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Mixing and entrainment in mantle plumes: A 3D experimental investigation WILLIAM NEWSOME, ALINE COTEL, University of Michigan, CAROLINA LITHGOW-BERTELLONI, University College London, STANLEY HART, JOHN WHITEHEAD, Woods Hole Oceanographic Institution — Significant differences exist between isotopic signatures of typical mid-ocean ridge basalts (MORB) and those associated with many ocean islands, with ocean island basalts (OIB) generally exhibiting more variability in trace element concentrations and also a bias towards enrichment in radiogenic isotopes such as Sr, Nd, Hf and Pb. Such observations coupled with other geophysical evidence have been used to suggest that OIB's are surface manifestations of thermal plumes originating in the deep interior near the core-mantle boundary that interact with distinct, heterogeneous reservoirs as material is transported from the Earth's interior to the surface. We experimentally investigate the structure and transport characteristics of isolated thermal plumes in corn syrup. The 3D velocity field is measured using a scanning stereoscopic particle image velocimetry system. Two types of tracer particles are simultaneously utilized, with thermochromic liquid crystals providing an estimate of the temperature field. Lagrangian coherent structures computed from the velocity field identify key material lines and surfaces that provide a taxonomic picture of plumes operating in different regimes. These govern how the plume interacts with the ambient during its ascent.

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