic successions of South China comprise some of the most complete and well-preserved records of the Ediacaran-Cambrian transition. Ongoing geochemical research is helping us to understand early stages in the development of the modern Earth system and serve to illustrate the transitional character of the Ediacaran-Cambrian interval from the evolution and early extinctions of the first bilaterian metazoans during the Ediacaran Period to their dominance of pelagic and benthic realms by the end of the early Cambrian. Geochemical data reveal a noisy transition of increasing baseline carbon isotope values punctuated by extreme isotopic oscillations. It is evident that highly negative carbon isotope values and large amplitude isotopic swings ceased once modern marine ecosystems had become firmly established by about 520 Ma. In this talk I will postulate that sub-surface bioturbation helped to strengthen the relationship between benthic oxidation state and P-retention, thus tightening an important negative feedback that helps to stabilize productivity, climate and oxygen levels in the modern Earth system. The disappearance of negative excursions after ~520 Ma might also suggest a key role for methanogenesis which would have declined following the rise of in-sediment sulphur cycling due to bioturbation. Further insight into this fascinating interval from relatively new approaches integrating nitrogen and molybdenum isotopes, iron speciation and modelling studies are helping to disentangle the complex interactions between biological evolution and biogeochemical cycling during the emergence of the modern Earth system.