Measuring the sinking characteristics of coccoliths: refinement of coccolith separation methods

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The use of coccoliths in geochemical analyses and paleoenvironmental reconstructions has been hindered by the difficulty in isolating coccoliths as compared to the greater ease in separating the larger sized foraminifera. Two main methods have been developed to concentrate near monospecific assemblages of coccoliths from bulk sediments: one is based on a decanting technique and the other is based on micro filtering. An improved separation technique could offer new perspectives on the study of earth history. Moreover, developments in coccolith oxygen and carbon isotope culturing and modeling studies in recent years have provided more reliable interpretations of coccolith isotope data and therefore increased the need for more purified coccolith fraction samples.

The most widely used and most efficient method, the micro filtering method, relies heavily on the specifications of the microfilter (such as 2μm, 3μm, 5μm, and 8μm) and has difficulty separating coccoliths with similar sizes, such as *Florisphaera profunda* and *Emiliania huxleyi*. Hence, in some studies, both of the microfilter and the sinking or centrifugation method were used for coccolith separation.

The earliest used method in isolating coccoliths, the repetitive sinking/decanting method, is poorly supported by Stokes' Law, which applies only to spherical objects, and the sinking velocities of coccoliths with their complex shapes and surfaces are difficult to calculate. So, it is still worthwhile to be able to refine the sinking/decanting method.

In this study, a new method was developed in order to improve the repetitive settling/decanting method. First, the sinking velocities of different coccoliths were carefully measured through a series of settling experiments. Second, the influence of different vessels used in the sinking experiment was proved to be negligible. Third, a formula for coccolith movement during centrifugation was developed and tested to improve the efficiency of coccolith separation. We now can offer a method that achieves near monospecific assemblages of coccoliths through repeated settling and have compared this to the established settling and filtering methods.