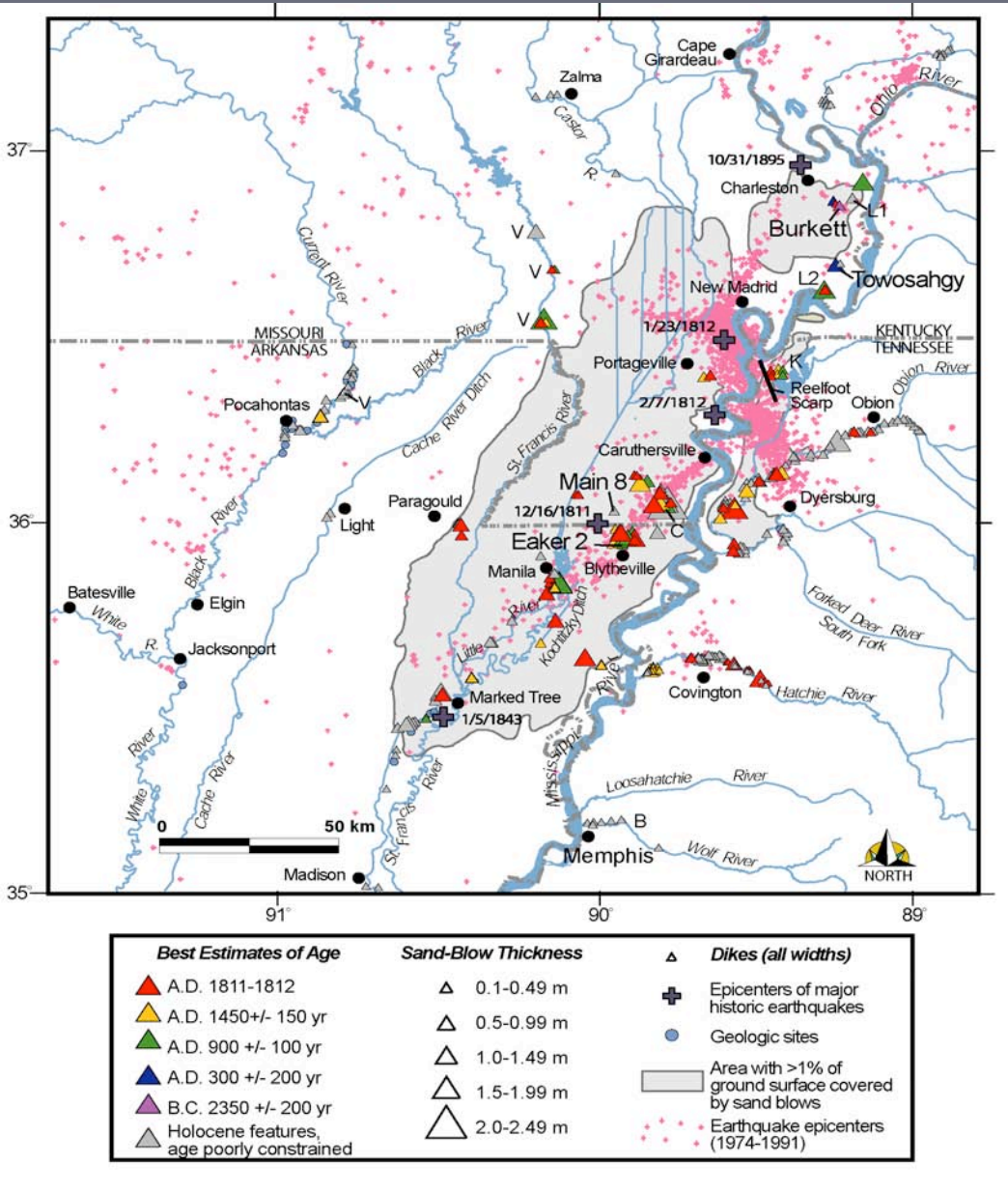
Recent Paleoseismic Results Related to NMSZ



From Tuttle et al., 2005

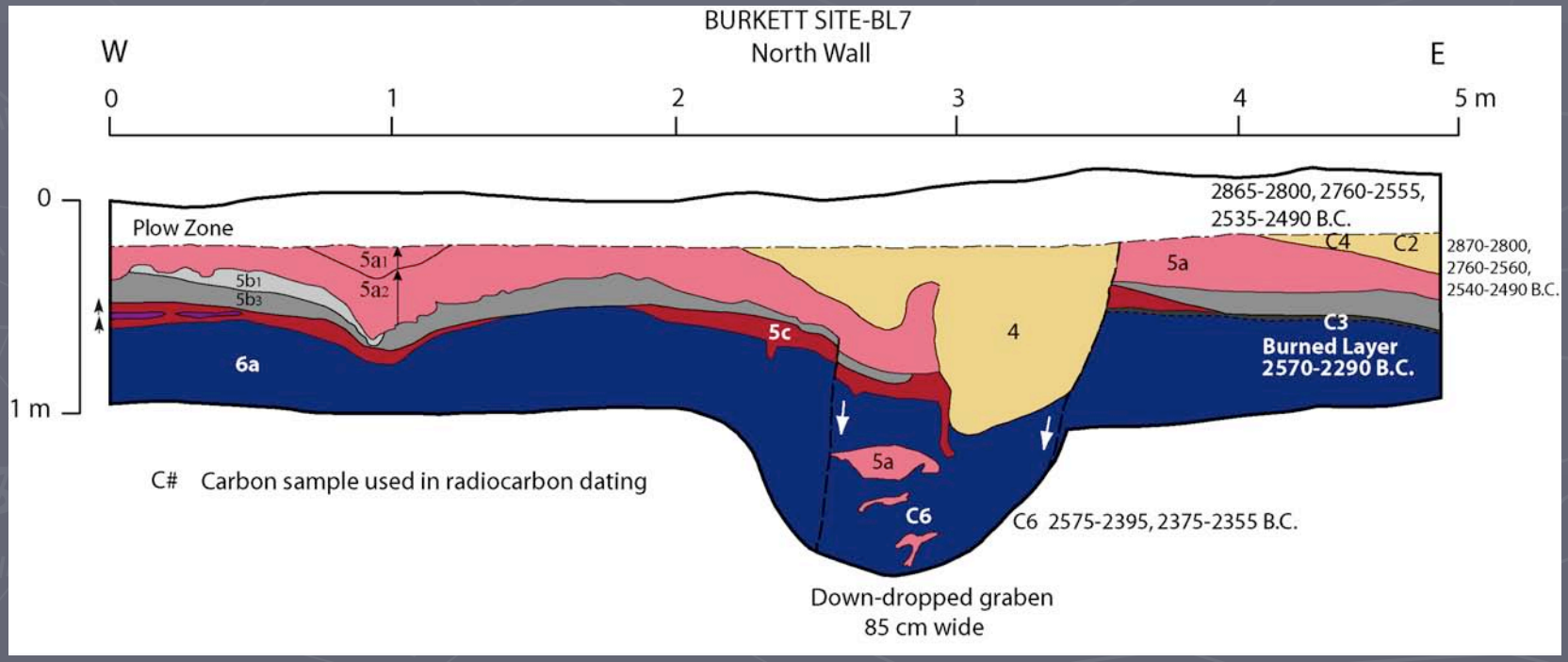
- Results from the Burkett and Towosahgy sites and how they relate to the earthquake chronology of the NMSZ
- Interpretation of liquefaction fields for 1811-1812, 1450 A.D., and 900 A.D. events
- Evidence for 4 liquefaction events in New Madrid seismic zone in 1811-12
- Studies conducted in collaboration with Buddy Schweig, John Sims, and others

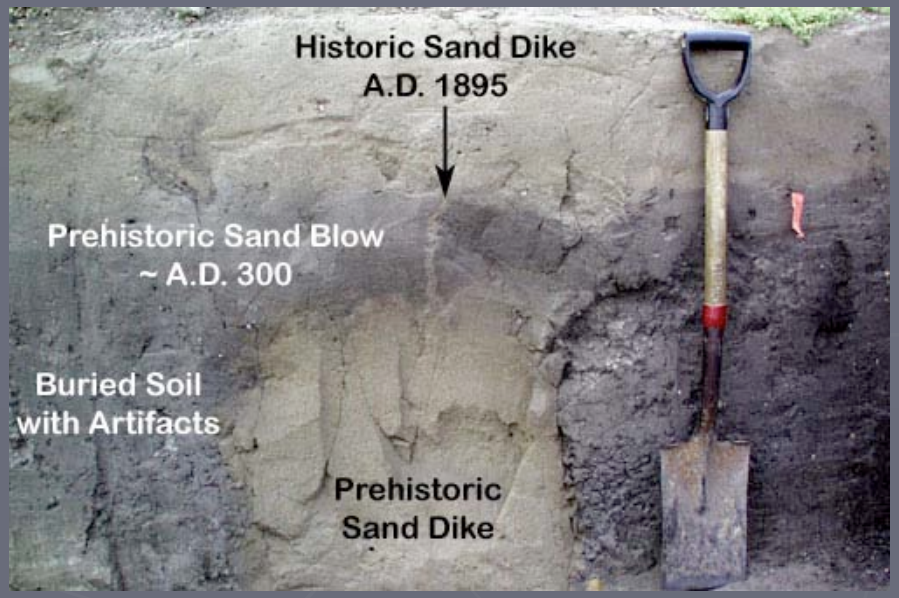
Burkett: 3 Generations of Liquefaction Features

- 1st generation - two sets of compound sand blows separated by base of a Late Archaic Mound; radiocarbon dating indicates they formed in 2350 B.C. ± 200 yr
- 2nd generation - sand blow with soil development that buries a Native American occupation horizon; radiocarbon dating and artifact analysis indicates it formed in 300 A.D. ± 200 yr
- 3rd generation - small sand dike that formed after 1670 A.D.

Burkett Sand Blows

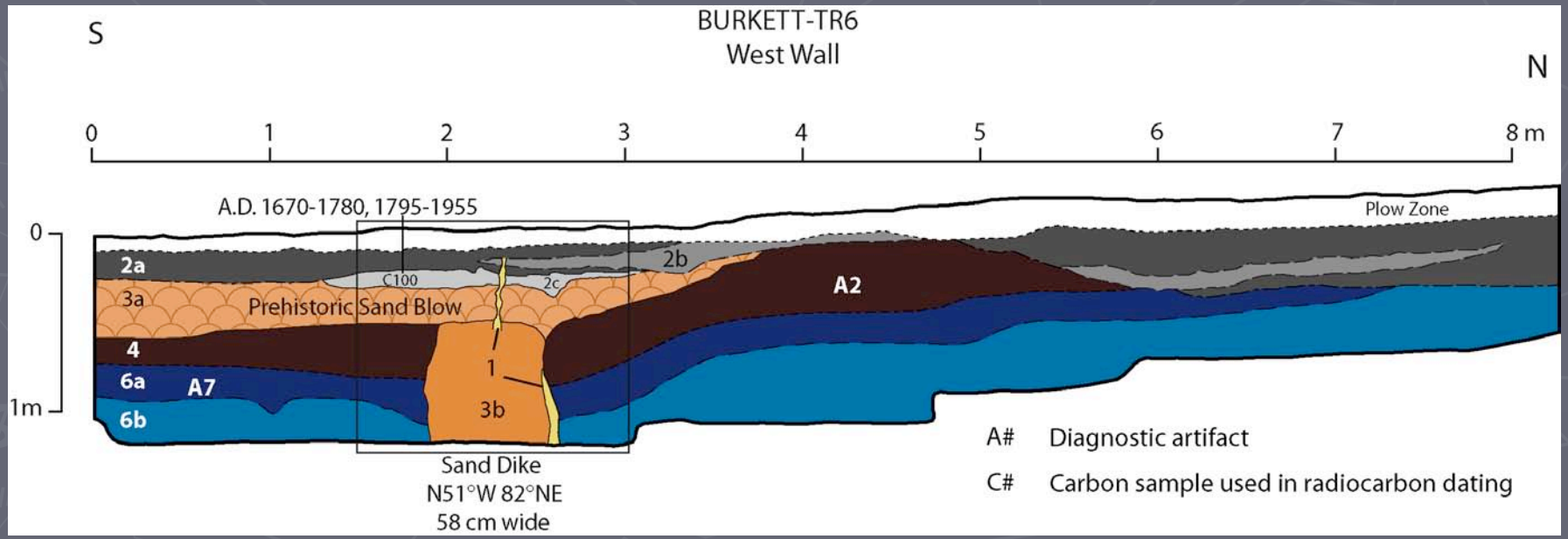
Sand blows that formed in 2350 B.C. ± 200 yr are interpreted as resulting from a NM earthquake sequence on the basis of their compound nature, relatively large size, and age similarity with other sand blows near Blytheville ~ 120 km to the southwest.





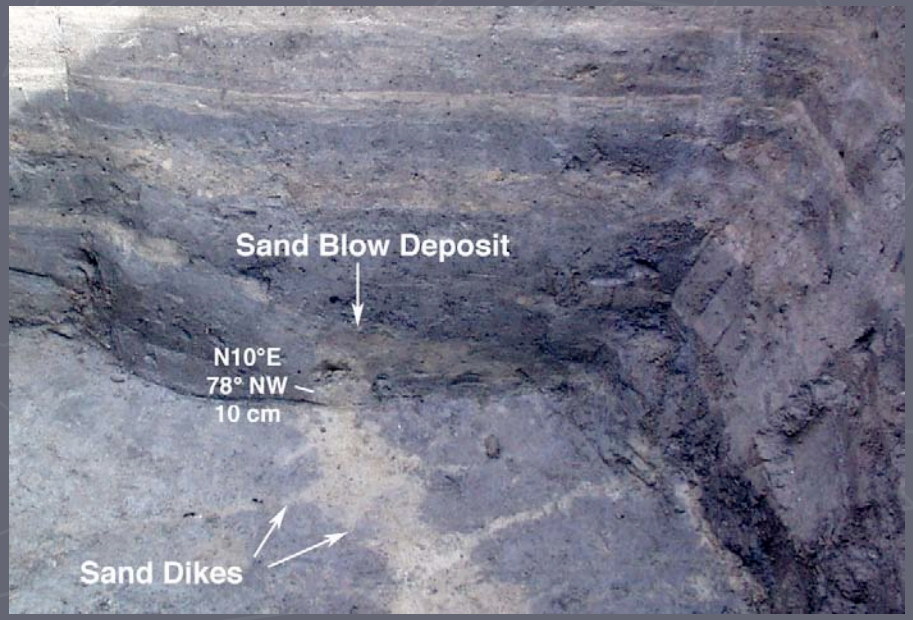
Burkett Sand Blows

A sand blow that formed in 300 A.D. ± 200 yr was interpreted to be the result of a NM earthquake on the basis of its large size and age similarity with the lower of two sand blows at Towosahgy ~ 20 km to the south (Saucier,1991).

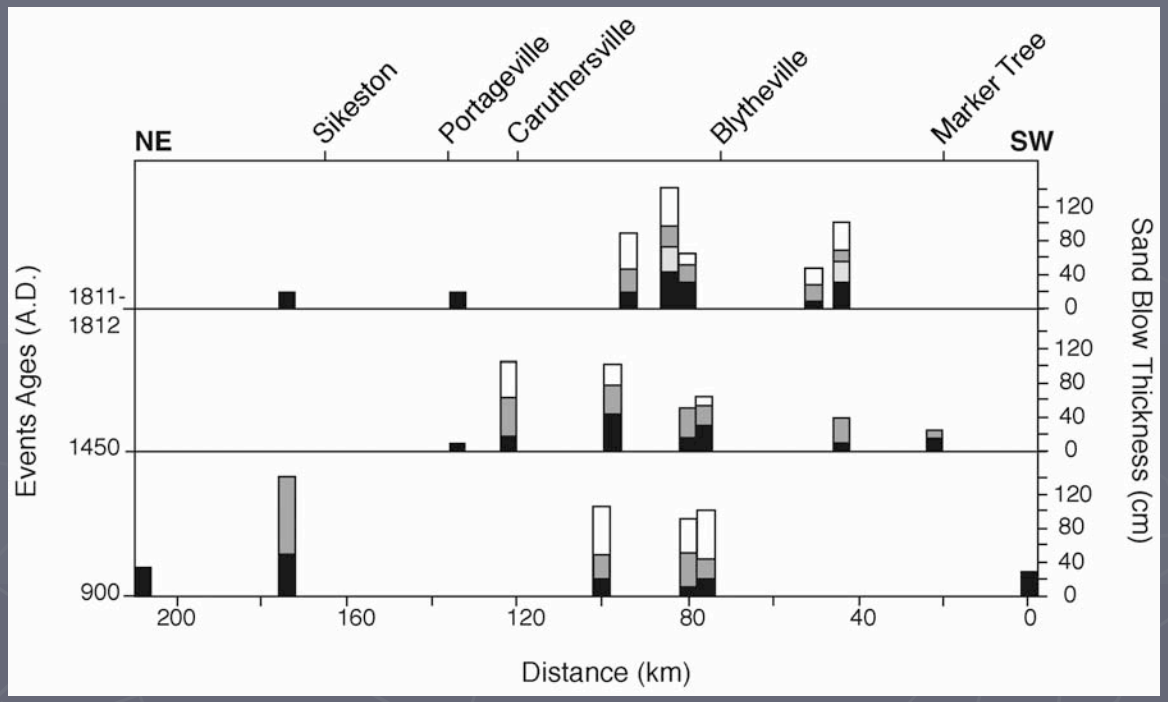


Towosahgy Revisited

- We re-excavated test units and found only one sand blow that was disturbed by human activity.
- Dating of charcoal from soil developed in the sand blow provides close minimum age constraint of 880-1010 A.D. suggesting that the sand blow formed during the 900 A.D. event.

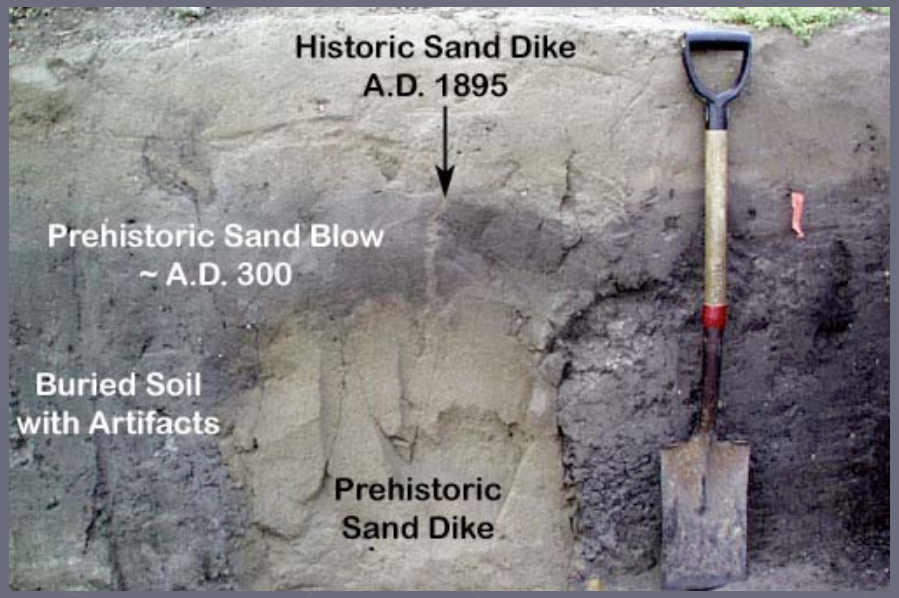


Thicknesses of Sand Blow and Depositional Units



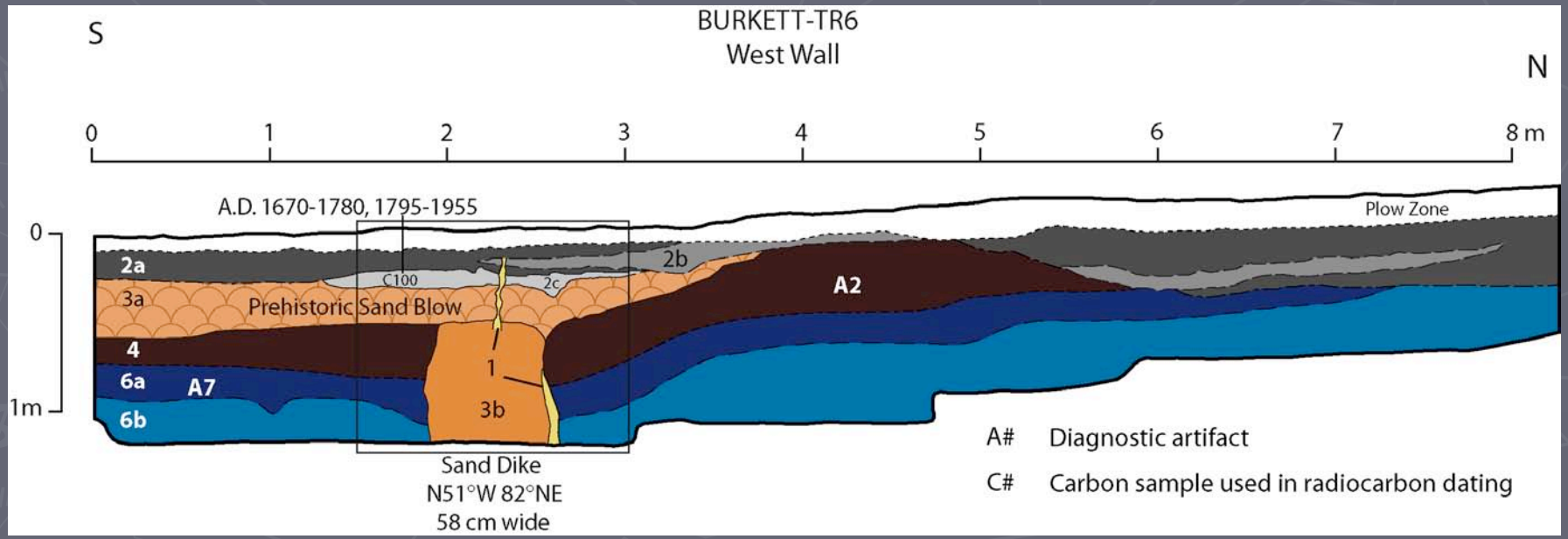
- Sand blows that formed in 1811-1812 are 20-140 cm thick and composed of 1-4 depositional units that are 15-60 cm thick. The 2nd generation (~300 A.D.) sand blow at Burkett is 30 cm thick, similar to sand blows that formed in 900 A.D. at nearby sites.

- Given its size, the 2nd generation sand blow may have formed as a result of a very large NM earthquake. If so, there should be other sand blows of this age. Either they have not yet been found and dated, or the age of the sand blow at Burkette has been misinterpreted.

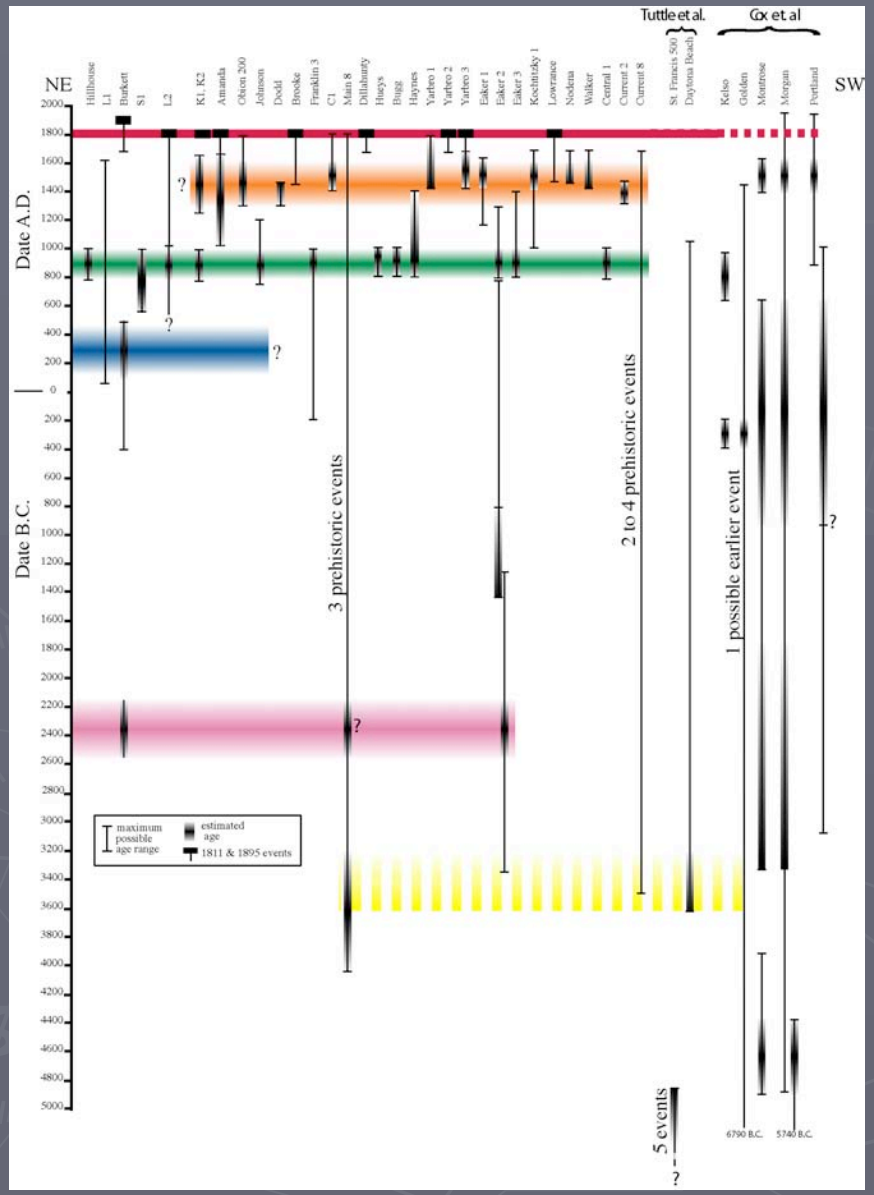


Burkett Sand Dike

A sand dike that formed after 1670 A.D. is attributed to the 1895 M 6.6 Charleston earthquake due to its small size and proximity of this site to liquefaction-related ground failures described for that event. Sand blows resulting from the 1895 event were only 5-95 cm in diameter and occurred in a 15 km^2 area.



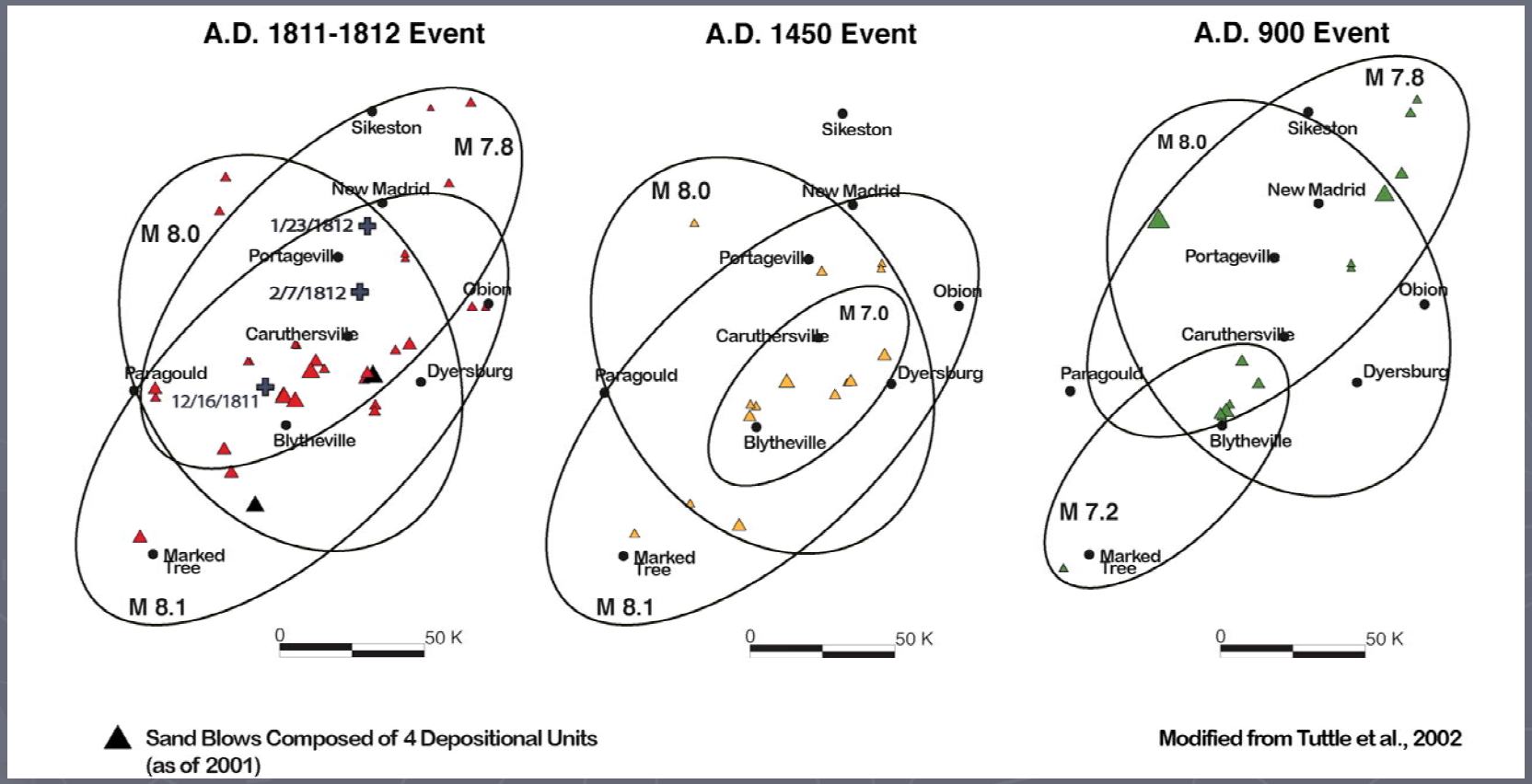
Paleoearthquake Chronology for NM Region



Sand Blow Correlation

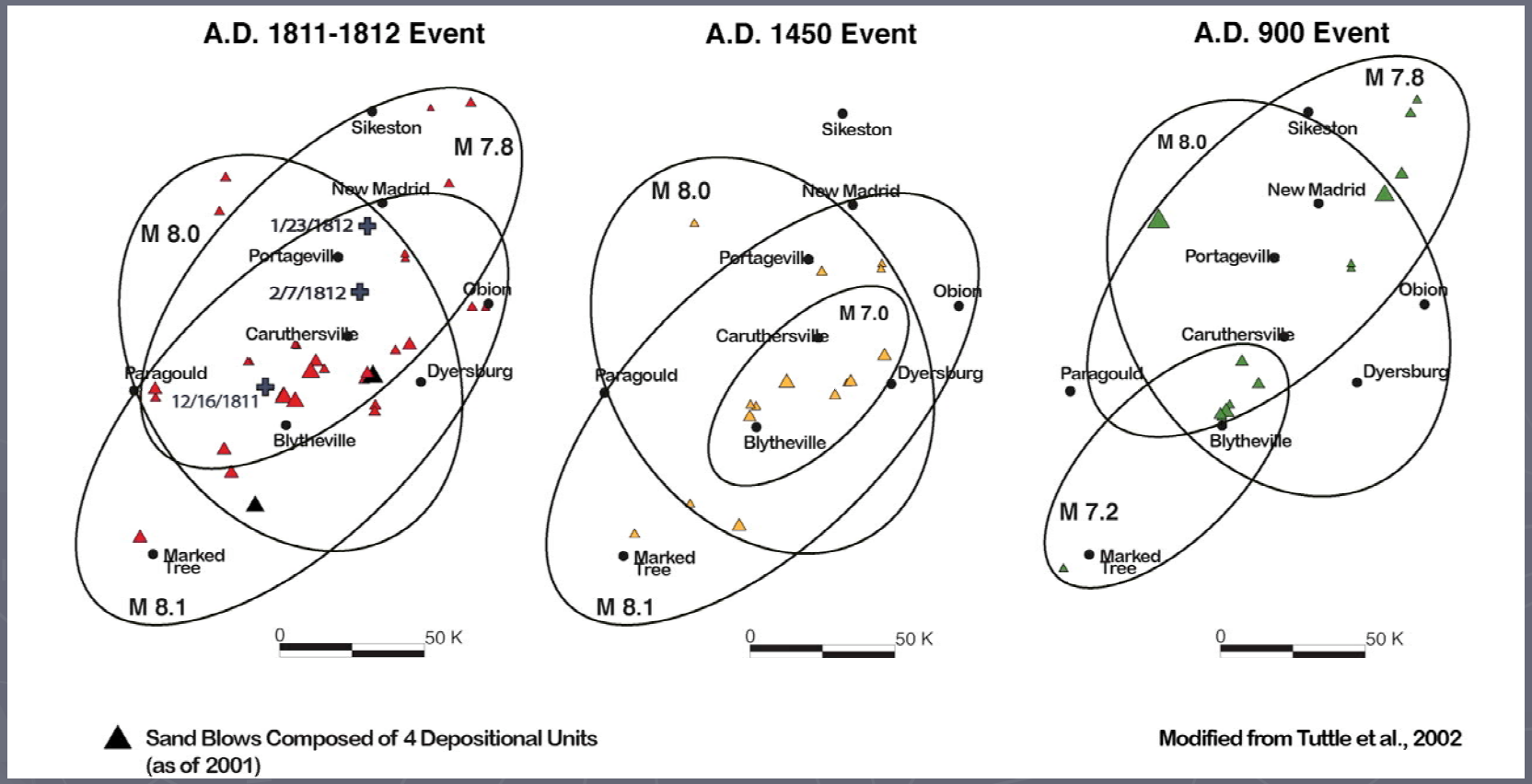
- Sand blows at Burkett that formed in 2350 B.C. ± 200 yr correlate with features at only two other sites. Additional investigations are needed in the intervening area to confirm this correlation.
- The Burkett results push the NM earthquake chronology back to 4,500 yr B.P. with a glaring 2,500 yr period of no events.
- Either the record is incomplete for this period or there was a fairly recent increase in earthquake frequency in the NMSZ.
- Modest effort has been made to study pre-900 AD events.
- Our findings further support temporally clustering of very large earthquakes in NMSZ.

Liquefaction Fields



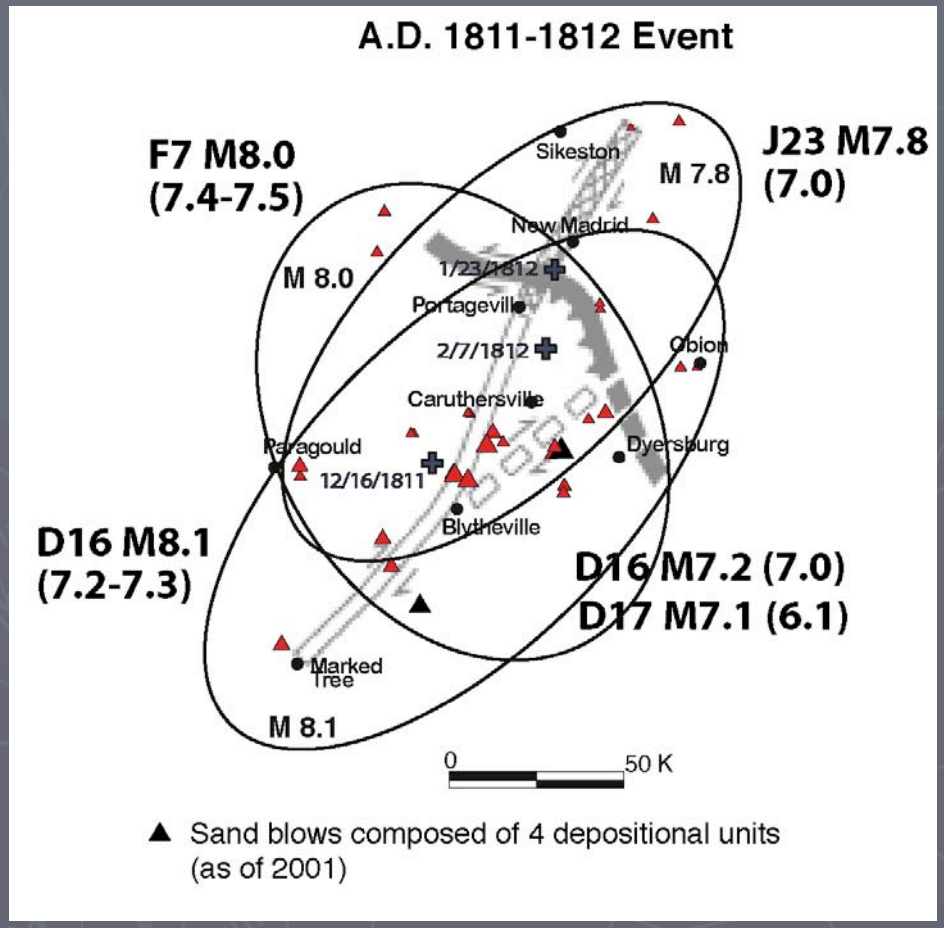
Each ellipse is meant to represent a liquefaction field produced by one earthquake. The fields are based on the size, distribution, and internal stratigraphy of sand blows. The figure was meant to be a working hypothesis and was expected to change as more data became available. The fields have not been updated since 2001.

Liquefaction Fields



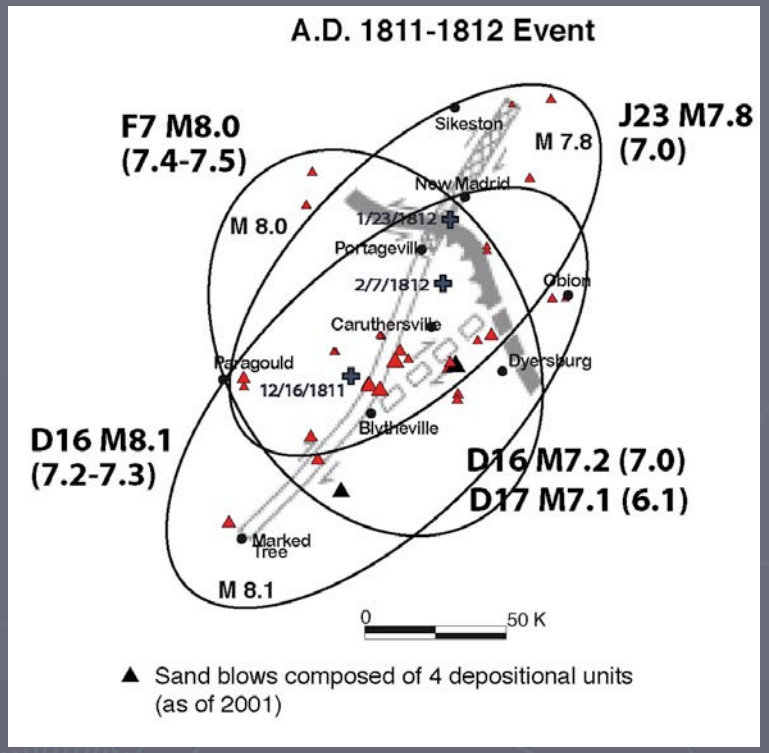
Based on data available in 2001, the liquefaction fields suggest that (1) the northwest-oriented central branch of the NMSZ or Reelfoot fault produced similar-size earthquakes during all three sequences, (2) the southern branch ruptured during each sequence, but produced a slightly smaller magnitude earthquake in A.D. 900, and (3) the northern branch ruptured in A.D. 900 and 1812, but not in A.D. 1450.

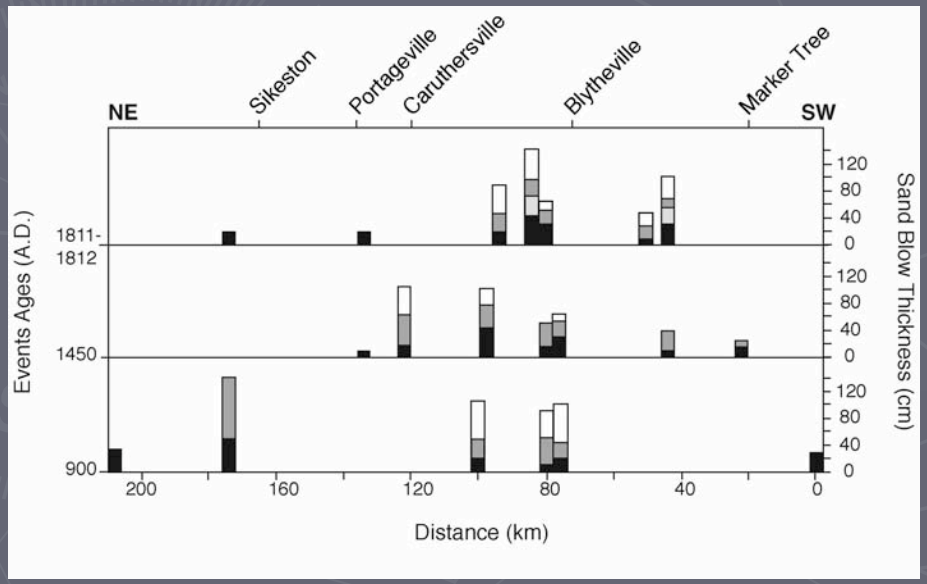
1811-1812 Liquefaction Fields



Rupture scenario from Johnston and Schweig, 1996; Revised magnitudes (#) from Hough et al., 2000; and Hough and Martin, 2002

- Some of the 1811-1812 sand blows near Blytheville and Wilson, AR and Dyersburg, TN are made up of 4 major depositional units, suggesting 4 earthquakes large enough to induce liquefaction at these sites.
- It seems likely that the four largest events, Dec. 16 mainshock, Dec. 16 aftershock, Jan. 23 mainshock, and Feb. 7 mainshock, were responsible for the 4 depositional units of the compound sand blows.
- This would support a NM location for the Jan 23rd mainshock which has recently been debated.





1811-1812 Liquefaction Fields

- The third depositional unit of some of the sand blows is thinner than the other three units, suggesting that ground shaking during the January 23rd earth-quake was not as strong in the Blytheville area as during the other three events. A more distant location, such as the northern branch of the seismic zone, might account for this observation.

Prehistoric Sand Blow in Western Kentucky

What's the earthquake source?

- New Madrid seismic zone, Wabash Valley seismic zone, or something else?