

## STABLE NITROGEN ISOTOPE VALUES OF INTACT EDIACARAN PORPHYRINS OFFER A GLIMPSE OF NEOPROTEROZOIC NITROGEN CYCLING AND NUTRIENT POOLS.

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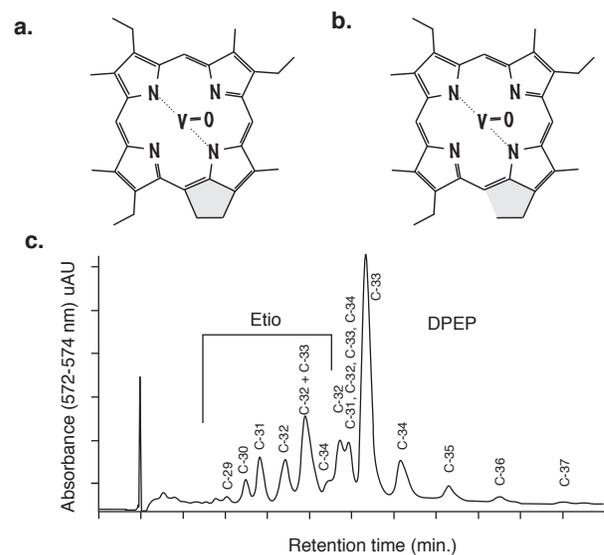
**Introduction:** Along with phosphorus, biological nitrogen availability most likely acted as the major nutritional bottleneck to primary production throughout Earth history [1] and thereby exerted a major control on Earth's marine carbon cycle [e.g. 2]. While the modern biogeochemical cycles of carbon and nitrogen are understood in broad terms [e.g. 3], this is not the case for much of the Precambrian. Tentative mechanisms of the paleo carbon cycle have been repeatedly reconstructed using stable carbon isotope variations found in sedimentary kerogen and carbonate [e.g. 4–6], yet similar approaches towards the paleo nitrogen cycle are sparse [e.g. 7], most likely due to significantly larger methodological hurdles. Yet an increased understanding of the latter could provide long-sought hints to other key questions in Precambrian geobiology, such as the origin and nature of large Neoproterozoic carbon cycle perturbations and the Ediacaran advent and Cambrian radiation of complex metazoan life.

The speciation of nitrogen is strongly dependent on environmental redox conditions [3] and, especially during the Neoproterozoic—which witnessed the gradational transitions of prevalent stratified and frequently euxinic water masses, through ferruginous intermediates towards a well-ventilated, largely oxic and quasi-modern marine redox structure [8]—environmental conditions could have exerted a major control on nutritional nitrogen bioavailability, primary productivity and the marine carbon cycle.

We have studied Ediacaran sediments from the South Oman Salt Basin (SOSB) with a focus on the terminal Neoproterozoic portion of this sedimentary sequence [9] and extracted the yet oldest intact porphyrins that are largely complexed with vanadium (Fig. 1), indicating an average low Eh marine environment within the SOSB where Ni<sup>2+</sup> availability is hindered by sulfide complexing [10]. Laboratory fragmentation of porphyrin molecules yielded GC-amenable maleimides, whose alkylation pattern allowed the distinction between biosynthesis by primary producers in surface waters vs. anoxygenic phototrophs at the chemocline. In this presentation we will discuss the molecular distribution of these compounds as well as their unusual stable nitrogen isotope composition within the framework of the source and speciation of nutrients during

deposition of sediments and biomass in the South Oman Salt Basin, and hypotheses on wider implications for Neoproterozoic biological evolution will be put forward.

**References:** [1] Holland H.D. (1984) *The chemical evolution of the atmosphere and oceans*, Princeton University Press, 598 pp. [2] Fennel K. et al. (2005) *AJS*, 305, 526–545. [3] Canfield D.E. et al. (2012) *Science*, 330, 192–196. [4] Schidlowski M. (1987) *Annu Rev earth Planet Sci*, 15, 47–72. [5] des Marais D.J. (1997) *Org Geochem*, 27, 185–193. [6] Johnston D.T. et al. *Nature*, 483, 320–323. [7] Beaumont V. and Robert F. (1999) *Precambrian Res*, 96, 63–82. [8] Canfield D.E. et al. (2008) *Science*, 321, 949–952. [9] Gorin et al. (1982) *AAPG Bull*, 66, 2609–2627. [10] Lewan M.D. (1984) *GCA*, 48, 2231–2238.



**Figure 1** Chromatogram (LC–UV/vis) showing the distribution (c) of C<sub>29</sub>–C<sub>37</sub> DPEP (a) and Etio (b) porphyrins in the South Oman Salt Basin.