

Mapping mantle activity in the Azores through 4-D analogue geodynamic experiments

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Plume-ridge interactions have captured the interests of scientists for years, as these sites are often associated with increased volcanism and other natural hazards. The unique tectonic setting of the Azores forms a natural laboratory where mantle simulations can be directly compared to observations from nature. Though volcanism at the Azores is complex and still poorly understood, our recently-developed analogue setup is ideally suited to mimicking the dynamics between plumes and mid-ocean ridges. Using a combination of counter-rotating belts capable of a full range of migrating plate motions and a reservoir of viscous glucose syrup that can be heated from below using a heating blanket, we can simulate a wide range of geodynamic hypotheses relating to the Azores specifically. Using high-resolution digital cameras and particle image velocimetry methods, we are able to obtain information about temperature and velocity in three dimensions throughout each experiment. These measurements lead to estimates of material transport, melting, and flow-induced anisotropy in the mantle. Previous work has already shown that migration is an important factor to consider when interpreting both geophysical and geochemical datasets at ridges as mantle material likely exhibits higher degrees of lateral transport than previously thought. Insights from this study include comparisons between observations from experiments of stationary and migrating ridges in the presence of plumes. These results highlight the need to consider the continually evolving and highly dynamic forces at work in the Azores when studying volcanism in the region.