

Geographic distribution of $^3\text{He}/^4\text{He}$ ratios along seismic source faults in Japan

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It is well known that mantle degassing does not occur homogeneously over the Earth's surface. The elevated $^3\text{He}/^4\text{He}$ ratios found in volcanic regions and tectonically active areas are higher than the atmospheric values. This distribution is interpreted to indicate transfer of mantle volatiles into the crust by processes or mechanisms such as magmatic intrusion, continental underplating and lithospheric rifting. This study was undertaken to elucidate the geographic distribution of $^3\text{He}/^4\text{He}$ ratios around seismic source faults in Japan, using helium isotope data obtained from gas samples. Several case studies suggest that there is a significant trend of high ^3He emanations along the trace of active faults, resulting in leakage of mantle volatiles through crustal pathways (faults) due to more frequent development of higher permeability pathways and/or upwelling of mantle fluids through the ductile lower crust. From the viewpoint of site selection and implementation of a geological disposal facility, helium isotopes may be regarded as a tool for investigating and/or mapping concealed active faults with no surface expression.

Keywords: helium isotope, active fault