Ancient mobilisation of radiogenic Pb and Ti during high-grade metamorphism

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Many zircons from early Archaean gneisses in the Napier Complex of East Antarctica, are reversely discordant. High spatial resolution ion microprobe imaging reveals Y and U zonation, characteristic of magmatic zircons, together with a micro-scale patchy distribution of ^{206}Pb and ^{207}Pb that does not correspond to either growth zonation or crystal imperfections. Some of these patches yield $^{207}Pb/^{206}Pb$ ages >4 Ga, whereas others yield ages younger than the magmatic crystallization age. Zircons from Dallwitz Nunatak record detrital ages between 3.5 Ga and 2.5, whereas those from Gage Ridge define multiple age groups, with concordant data between 3.6 Ga and 3.3 Ga and reversely discordant data that form a distinctive ca. 3.8 Ga population. These oldest zircons are interpreted as xenocrysts, with the age of the protolith being ca. 3.3 Ga or younger. The patchy distribution of Pb is the result of mobilisation of ancient radiogenic Pb, which can lead to reverse discordance [1]; this is independent of the degree of metamictisation, oxygen isotope and REE content of the zircons. Zircons from Mount Sones which show this effect underwent high-grade metamorphism at both ~2.8 Ga and 2.5 Ga, the latter reaching temperatures of >1000°C. It is likely that one or both of these events caused re-mobilisation of Pb. However, the precise mechanism is unclear and further work is in progress in an attempt to constrain this. Importantly, Ti also exhibits a random, patchy distribution in some zircon grains. This has the potential to affect Ti-in-zircon thermometry, with implications for the accurate determination of zircon crystallization temperatures.

[1] Kusiak *et al*. (2013), *Geology* **41**, 291-294.

Quantitative 18S rDNA analysis using 3rd generation sequencing methods to determine the effects of Modified Circumpolar Deep Water, iron and siderophores on phytoplankton assemblage composition in the Ross Sea

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We participated in the SEAFARERS cruise (along with other investigators Hatta, Kohut, Lam, Measures, Milligan and White) in the Ross Sea to test hypotheses regarding the influence of Fe supplied from Modified Circumpolar Deep Water (MCDW) and from putatively accessible and somewhat refractory forms ($FeCl_3$ and Fe-enterobactin) on primary production. Incubation experiments revealed widespread and chronic Fe limitation that was more pronounced in surface waters above Joides Trough than on Pennell Bank. Addition of MCDW did not stimulate growth at any station. Iron supplied as the Fe- catecholate complex enterobactin stimulated bulk chlorophyll production in a station dependent manner, which might be explained by clade-specific differences in Fe-catecholate bioavailability. We developed a quantitative approach to characterize community composition - based on amplification of the v7-v9 regions of 18S rDNA (>500 bp) and single-molecule real-time (SMRT) sequencing - which increased phylogenetic resolution compared to some previous methods. The inclusion of various xenobiotic standards immediately prior to DNA extraction and to PCR amplification allow us to evaluate absolute changes in community composition, facilitating the calculation of clade-specific growth rates under various treatments. To our knowledge, this is the first quantitative application of third generation sequencing methods in marine environments.

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