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Helium-3 flux at the Mid-Okinawa Trough, SW Japan

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Helium-3 is the most important isotopic signature of mantle-derived materials and its flux at the Earth surface may provide constrains on the source of the terrestrial heat flow as well as the mass balance of atmospheric helium. However, the direct observation of helium-3 flux in the ocean floor is not well documented and restricted to the Mid Ocean Ridges (MOR). We present here the ocean-floor helium-3 flux estimated from vertical profiles of $^{3}He/^{20}Ne$ ratios measured in pore water from deep-sea sediments at the Mid-Okinawa Trough subduction zone, SW Japan. Fluxes were calculated by assuming a constant ^{20}Ne content with varying depth and a pure diffusive regime. Resulting helium-3 fluxes vary from 1.6 atom/cm^{2}sec at the site close to the hydrothermal area of the Izena Cauldron to 0.57 atom/cm^{2}sec at the control site, 13 km ENE from the cauldron. These values are smaller than the ^{3}He flux of 4 atom/cm^{2}sec measured at the East Pacific Rise, suggesting the ^{3}He flux at subduction zone is lower than that at MOR. These values are about 20% of the Mid-Ocean Ridge ^{3}He flux, supporting the never-proven hypothesis that the total volcanic output in subduction zones is a quarter of that in the ocean-ridge magmatism. On the other hand, the estimated ^{4}He flux by using observed $^{4}He/^{20}Ne$ gradient is ranging from $3.3x10^{5}$ to $4.8x10^{5}$ atom/cm^{2}sec, larger than those between $2x10^{3}$ and $3.6x10^{5}$atom/cm^{2}sec measured worldwide in ocean floors.