



Capture of the Canary mantle plume head by the Gibraltar arc mantle wedge during slab roll back

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Recent evidence suggests that a portion of the Canary plume travelled northeastwards across the Atlas Mountains in North Africa and was captured ~ 10 Ma ago by the Western Mediterranean Gibraltar subduction system. The capture would have been associated with the retreating slab-induced mantle return flow that would have dragged and trapped a portion of the plume head in the mantle wedge of the Gibraltar subduction zone. Such material eventually contaminated the subduction related volcanism in the Alboran region. In this work we used scaled analogue models of slab-plume head interaction to investigate the plausibility of the plume capture. A 400 km narrow dense plate was drawn into subduction in a viscous upper mantle, while a buoyant plume was initiated at the base of the upper mantle 800 km aside of the plate centreline. First, a transient phase took place during which the plate sunk to the base of the upper mantle and the plume rose up to the surface without interaction, as plate and plume were 2375 km apart. During the second phase of interest, the slab started retreating towards the plume whose head began to grow. The influence of the subducting plate on the spreading plume head was seen with the onset of asymmetry in the plume head in a direction of the trench and parallel to the plate. The asymmetry began as the trench was 862 km away from the plume head centre and the plume head edge was 138 km far from the plate edge. With the passing of the trench at the apex of the plume head centre, capture of the plume head towards the mantle wedge began, and after 6 Myr, 9.5% of the plume head had been captured. Our results support the evidence that mantle plume material may have been sucked towards the mantle wedge of the Gibraltar subduction system during slab rollback induced toroidal mantle flow.