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Ballast minerals and particle sinking velocities in opal- and carbonate-dominated production systems of the Atlantic Ocean

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Recently several studies stressed the role of mineral ballast for the transfer of organic carbon from the surface to the deep ocean. Armstrong et al. (2002) argued that the production of ballast minerals is even more important for the biological pump than primary production. Both carbonate derived from coccolithophorids and lithogenic materials, e.g. dust may be potential particle carriers. However, little is still known about the mechanisms behind the ballast theory. Sinking speeds of larger particles such as marine snow or fecal pellets which are responsible for particle transfer may be an important issue. Francois et al. (2002) postulated that organic carbon remineralisation in low-latitude oceans is relatively low due to the formation of carbonate-rich dense and fast sinking pellets. On the other hand, more loosely-packed diatom-rich aggregates from high latitude oceans may be characterized by reduced sinking speeds. Here we tested this hypothesis by approximating particle sinking velocities using sediment trap experiments from opal- and carbonate production systems in the Atlantic Ocean. We obtained a trend of increasing settling velocities from high to lower latitudes by means of two different approaches. Very high sinking speeds between 300-600 m d^{-1} were estimated for the ocean area off NW Africa which is dominated by carbonate producers but also by high dust input. We have indication that sinking speeds increase with water depths as suggested by Berelson et al. (2000). These findings have important implications for the biogeochemical cycling of elements in the ocean.

References:

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