Multi-proxy reconstruction of surface water pCO_2 in the northern Arabian Sea since 29 ka

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Reliable reconstruction of past surface ocean carbon dioxide (pCO_2) is essential in understanding the mechanisms controlling global climate on glacial-interglacial timescales. Hence several techniques have been proposed and individually applied as pCO_2 proxies. This study combines a group of independent proxies over a contemporaneous time interval at one location. We show that consistent pCO_2 values are obtained when foraminifera boron isotope and B/Ca proxies are coupled with a paleo-temperature proxy (Mg/Ca), and when alkenone data are coupled with a paleo-nutrient proxy (Cd/Ca). Our multi-proxy record shows that the Arabian Sea has been a perennial source of CO_2 to the atmosphere (as measured by ΔCO_2) over the past 29,000 years (Fig. 1A), and that variations in the strength of this source are directly in phase with precession-driven insolation over the Tibetan plateau (Fig. 1B).

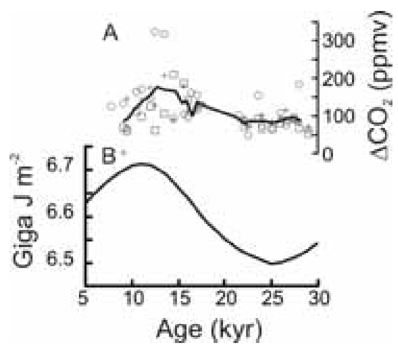

Figure 1: (A) ΔCO_2 in surface waters of Northern Arabian Sea. (B) Insolation over Tibetan plateau.

Diamond origin and genesis: A C and N stable isotope study of diamonds from a single eclogite xenolith (Kaalvallei, South Africa)

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In order to study diamonds with similar growth conditions formed in a very local piece of mantle, we carried out a detailed $\delta^{15}N$, $\delta^{13}C$, N contents and aggregation state study of 35 diamonds extracted from a single eclogite xenolith (Kaalvallei kimberlite, South Africa).

Nitrogen contents determined by infrared spectroscopy range from 239ppm to 1272ppm, with nitrogen aggregation state which varies between 11.5% and 43.7% of IaB defects. These two parameters are positively correlated. Modeling these according to a second order kinetic law [1], the samples likely represent a unique population formed 1.2G.y. ago at a temperature ~1125°C. $\delta^{13}C$ values range from -5.96‰ to -4.22‰. For nitrogen, $\delta^{15}N$ vary from -8.95‰ to -4.14‰. This xenolith belongs to population B based on chemistry [2]. Garnets of this population show slight positive Eu anomaly and relatively wide of $\delta^{18}O$ values from +4.9‰ to +6.1‰ [3], that the eclogites represent recycled hydrothermally-altered oceanic crust.

The $\delta^{13}C$ and $\delta^{15}N$ isotopic compositions cover only 5% and 15% of the worldwide diamond isotopic range. Because the range in $\delta^{13}C$ is small, we cannot identify any clear trends among the parameters. Nevertheless isotopic data are more compatible with diamond formation from a fluid than a solid by diffusion. Indeed, diffusion would generate kinetic isotope fractionations leading to a correlation between $\delta^{13}C$ and $\delta^{15}N$ among these diamonds, and a larger isotopic range of these, this is however not the case. $\delta^{15}N$ values seem incompatible with diamond formation from recycled materials which are enriched in ^{15}N (positive $\delta^{15}N$). Instead the values are clearly within the so-called mantle range ($\delta^{15}N_{mantle}$ = -5±2‰) and further illustrate a mantle-related diamond population. Thus, we envisage that xenolith was formed from subducted oceanic crust, followed by diamond crystallization by metasomatism from an intrusive mantle fluid.

[1] Evans & Qi (1982) *Proc. Roy. Soc. London* **A381**, 159-178. [2] Viljoen *et al.* (2005) *J. Petro.* **46**, 2059-2090. [3] Kiviets *et al.* (2003) *J. Geophys. Res. Abs.* **5**, 05625.