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CHARACTERISTIC OF ORGANIC MATTER IN SURFACE SEDIMENTS FROM THE PERU MARGIN – IS THE PRESERVATION OF ORGANIC CARBON RELATED TO THE GENERAL DEGRADATION STATUS?

Alice THOFT[1], Bo Barker JØRGENSEN[2], Jutta NIGGEMANN[1] and Bente Aa. LOMSTEIN[1]

[1]Department of Biological Sciences, Section for Microbiology, University of Aarhus, Ny Munkegade, Building 1540, DK-8000 Aarhus C, Denmark. [2]Max Planck Institute for Marine Microbiology, Department of Biogeochemistry, Celsiusstrasse 1, D-28359 Bremen, Germany.

The Peru margin offers a unique opportunity to study the composition of pre-burial organic matter that accumulates at the sediment – water interface. Such studies provide the baseline characteristics of organic matter that will be modified during diagenesis and ultimate burial (Arthur et al. 1998). The upwelling of Peru is perennial, wind-driven, and presently concentrated in the zones 7°-8°S, 11°-12°S and 14°-16°S. The upwelling system is dominated by two currents: the equator-ward O_2-rich Peru-Chile-current in the upper 200 m of the water column, and the pole-ward flowing Peru Undercurrent underneath (Hill et al. 1998). The latter transports oxygen-poor, nutrient rich water, which is brought to the euphotic zone by upwelling. This results in high primary production, which leads to high sedimentation rates. Remineralization of the large amount of sinking organic material results in an oxygen minimum zone (OMZ) which is located at ~50-650 m water depth (Emeis er al 1991; Lückge and Reinhardt 2000). High primary production, high sedimentation rates, shallow water depth, and oxygen limitation in the water column and sediments favor the accumulation of organic rich sediments (e.g. Thiede and Suess 1983). The sedimentary OM is predominantly of marine origin, as input from the dry coastal area is limited (Niggemann 2005).

Although the characteristics of organic matter on the Peru margin have been studied previously (see intensive study by Arthur et al. 1998 and refs in there), there has been no previous intensive characterization of surface sediments by use of multiple amino acid based freshness and preservation indicators along several onshore – offshore transects across the water column redox gradient. The investigated region off Peru reached from 9.5°S to 13.5°S latitude and included both shelf and slope and sediments within and outside the OMZ. The diagenetic indicators applied in the present study were the percentage of total organic carbon present as amino acid carbon ($\%T_{AA}C$) and the percentage of total nitrogen present as amino acid nitrogen ($\%T_{AA}N$), which are particularly useful as diagenetic indicators; they are sensitive to different stages of alteration and appear to be uncompromised by source variations (Cowie and Hedges 1994). We gained further information on the degradation state of organic matter from the relative abundance of non-protein amino acids, which generally increases during diagenesis. The result of this is a decrease in the ratio between the protein

precursor (e.g. aspartate) and the non-protein degradation product (e.g. ß-alanine; Cowie and Hedges 1994). Applied together, $\%T_{AA}C$, $\%T_{AA}N$ and the ratio between source protein amino acid and its non-protein degradation product offer congruent information on the relative diagenetic stage and reaction potential of natural organic material (Cowie and Hedges 1994, Keil et al. 2000, Lomstein et al. 2006). In addition, the diagenetic status of the sediment was evaluated by use of the amino acid composition based degradation index (Dauwe and Middelburg 1998). Finally the reactivity of THAA was evaluated from estimated THAA-N mineralization rates. Preservation of organic carbon, in the form of bacterial cell walls (live+dead + remains) was inferred from the concentrations of D-aspartate, D-glutamic acid, D-serine and D-alanine. This method has been successfully applied to give indications on the importance of bacteria in the preservation of organic carbon in coastal Chilean sediments (Lomstein et al. 2006). Sampling was carried out during RV Sonne cruise 147 in June 2000. Sediment cores from 20 stations were retrieved by multicorer from water depths between 50 and 1369 m.

All the applied diagenetic indicators showed consistent trends with water depth, indicating that organic matter was increasingly decomposed when it reached the sediment surface at greater water depth (i.e. residence time of organic matter in the water column had been longer). At present we are still working on the D-amino acid data, which at the moment do not allow us to conclude on the contribution of bacterially derived amino acids to bulk THAA and thus the importance of bacteria in the preservation of organic carbon. Results from this work will be available in due time before the meeting and be incorporated in the presentation.

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