[JJ] Evening Poster | S (Solid Earth Sciences) | S-CG Complex & General

[S-CG61]Ocean Floor Geoscience

convener:Kyoko Okino(Atmosphere and Ocean Research Institute, The University of Tokyo)
Wed. May 23, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
Most of Earth's volcanism and much of its tectonic activity occur on and beneath the seafloor. Various phenomena on the seafloor are closely linked to plate tectonics, Earth structure and dynamics, and also related to Earth's environments through the hydrosphere and atmosphere. Seafloor rocks and sediments record Earth's evolution and heat and material fluxes on the Earth. Ocean Floor Geoscience session covers a broad range of research on seafloor such as mid-ocean ridge process, subduction dynamics, arc magmatism, hot spot and LIPs, crustal movement and structure etc. Every field of researches and every approaches are welcomed. The session aims to encourage discussion among scientists from different study fields and to integrate our understanding of ocean floor. The session is co-dhaired by K. Tadokoro (Nagoya Univ.), O. Ishizuka (AIST), T. Toki (Univ. Ryukyu), and N. Takahashi (JAMSTEC).

[SCG61-P19]Recent attempts of marine self-potential surveys for exploring hydrothermal ore deposits

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To explore seafloor mineral deposits, methods used in initial surveys should be as simple as possible. The self-potential method, which was originated in the 1970s in marine environments, measures in situ electrostatic potential and is a candidate for this purpose. The self-potential signal responds to redox chemical reactions occurring around mineral deposits, which has been known well in on-lend environments. The self-potential signal detects redox reactions almost exclusively in marine environments because the streaming potential that is dominant in on-land environments gives a minor contribution in the presence of saline seawater. From a practical point of view, the marine self-potential method is easy to implement. Towing an electrode array can detect the signal. In on-land environments, by contrast, shallow holes filled by clay muds are required at each observation point, which takes an effort.

As a part of the SIP program ‘Zipangu in the Ocean’, we have conducted self-potential surveys at known active seafloor hydrothermal fields around the Japan Islands (e.g. Sato et al., 2017; Kawada and Kasaya, 2017). The instrumentation used during these surveys is identical to a receiver unit of marine electric surveys; the raw data is the electric field along the survey line. Using a deep-tows and autonomous underwater vehicles, we have confirmed that towing an electrode array can detect the self-potential signals from ore deposits. Negative self-potential anomalies have been observed both above active and inactive hydrothermal sulphide mounds without no complicated data analysis but integrating the observed electric field along the survey line. The self-potential signal is detectable 50 to 100 m above the seafloor at active hydrothermal areas, whereas the detection limit is 5 m above the seafloor at less active areas. The typical source depth of the self-potential signal can be roughly estimated. For example, at an active hydrothermal field in the mid-Okinawa Trough, the source depth is estimated to several tens of metres below the seafloor, assuming the source to be a point source of an electric current dipole. We will introduce some of our recent results of the marine self-potential surveys in the presentation.

For future surveys, the marine self-potential method can be (should be) combined with active surveys like electric and electromagnetic methods that transmit electric current and receive the signal as the electric or magnetic field (Kasaya et al, 2016a, 2016b). The self-potential signal is obtained during these active surveys as an unavoidable ‘side effect’, which is included in the fluctuations in the baseline and may be extracted easily. In doing so, rough information is given from the self-potential signal without complicated data analysis, while precise information is obtained from the electric survey after detailed analysis.