Theoretical hydrodynamic efficiency of coccoliths and coccolithophores

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Several factors can influence the sinking of a particle: for example, the medium in which it is found and the specific characteristics of the particle. Coccolithophores and coccoliths have various shapes and sizes, and their sinking velocities and sinking trajectories are closely dependent upon the above factors.

In order to describe the sinking efficiency of coccoliths, sinking velocities (Vh) and sinking trajectories were estimated from experiments in a graduated fish tank with PLA (polylactic acid) scaled figures. Videos were used to record the sinking of the figures, which then were analyzed, and a model was generated with bilinear interpolation to estimate the sinking time in the mixing layer (CM) and below the CM.

The trajectories exhibited by the scaled figures had heterogeneous displacements. *Discoaster pentaradiatus* had the most uniform pattern, and *Florisphaera profunda* had the most variable. The Vh results from the model showed that an increase in diameter of spherical particles (PE) generated an increase in Vh. Sizes with a range of 0–20μm had a Vh of less than 200μm/second, whereas for sizes larger than 20μm, the increase in Vh was relatively constant or 200μm/second for every 10μm of increase in size.

For particles inside of the CM, size does not influence the sinking because its behavior in the CM depends primarily on the dynamics of the CM. Below the CM, the Vh of large PE is 1000 times greater. If shape is compared, the Vh of large PE is markedly higher than the non-spherical ones. For small particles, Vh is similar between PE and non-spherical.