[EE] Evening Poster | S (Solid Earth Sciences) | S-IT Science of the Earth's Interior & Tectonophysics

[S-IT21]Do plumes exist?

convener:Hidehisa Mashima(Center for Obsidian and Lithic Studies, Meiji University), Gillian R Foulger (Durham University), Dapeng Zhao(東北大学大学院理学研究科附属地震・噴火予知研究観測センター)
Sun. May 20, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
The debate regarding whether anomalous volcanic areas on Earth's surface are fed by deep-mantle plumes is widely considered to be the most significant debate currently ongoing in Earth science. Not only does the debate touch on a fundamental aspect of how Earth works dynamically, but the subject is extraordinarily cross-disciplinary to an extent that probably few scientists fully realize. Sub-disciplines that can contribute to efforts to resolve the debate include sedimentology, palaeontology, tectonophysics, geochronology, volcanology, petrology, geochemistry, geothermal research, seismology, geodesy, electromagnetics and many others.

In addition to the disciplines of Earth science, the plume debate provides a remarkable and thought-provoking subject for scientific philosophy and reflections on correct scientific methodology: (1) What exactly is a plume? People often change their definition of a plume a posteriori in order to fit their observations. (2) How can the plume- or the plate hypothesis be falsified? (3) Do Earth scientists tend to present only one possible interpretation of their data, or do papers reflect all possible interpretations? Unfortunately, the former is often the case. (4) Are published interpretations consistent with other data from the subject field area? Often they are not, and the inconsistencies are not sufficiently highlighted nor discussed. These issues are particularly useful for inducting students into correct scientific working. In summary, the debate provides enormously fertile ground for new, fundamental questions and cross-disciplinary research.

This session welcomes studies of melting anomalies on Earth from the point of view of any sub-discipline. We also welcomes studies of geological phenomena which are attributed to mantle plumes, such as back-arc extension, plate motion, sedimentary basin formation and lithospheric uplift, and any other work that bears on this fascinating and challenging geological debate.

[SIT21-P02]The Setouchi high magnesium andesites never the evidence for plume-like active mantle upwelling for the Japan Sea opening

*Hidehisa Mashima[1] (1.Center for Obsidian and Lithic Studies, Meiji University)

Several researchers considered that plume-like active mantle upwelling would have opened the Japan Sea. The mantle/melting model for the Setouchi high magnesium andesites, which emphasized partial melting of sediments on the subducting plate, would led researchers to such a hypothesis. The mantle/melt reaction model for the Setouchi HMAs, however, have significant incompleteness. (1) There is no successional and petrographical evidence indicating the HMA magmas would have been significantly hydrous. (2) The HMAs associate with basalts in some localities, such as Shodoshima. The mantle/melt reaction model requires an unrealistic temperature variation such as larger than 150 ^{o}C at 1GPa to explain the association of basalts and HMAs in Setouchi. (3) Geochemical features are considered to be strong evidence indicating contributions of sediments on the subducting slab to the HMA magma genesis. SW Japan, however, is composed of accretional prisms. Geochemistry could not distinguish which contributed to the HMA magma genesis, subducting sediments on the slab or accreted sediments at the

deeper part of the crust. Therefore, an alternative model for the HMA magma genesis was proposed (Mashima, 2009). The alternative model proposed that HMA magmas would have been formed partial melting of relatively anhydrous mantle involving accreted sediments at low pressures such as 0.5 GPa. Accumulations of geological, geophysical and petrological observations support the low-pressure and anhydrous partial melting model for the Setouchi HMAs. The subducting slab inferred from deep earthquakes is absent beneath Shodoshima, which indicates that the slab would not extend there even at the present day. Geophysical observations along the Muroto, where the youngest part of Shioku Basin subducts, indicate that all of sediments on the slab accrete to the overriding plate at the present day. Becasue the slab at 14 Ma was young, mechanical coupling between the plates would have been greater than that at the present day. Thus sediments on the slab would have accreted to the overriding plate at that time. Seismic explorations indicate that the MTL striking northern margin of the Sambagawa Belt dips northward to extend to Shodoshima, which indicates that metamorphic rocks originally accreted sediments would essentially constitute the deeper part of the Setouchi crust. This geophysical interpretation is confirmed by xenoliths of partial pelitic schists included in Setouchi volcanic rocks from Osaka. The alternative model needs the thin crust such as 15 km thickness. The San’in folded zone developed in the late Miocene indicates that the Setouchi crust at 14 Ma would have been thinner than that at the present day, which would have enabled the segregation of the HMA magmas at such a low pressure. The alternative model assumed mantle upwelling along 1300 ℃ adiabat of melting mantle. The Setouchi HMAs do not require their source mantle with abnormally high temperature. The HMAs are not the evidence for a plume-like active mantle upwelling for the Japan Sea opening.