

ABSTRACT FINAL ID: T43K-08;

TITLE: Onset of Yellowstone-related volcanism due to propagating rupture of the Farallon slab

SESSION TYPE: Oral

SESSION TITLE: T43K. The Origin of Intraplate Volcanism: Hotspots, Nonhotspots, and Large Igneous Provinces I

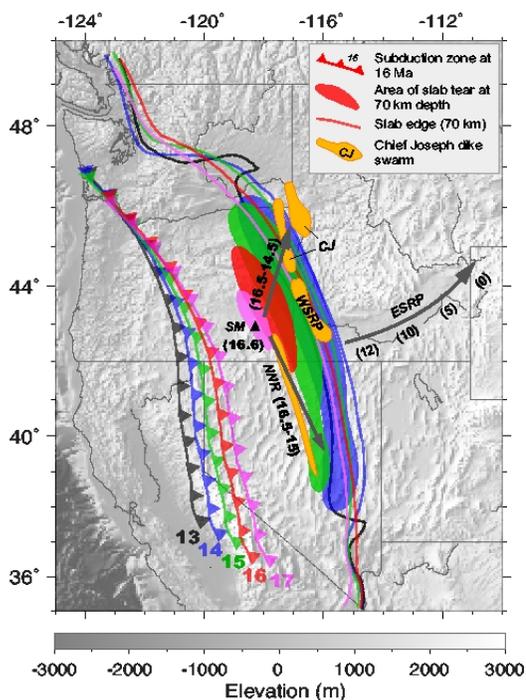
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ABSTRACT BODY: The origin of Yellowstone volcanism, presumed to initiate with the Steens-Columbia River flood basalts, has remained controversial, with the proposed conceptual models involving either a mantle plume or back-arc processes. Recent tomographic inversions based on the USArray data reveal unprecedented details on upper mantle structures of western United States. Geodynamic models simulating Farallon subduction constrained by these seismic images depict an episode of slab tear starting ~17 Myr ago in eastern Oregon, with strong oceanic asthenosphere upwelling occurring inside the slab gap at shallow depth due to a gradient of dynamic pressure. The tear ruptured quickly north and south and within ~2 Myr covered a distance of ~900 km along the entire eastern Oregon and northern Nevada, consistent with the sequence of major volcanic dikes during the Steens-Columbia River-North Nevada Rift flood basalt event. The predicted flood basalt formation is similar to processes at a mid-oceanic ridge (MOR), but with melting first starting from the base of the oceanic lithosphere. Assuming a melt fraction of ~2%, a value for MOR, the model can also reproduce the observed magma volume erupted during this event. Our study, therefore, suggests a new mechanism for the formation of large igneous provinces.

KEYWORDS: [8137] TECTONOPHYSICS / Hotspots, large igneous provinces, and flood basalt volcanism, [8170] TECTONOPHYSICS / Subduction zone processes, [8414] VOLCANOLOGY / Eruption mechanisms and flow emplacement, [8415] VOLCANOLOGY / Intra-plate processes.



Development of the Farallon slab rupture beneath western U.S. during the Mid-Miocene. Geometry of the Farallon subduction at different times (corresponding to different colors) is projected onto the reference frame of North America. Both the slab edge (solid lines) and slab gap (filled area) are at 70 km depth, outlined by an isotherm (-150°C for 17 Myr ago, -50°C for other times, relative to the ambient mantle). Major Steens-Columbia River volcanic dikes are shown as yellow patterns (with ages in Myr in parenthesis), without a palinspastic restoration due to the B&R extension. Grey arrows indicate the direction of age progression of surface eruptions. SM, Steens Mountain; CJ, Chief Joseph dikes; WSRP, western Snake River Plain; ESRP, eastern Snake River Plain; NNR, north Nevada rift zone.

(No Table Selected)

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Additional Details

Previously Presented Material: Non of these materials are published.

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