Lead isotopes and concentrations in the South Atlantic from the UK GEOTRACES transect along 40°S

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Documenting the distributions of trace elements and their isotopes (TEIs) in the ocean and understanding the processes responsible for these distributions is one of the overarching goals of the ongoing GEOTRACES program [1]. The marine geochemical cycle of lead (Pb) has been extensively influenced by anthropogenic activities since the mid-19th century and, in particular, by the use of leaded gasoline [2]. The characteristic isotope fingerprint of different anthropgoenic sources, combined with the short residence time of Pb in the ocean, makes the Pb isotope system a unique source tracer and monitor of ocean circulation [3].

We here present new results from two UK GEOTRACES cruises (D357 and JC068), forming a South Atlantic transect along 40°S. Seawater samples were analysed using a TIMS double spike methodology developed at Imperial College London. This method allows precise measurements for small seawater samples (2L) of both Pb concentrations and isotopic ratios, including the minor isotope ^{204}Pb.

Lead concentrations are generally higher in surface waters (15 to 35 pmol/kg) than in deep water (5 to 15 pmol/kg), and are higher in water depths associated with North Atlantic Deep Water (NADW) than in intermediate waters sourced from the south. The highest Pb concentrations can be found in surface waters close to the South African continent. Lead isotopic compositions clearly support the identification of the major water masses in the region. Excluding coastal areas, surface waters are characterized by ^{206}Pb/^{204}Pb ratios of 18.15 to 18.30, which is distinct from the ^{206}Pb/^{204}Pb ratios of 17.95 to 18.05 characteristic of AAIW. Deep waters usually display higher isotopic ratios with the most radiogenic ^{206}Pb/^{204}Pb ratios of 18.54 being observed at 4500 m depth (Antarctic Bottom Water).

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Searching radiation-resistant microorganisms in high-Mn sites

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Recently, several physiological parameters have been described to play a role on radiation resistance [1, 2]. In particular, a strong positive correlation has been demonstrated between intracellular accumulation of manganese and high resistance to radiation in several biological models [3]. However, the question of the evolution of radiation resistance has never been studied using an approach of environmental microbiology. In order to tackle this problem, soil samples were collected from different locations: (i) a manganese mine in Arizona, (ii) the Atacama desert, Chile, and (iii) the Moffett Field campus, CA. Samples were submitted to UV-C irradiation (300 J/m2) and resistant microorganisms were selected from three different culture media: Marine Agar, LB (Sigma) and R2A (Difco). All isolates were molecularly identified by PCR of the 16S rRNA gene. Each isolate was then subjected to another round of UV-C irradiation and classified according to their tolerance. Survival curves were performed in triplicate for the most resistant isolates and their intracellular Mn/Fe ratio was determined by ICP-MS. UV-resistant isolates have Mn/Fe ratios around two orders of magnitude higher than UV-sensitive ones. Three isolates are more resistant than *Deinococcus radiodurans* to UV-C irradiation, and show a higher Mn/Fe intracellular ratio. A better characterization of these isolates is currently in progress. Access to microbial resources in soils enriched in manganese will be essential for the development of new products and processes for application in various fields of knowledge. The discovery of radiation-resistant microorganisms naturally occurring in manganese-enriched sites will have a profound impact on several lines of research, including future space exploration.

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