New Potential Sources from Paleoseismology Southwest of Memphis

Haydar Al-Shukri and Hanan Mahdi, UALR
and
Martitia Tuttle, M. Tuttle & Associate

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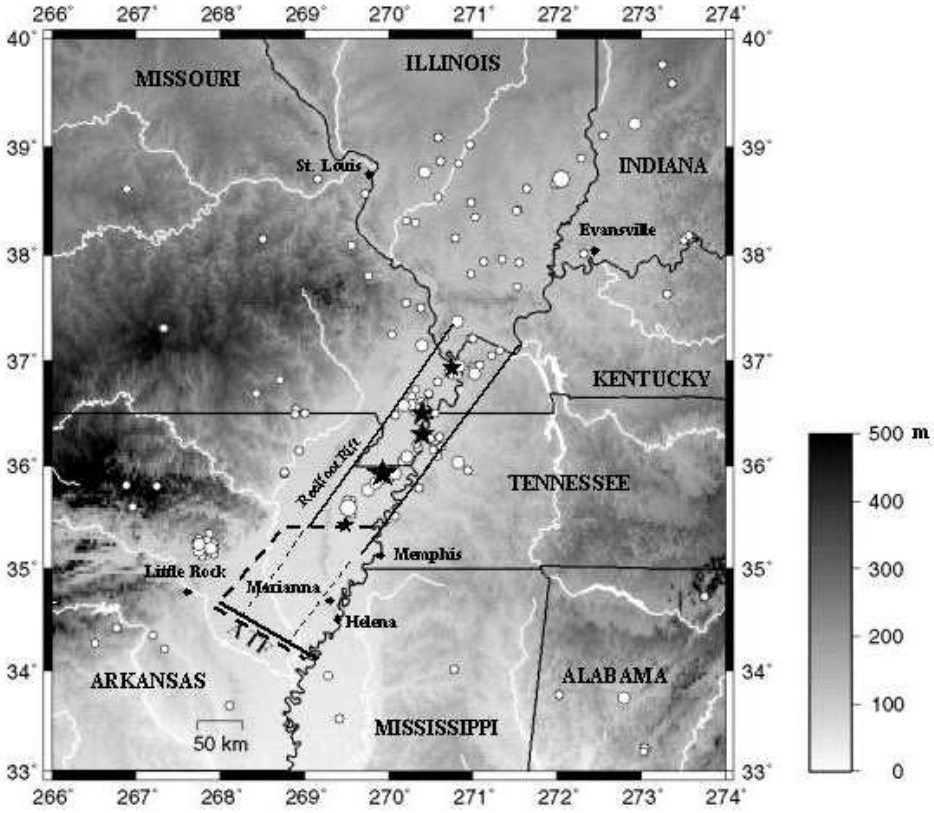
Historic perspective:



- Based on modern seismicity, the 1811-1812 earthquakes, and paleoseismic evidence (albeit limited to ~1200 yr) of prior NM events, the NMSZ has been thought to present the greatest hazard in the central US.
- Over the past 10 years, several late Quaternary faults, including the eastern Reelfoot Rift margin fault, have been found outside the NMSZ proper. In addition, sizeable Holocene sand blows have been found 100s of km from the NMSZ.
- These findings have raised questions about the hazard presented from other sources and the relationships of these sources with the NMSZ.

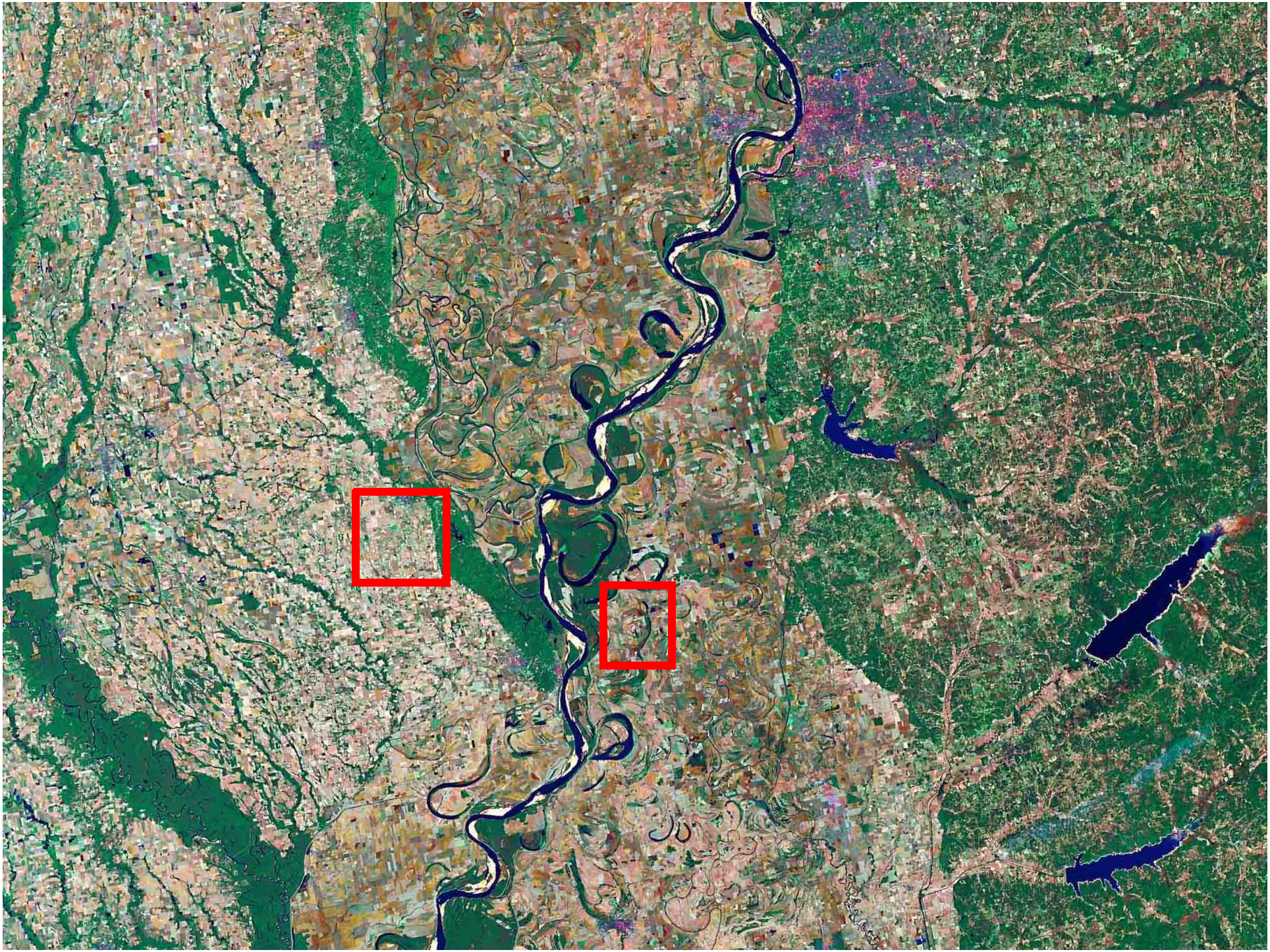
Historic perspective:

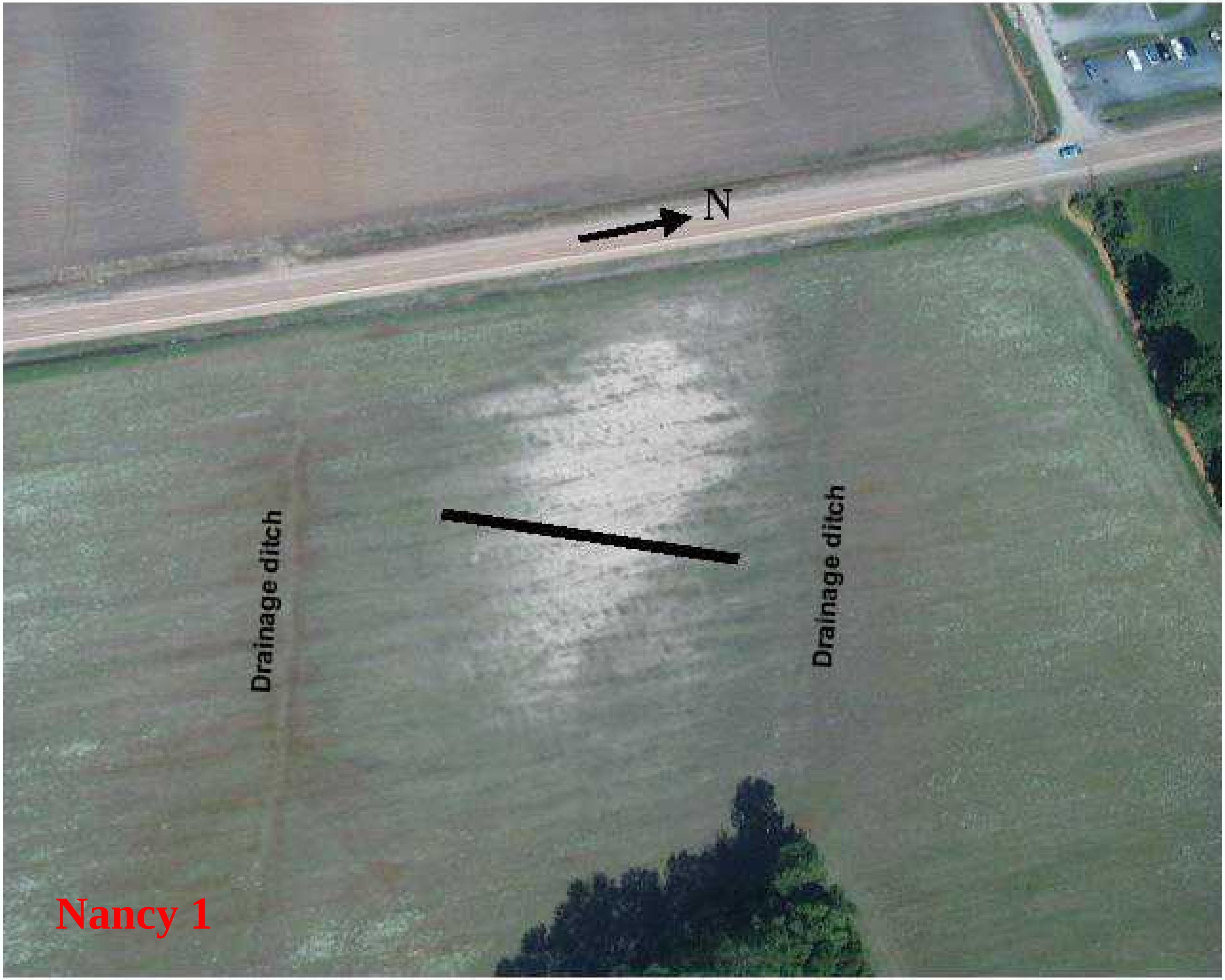
1999 – 2002 (funded by NEHRP, ASTA, UALR)

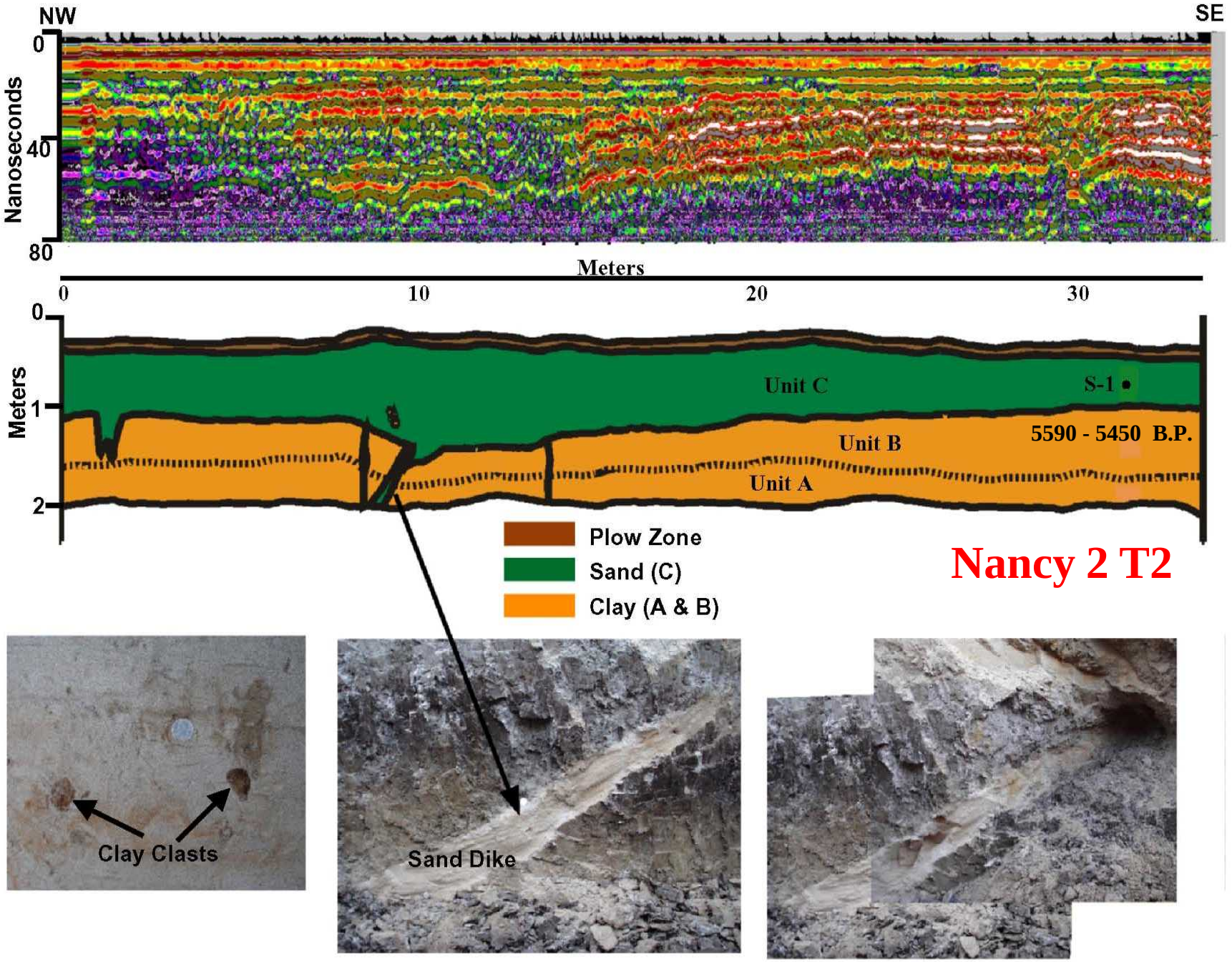
Research Team from UALR

2002 – Present (funded by NEHRP, UALR)

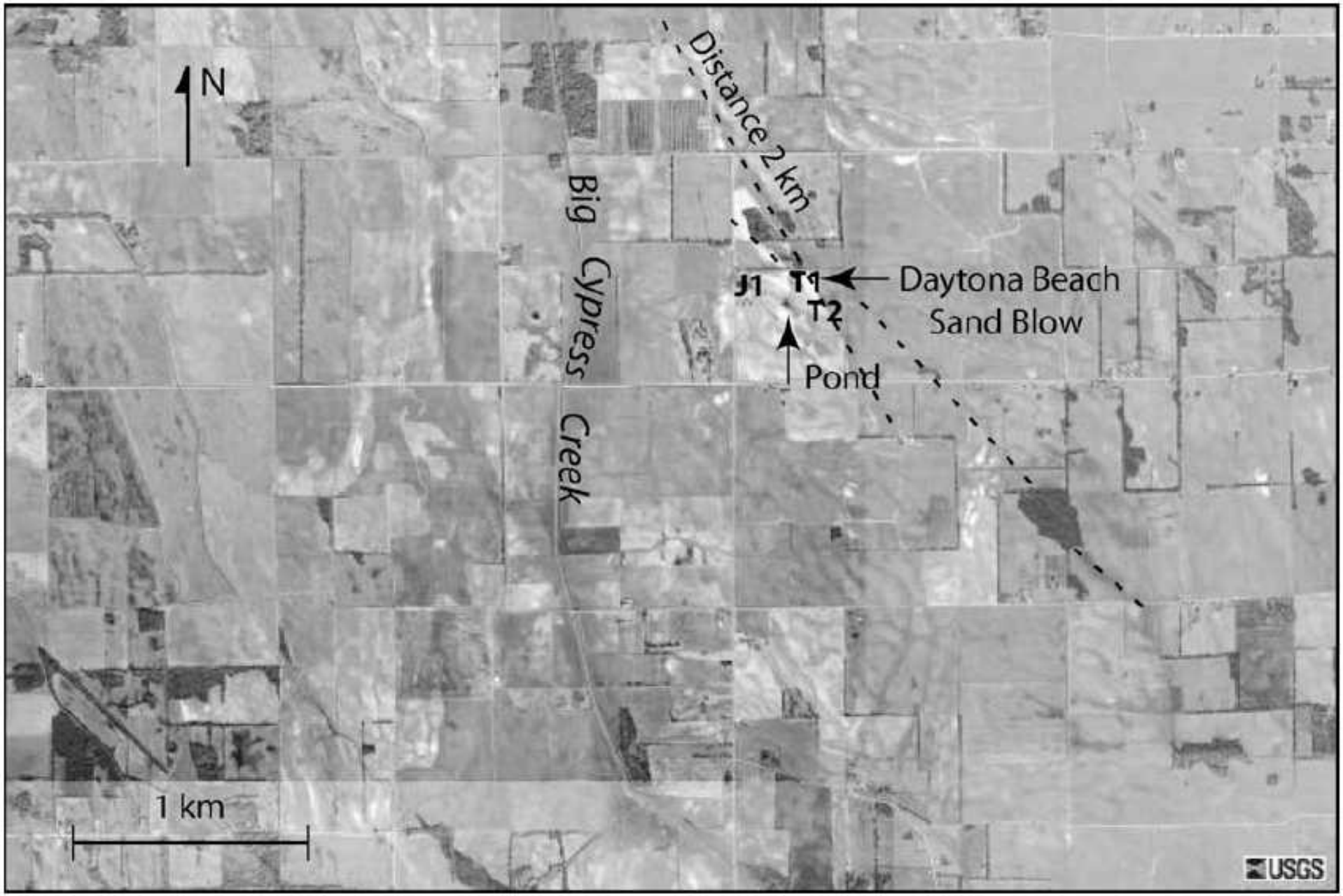
Research Team from UALR
and M. Tuttle & Associate

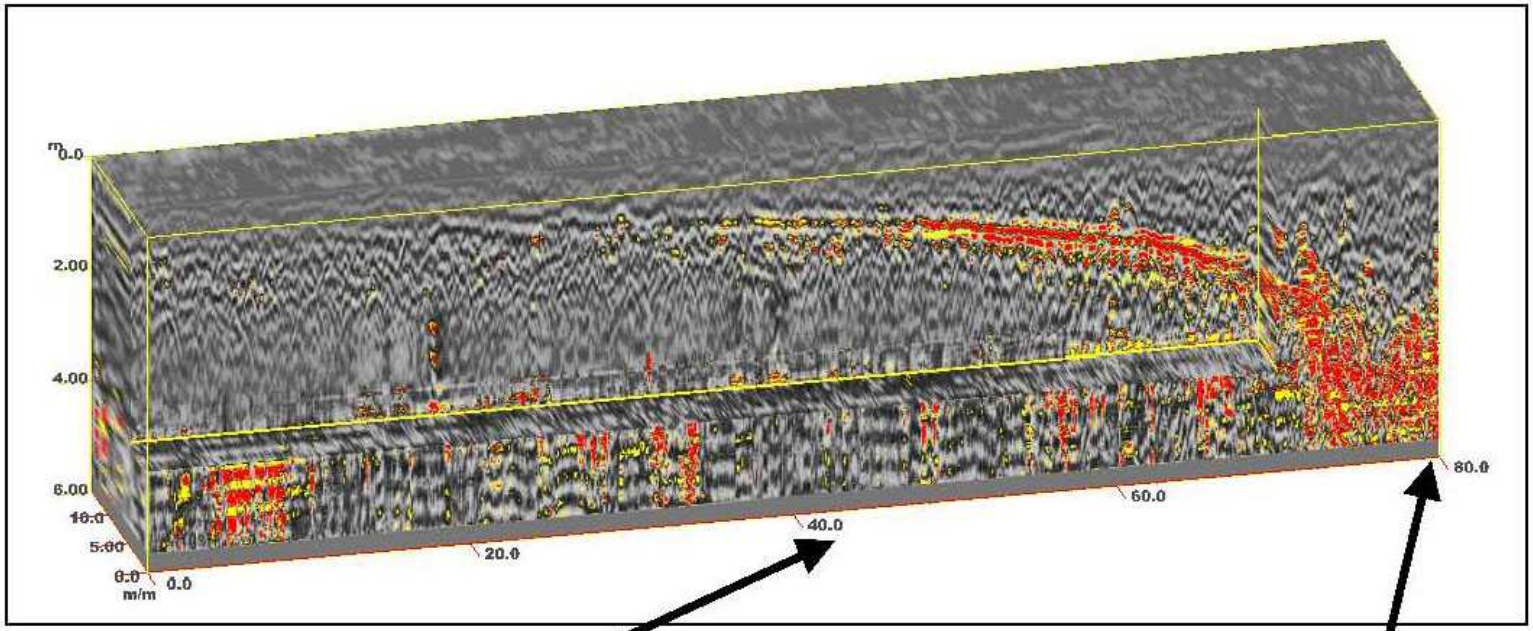


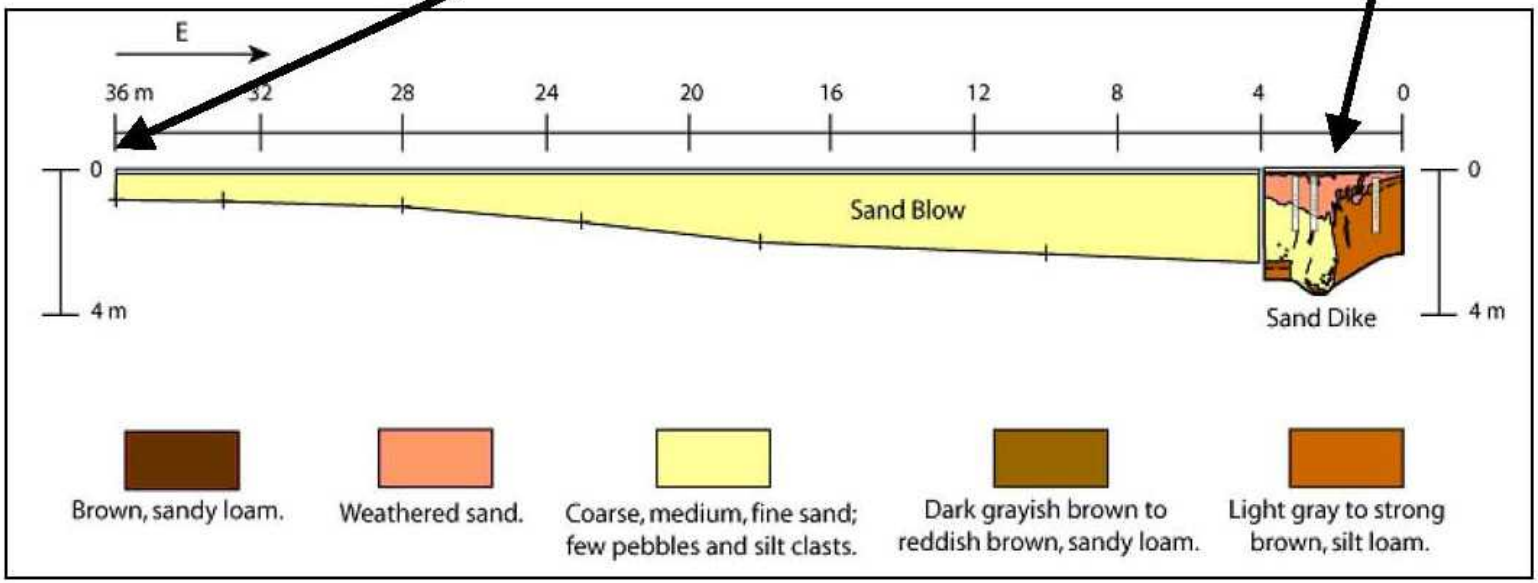

N
Drainage ditch
Drainage ditch
Nancy 1

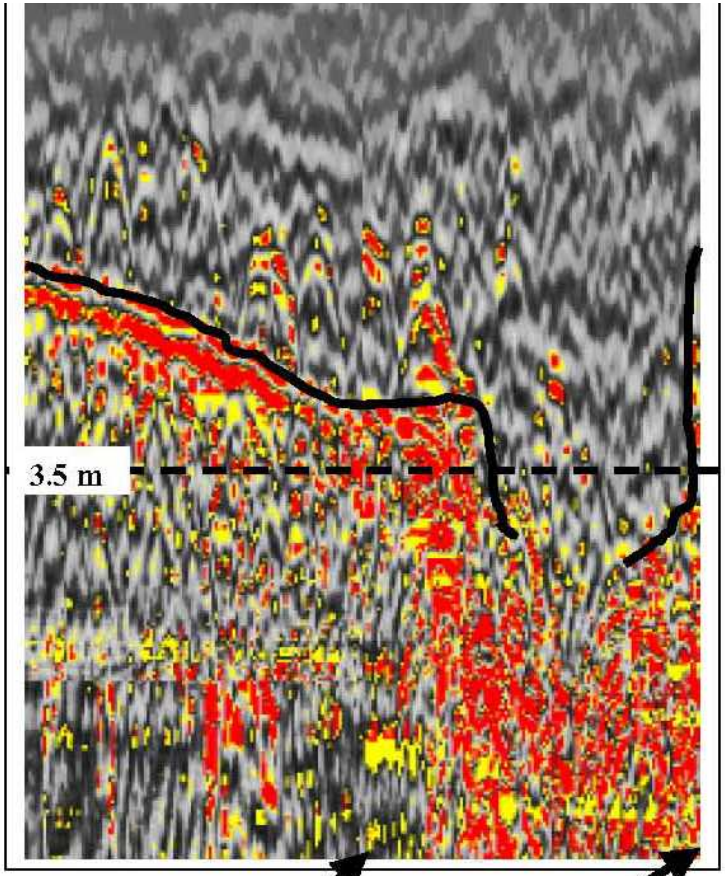

NW
SE
Nanoseconds
0
40
80
Meters
0
10
20
30
Meters
0
1
2
Unit C
S-1
5590 - 5450 B.P.
Unit B
Unit A
Plow Zone
Sand (C)
Clay (A & B)
Nancy 2 T2
Clay Clasts
Sand Dike

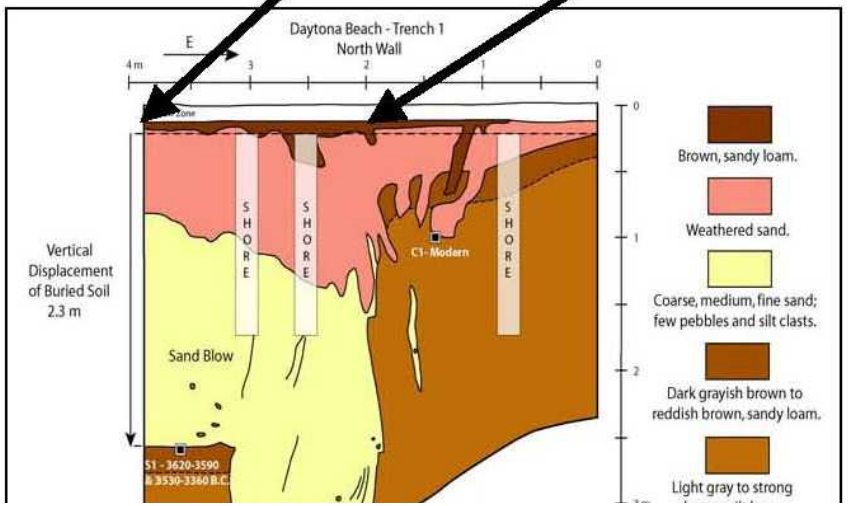
Fault-Controlled Implacement of Sand Dike?




m
0.0
2.00
4.00
6.00
10.0
5.00
0.0
m/m
0.0
20.0
40.0
60.0
80.0


E
36 m
32
28
24
20
16
12
8
4
0
0
4 m
Sand Blow
Sand Dike
0
4 m
Brown, sandy loam.
Weathered sand.
Coarse, medium, fine sand; few pebbles and silt clasts.
Dark grayish brown to reddish brown, sandy loam.
Light gray to strong brown, silt loam.


3.5 m


Daytona Beach - Trench 1
North Wall
E
4 m
3
2
1
0
SHORE
SHORE
SHORE
C1- Modern
Vertical
Displacement
of Buried Soil
2.3 m
Sand Blow
S1 - 3620-3590
& 3530-3360 B.C.
Brown, sandy loam.
Weathered sand.
Coarse, medium, fine sand;
few pebbles and silt clasts.
Dark grayish brown to
reddish brown, sandy loam.
Light gray to strong

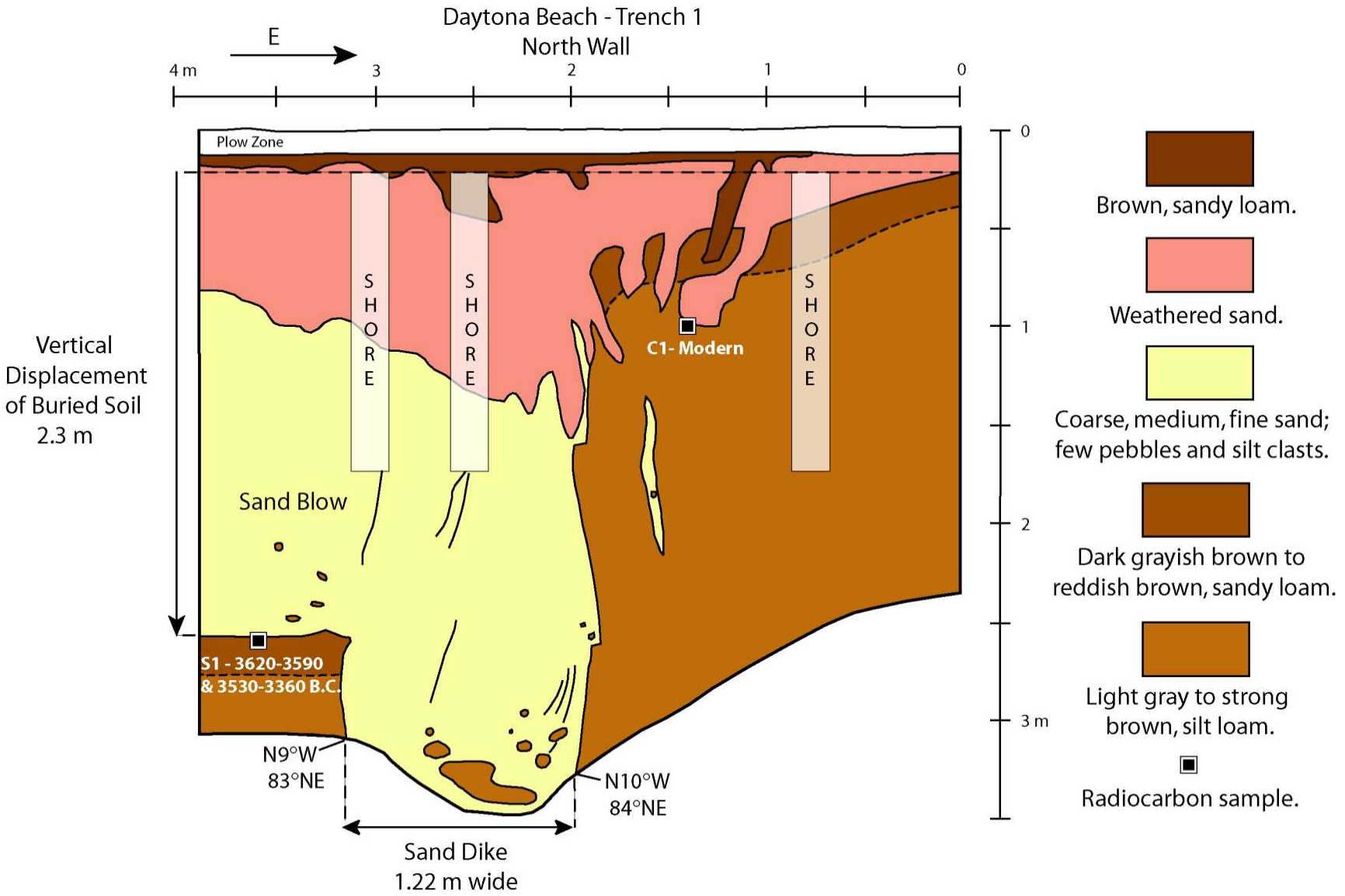


Figure 6. Log of trench 1 wall at Daytona Beach site near Marianna, Arkansas. Liquefaction-related ground failure includes large lateral and vertical displacements of surface soil and formation of 1.22-m-wide sand dike and 2.45-m-thick sand blow. Intense weathering and bioturbation suggest that features are hundreds if not thousands of years old. Radiocarbon dating of soil buried immediately below sand blow indicates that it formed after 3620 B.C. Log by M. Tuttle and H. Al-Shukri.

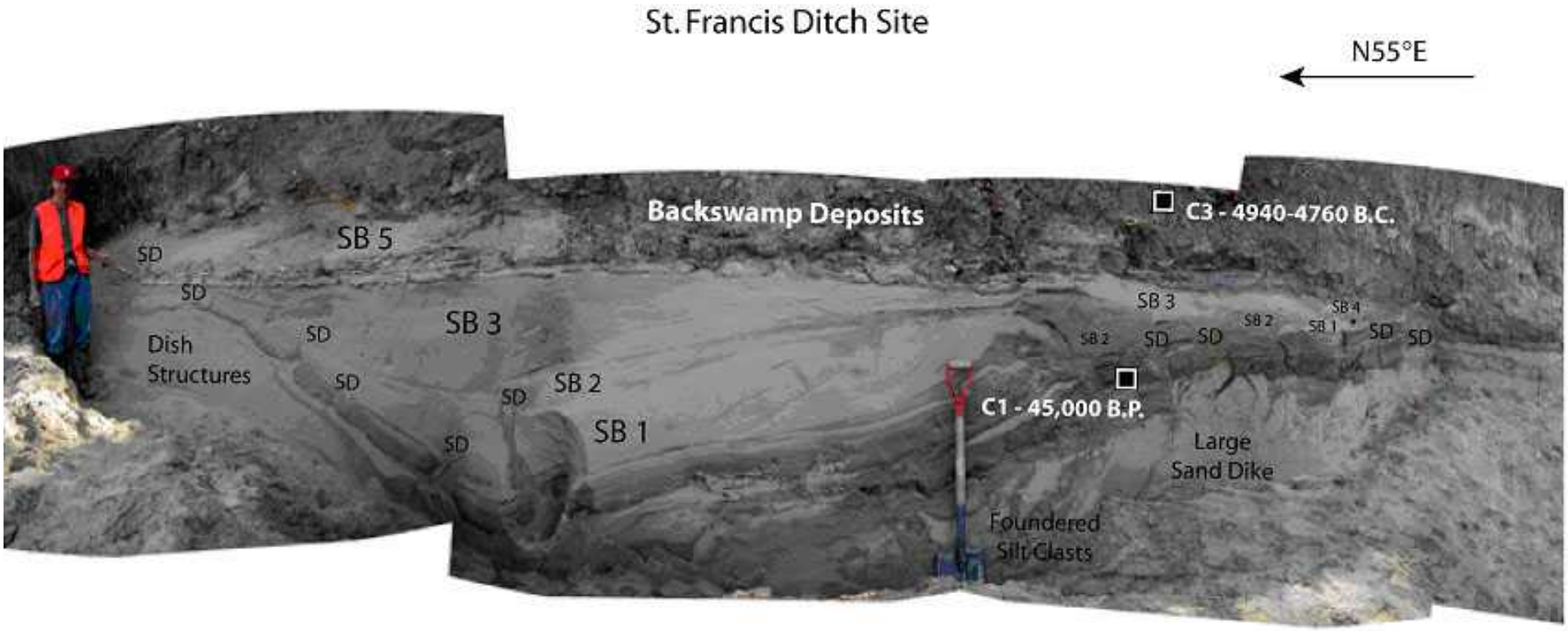
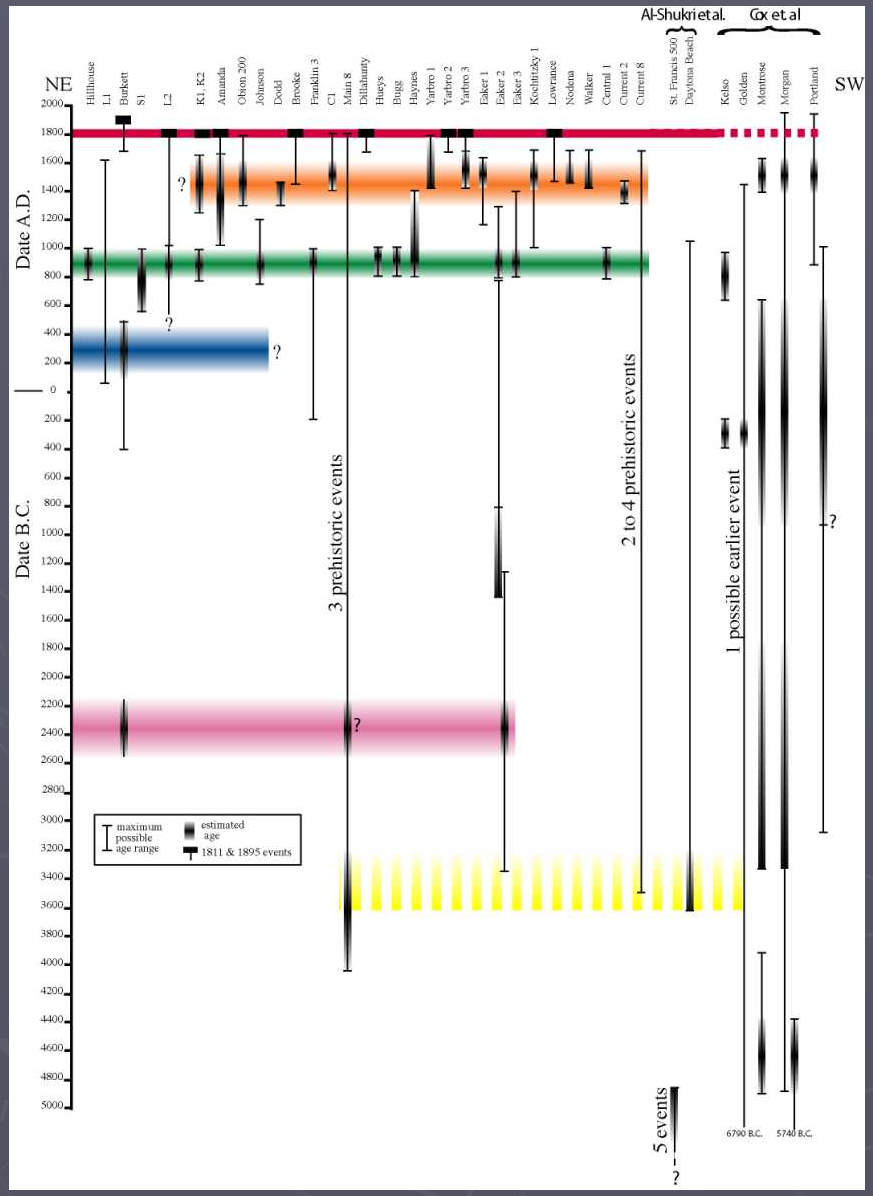
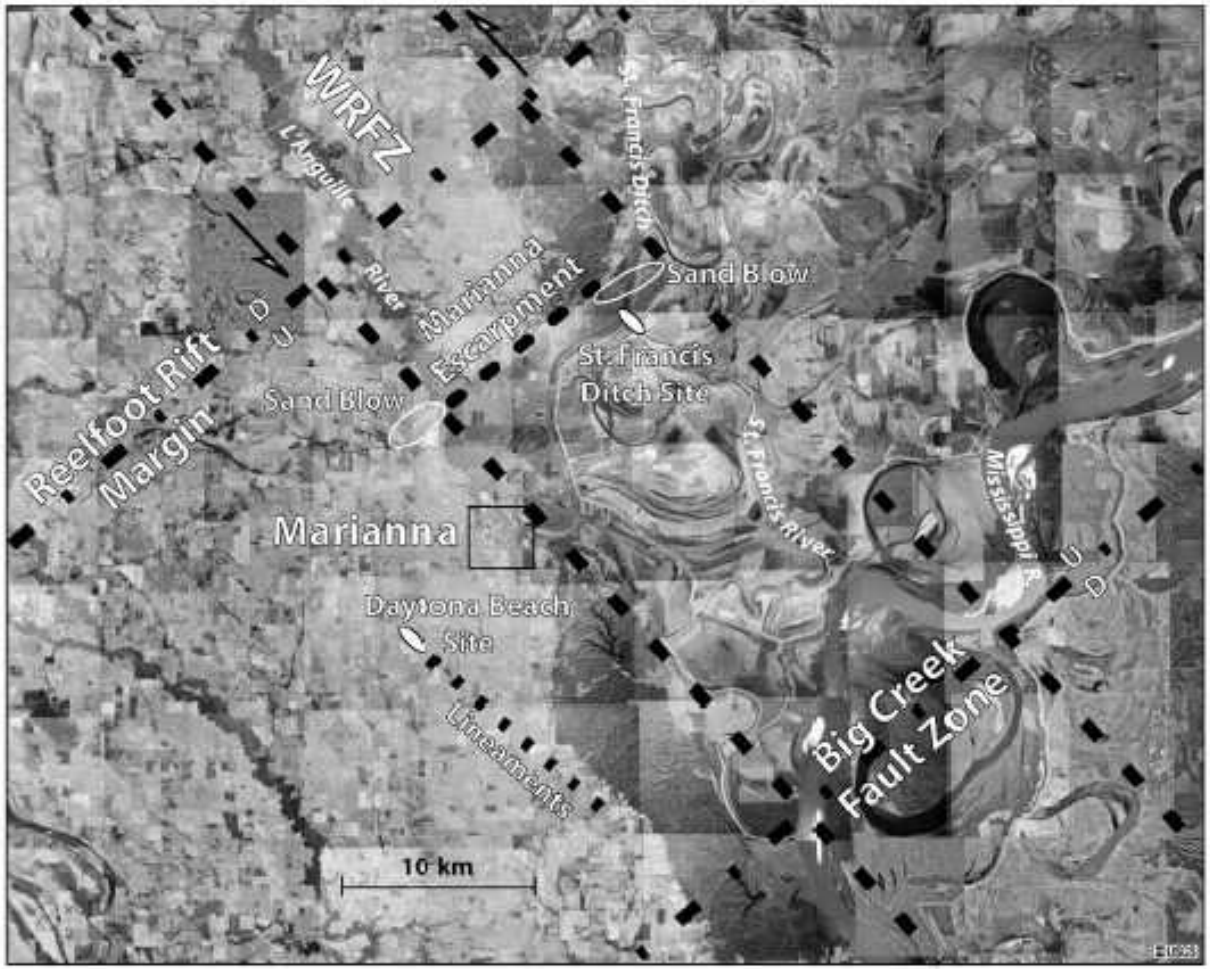


Figure 11. Photomosaic of cutbank exposure at St. Francis Ditch site showing cluster of sand blows and related feeder dikes. From lowermost to uppermost, sand blows are labeled SB 1 to SB5. Sand dikes are indicated by SD. Lower four sand blows are buried by 4.7 m of backswamp deposits containing calcium-carbonate nodules. Uppermost sand blow is interbedded with backswamp deposits. Radiocarbon dating of organics in backswamp deposits indicate that sand blows formed before 4760 B.C. Photomosaic by M. Tuttle.

Regional Earthquake Chronology



- The Daytona Beach and St. Francis Ditch sand blows suggest that there were at least two very large events centered in this area about 5,000 and 7,000 years ago
- The Daytona Beach sand blow is exceptionally large and formed about the same time as a small sand blow near Blytheville and possibly a couple features to the south
- If so, these occurrence may be outliers of a very large earthquake centered near Marianna about 5,000 yr ago



- **Several faults in east-central Arkansas have been inferred to be active on the basis of geomorphology and disturbed drainages.**
- **Eastern Reelfoot Rift margin fault seems the most likely source of the earthquakes given its length (~300 km), history of seismic activity and late Quaternary displacement in western TN, and relationship to NM fault system.**

Conclusions

- We found very large sand blows near Marianna, AR
- Dating (radiocarbon and OSL) indicates the events occurred 5000 -7000 years ago
- Many fault zones exist within and near the study area, however, the ERRM is the most likely source
- From the size of sand blows, the extent of the liquefaction fields, and CPT, the event magnitude could be more than 7
- The results potentially have implications for seismic activity migration within the Reelfoot rift
- Continuation of the work is essential to resolve several unknowns in this area (source region, earthquake magnitude, and return period)