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S receiver function observations of flat subduction and partial delamination of the Farallon plate

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We used more than 40,000 S receiver functions recorded by the USArray project to study the transition of the structure of the mantle lithosphere from the Phanerozoic western United States to the cratonic central parts. We observed the lower boundary of the flat subduction of the Farallon plate continuously from near the Pacific coast at about 100 km depth to about the Mid Continental Rift System at about 200 km depth. We also observed a large break in this plate from about 42 to 46°N, striking north-south along about 110°W. Yellowstone is located at the northern end of this break. East of the break the lithosphere-asthenosphere boundary (LAB) is near 200 km depth and to the west of the break it is near 100 km depth. East of the break the LAB is rises to about 100 km depth below the Great Plains. We suggest that this structure is a reversely inclined part of the Farallon slab due to delamination. Our observations agree partly with tomographic models. East of the Mid Continental Rift System we observe the cratonic LAB at its expected depth near 200 km. We observe in addition the bottom of the asthenosphere (Lehmann discontinuity) and a negative discontinuity above the 410 km discontinuity, indicating partial melt.