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New Insights from Legacy Seismic Data Regarding Basalt Elevations and Variability on the Hanford Site
May, 2023

Supplementary figures:

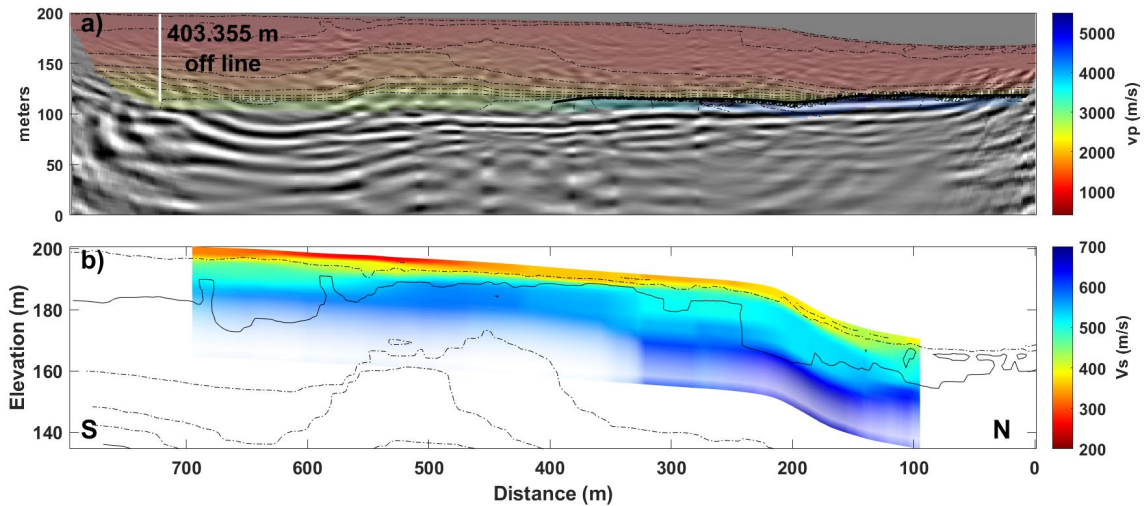


Figure S1. Line A South Vp result overlaid on PSDEM image (a) and Vs with Vp contours overlaid (b). Well observation showing basalt elevation (white line) agrees with the higher vertical Vp gradient, but basalt is too deep to confidently constrain basalt elevation south of $x = 400$ m. Black line shows the 3000 m/s contour used to interpret basalt elevation. This interpretation is only made north of $x=400$ m. The PSDEM image shows a prominent reflector interpreted as basalt. It is negatively correlated with topography, whereas the Vp result suggests that basalt elevation stays relatively constant. Vs image is broadly consistent with shallow Vp structure showing a velocity high near the center of the profile and the region of $V_s < 500$ m/s increases in thickness on the north and south ends of the line.

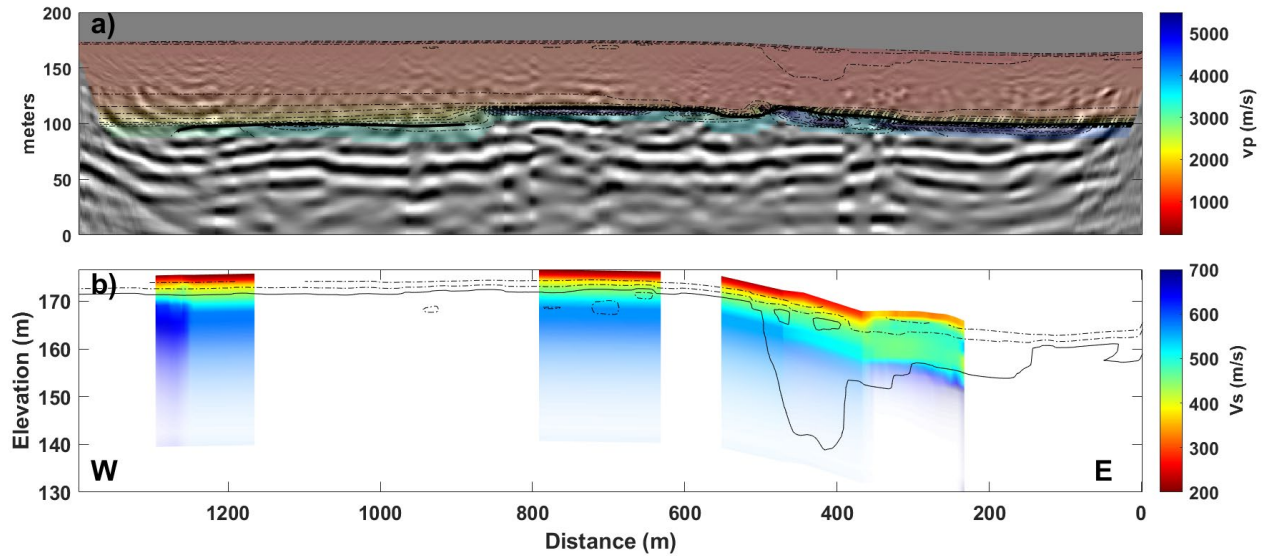


Figure S2. Line C West Vp result overlaid on PSDM image (a) and Vs with Vp contours overlaid (b). There are not observation wells close enough to Line C West to compare to the Vp result. The elevation of the Vp=3000 m/s contour is consistent in shape with the prominent reflection observed in the PSDM image, but the PSDM image suggests that the basalt is deeper than the Vp result does. The Vs image is broadly consistent with the shallow Vp structure, the Vp contours are very uniform everywhere except for near x=100 to 400 m. Here the Vp shows a low velocity anomaly that is less pronounced in the Vs image. Vs is reduced here, but model sensitivity (depicted with mask) shows that the data are not sensitive enough to adequately constrain Vs at depths greater than ~10 m.

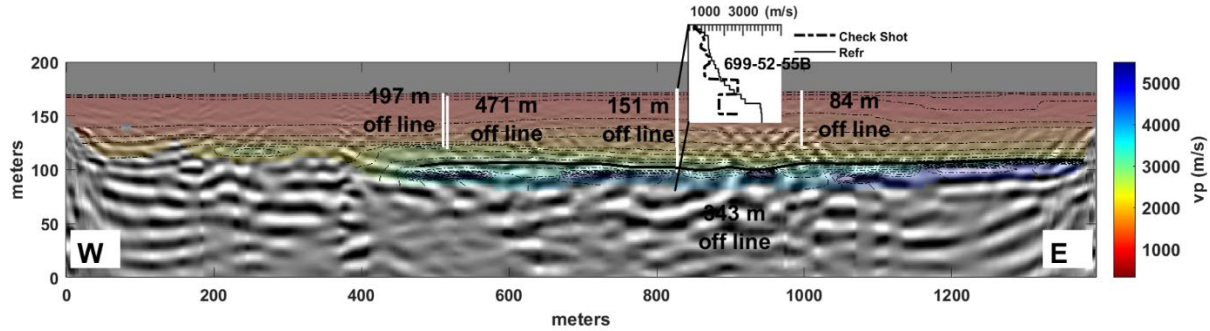


Figure S3. Line C East Vp result overlaid on PSDM image. White lines show nearby basalt elevation from well observations and a check shot (699-53-55B) is available for comparison. Compared do the PSDM image, Vp along this line shows a good agreement between the elevation of Vp=3000 m/s and the prominent reflection in the PSDM image. Compared to the nearby well observations, there is much more variation. Even the wells in this area show high variability over short distances (see Figure XX in main text, which shows the contoured basalt elevation in map view), suggesting that this is an area where basalt elevation is complicated. Vp in well 699-53-55B appears to have penetrated two layers of basalt with a sediment interbed. The refraction result doesn't recover a similar structure, the method is generally not capable of resolving velocity reversals. The observation well immediately north of 699-53-55B shows a depth to basalt that is consistent with both the PSDM image and the Vp result. It is possible that 699-53-55B encountered an isolated block of uneroded basalt. It is notable that the PSDM appears to show two reflections near the basalt interface, perhaps the PSDM image is resolving the interbedded sediment and basalt structure. Surface waves along this profile were too noisy to interpret so there is no Vs image available.

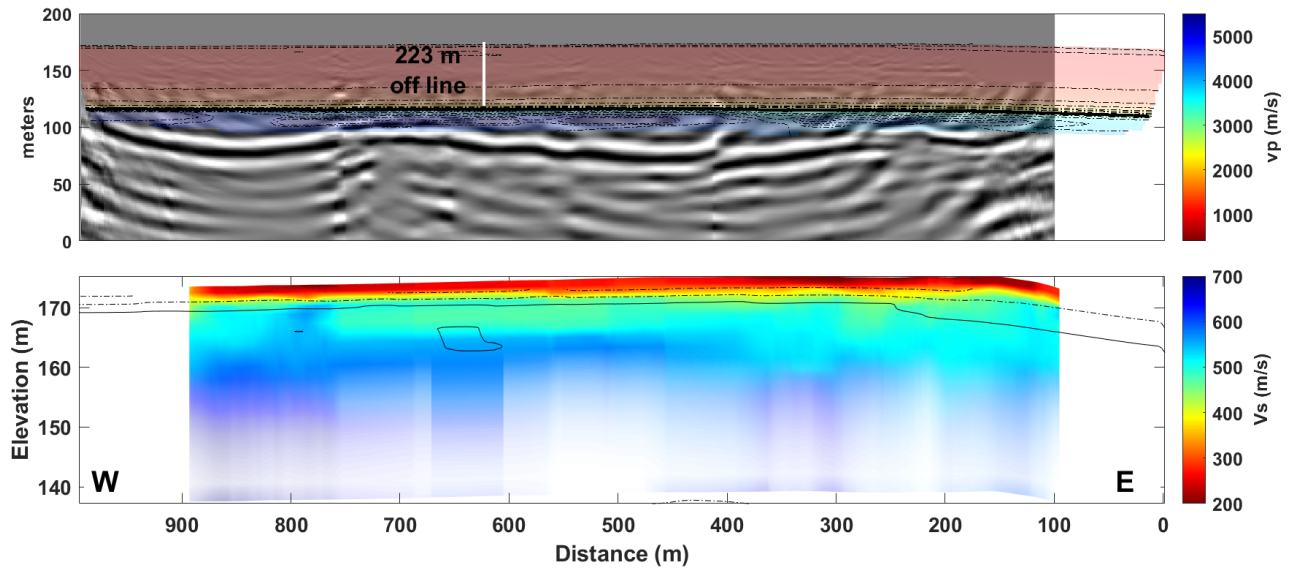


Figure S4. Line D Vp result overlaid on PDSM image (a) and Vs with Vp contours overlaid (b). Well observation showing basalt elevation (white line) agrees well with the $V_p=3000$ m/s contour (thicker black line). The PDSM image shows a prominent reflection interpreted to be basalt that is deeper than the Vp result suggests the boundary should be. Vs along this profile is relatively homogeneous along the length of the line, similar to the Vp result.