

Paper Number: 4208

Yakima Fold Belt Structures, Eastern WA: Style and Rate of Faulting Based on Structural Analyses and Quaternary Studies

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As part of the SSHAC Level 3 Hanford Sitewide Probabilistic Seismic Hazard Analysis (PSHA) study, regional fault sources in the Yakima Fold Belt (YFB) were characterized to evaluate timing, recency of faulting, and slip rate. Since the initial detailed studies in the 1970s, controversy has existed regarding the style and rate of contemporary deformation in the YFB. To understand the slip history of individual structures within the YFB, a structural analysis combining field, GIS-based mapping, and subsurface information from a regional hydrogeologic model was performed for 15 faults and associated anticlines within the Columbia River Basalts (CRB). A combination of 1-m and 10-m resolution Digital Elevation Models (DEM) were used to evaluate the amplitude and wavelength of the YFB folds, which in turn provide constraints on the geometry of the underlying dominantly reverse and reverse-oblique faults. Topographic analysis of the folds in conjunction with regional geologic maps, were evaluated to assess varying amounts of structural relief along the entire trend of each fold and potential characteristic rupture segments (Figure 1).

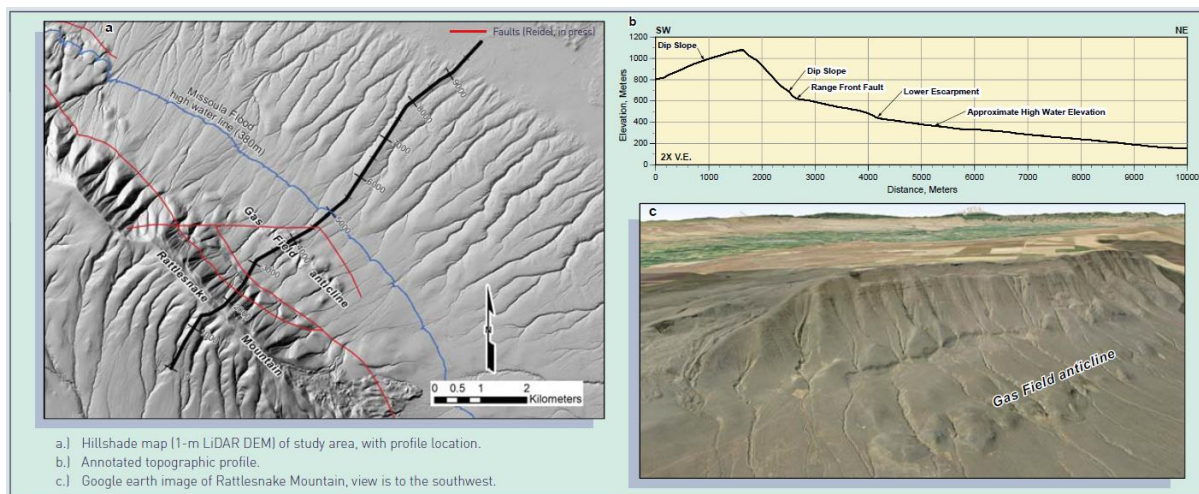


Figure 1: (a) Hillshade, (b) topographic profile, and (c) aerial imagery of Rattlesnake Mountain. The thrust fault underlying the uplifted Columbia River basalt sequence was a fault source in the seismic source model for the PSHA at the Hanford Site and therefore was the focus of a major field study effort.

Long-term average slip rates used to characterize fault sources in the SSC model were derived from the vertical slip required to generate the structural relief on the CRB in the YFB, and the period of time over which regional shortening occurred (6 and 10 Ma). Quaternary mapping and geochronology studies provided new slip-rate information for three of the faults—Rattlesnake Mountain, Manastash, and

Umtanum. Late Quaternary vertical slip rates were similar to the long-term (post-10 Ma) average slip rates (generally ranging from ~ 0.02 to 0.12 mm/yr).

