ABSTRACT FINAL ID: T43K-04;

TITLE: Three-Dimensional Geophysical Structure of the Yellowstone / Snake River Plain Hotspot System: Is a Deep Mantle Plume Required?

SESSION TYPE: Oral

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

AUTHORS (FIRST NAME, LAST NAME): Matthew J Fouch[1], David E James[1], Anna Kelbert[2], Gary D Egbert[2], Lara S Wagner[3], Richard W Carlson[1], Jeffrey B Roth[4]

INSTITUTIONS (ALL): 1. Department of Terrestrial Magnetism, Carnegie Institution of Washington, Washington, DC, United States.
2. College of Oceanic and Atmospheric Science, Oregon State University, Corvallis, OR, United States.
3. Department of Geological Sciences, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States.
4. ExxonMobil Exploration Company, Houston, TX, United States.

Title of Team:

ABSTRACT BODY: Providing new constraints on the origin of the Yellowstone / Snake River Plain (YSRP) hotspot system is an important contribution enabled the EarthScope program. This age-progressive track of rhyolitic volcanism has long been hypothesized as resulting from a deep mantle plume. Here we present an integrated view of new results from EarthScope seismic and magnetotelluric (MT) data that shed new light on the deep structure and dynamics of the YSRP system.

Nearly all new body wave tomographic models utilizing EarthScope data show a distinct swath of strongly reduced seismic wavespeeds extending laterally from the central SRP to Yellowstone, extending to depths of no greater than ~200 km. There is no evidence for a singular, concentrated conduit of reduced velocities below 200 km, as expected from a focused mantle plume upwelling. Surface wave tomography shows similar patterns for the YSRP region, with shear wavespeeds consistent with partial melt zones within the YSRP crust and uppermost mantle extending to depths of ~125 km, and aligned with the widespread distribution of Quaternary basaltic volcanism all along the SRP. Results from regional 3D MT models show focused zones of highly conductive crust and upper mantle, with the strongest conductivities in the uppermost mantle residing beneath the central Snake River Plain and the largest contrasts extending to ~100km depth.

Given the paucity of evidence for a present-day plume, we explore geophysical proxies in the mantle flow field for past plume-related dynamics, appealing to proxies for mantle flow. Data from several seismic anisotropy studies confirm that the Yellowstone region exhibits little evidence for vertical mantle flow across the region. Further, the downgoing Juan de Fuca plate, imaged clearly in the tomographic studies, would provide a barrier to an upwelling mantle plume.

An alternative to the plume model involves mantle flow around a stranded fragment of the Farallon plate whose northern edge parallels the SRP, and whose eastern edge is beneath Yellowstone. Flow of deep mantle around this sinking portion of the Farallon would introduce ascending mantle beneath the whole of the YSRP, not just Yellowstone, and could also explain the significant tectonomagmatism of the Columbia River flood basalt event and continuing volcanic activity on the High Lava Plains.

KEYWORDS: [7208] SEISMOLOGY / Mantle, [8170] TECTONOPHYSICS / Subduction zone processes, [7218] SEISMOLOGY / Lithosphere, [8400] VOLCANOLOGY.

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SPONSOR NAME: Matthew Fouch

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Contact Details

CONTACT (NAME ONLY): Matthew Fouch

CONTACT (E-MAIL ONLY): fouch@dtm.ciw.edu