

Vegetation and climate: The potential role of terpene emissions and aerosol particle formation on local climate conditions

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Any ecosystem and its individual biogenic species survive at specific climate conditions such as temperature, water supply, nutrients and chemical stress factors. In order to take measures to buffer extremes several possible pathways have been suggested. One of these include the emission of terpenes, their influence at ambient oxidant levels as well as in new aerosol particle formation. In this talk the role of individual mono- and sesquiterpenes will be discussed in a broader context emphasizing the ability of coniferous forests to compete with deciduous invaders in the context of changing climate conditions. The presentation is started with unraveling of new particle formation induced by organic volatile compounds conducted at three different scales, i.e. from gas-phase smog chamber studies via plant chamber to ecosystem smog chamber investigations. I will present a detailed understanding of the particle formation process taking into account the mixture of different mono- and sesquiterpenes emitted and their reactivity with ozone and OH. Both are essential for understanding since they limit the formation process at different steps via production of different large radicals. Since isoprene produces too small radicals any addition of isoprene attributed to changing environmental conditions leads to serious consequences on feedback processes and climate cooling. In this context I discuss the effect of a) deciduous emissions such as isoprene and b) of anthropogenic emissions such as of NO on the intensity of new particle formation. My presentation is then finalized by drawing conclusions on potential radiation and climate effects.

Chromium isotopes as an indicator of redox conditions in the Cryogenian shallow oceans

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Variations in atmospheric oxygen concentrations and the oxygenation level of the oceans during the geological past have been widely studied over the last 30 years [1]. A large increase in atmospheric O₂ during the Neoproterozoic has been postulated and is probably associated with a change in the redox condition of the oceans which enabled the explosion of life on Earth. Several models have been proposed, which have attempted to determine oceanic redox conditions during this Era [2]. The deeper oceans during the Neoproterozoic are generally believed to be anoxic until the end of the Ediacaran Period. However, little is known about redox conditions in the shallow oceans during the Neoproterozoic.

This study aims to determine the variation in redox conditions in the Cryogenian shallow oceans using REE chemistry and Cr isotopes in carbonate rocks. Chromium is a redox-sensitive element and its isotopes are fractionated during redox reactions [3]. Cryogenian carbonates from the Scottish Dalradian and the Greenland Eleanore Bay Supergroups are characterised by the lack of a Ce anomaly and positive $\delta^{53}\text{Cr}$ values. The lack of a Ce anomaly in ancient carbonates has been interpreted to reflect anoxic conditions [4]. However, these samples do record positive $\delta^{53}\text{Cr}$ values which are similar to modern and Phanerozoic carbonates [5]. These heavy $\delta^{53}\text{Cr}$ are interpreted to reflect oxidative weathering and the presence of sufficient O₂ to produce Cr(VI). These Cr isotopes data indicate that the shallow oceans during the Cryogenian was not anoxic and modelling suggests either dysoxic or suboxic conditions.

[1] Holland (2006), *FTRS*, **361**, 903-915; [2] Li *et al.* (2010) *Science*, **328**, 80-83.; [3] Ellis *et al.* (2002) *Science*, **295**, 2060-2062; [4] Kamber and Webb (2001), *GCA*, **65**, 2509-2525; [5] Bonnand *et al.* (2011), *JAAS*, **26**, 528-535.