



## Mass sedimentation of picoplankton embedded in organic aggregates

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**ABSTRACT:** During a survey cruise crossing the Subtropical Front over the Chatham Rise east of New Zealand, we made the first observation in High Nutrient Low Chlorophyll waters of massive sedimentation of picoplankton embedded in large (>0.5 mm diam.) organic aggregates (OAs) sensu Riley (1963). We estimate  $9.3 \text{ mg C m}^{-2} \text{ yr}^{-1}$  of prokaryotic picoplankton biomass alone may be transported below the euphotic zone via this mechanism. Using confocal microscopy, we made direct observations of picoplankton within undisrupted individual OAs, collected in sediment traps fitted with acrylimide gels, which largely conserved particle structure. Prokaryotic picoplankton autofluorescence was well-preserved and concentrations were extremely high within large rapidly sedimenting aggregates, ranging from  $1.06 \times 10^8 \text{ ml}^{-1}$  in the 120 m sediment traps in subantarctic waters to  $7.5 \times 10^6 \text{ ml}^{-1}$  at 550 m in subtropical waters, yielding Enrichment Factors of  $10^3 - 10^5$  relative to picoplankton concentrations in the water column. Aggregate picoplankton concentrations showed a well-constrained exponential decline with depth, which we speculate may represent an estimate of protozoan grazing rate within the aggregates. Picoplankton were found within heterotrophic flagellates, within copepod fecal pellets, and within organic matrices, all of which were incorporated in OAs. The key event of picoplankton incorporation into initial particles occurs in the upper water column, very likely through grazing with low assimilation efficiency. Once OAs are formed, their changing porosity and reduction in picoplankton cell numbers via heterotrophy is likely to be a key factor mediating picoplankton carbon fluxes in moderately productive ecosystems, and in determining the overall particle structure of sedimenting OAs.

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