Detrainment and Settling of Sediment in Turbidity Currents: A Study to Inform Deep Seabed Mining

by
Kelsey O'Brien Cathcart

Submitted to the Department of Mechanical Engineering
on May 10, 2023, in partial fulfillment of the
requirements for the degrees of
Naval Engineer
and
Masters of Science in Mechanical Engineering

Abstract

Deep-sea mining for high demand minerals has recently been a topic of global conversation in relation to potential monetary value, geopolitical cooperation, and environmental impact. The governing body of the deep-ocean, the International Seabed Authority (ISA), has simultaneously been attempting to protect the deep-sea from ruin by potentially harmful practices while also seeking to approve mining practices for mineral extraction from the deep-ocean for several years. Understanding there is much to learn about not only the deep-ocean but how to build best practices for mining the deep-sea has led to several deep-ocean research projects to inform researchers, and in turn the ISA, on how to do so in a manner that leaves the smallest human footprint on this vast ecosystem. Through both exploratory deep-ocean and laboratory research projects it has become apparent that the creation, and subsequent traveling, of turbidity currents across the seabed as a result of deep-sea mining will lead to impacts on a scale that is not yet entirely understood. Building on decades of studies on gravity currents (both related and unrelated to deep-sea mining) the focus of this thesis and requisite experimentation focuses on not the head of the gravity current but rather the tail end of the current and observing the detrainment and settling that occurs after the gravity current has been created (or released). The study of how these particles settle will inform the deep-sea mining field and the ISA on the potential environmental impact of this new practice and how to best move forward with potential deep-seabed exploitation following science informed practices and regulations.

Thesis Supervisor: Thomas Peacock
Title: Professor of Mechanical Engineering