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3-D SEISMIC VELOCITY ANOMALIES IN THE CRUST AND UPPER MANTLE ASSOCIATED WITH GEOTHERMAL AREAS OF THE WESTERN UNITED STATES

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I shall review the 3-D seismic velocity structures determined by seismic arrays operated in the western United States, with special reference to anomalies associated with known geothermal areas.

From the teleseismic P-time residual data obtained at the nation-wide network, large-scale anomalies were identified under the western United States by Romanowicz, who interpreted them as the seismic image of the window in the Farallon plate proposed by Dickinson and Snyder. The window was created because the San Andreas transform boundary cannot supply lithospheric material behind the subducting Farallon plate. Dickinson and Snyder explain the recent history of volcanism and uplift in the western United States by the upwelling of hot material from the asthenosphere through the window.

Cockerham and Ellsworth used the data from the dense Central California network and discovered a remarkable "inclined low-velocity zone" dipping eastward from the San Andreas, which could be identified as the Dickinson-Snyder window filled with soft ductile material.

Geothermal areas within the surface projection of the Dickinson-Snyder window show distinct low-velocity bodies in the crust and upper mantle, which apparently have deformed shapes. Examples are the Coso, Roosevelt Hot Springs, and Geysers Clear Lake areas studied by Iyer and his colleagues.

Under the Yellowstone caldera, which are located outside the window, the low-velocity body appears to be upright and undeformed.

Under the Cascades volcanoes, also located outside the window, Iyer and his colleagues have not found any pronounced low-velocity body.

Whatever is causing the difference in velocity structure between geothermal areas inside and outside the Dickinson-Snyder window, the consistent occurrence of low-velocity bodies in the crust and upper mantle immediately beneath geothermal areas within the window may be used as a guide for finding new geothermal areas, at least within the window area.