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**Title:** LITHOSPHERIC NORTH AMERICA: INSIGHT FROM  
XENOLITHS AND APPLICATIONS TO EARTHSCOPE

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**Abstract:** EarthScope is a multi-year NSF initiative to probe the structure and evolution of western North America. Initial data gathering focuses on geophysics. However, as Bill Dickinson has demonstrated throughout his career, data interpretation will rely on highest quality geologic understanding. The initiative calls for geologic and geochronologic investigations, including the study of xenoliths. Xenoliths, because they represent otherwise inaccessible levels of the crust and mantle, are crucial to the success of the EarthScope endeavor. This study describes peridotite and pyroxenite xenoliths from three locations in the western US: Cima volcanic field in the Walker Lane tectonic area, San Carlos volcanic field in the Basin and Range of Arizona, and Kilbourne Hole in the Rio Grande rift. Thus, the xenolith localities represent different Cenozoic tectonic settings. In addition, they represent contrasting Precambrian terranes, with Cima in the Mohave and San Carlos and Potrillo in the Mazatzal. All three locations have temperatures of 1000 C immediately below the Moho, reflecting active tectonics and advective heat transfer in these areas. Peridotites are the dominant lithology of the mantle. Pyroxenites represent modification of the peridotite mantle via melt and fluid interaction and high-pressure cumulates from basaltic magmas. Pyroxenites modify the lithosphere in the areas where they form and, along with the high temperatures for both lithologies, explain slow mantle seismic velocities observed throughout the western US. Despite the recent Cenozoic processes represented by pyroxenites, the peridotite “country rock” is similar for the locations, indicating that Proterozoic assembly of North America, which creates strongly contrasting crustal provinces, is underpinned by a uniform lithospheric mantle. Presently, understanding of the processes described here is limited to study of individual xenolith localities and geographically restricted 2-D (and some 3-D) seismic deployments. EarthScope will revolutionize this data set. Efforts are underway to create a systematic database for xenolith locations throughout North America. The geophysical component of EarthScope will provide continent-wide 3-D images of mantle structure.