

Enabling global mapping of marine omics and biogeochemistry with an autonomous vertical profiling sampler

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The genomes (DNA), transcriptomes (RNA), proteomes (proteins), metabolomes (metabolites), and metallomes (metals) of microorganisms hold valuable information about their physiological potential and metabolic status. Measuring these cellular molecules in environmental samples via “omics” approaches can provide important insights into what microbes are present and how they are interacting with their geochemical environment. However, in the oceans, where biological and geochemical processes are intimately linked across dynamic conditions in time and space, collecting samples that sufficiently capture environmental variation remains a critical challenge. Here we describe the development of a rapid vertical profiling autonomous underwater vehicle capable of taking samples for omics and biogeochemistry studies. Named *Clio*, this vehicle will be wireless and capable of high throughput sampling and sensing to depths of 6000 m. At each sampling station, *Clio* would collect filtered material and filtrate from up to 150 L of seawater sampled at 16 to 32 depths in as little as 14 hours. Samples collected on filters can be preserved *in situ* with solutions such as RNAlater. We envision that such a sampler will be valuable in adding a biological dimension to geochemical studies and programs such as the GEOTRACES. Ultimately, this will enable the global mapping of marine microbial omics in the context of geochemistry, thus revealing the complexity of marine biogeochemical processes and informing biogeochemical models.