Marine organic particle decomposition in laboratory controlled conditions: changes in biochemical composition

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The rates of particle sinking and destruction through biotic and abiotic processes such as break-up, remineralization and dissolution are critical variables determining the vertical flux of material. Bacterial activity is known to be a major determinant in biological alteration (Cho and Azam, 1988; Smith *et al.*, 1992; Harvey *et al.*, 1995) of the marine particles. However, little is known about dissolved organic carbon (DOC) release during degradation, bacterial growth efficiency (BGE) as well as turnover rates of particulate organic carbon (POC) and those of the various classes of organic compounds including carbohydrates, lipids and amino-acids during microbial decomposition.

In this study, marine large organic particles (> 10 μm) were collected by *in situ* pumps as well as sediment traps and zooplankton hauls in Northwestern Mediterranean Sea and in Antarctic Ocean. These particles were then diluted in 0.2 μm filtrated seawater collected at the same depth for incubation experiments conducted in the laboratory in the dark at *in situ* temperature under oxic conditions. Changes in POC and DOC as well as abundance and production of bacteria were followed over time (*c.* 10 days). For some experiments we also measured colloid production and change in carbohydrate and lipid composition during the time course experiment. Behaviour of thorium isotopes and aluminum, barium and manganese during two experiments were also studied for two experiments (Roy Barman *et al.*, 1998; Arraes-Mescoff *et al.*, 1998). The results showed that TOC decrease covaried with an increase in bacterial production. Moreover, microscope observations indicated that bacteria were largely the main organisms in the batch suggesting that they play a major role in particle degradation. In addition, 14–80% of initial TOC was consumed by microbes within 48 hours with decay rates ranging from 0.17 to 1.1 d^{-1}. Among the particulate pools, turnover rates of carbohydrates and lipids ranged from 0. 07 to 0. 09 d^{-1} and from 0. 06 to 0. 14 d^{-1} respectively. Much of the DOC released from the particles was likely remineralized by bacteria or converted to bacterial biomass being consistent with previous studies (Cho and Azam, 1988; Turley and Mackie, 1994). BGE calculated from the increase of bacterial biomass-C versus the amount of TOC consumed ranged from 1 to 50% being minimum for bacteria growing on cadavers of the zooplankton specie *Thalia democratica* and maximum for particles collected by sediment trap at 200 m in Mediterranean Sea.

References

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