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Sub-orbital variability of productivity and organic carbon burial in the Ross Sea during the mid-Pliocene Warm Period: linkage with the Western Antarctica Ice margin dynamics

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The West Antarctic Ice Sheet (WAIS) is highly susceptible to melt under global warming stress. Subsequent changes in the regional land/ocean carbon cycle may be expected. From this viewpoint, the mid-Pliocene warm period (mPWP), the most recent time when atmospheric CO_2 levels were close to the present-day values, may provide clues about such processes. We thus analyzed a sedimentary record of the mPWP, using samples from IODP Site U1524 cores. Total organic carbon (OC) content, OC/total N ratio, d^{13}Corg of bulk samples, $^{87}Sr/^{86}S$ and εNd_0 of the <64µm fraction, were determined.

The OC content, its $d^{13}C$ value, and the OC/total N ratio record high frequency (~ 14 ka) variations in primary productivity and organic carbon sources punctuated either by WAIS ice margin advances/retreats or short perennial sea-ice spreadings. Radiogenic isotopes (Sr and Nd) depart from the organic matter behaviour, and suggest that they may record large scale properties of sediment sources and Nd-exchanges with ambient water masses. The average spectral analysis of data indicate a significant influence of obliquity during the mPWP interval, clearly modulated by other orbital parameters and/or climate (pCO_2?)/ocean feedback mechanisms resulting in the observed ~ 14 ka apparent frequency of organic matter and sediment properties. Due the present high amplitude variability of obliquity, contrasting with its much lower amplitude during the mPWP, the responses of the WAIS and carbon cycle to the ongoing pCO_2 and global temperature rises may significantly differ from those observed during the mPWP.