Midway Valley above Quaternary alluvium. The alluvium rests unconformably on faulted and tilted nonwelded to densely welded Miocene silicic tuffs. To characterize the site, the Department of Energy (DOE) collected detailed geological, geotechnical, and geophysical data, including data from sixteen boreholes. Our interpretations of the DOE data suggest that lithologic variations at the site are important to site response, especially distinct contrasts in S-wave velocity and density at two lithologic interfaces: the alluvium-tuff contact, and the contact between the nonwelded to moderately welded and densely welded tuff strata. One-dimensional site response modeling, using an equivalent linear approach, was performed in order to evaluate the effect of stratigraphic variability on ground-motion amplification within the site boundary. Our results show large variations in predicted ground motions with large amplifications in areas with thick accumulations of alluvium and nonwelded tuff. Our method differs from the current DOE approach in that the DOE uses randomized velocity and density profiles developed from the site data without explicitly considering subsurface stratigraphy.

This abstract is an independent product of the CNWRA and does not necessarily reflect the view or regulatory position of the NRC. The NRC staff views expressed herein are preliminary and do not constitute a final judgment or determination of the matters addressed or of the acceptability of a license application for a geologic repository at Yucca Mountain.

Regency Ballroom

Walker Lane, Central Nevada Seismic Belt, and Eastern Sierra Nevada Margin

Thursday/Friday Poster Session

Mantle Lithospheric Clues to Walker Lane Evolution

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Maps of shallow-mantle velocity structure can be interpreted in terms of relative strength of the mantle contribution to total lithospheric strength, given accepted velocity-scaling relationships. In general the signs of scaling relationships agree: Higher compressional velocity corresponds to stronger shallow mantle. Regional-scale tomographic imaging removes the absolute velocity, so one cannot say from the images alone whether velocity, and thus strength, varies around so low a value that the mantle is always weak compared to the crust, or whether observed high-velocity anomalies are significant for lithospheric strength. Mantle strength, even in the western Basin and Range, cannot be dismissed out of hand within the range of reduced heat flow, about 1.7 to 2.1 HFU. At strain rates of 1e–15, most of the lithospheric strength could be in either the crust or the upper mantle, especially if the mantle is relatively dry. While the Walker Lane and western Basin and Range were likely thoroughly hydrated during Laramide and post-Laramide subduction, late Tertiary ignimbritic volcanism likely changed this, at least locally. One and possibly several such regions are visible in tomographic images. Hydration would have most weakened the crust and mantle just east of the Sierran block, a weakness that concentrated strain and resulted in the development of the Walker Lane. Recent compilations of volcanism provide a further spatial basis for inferring locations where the upper mantle is near or slightly above the solidus. Notable lineations include the eastern third of the Sierra Nevada block. A reliable mapping of shallow-mantle velocity with lithospheric strength would be a valuable tool for kinematic modeling of the development of the Walker Lane.

Geophysical Investigation of a Fault as a Hydrologic Barrier in Reno, Nevada

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The Truckee Meadows area is an alluvium-filled basin situated in the transition zone between the Sierra Nevada and the more moderate elevation of the Basin and Range Province. The Genoa Fault system (GFS) makes up the eastern boundary of a broad structural corridor between these two zones. The northern extension of the main fault in the GFS has been mapped into the Reno, Nevada metropolitan area of the Truckee Meadows. Groundwater elevation differences across the projection of this fault suggest that it is a locally significant groundwater flow barrier in the basin. The Central Truckee Meadows Remediation District is currently updating a groundwater flow and transport model used as a management tool for addressing a PCE contamination problem. Better characterization of the location, orientation, and hydrologic properties of the fault are needed to reduce the uncertainty in modeling groundwater flow in this part of the basin. High-resolution seismic-reflection surveys allow for the evaluation of the possible extension of the fault trace in an area approx. 750 m to the north and 500 m to the east of the north end of the mapped trace. These surveys also further constrain the geometry of the fault. Microtremor seismic surveys allow for a comparison of shallow shear velocities on opposite sides of the fault, suggesting the possible location of the fault for evaluation by reflection imaging. Aquifer test and geotechnical data may provide insights into the hydraulic characteristics of the fault as well.

Landslides, Active Faulting, and Paleoseismicity in Lake Tahoe

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High-resolution seismic-reflection profiles and a suite of fourteen piston cores were analyzed to delineate the late Quaternary history of submarine faulting and landsliding in Lake Tahoe. The structure of the Lake Tahoe basin is controlled by the North Tahoe-Incline Village and West Tahoe-Dollar Point fault zones, which cut late-Quaternary lake sediments along numerous subparallel faults. The McKinney Bay megaslide scattered very large slide blocks of coherent Pleistocene sedimentary strata throughout the lake, deposited a 70-m-thick chaotic layer, and changed the basin morphology in the Late Pleistocene. Several subsequent generations of moderate to large landslides occur in McKinney Bay and the west Tahoe basin, attesting to several episodes of faulting and landslide activity. The preliminary data suggest several intervals of landslide activity and presumably shaking, perhaps seismically triggered, during the Holocene.

The Idaho-Nevada-California Refraction Experiment: Developing a Central Walker Lane and Sierra Nevada Crustal Model

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In August 2004, we deployed 411 4.5-Hz geophones connected to 24-bit single-channel portable seismographs across a 600-km-long transect extending from Battle Mountain, Nevada through western Nevada, across the Long Valley caldera and the central Sierra Nevada, and into Fresno, California. The portable seismographs recorded events from blasts at Barrick's GoldStrike and Round Mountain mines, small local earthquakes, and two larger Paso Robles, California earthquakes and were used to obtain a crustal refraction profile for central Nevada and the Sierra Nevada. Preliminary results show clear and detailed crustal refraction arrivals, including reversed profiles made possible by a 2.8 Paso Robles event on 20 August 2004 and a 3.8 Lake Nacimiento earthquake on 16 August 2004. First arrivals from the Barrick GoldStrike blast were detected to a distance of approximately 400 km and exhibit 5.9 km/s Pg and 7.4 km/s Pn apparent velocities. A crossover distance of only 95 km is also clear. We observe 6.0 km/s Pg and 7.2 km/s Pn apparent velocities from the 2.8 Paso Robles, California earthquake. The earthquake was detected by our transect out to 435 km and has a crossover distance of approximately 250 km. Small M 1–2 local earthquakes, such as those at Tom's Place, California are observable to distances of at least 100 km. The pronounced detail of the profiles is in part due to the 1.5 km spacing of the seismographs, producing a continuous crossing through northern and central Nevada, as well as across the central Sierra Nevada. This research will provide a crustal root model for the central Walker Lane and Sierra Nevada, for which little seismic refraction control exists.

The Stillwater Range/Dixie Valley Normal Fault Zone: Steep, Hot, and Complex

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Because of the large geothermal system associated with the Stillwater Range/Dixie Valley normal fault, extensive studies have been associated with the fault zone. We describe an interpretation of the structure of the fault system based on the results of detailed geological, geophysical, and drilling studies. The data sets available include a gravity survey, three aeromagnetic surveys, 16 seismic-reflection profiles, geologic mapping, and 29 deep drill holes (up to almost 4 km deep). The fault has been extensively explored over a 25-km-long segment. This segment is between the scarps associated with the 1954 Dixie Valley and the 1915 Pleasant Valley earthquakes. Much of the intervening area broke about 2,500 ya. I has been proposed, however, that the portion of the fault associated with the producing geothermal system did not break during the 2,500 ya event.