SEISMOTECTONICS OF THE ILLINOIS BASIN AND THE NORTHERN HALF OF THE OZARK UPLIFT

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This dissertation is a re-examination of all earthquakes (1974 to 1990), located by the Central Mississippi Valley Seismic Network (magnitudes, $m_{bLg} \geq 1.5$), within the Illinois Basin (southern Illinois, southwestern Indiana, and western Kentucky) and the St. Francois Uplift (eastern Missouri). An analysis for possible spatial correlation of the seismicity to mapped tectonic features, calculation of single-event and composite focal mechanisms for the well-recorded earthquakes, and a comparison of those mechanisms to previously published mechanisms, was performed.

The three principal conclusions made by this work are:

(1) Seismicity within the Illinois Basin and the adjacent St. Francois Uplift does not occur in a diffuse, random pattern. Rather, it is associated with basement faults. Nodal planes of the calculated focal mechanisms are subparallel to these basement faults, and the fault movement inferred is consistent with a sub-horizontal east-west trending compressional stress field. Large historical earthquakes such as those in 1891, 1857, and 1838, can now be explained by the reactivation of these basement faults.

(2) A north-south linear trend of seismicity has been identified running 30 to 50 km west of the Wabash Valley Fault Zone. Contemporary seismicity is spatially correlated with two sites of interpreted basement faults, imaged in COCORP reflection data. This is the first time in the Illinois Basin, that specific structures have correlated with contemporary seismicity.

(3) Focal mechanisms from this study confirm previous work, and suggest that this region has the potential to release a structurally damaging earthquake as close as 60 km to St. Louis. In terms of planning the proper response to a Midwest earthquake, the risk to St. Louis from the Illinois Basin and St. Francois Uplift could be as important as that from the New Madrid Seismic Zone.