BBL Characteristics at the Iberian Sea transect

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Task III.1.1

Objectives: to determine and quantify the distribution, amount, composition and residence time of SPM in nepheloid layers and in clear water.

Sediment stability and characteristics of resuspended aggregates of the western European continental margin

Sediment stability and characteristics of resuspended aggregates were experimentally determined on recovered cores from different locations of the western European continental margin by means of a benthic erosion chamber augmented by an image analysis system. Bottom sediments (670 to 3660 m water depth) consisted of a thin surface layer which resuspended as aggregates (mean diameter 138 - 2768 µm) under critical shear velocities [u_{*c}] of 0.4 to 0.9 cm s^{-1}. For the underlying sediments, eroded as primary particles, u_{*c} increased with water depth from 0.7 cm s^{-1} (sandy upper slope sediments) to 1.7 cm s^{-1} (cohesive clay sediments). In conjuction with hydrodynamic details published elsewhere, the experiments demonstrate that under tidal flow conditions typical for continental margins, the interfacial layer erodes as aggregates. These aggregates can subsequently be transported in tide-related resuspension-deposition loops over long distances. In these resuspension loops, confined vertically to the bottom-nearest part of the benthic boundary layer, the aggregates have important implications for the benthos despite their relatively low number (260 particles dm^{-3}) as they carry sufficient nutrients to serve as an additional food source for the benthic community.

The aggregates consisted up to 75 % wt of organic matter, which was mostly refractory with a carbon/nitrogen ratio exceeding 10, and the lithogenic material (25%) was embedded in the amorphous matrix of the organics. Aggregates contained remnants of faecal pellets, meiofauna organisms and shell debris of foraminifera. The mineralogical composition of the aggregates was similar to that found in the underlying sediments. The mineral composition showed that illite, kaolinite and chloride were dominant. 35 - 65 % of the bacterial mass of the BBL were particle attached and covered the organic matrix of the aggregates. Approximately 1 % of the organic fraction was labile bacterial organic carbon. For all critical friction velocities determined, there was a negative correlation between particle size and erosion resistance (Kendall's Tau = - 0.7, $p < 0.0001$).

These results are submitted as a manuscript to Deep Sea Research by Thomsen and Gust, G.

Task III.1.2

Objectives: to assess the spatial and temporal magnitudes and variabilty of benthic boundary layer dynamics

Deliverable at month 24.

Task III.1.5

Objectives: to define contrast between upwelling and non-upwelling dominated sediment transport processes.

Deliverable at month 30.

Task III.3.1

Objectives: to determine the role and importance of bioentrainment and deposition in carbon cycling in surface sediments

Aggregate scavenging rates of benthic interface feeders at the Iberian continental margin

Experimental studies in laboratory flumes show that benthic Foraminifera (*Marsipella* spec.) dominating a mid slope station (1645 m) at the Iberian continental margin can scavenge aggregates transported in the benthic boundary layer. These BBL aggregates occur in concentrations of 0.5 and 5 cm^{-3} at 0.5 cm height above the sea floor, when free stream flow velocities were in the order of 33 and 3 cm s^{-1} respectively. Aggregate encounter rates varied between 1.6 - 9.4 x 10^{-4} and aggregate capture rates ranged from 1.6 - 10 aggregates $ind.^{-1}$ d^{-1}. These low capture rates can still be high enough to balance the carbon demands of the Foraminifera. The estimated POC biodeposition of the foraminifer community was 0.22 - 0.67 mg m^{-2} d^{-1}, which is roughly 1 - 4 % of the total carbon deposition needed to feed mid-slope benthic communities.

The benthic community at the station was dominated by tubular arenaceous Foraminifera with a total abundance of 647±39 m^{-2}. *Marsipella elongata* (Norman, 1878) dominated the foraminifer community with a mean abundance of 583 ind. m^{-2}, followed by *Marsipella caervicornis* (Hofger, 1972) with 64 ind. m^{-2}. During time of investigation *Marsipella elongata* had built up a permanent cyst of sponge spicules and debris in the aperture region. The spicules were used to support a spherical shaped pseudopodial network which served as filter apparatus. The tests stood erected in the sediments. Approximately 50 - 60 % of the tube was embedded in the sediment while the remainder penetrated up to 0.4 cm into the water column. The less dominant foraminifer *Marsipella caervicornis* was branched and penetrated 0.3 - 0.4 cm into the boundary layer with 60 % of the agglutinated tube being embedded in the sediment. Sponge spicules were also used to build up a hemispherical collector, but the upper part of the tubes were also covered with protoplasm and used as cylindrical filter apparatus. Both types of Marsipella were able to withstand flow velocities exceeding 50 cm s^{-1} an u_{100} althoughthey were fully exposed to the turbulent logarithmic layer. POCdeposition via aggregates was low when compared to the biodeposition trates estimented for the Goban Spur study site of the OMEX I project.

These results are submitted as a manuscript to Limnology and Oceanography

Erosion resistance: see also Task III.1.1.

Task III.3.4

Objectives: to investigate benthic community structure in relation to BBL dynamics

Deliverables: month 24.

Task.III.3.5.

Objectives: to define role and importance of benthic fauna in recycling of carbon at different margins

Deliverables: month 36.

Results from the OMEX II phase in comparison with the OMEX I data are „in press" in a special volume of the Journal of Sea Research.