Revealing Pacific Ocean organic matter remineralization and circulation using the dual isotopic composition of nitrate

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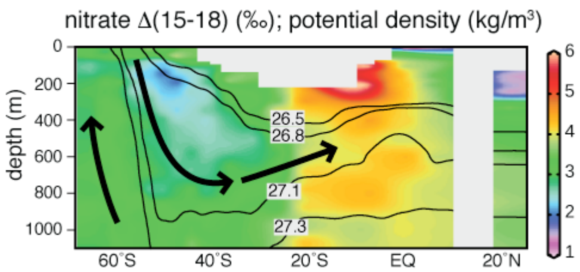
Here we show that the difference between the N and O isotopic composition of nitrate, or Δ(15-18), is sensitive to organic matter remineralization and largely reflects known patterns of surface ocean nitrogen cycling. For example, incomplete nitrate consumption in high latitude surface waters and N fixation in the subtropical North Pacific lowers subsurface Δ(15-18), while complete consumption in the lower latitudes elevates subsurface Δ(15-18) (see Figure 1 below). This sensitivity is exploited to estimate the $^{15}N/^{14}N$ of sinking organic matter and to track the modification of nitrate as it passes from the deep Pacific Ocean, through the Southern Ocean surface, and into intermediate-depth waters—a pathway that is necessary for resupplying the low latitude surface ocean with nutrients (Figure 1).

Figure 1: Nitrate Δ(15-18) along ≈150°W in the Pacific Ocean (see colour bar) and potential density (lines). Deep-sea nutrients are brought to the high latitude surface ocean and transported to lower latitudes within the potential density range of 26.5 to 27.1 kg/m^3 (arrows). Changes in nitrate Δ(15-18) along these isopycnals largely result from organic matter remineralization.



Growth medium and carbon source of unusual rounded diamonds from alluvial placers of the North-East of Siberian Platform

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About 70% of diamond placer deposits of the Siberian platform are concentrated in the northeastern part. Primary sources of diamonds of these placers have not yet been established. Some diamonds are neither characteristic to the pipes located nearby nor to any of the known kimberlite pipes of Yakutia. A significant part of the diamonds belongs the variety V [1]. These diamonds are characterized by rounded morphology and radial mosaic-block internal structure. The diamonds enriched in isomorphic nitrogen (up to 3500 ppm) and have light carbon isotopic composition ($\delta^{13}C$:-19.6÷-24.1‰). The Coe inclusions suggests eclogite paragenesis also supported by the light carbon isotopic composition. Moreover, diamonds contain numerous microinclusions (<1 μm). Rt, Grt, Ap, Kfs, Dy, Omph and Jd have been identified among microinclusions associated with fluid (or melt) inclusions of composition varied from carbonatitic (enriched in Ca, Mg, Fe, Cl, Ba and Sr) to silicic (enriched in Si, Al, Ti, K). Bulk trace element patterns of microinclusions as determined by LA-ICP-MS are similar to that observed in cuboid diamonds from Siberian Platform. Fluid inclusions have demonstrated that growth environment involved H_2O, CO_2, N_2, CH_4 and heavier hydrocarbons [2]. The compositions of fluid inclusions in one crystal could change from CO_2 to essentially hydrocarbons from center to the periphery.

Thus the obtained data for unusual rounded diamonds (variety V) indicates the possible connection between the formation of diamonds and subduction events. Variations of the growth media composition may be caused by the interaction between the metasomatizing fluids and silicate substrate.

[1] Orlov Yu.L. (1977) The Mineralogy of the Diamond. Wiley and Sons, New York, 1977, 235 p. [2] Tomilenko A.A. *et al*. (2001) *Doklady Earth Sciences* **379**, 571–574.

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