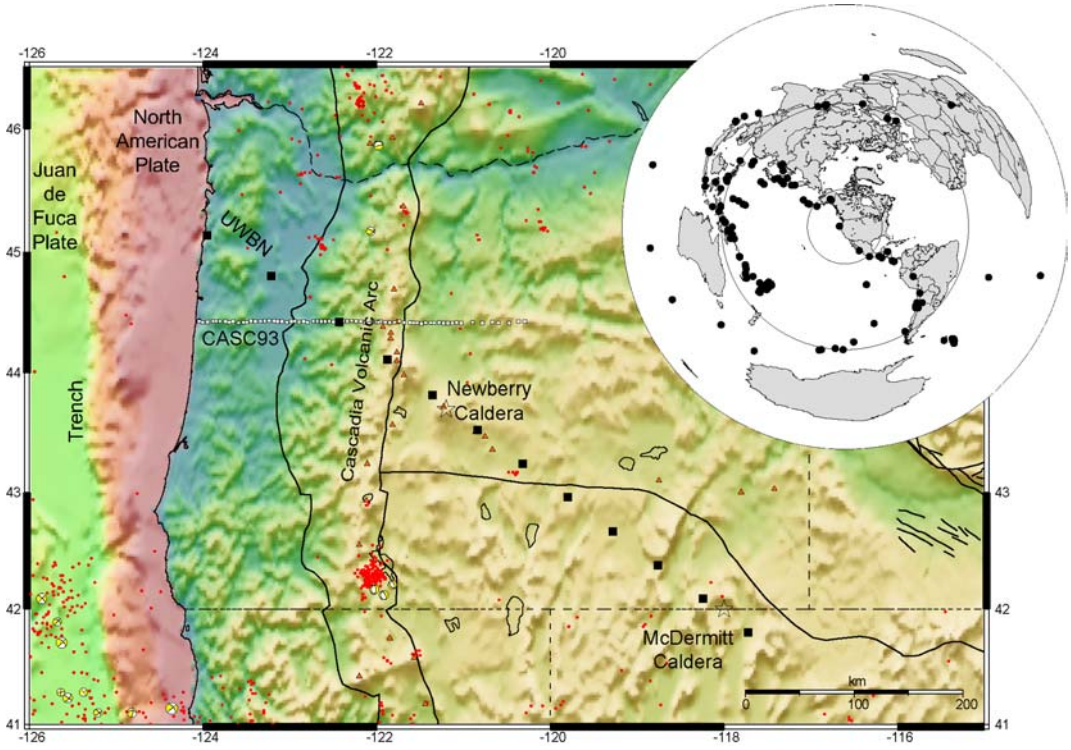
Newberry upwelling and Cascadian subduction: Convective interactions in the mantle beneath Oregon

Hotspots, anomalous volcanic outpourings away from plate boundaries, are often associated with a track of age-progressive volcanism. Most tracks are parallel to plate motion suggesting a stationary mantle source beneath an overriding tectonic plate. In the northwestern United States there are two hotspot tracks oriented at ~120 degrees to one another: the Yellowstone track parallel to North American Plate motion, and the Newberry track which is nearly perpendicular to it. The Newberry track projects back to a possible origin at the McDermitt Caldera which was last active around 16 Ma. From this origin point, a string of rhyolitic domes dated as <10 Ma progress to the northwest ending at the active Newberry Caldera ~50 km east of the High Cascades. The orientation of the Newberry track requires a causal mechanism which has yet to be defined.

The low seismicity associated with subduction of the Juan de Fuca plate beneath the Pacific Northwest is perhaps due to the relatively young age, and warm temperature, of the slab. Various geophysical studies provide clear evidence for a gradual increase in dip of the slab to the east reaching a depth of ~100 km beneath the High Cascade magmatic arc. North of Oregon there is evidence for the slab continuing to ~400 km depth with a ~65 degree dip, but there is little evidence for a slab deeper than ~150 km beneath Oregon, and some results suggest a near vertical dip. The apparent absence of the slab may be due to poor seismic constraints or due to a low velocity contrast as the asthenosphere warms the sinking slab making it indistinct from the surrounding mantle. If the slab does exist as a cohesive unit east of the High Cascades then it is likely that slab processes are interacting with the processes responsible for the overlying Newberry Caldera and track.

We propose to deploy a seismic array across Oregon extending from the McDermitt Caldera to the northwest along the Newberry track, past the Newberry Caldera, over the High Cascades and on to the coast within ~100 km of the trench. The array will allow us to constrain the subsurface structure associated with the Newberry track and caldera, and the subducted Juan de Fuca slab using the large number of teleseismic earthquake sources within a few degrees of the array azimuth. The data collected by the two-year deployment of twelve 3-component stations belonging to the University of Wisconsin Broadband Network (UWBN) will be supplemented by that collected in the CASC93 experiment.



Station map for the deployment showing Oregon and the surrounding regions. UWBN stations are shown as black squares, the CASC93 stations are shown as white squares. Inset: Global earthquake distribution centered on Oregon showing one year of teleseismic sources (2002 events with magnitude > 6).

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