

## Carbon isotope and lipid biomarker stratigraphy from organic-rich strata through the Neoproterozoic Shuram excursion in South Oman

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The regulation of oxygen levels in Earth's atmosphere and oceans is inextricably linked to the carbon cycle. Carbon isotope ratios of carbonate and sedimentary organic matter provide first order insights into the operation of the carbon cycle in the geologic past. During the Ediacaran period, the ~580 Ma 'Shuram Excursion' (SE) records a dramatic, systematic shift in  $\delta^{13}\text{C}_{\text{carbonate}}$  values to as low as *ca.* -12‰, lasting potentially millions to tens of millions of years in duration and constitutes the largest carbon isotope excursion known in the record [1]. The extremely negative carbon isotope values in carbonate challenges our understanding of the ancient carbon cycle and is difficult to rationalise *via* uniform carbon cycle principles. Several hypotheses have been developed to explain this behaviour, all of which make different predictions for the abundance, structure, and isotopic composition of organic carbon through the excursion [1,2,3,4].

For a direct test of these ideas, we report paired organic and inorganic stable carbon isotope ratios in addition to detailed lipid biomarker stratigraphic records from a subsurface well drilled on the eastern flank of the South Oman Salt Basin, Sultanate of Oman. This well captures thermally immature and organic-rich Nafun Group strata traversing the SE, yielding variable but primary biomarker characteristics typical of Neoproterozoic rocks from this region [5].

Despite the high organic matter contents, the carbon isotopic compositions of carbonates do not covary with those of organic phases. Furthermore, lipid biomarker data reveal that organic matter composition and source inputs varied stratigraphically, reflecting biological community shifts in non-migrated, syngenetic organic matter deposited during this interval. Together these observations imply that carbonate-organic isotopic decoupling during the SE is not a result of mixing of fossil or exogenous carbon sources (either DOC, detrital, or migrated) with syngenetic organic matter.

[1] Fike *et al.*, (2006) [2] Johnston *et al.*, (2012) [3] Schrag *et al.*, 2013 [4] Rothman *et al.*, (2003); [5] Love *et al.*, (2009)

## Mineralogical characterization of chrysotile-containing soils

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Asbestos-containing soils occur mainly at ultramafic rocks and hydrothermally altered carbamate rocks in S. Korea. Remediation of asbestos-containing soils is considered a high priority by the Korean Government because these soils, if left untreated, represent a hazard to the environment and human health. The objective of this study was to show physicochemical and mineralogical characterization of asbestos-contaminated soil can direct the development of remediation strategies.

Two sites (Hongseong and Gapyeong, S. Korea) at abandoned asbestos mines were selected for soil and mineralogical characterization. At each site, samples were taken at soil surface. Soil preparation consisted of sieving air-dried soil through a 2-mm sieve. The sieved soils (< 2-mm) were used for soil characterization and mineralogical analysis. Following particle size fractionations, mineralogical characterization was investigated by TG-DTA, XRD, PLM, SEM and EDS analyses. Point counting was used to quantify asbestos in the whole soil and size fractionated samples.

The soil color of the both sites was gley. The soil texture of the Hongseong and Gapyeong soils was loamy sand and sand, respectively. XRD, PLM, SEM and EDS analyses showed that the fibrous chrysotile was observed at both soils, and both fibrous chrysotile and the needle or straight-shaped tremolite asbestos existed in Gapyeong soils. Hongseong soils contained 4.8% asbestos in sand fraction and 2.5% asbestos in silt fraction. And Gapyeong soils contained 6.6% asbestos in sand fraction and 1.7% asbestos in silt fraction. Therefore, the soils of the both sites were designated as asbestos-containing materials (greater than or equal to 1%) according to the criteria of the U.S. EPA. TG-DTA showed that chrysotile and tremolite asbestos in soil at both sites were transformed to forsterite and diopside with the temperatures about 810°C and 1060°C, respectively. These results indicated that thermal treatment of asbestos-containing soils was effective for phase transformation of the asbestos in soils.