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Grain size analysis of sands by an optical microscopy/digital image method

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Grain size is a fundamental property of earth materials. However, no two of the many techniques yield a consistent measurement of this property; thus, elucidating the relationships among different methods is valuable for understanding what constitutes grain size. This study compares the grain size distributions analyzed by optical microscopy/digital image (Morphologi G3 instrument (Malvern Ltd; the UK)) and those analyzed by laser diffraction. In most of the investigated samples, the size distributions obtained by both methods were very similar. However, a shift toward a coarser grain-size distribution was observed in the optical microscopy analysis of finer sand samples, and the frequency distribution was broadened. The fractions of sand and silt size fractions were also consistent between the two methods, but optical microscopy indicated a smaller clay size fraction than the laser diffraction method. The median particle size (30 – 200 μm) was similar in both methods. The standard deviation was lower in the optical microscopy method than that in the laser diffraction method. We conclude that optical microscopy is a useful technique for determining the grain size distribution. Additionally, we investigated the particle shape and particle size in the experimental fault formed by ring-shearing test. This study is financially supported by METI and Research Consortium for Methane Hydrate Resources in Japan (the MH21 Research Consortium).

Keywords: grain size analysis, digital image method, laser diffraction method, sand, ring-shear test