

Organic carbon export in Taiwan: insights from marine sediments

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Terrestrial organic C (OC) delivered to the ocean by rivers is a mix of recent OC and fossil OC derived from erosion of rocks. Burial of fossil OC in marine sediments is a simple recycling of reduced carbon and has no effect on atmospheric CO₂ and O₂ levels. Conversely, its oxidation consumes atmospheric O₂ and returns CO₂ to the atmosphere. In large-scale erosion systems (Himalaya), only graphite resists to oxidation during river transport and/or transient storage in floodplains. In contrast, disordered fossil OC observed in mountainous bedrocks and mountain rivers disappear during transport in large rivers, and are not observed in marine sediments [1]. In addition, such large scale systems may act like a CO₂ pump as a huge amount of modern OC is delivered and buried in the Bengal Fan marine sediments [2].

Here, we investigate the isotopic composition (¹⁴C, ¹³C), organic geochemistry and structure (Raman spectroscopy) of OC in recent turbidite deposits all around Taiwan. We show that the bulk OC is primarily composed by terrestrial modern and fossil OC, but also includes marine OC. We discuss the geochemistry of OC in marine sediments with respect to the modern and fossil OC sources on the Taiwan island. We quantify the respective contributions of these three end-members to the total OC, and discuss the sediments provenance based on the structure and geochemistry of fossil OC. Comparison of the OC in marine sediments with data existing for Taiwanese rivers [3] allows for discussing the carbon budget of erosion. In particular, unlike large-scale systems, fossil OC is massively transferred to marine sediments during erosion in Taiwan. Globally, such small-scale systems with very active erosion and short transfer to the ocean may act as an important sink for OC in the long-term carbon cycle.

[1] Galy V. *et al.* (2007) *Nature* **450**, 407-410. [2] Galy V. (2008) *Science* **322** 943-945. [3] Hilton R.G. *et al.* (2010) *GCA* **74** 3164-3181.

Assimilation of sediments embedded in the oceanic arc crust: myth or reality?

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Volcanic products from oceanic arcs afford a unique opportunity to study the subduction factory. Although most of these products are not primitive, the impact of assimilation of the arc crust is often ignored with the consequence that trace element and isotopic compositions are commonly attributed only to varying contributions from different source components. This jeopardises the integrity of recycling mass balance calculations. Here we use Sr and O isotope mineral data from a suite of volcanic rocks from the Lesser Antilles arc to show that assimilation can be significant in oceanic arc basement. Analysis of ⁸⁷Sr/⁸⁶Sr in single plagioclase phenocrysts from the Soufrière Volcanic Complex (St Lucia) reveal isotopic heterogeneity within and among hand samples ranging from 0.7083 to 0.7094. $\delta^{18}\text{O}$ measurements show extreme variation beyond the mantle range: up to +10.9‰ for plagioclase, +11.8‰ for quartz, +9.8‰ for amphibole and +9.5‰ for pyroxene. Such ⁸⁷Sr/⁸⁶Sr isotope disequilibrium and extreme $\delta^{18}\text{O}$ values strongly argue for assimilation of material located within the arc crust. A positive correlation between mineral $\delta^{18}\text{O}$ and the whole rock radiogenic isotopes shows that assimilation seems to be responsible for the isotopic heterogeneity observed in St Lucia but also in the whole Lesser Antilles since St Lucia covers almost the whole-arc range of isotopic composition. This highlights the need for detailed mineral-scale investigation of oceanic arcs suites to quantify differentiation that could lead to misinterpretation of source composition and subduction processes.