# Composition of deep crust imaged by USArray

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The deployment of Earthscope/USArray has helped produce high resolution seismic models of the crust and uppermost mantle for the continental US and Alaska. In this work, we push one step forward by using the seismic observables to quantify the silica content ($SiO_2$) of the crust, a key to understanding the chemical and dynamic evolution of the crust-mantle system as well as the formation mechanism of the continent. In this presentation, we first show that by applying a sequential H-κ stacking method to the rigorously quality-controlled receiver functions, reliable Vp/Vs ratios of the crystalline crust can be measured from the seismograms recorded by USArray (**Fig1**). Combining the result with the high-resolution shear velocities (Vs), a 1-D $SiO_2$ wt% model beneath each station of the USArray can be constructed based on relationship derived from the petrological database. With the $SiO_2$ wt% mapped at more than 1400 stations (**Fig2**), horizontal, vertical and secular patterns are found in the contienntal US, including: 1)Western US is more felsic than Central-Eastern US on average, and different types of crust exhibit different $SiO_2$ wt% distributions. 2) From shallow to deep crust, the average $SiO_2$ decreases from being felsic to mafic. Mid-Lower crust has similar $SiO_2$ wt% distribution to xenoliths rather than samples from the high grade metamorphic terrains. 3)There is little change in $SiO_2$ wt% between Archean-Proterozoic boundary as suggested in some previous studies. Overall, the results reveal that crustal composition is strongly affected by Phanerozoic tectonism and provides insights of the nature of the deep crust, allowing a better assessment of global crustal composition.

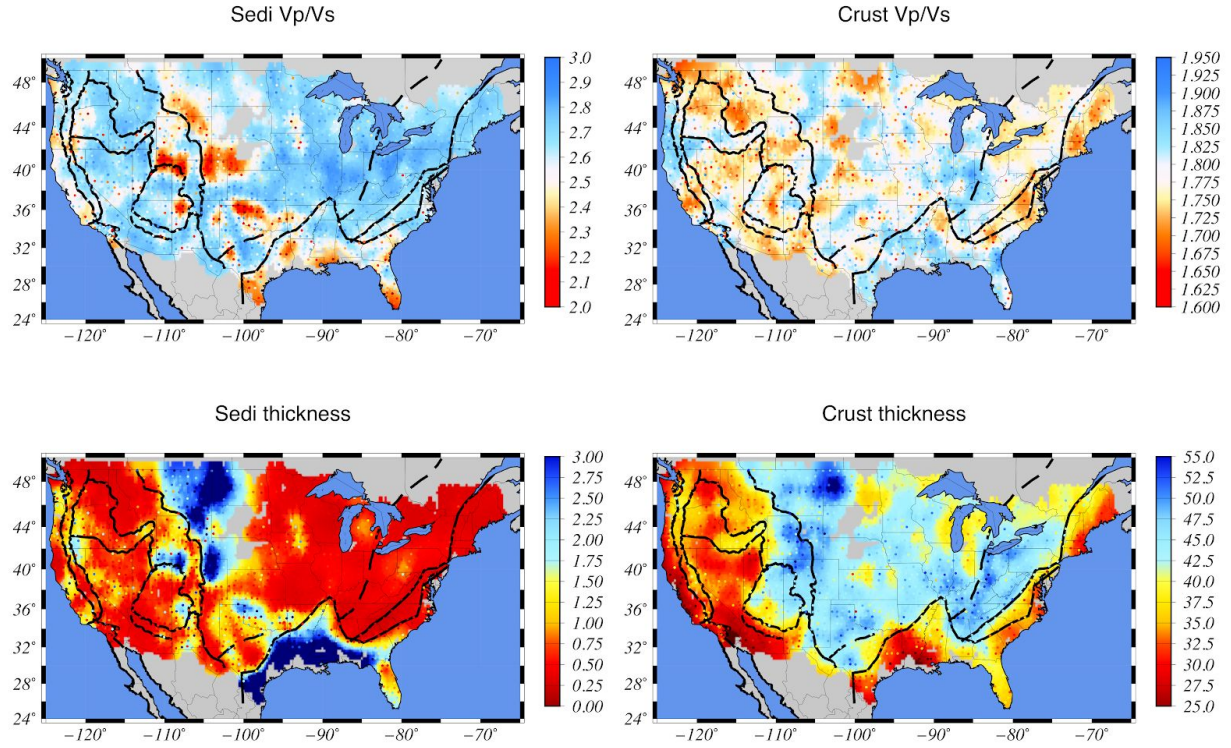


**Fig1 Vp/Vs and thickness from sequential H-κ stacking**

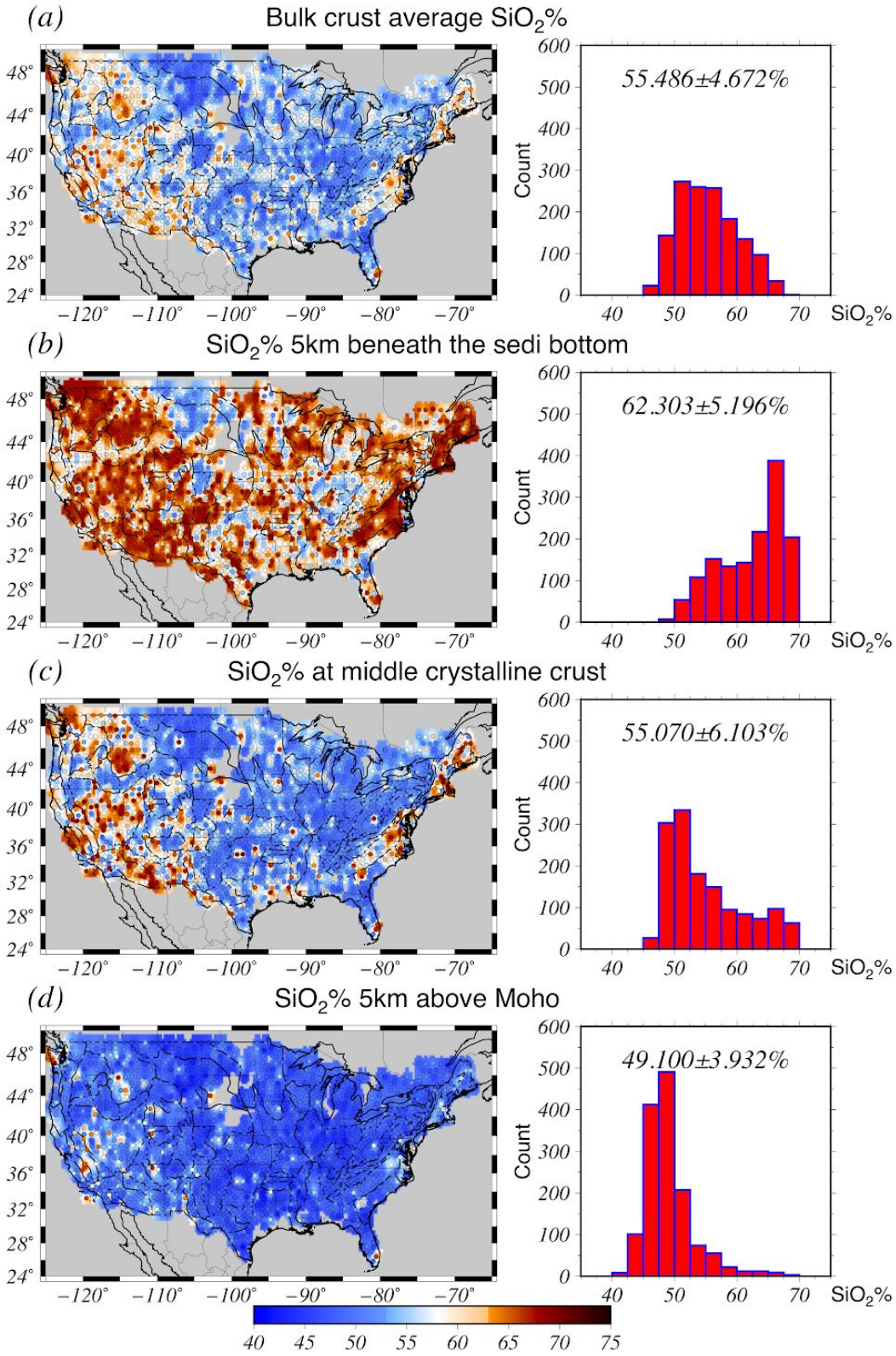


**Fig. 2 $SiO_2$ wt% estimation at different depths.** *The $SiO_2$ wt% spatial distributions and corresponding histograms for the bulk crust (a), upper crust (5 km beneath the base of the sedimentary layer), b), middle crust (c), and lower crust (5 km above Moho), d). The numbers in the histograms are the means and standard deviations.*