

Distribution of the helium isotope ratios in northeast Japan in terms of geological setting

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The distribution of slab fluid defined by high Li/Cl ratios conforms the area of "hot fingers"(Tamura et al., 2002) in Northeast Japan (Kazahaya et al., submitted). Conversely, the high ³He/⁴He ratios distribute wider and do not match with slab-derived fluids indicating that some of the mantle-derived helium would not be transported with magmas or slab fluids but directly upwells as mantle-derived fluid. The ³He/⁴He ratios vary along the volcanic front showing an areal contrast; such as a low-ratio-area close to volcanoes are observed in the central part of Tohoku. We propose here an extended helium upwell model which can explain the spatial variation of ³He/⁴He ratios with the following concept; 1) The most important constraint for mantle helium upwelling is the crustal structure divided by tectonic lines; Hatagawa Tectonic Line (HTL) divides the Kitakami and Abukuma belts. Ryoke belt and north part of Abukuma belt is torn apart by number of faulting events. The rest of parts, Abukuma granitic province and Kitakami province form very large stable blocks which might prohibit helium to upwell from mantle. 2) A view from U-Th content in the crust is important to understand the flat distribution of mantle helium in back-arc region; Low U-Th crust in the back-arc with less crustal ⁴He production is favorable to explain the flat and high ³He/⁴He signature, such as oceanic crust might have. Tanakura Tectonic Line (TTL) divides the thick crust of continental margin (sedimentary prism and granite) with Ryoke belt.

Keywords: helium isotope ratio, northeast Japan, areal distribution, geological structure