Wabash Valley Seismic Experiment

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The Wabash Valley Seismic Zone (WVSZ) running through the deepest part of the Illinois basin has produced several M4-5 earthquakes in the last several decades. Although comparisons to the neighboring New Madrid system are inevitable, the WVSZ behaves quite differently from New Madrid in several respects. Focal depths tend to be ~15 km in Wabash vs. ~5 km in New Madrid, and preliminary GPS shows strain is measurably faster. Despite there being far fewer recorded events in Wabash than New Madrid for just about any desired time slice (< 1:10), the last fifty years have seen far more seismic moment release from Wabash than New Madrid. The trend of few small events relative to the number of more moderate sized events maps directly into anomalously low b-values (~0.6-0.7) of Wabash. It is possible that there are many undercounted small earthquakes in Wabash to explain the low b-values, but thus far regional surveys suggest that there is indeed a dearth of small events and the b-values remain some of the lowest observed anywhere. While speculative, this may be suggestive of the idea that the WVSZ is 'heating up' while New Madrid is slowing down.

EarthScope is funding a FlexArray experiment aimed at improving our understanding of this enigmatic feature. The experiment is carried out through joint efforts from SIU and SLU with contributions from Carnegie and Miami (Ohio). The experiment has a broadband component to be laid out in a main line across the valley with higher density over the reactivated rift faults. There is also a short-period component aimed at locating microseismicity in the region to better characterize the context of the moderate magnitude events occurring over the last few decades. The FlexArray broadband stations will be deployed when they become available in spring 2014. The short-period instruments plus several institutional broadband instruments should be in place by fall of this year. The layout will be ideal for receiver function and tomographic analysis. Other techniques such as shear wave splitting will also be well served, especially with augmentation from the Transportable Array stations and the currently underway OIINK experiment. The seismic structure of the mid to lower crust along with the upper mantle are likely key to understanding the behavior and geodynamics of the seismic zone – an opportunity unlikely to arise without the EarthScope mission.