Oceanic anoxia, organic carbon burial and climate change during OAE-2

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The late Cenomanian/Turonian oceanic anoxic event-2 (OAE) caused a major perturbation of the global carbon cycle due to widespread burial of marine organic matter. This is evident from the global stable carbon positive isotope excursions in carbonate, total organic carbon (TOC), and various phytoplanktonic biomarkers [1, 2]. Oceanic anoxia played an important role in increased burial of organic matter; in the southern proto North Atlantic Ocean records of derivatives of the pigments isorenieratene and chlorobactene, derived from photosynthetic green sulfur bacteria, reveal that the base of the photic zone was often euxinic. In this area accumulation rates of organic carbon during OAE-2 are high, even in the deep sea, suggesting that the southern proto North Atlantic Ocean was a hotspot for organic carbon accumulation, potentially due to reduced organic carbon mineralisation in the euxinic water column.

A consequence of the increased burial of organic carbon during OAE-2 is a significant reduction in atmospheric pCO_2 levels. For the Cape Verde basin (DSDP Site 367) the $\delta^{13}C$ values of both sulfur-bound phytane (derived from chlorophyll) and C_{35} hopane (derived from cyanobacteria) were used to independently estimate pCO_2 levels and indicate pCO_2 levels of ca. 1300 ppmv before the OAE burial event and around 1000 ppmv after OAE-2, a reduction of ca. 25% [3]. At three different sites in the proto North Atlantic Ocean, we have detected using the TEX_{86} palaeothermometer a substantial cooling of the very warm surface waters before the OAE (ca. 34°C) that occurs in phase with the drop in pCO_2. In the southern tropical proto North Atlantic (DSDP Site 367 and ODP Site 1260), this drop is only a few degrees but at the ODP 1276 site in the northern proto North Atlantic (New Foundland Basin) this cooling amounts to 8°C. These results indicate that burial of organic matter can have a large effect on atmospheric CO_2 levels and, in turn, affects global climate.

[1] Arthur *et al.* (1988) *Nature* **335**, 714-717. [2] Kuypers *et al.* (2003) *Paleoceanography* **17,** doi:10.1029/2000PA00569. [3] Damsté *et al.* (2007) *Org. Geochem.* **39,** 1703-1718.

Alteration of Late Cretaceous dacites in the Murgul Area (Artvin, KD Turkey)

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Murgul (Artvin, NE Turkey) volcanogenic massive sulfide deposit in the eastern Black Sea Region of Turkey is associated with the Upper Cretaceous dacitic volcanics located along the margin of a caldera with a diameter of approximately 35 km. In the mine area, there are at least two types of dacites formerly known as the pyrite-bearing dacite (footwall dacite) and purple and green colored porphyritic dacite with no mineralization (hanging-wall dacite). The footwall dacite consists of dacites and dacitic pyroclastic rocks. Pytrite is ubiquitous in the footwall dacite, the most heavily altered dacite. Hanging-wall dacite is characterized by the columnar joints and consists of slightly altered dacite and tuffs.

Mineralogical and geochemical studies indicate the presence of hydrothermal alteration zones around the Murgul deposit. Silisification, sericitisation/illitisation, chloritisation, carbonatisation are seen in the footwall dacite which contain sericite/illite, kaolinite, chlorite, quartz, carbonate minerals, iron-oxide, and rare smectite as the alteration products. Sericitisation/illitisation and kaolinitisation are the most common type of the hydrothermal alteration associated with the footwall dacite, and chloritisation is the second. Pyritisation is seen commonly in the footwall dacites. In some fields, limonitisation is occasionally present. Sericitisation/illitisation, carbonatisation, epidotisation and rare chloritisation are seen in the hanging-wall dacite.

Geochemically, All dacitic rocks exhibit tholeiitic and transitional characteristics, and display geochemical characteristics of volcanic arcs. The footwall and hanging-wall dacites have several geochemical characteristics that show systematic changes with increasing proximity to ore body such as Na depletion as well as elevated alteration index (AI) and chlorite-carbonate-pyrite index (CCPI). Generally, the hanging-wall dacite has low CCPI whereas the footwall dacite has high CCPI values, indicating the importance of chlorite and pyrite formation in these rocks.