Multi-elemental characterization of submarine hydrothermal deposits in the Okinawa Trough based on independent component analysis

*Kazutaka Yasukawa[1], Akito Aichi[1], Kentaro Nakamura[1,2], Tatsuo Nozaki[3,1,4,2], Yutaro Takaya[1,3], Mizuki Ishida[1], Yasuhiro Kato[1,2]

1. School of Engineering, The University of Tokyo, 2. Ocean Resources Research Center for Next Generation, Chiba Institute of Technology, 3. Submarine Resources Research Center, JAMSTEC, 4. Graduate School of Science, Kobe University

Submarine hydrothermal activity constitutes a key process that transfers energy and materials from the Earth's interior to surficial systems including hydrosphere and biosphere. Producing mineral deposits of economic interest is also an important aspect of such a physicochemical process. In the Okinawa Trough, a back-arc basin bearing multiple hydrothermal deposits [1], a number of scientific research cruises have been conducted [1-5]. Previous studies have implemented a variety of geochemical and mineralogical analyses and discussed the ore-forming processes [4,5], using drilling core samples containing various altered/unaltered volcaniclastic and hemipelagic sediments, as well as sulfidic rocks, obtained by the drilling vessel CHIKYU.
In this study, we statistically analyzed a comprehensive dataset of bulk chemical composition (>1,300 samples x 47 element contents) of the drilling core samples using independent component analysis (ICA). ICA is a powerful method to recover mutually independent signals from an observed mixture of the source signals, which has been successfully applied to geochemical datasets [6-8]. In the presentation, we will discuss the features and spatial distributions of the statistically independent components that reflect multi-elemental information and characterize the (sub)seafloor hydrothermal deposits in the study area.

[1] Glasby and Notsu (2003) *Ore. Geol. Rev.* 23, 299-339. [2] Nakajima et al. (2015) *PLoS One.* 10, e0123095. [3] Nozaki et al. (2016) *Sci. Rep.* 6, 22163. [4] Totsuka et al. (2019) *Chem. Geol.* 514, 90-104. [5] Nozaki et al. (2021) *Sci. Rep.* 11, 8809. [6] Iwamori & Albarède (2008) *Geochem. Geophys. Geosyst.* 9, Q04033. [7] Yasukawa et al. (2016) *Sci. Rep.* 6, 29603. [8] Yasukawa et al. (2019) *Geochem. Geophys. Geosyst.* 20, 3402-3430.

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