Rheological properties of composite serpentine-brucite suspensions: Implications for mudflow behavior on forearc seamounts

*亀田 純[1]、平内 健一[2]
*Jun Kameda[1], Ken-ichi Hirauchi[2]

1. 北海道大学自然史科学専攻、2. 静岡大学理学部地球科学科
1. Earth and Planetary System Science, Hokkaido University, 2. Department of Geosciences, Shizuoka University

To better understand the factors that influence seafloor serpentinite mudflows, such as those recently documented on the Marianas seamounts, we have conducted rheological measurements on composite serpentine-brucite suspensions at 7 ˚C and a salt concentration of 0.6 M. The resulting flow curves were fitted by the Bingham fluid model, from which the Bingham yield stress and dynamic viscosity of each suspension was determined. Both the yield stress and dynamic viscosity increase as the water content of the suspension decreases. Increasing the brucite fraction in the solid mixture results in an increase in yield stress and a decrease in viscosity of the suspension for the same water/solid ratio. Physicochemical parameters such as pH, temperature and electrolyte concentration also moderately affect the rheology of the suspension, but the influence is not as significant as has been previously observed for suspensions containing smectite (Kameda and Morisaki, 2017). The results suggest that mineral composition of the serpentinite mud, especially the abundance of brucite, has as much of an impact as water content on variable mudflow behaviors. In order to examine the effect of these changes in rheology on runout distances of serpentinite mudflows, we have constructed 1D numerical models for downslope spreading using the software BING (Imran et al., 2001). The results indicate that the runout distance gradually decreases with increasing brucite content until ~25% brucite content, above which there is a much more rapid decrease. It is noted that these findings are fairly consistent with the observation on the typical serpentinite seamounts on the Mariana forearc: S. Chamoro seamont has a distinctive summit knoll that is absent on the Conical seamount, because the only the mudflow documented on S. Chamoro contains more than 20 wt% brucite. We therefore suggest that, in addition to water content, variations in the mineralogy of the serpentinite mud can be another significant factor for variable mudflow behaviors on the Mariana seamounts.

キーワード：蛇紋岩泥流、蛇紋岩海山、レオロジー
Keywords: serpentinite mudflow, Mariana seamount, mud rheology

