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Identification of the source fault of the 2000 western Tottori earthquake (Part II): Helium isotopes

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A magnitude (Mj) 7.3 crustal earthquake occurred in the western Tottori area, southwest Japan, on 6 October 2000. However, there was no obvious pre-faulting indication at surface of a fault corresponding to the Western Tottori Earthquake in 2000. This study was undertaken to elucidate the geographic distribution of 3He/4He ratios around the seismic source region using helium isotope data obtained from groundwater samples from drinking water wells. The maximum 3He/4 He ratio observed was from the water well nearest to the epicenter of the mainshock. In addition, there appears to be a clear trend of decreasing 3He/4He ratios with distance away from the main trace of the probable fault segments. The observations provide significant evidence that the source fault of the earthquake in 2000 is associated with leakage of mantle volatiles through the crust to the Earth's surface. We suggest that helium isotopes can be regarded as a tool for investigating and/or mapping concealed active faults with no surface expression.