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Oxygenation of bottom waters in Santa Barbara Basin during the last 35 ka: A Questioning Contribution from Sedimentary Magnetism

C. Blanchet (1), N. Thouveny (2) and L. Vidal(2)

(1) Bremen University, Germany, (2) CEREGE-CNRS, Aix en Provence, France (blanchet@uni-bremen.de)

As shown by previous studies, the sediments deposited in Santa Barbara Basin (California, 35°N) have recorded rapid oceanological changes during the last glacial period (Kennett et al., 1995). Sedimentary facies (laminated/non laminated and bioturbated) and faunal assemblages in ODP hole 893A were related by Behl and Kennett (1996) to the bottom water oxygenation levels, presented as a "Bioturbation Index". The accurate chronological reconstruction (Ingram and Kennett, 1995; Hendy et al., 2002) allowed relating the regimes of oxygenation and anoxia to cold and warm events of the North Atlantic climate, respectively (Behl and Kennett, 1996).

Here we present magnetic and geochemical results obtained on core MD02-2503 collected during the coring campaign IMAGESVIII-MONA at the same location as core ODP893A, in presently anoxic waters (596 m water depth). A high-resolution correlation of magnetic susceptibility records demonstrate that core MD02-2503 covers the last 33 ka. Sediments are affected by a strong reductive diagenesis, transforming most iron oxides into iron sulfides.

By combining magnetic properties (magnetic susceptibility, IRM, hysteresis parameters, thermomagnetic curves) and relative quantification of Fe, Ti and S by X-ray fluorescence, we could distinguish layers enriched in ferrimagnetic sulfides from the ubiquitous paramagnetic pyrite. The degree of reduction of sulfides could be linked with different oxygenation levels: the paramagnetic and more reduced pyrite (FeS_2) formed in anoxic conditions whilst the ferrimagnetic sulfides (greigite, Fe_3S_4 and pyrrhotite, Fe_7S_8), less reduced, formed in slightly more oxic conditions qualified as "dysoxic". The ferrimagnetic sulfide index IRM/χ matches the Bioturbation Index for the last 15

ka. It moreover reveals that dysoxic conditions documented in non-laminated (bioturbated) layers occurred at the times of the Last Glacial and of Heinrich events 2 and 3, previously described as fully oxic periods. Such evidences imply either an increase of the primary productivity in surface waters or a reduction of the ventilation of Santa Barbara Basin. Calving events of the North-west American ice sheets may have played a role on the convection regime of Californian margin oceanic waters.