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# Evolution of volcanically-induced palaeoenvironmental changes leading to the onset of OAE1a (early Aptian, Cretaceous)

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During the Cretaceous, several major volcanic events occurred that initiated climate warming, altered marine circulation and increased marine productivity, which in turn often resulted in the widespread black shale deposits of the Oceanic Anoxic Events (OAE). In the sediments underlying the early Aptian OAE1a black shales, a prominent negative carbon isotope excursion is recorded. Its origin had long been controversial (e.g. Arthur, 2000; Jahren et al., 2001) before recent studies attributed it to the Ontong Java volcanism (Méhay et al., 2009; Tejada et al., 2009).

Therefore the negative C-isotope excursion covers the interval between the time, when volcanic activity became important enough to be recorded in the C-isotope composition of the oceans to the onset of widespread anoxic conditions (OAE1a). We chose this interval at the locality of Pusiano (N-Italy) to study the effect of a volcanically-induced increase in $pCO_2$ on the marine palaeoenvironment and to observe the evolving palaeoenvironmental conditions that finally led to OAE1a. The Pusiano section (Maiolica Formation) was deposited at the southern continental margin of the alpine Tethys Ocean and has been bio- and magnetostratigraphically dated by Channell et al. (1995). We selected 18 samples from 12 black shale horizons for palynofacies analyses. Palynofacies assemblages consist of several types of particulate organic matter, providing information on the origin of the organic matter (terrestrial/marine) and conditions during deposition (oxic/anoxic). We then linked the palynofacies results to high-resolution inorganic and organic C-isotope values and total organic carbon content measurements.

The pelagic Pusiano section consists of repeated limestone-black shale couplets, which are interpreted to be the result of changes in oxygenation of bottom waters. Towards the end of the negative C-isotope excursion we observe enhanced preservation of the fragile amorphous organic matter resulting in increased total organic carbon values in the black shale as well as in the limestone intervals. This shows how a rising $pCO_2$ triggered changes in climate and oceanography and resulted in an increasing oxygen-deficiency of the bottom waters that persisted even during the "limestone intervals" before oxygen-depletion finally became a global phenomenon.

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