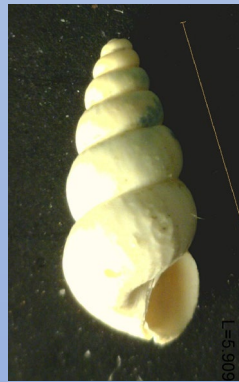


CONTEMPORANEOUS AND ACCELERATED SLACKWATER LAKE AND LOESS SEDIMENTATION IN SOUTHERN ILLINOIS DURING THE LAST GLACIAL MAXIMUM (SHELBY PHASE)

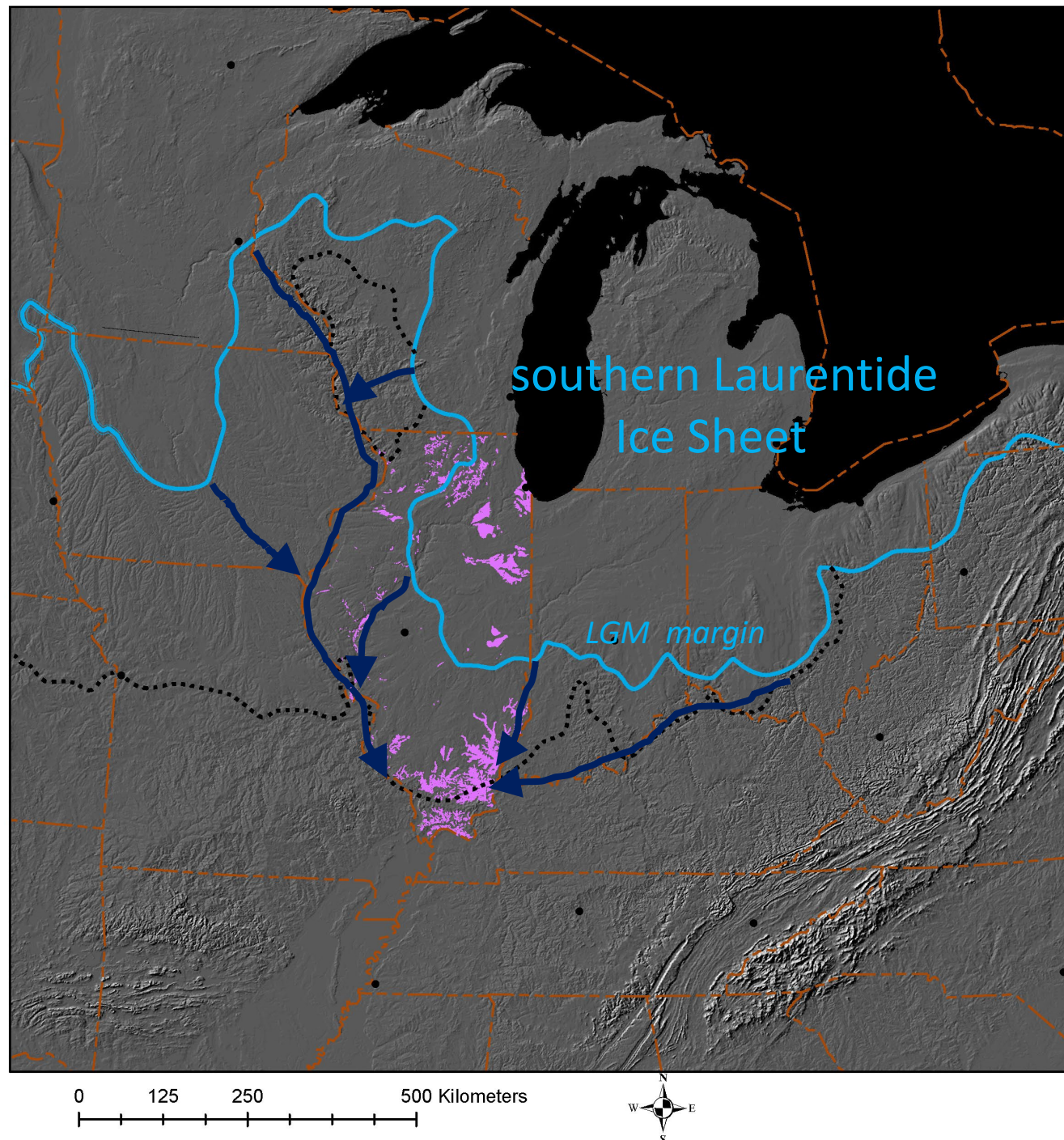


David A. Grimley, Andrew C. Phillips, B. Brandon Curry

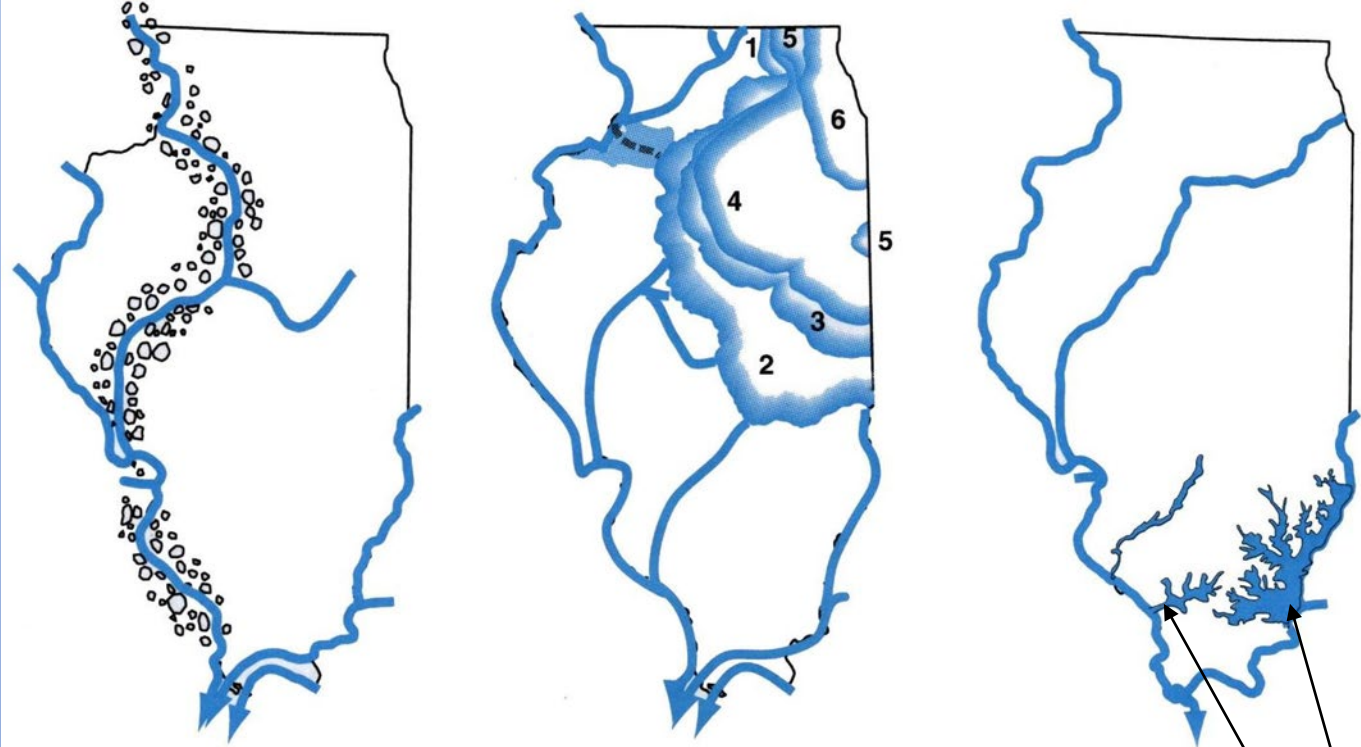
Illinois State Geological Survey, Prairie Research Institute, University of Illinois

last glacial
(Wisconsin
Episode)
lake deposits in
Illinois

slackwater
lakes formed
in response to
aggradation
from glacial
meltwaters

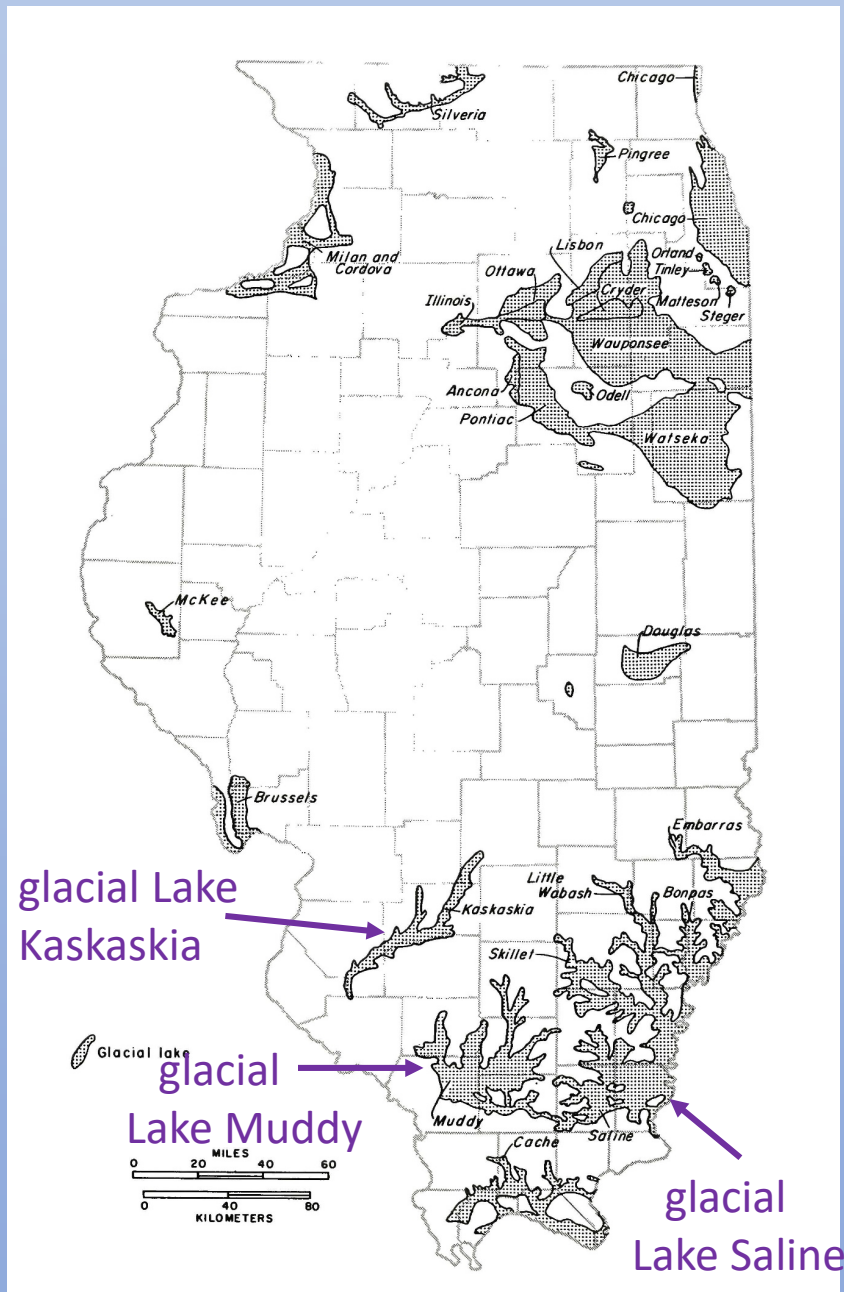


Last glacial (Wisconsin Episode) slackwater lakes in southern Illinois

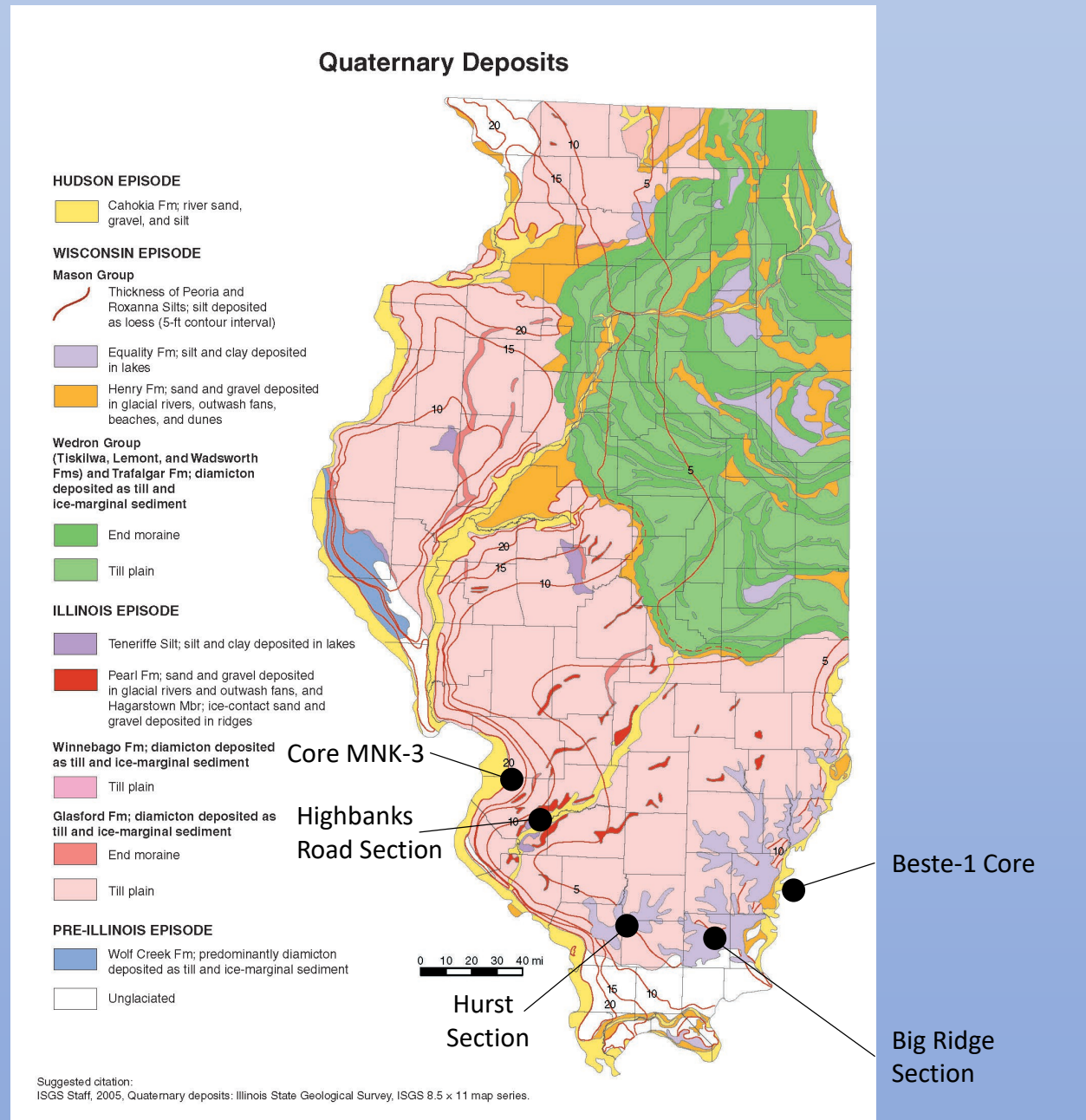


- slackwater lakes of greater extent in SE Illinois because of less relief and lower valley gradients

slackwater lakes

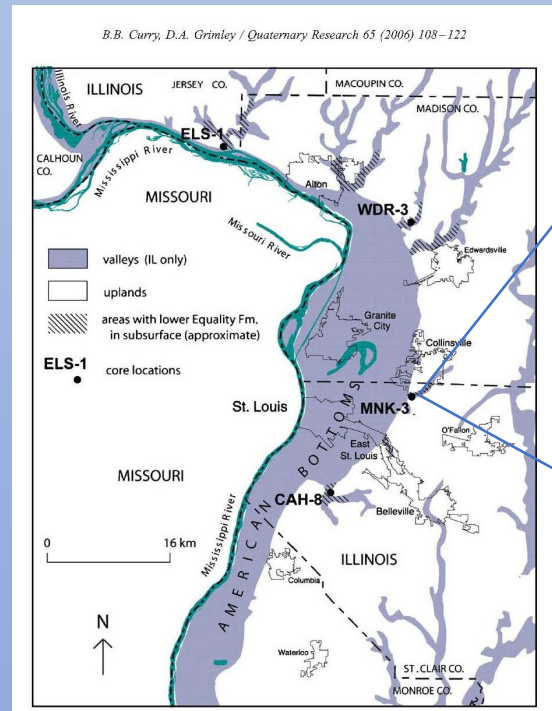


(Frye & Willman, 1970): last glacial lakes

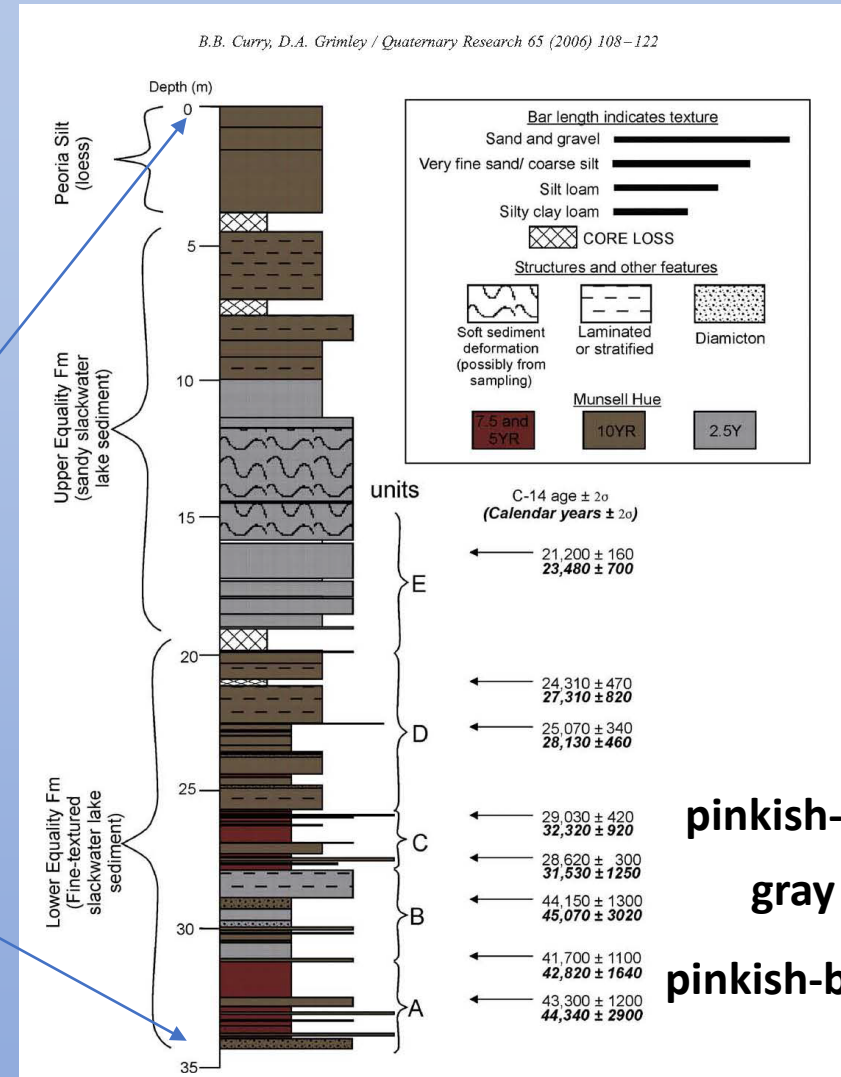


Early slackwater lake deposits

- beginning ~ 45 ka
- glaciers enter drainage basin (MIS 3)



MNK-3 Core



~ 17 (?) - 26 cal ka

27- 33 cal ka

42- 45 cal ka

Curry and Grimley, QR, 2006

MNK-3 Core (lower part)



< 26
cal ka

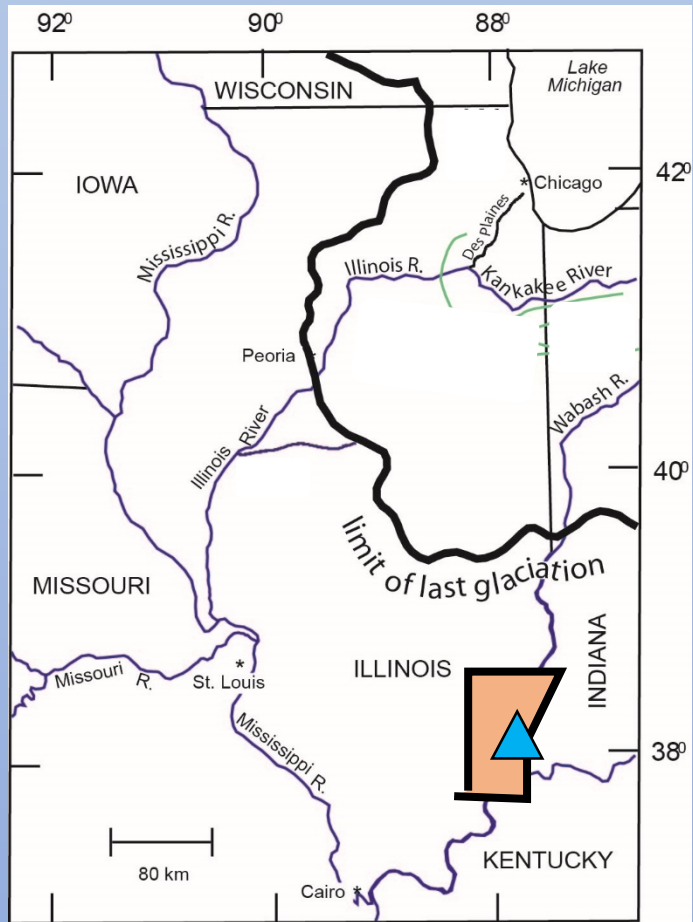


27 - 33
cal ka

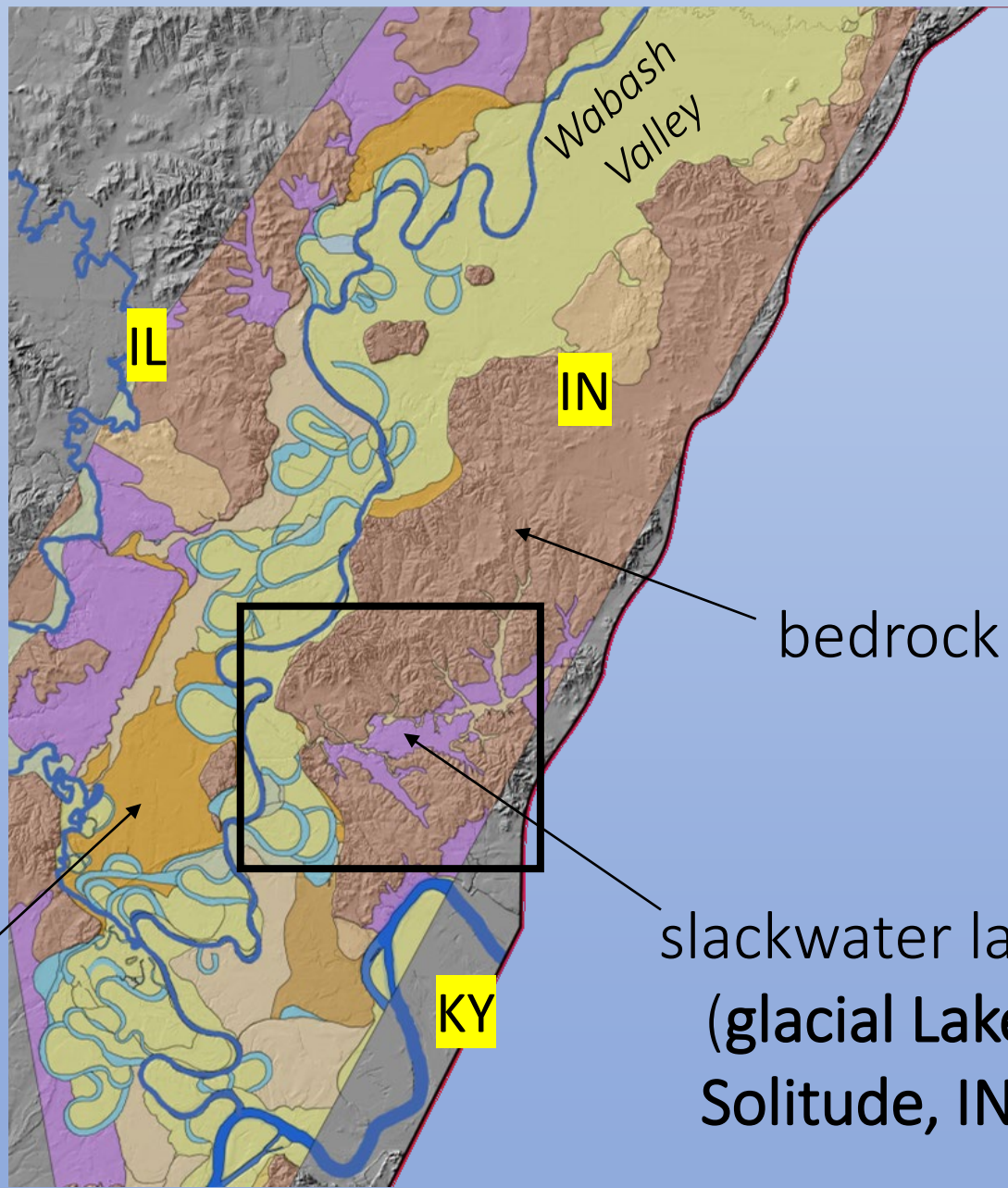


42 - 45
cal ka





outwash



bedrock upland

slackwater lake
(glacial Lake Solitude, IN)

GLACIAL LAKE SOLITUDE

Gastropods & ostracods in slackwater lake deposits

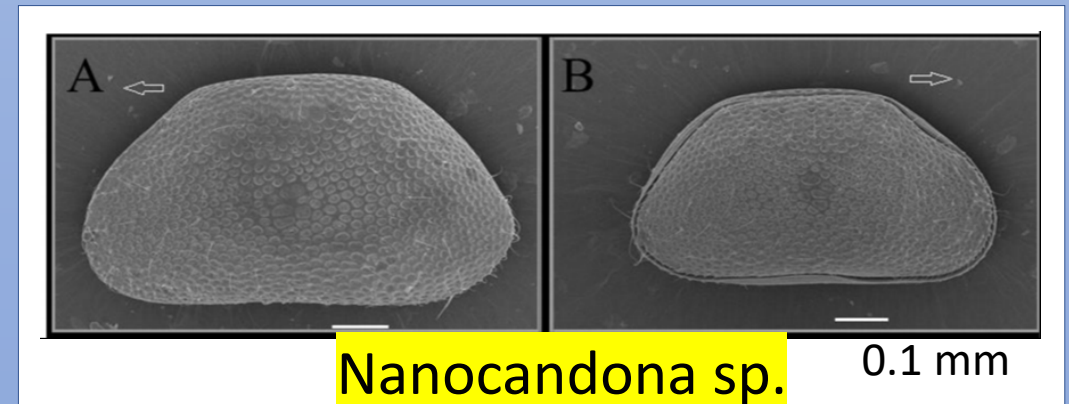
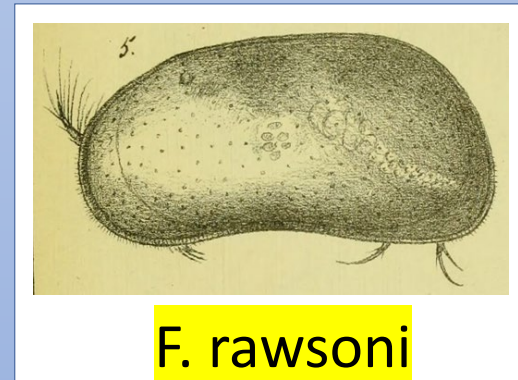
TERRESTRIAL



AMPHIBIOUS

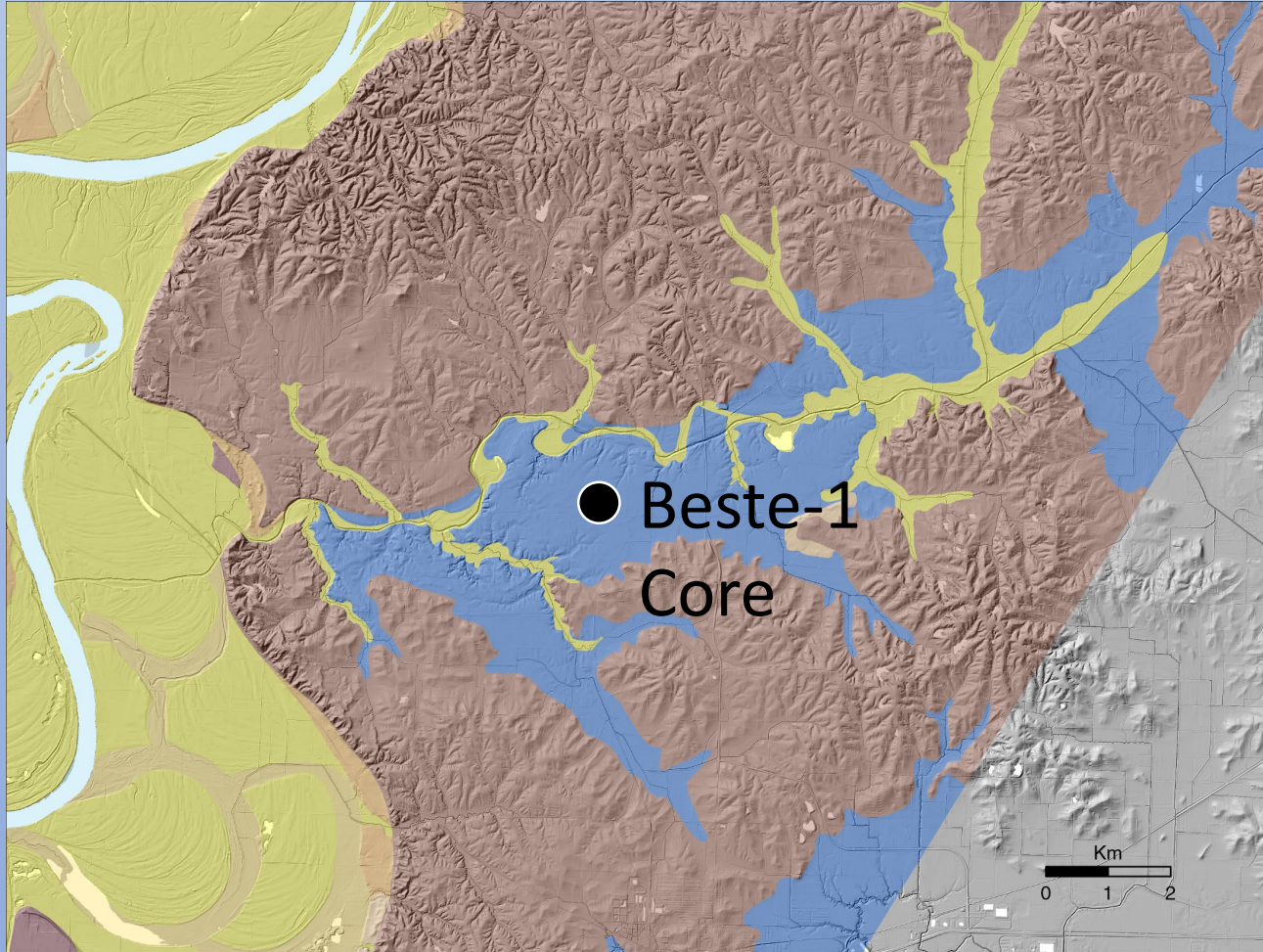


FRESHWATER AQUATIC



GLACIAL LAKE SOLITUDE

last glacial slackwater lake



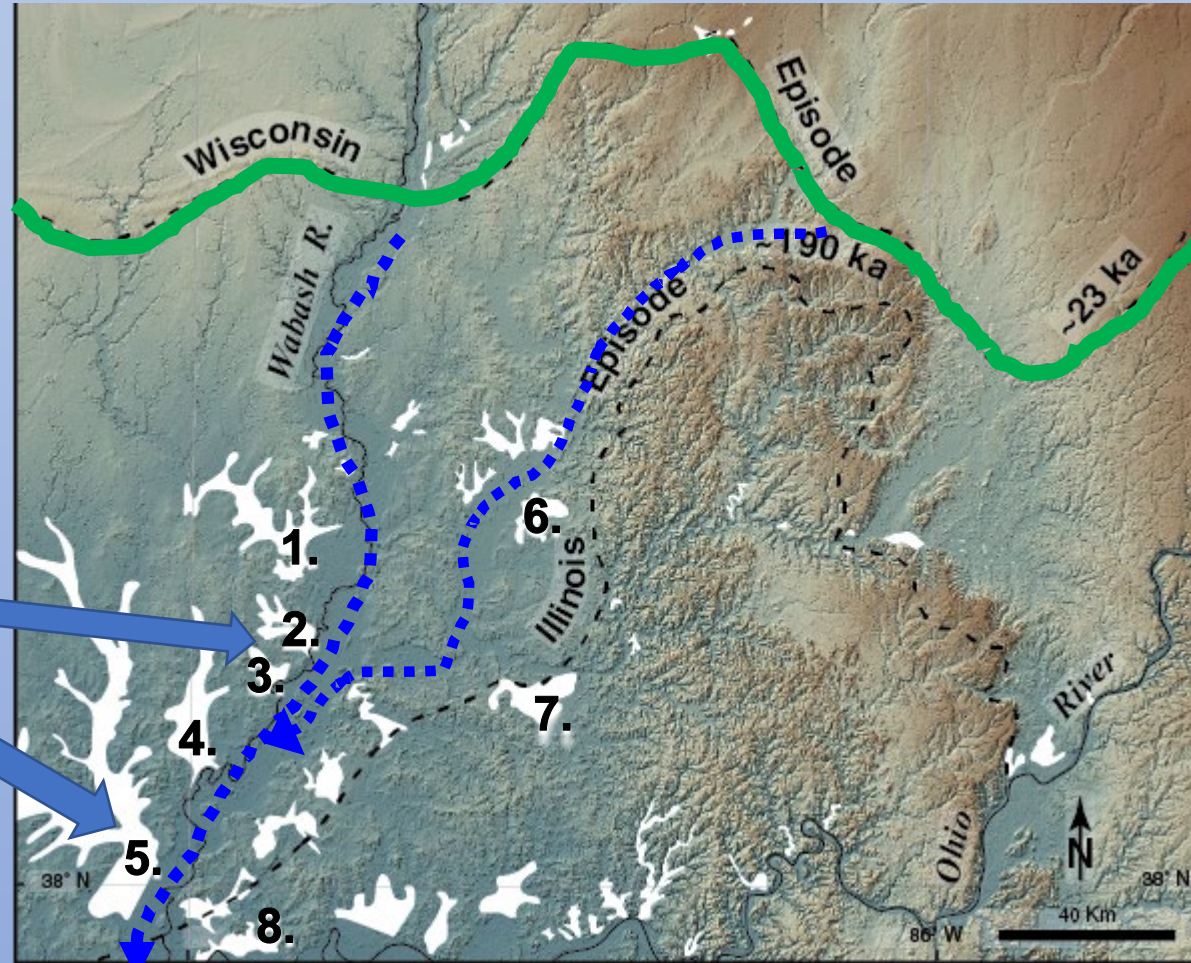
**upper
Equality Fm.
16 – 29 cal ka**

**lower
Equality Fm.
40 – 45 cal ka**

<i>BESTE-1 Core</i>		calibrated ka
Depth (m)		
0	Silt loam, bedded	
2		16.3 ± (needles)
4	Silt-sand, laminated	24.6 ± (Pomatiopsis)
6		29.0 ± (charcoal)
8		45 ± 3 (Pomatiopsis)
10	Clay-silt, laminated	
12		44 ± 3 (plant frags.)
14		42 ± 1 (needles) 44 ± 1 (wood)
16	Silt loam, laminated	41 ± 3 (OSL)
18	Silty clay laminated	42 ± 1 (plant frags.)

GLACIAL LAKE SOLITUDE

& other last glacial slackwater lakes in SE Illinois and SE Indiana



1. glacial Lake Embarras
2. glacial Lake Crawfish
3. glacial Lake Coffee
4. glacial Lake Bonpas
5. glacial Lake Li'l Wabash
6. glacial Lake Prairie (IN)
7. glacial Lake Pride (IN)

Drew Phillips
mapping ---

numerous ages from

17 to 45 cal ka

for Equality Fm.

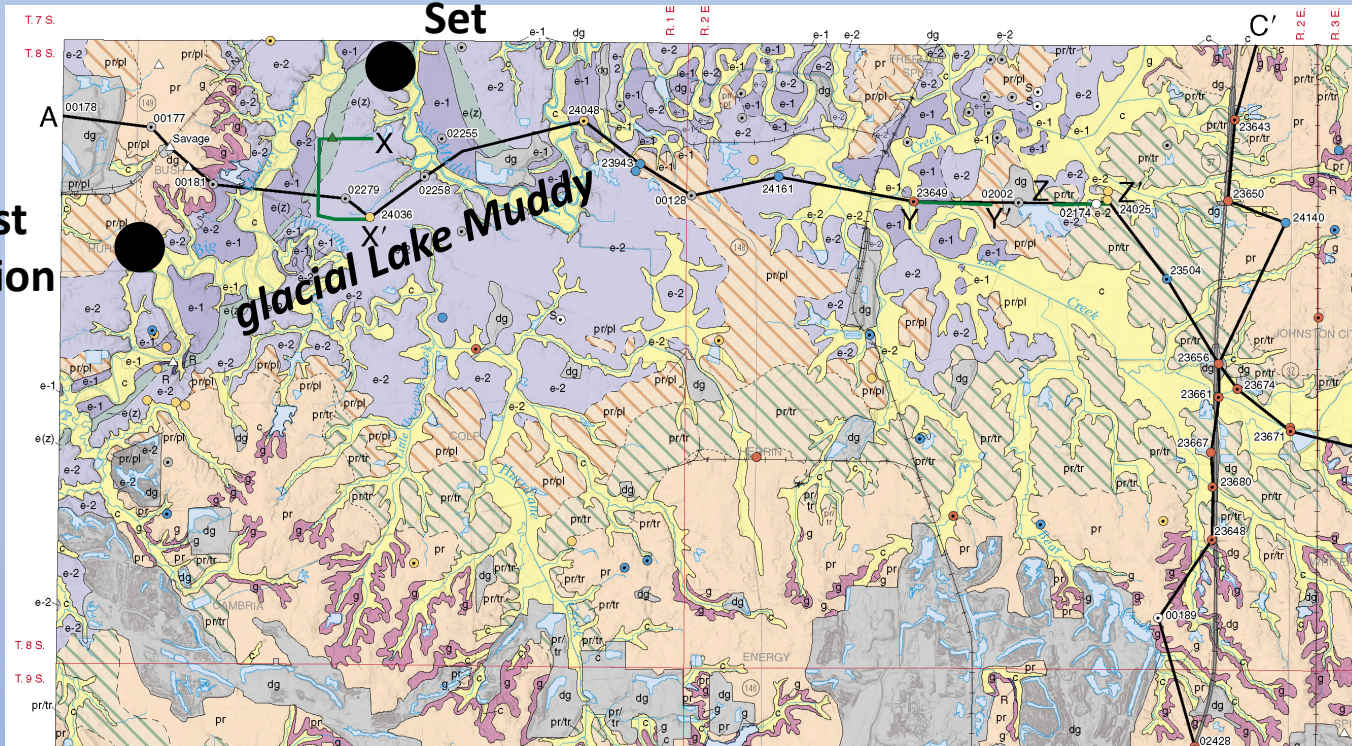
(shells, wood,
charcoal, needles,
seeds...)

**8. Glacial Lake
Solitude**

Sample

Set

Hurst Section

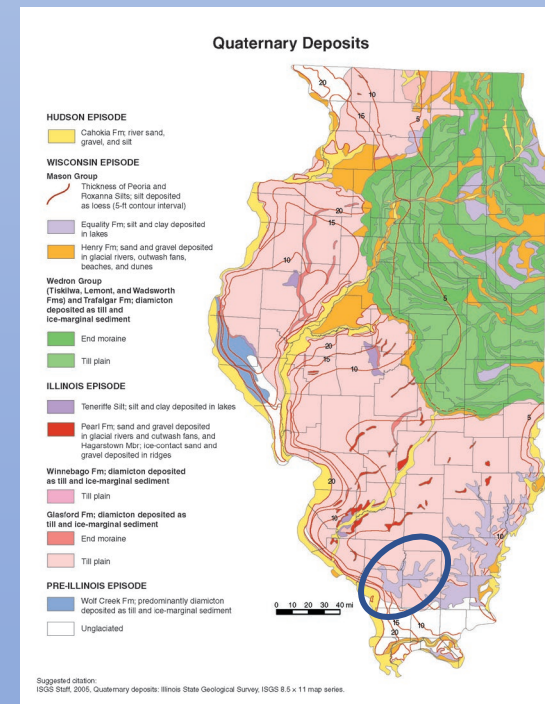
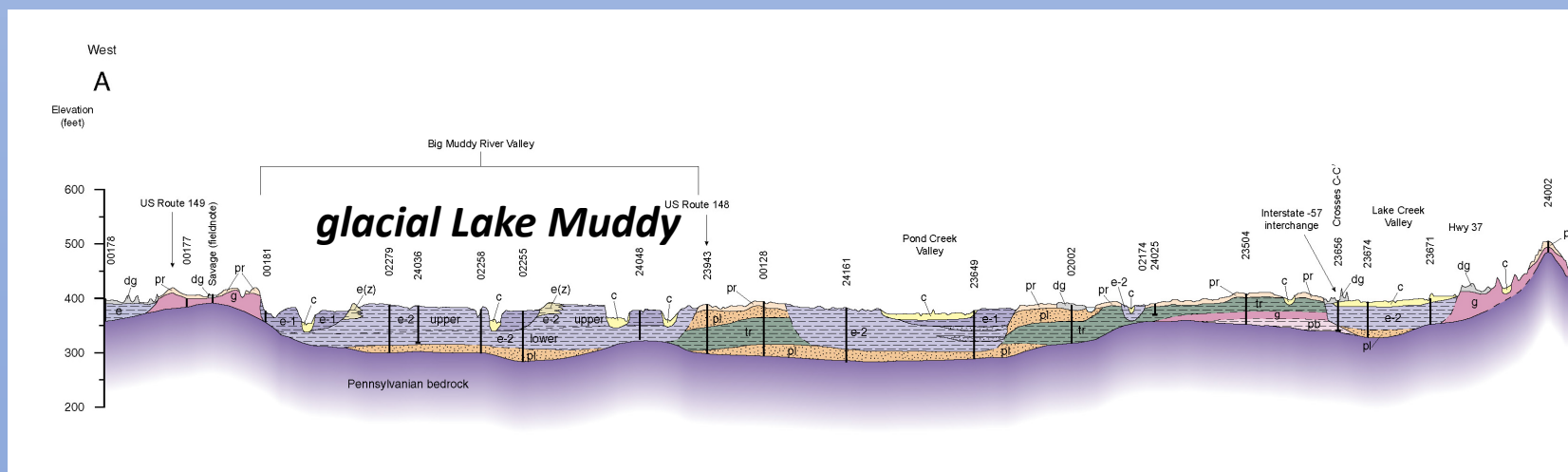


1 mile

Glacial Lake Muddy

[Williamson County, IL]

- up to 100 feet of lake sediments in the subsurface
- fills a preglacial bedrock valley



Hurst Section along the Big Muddy River



Equality Formation: last glacial
slackwater lacustrine sediment

Bridge Boring Record (IDOT):

BRIDGE FOUNDATION BORING LOG
 STRUCTURE CARRYING TWP. RD. 557 OVER LIMB BRANCH CREEK

2640' SL, 250' EL
 Sec. 35, T9S, R2E

Illinois Department of Transportation

BRIDGE FOUNDATION BORING LOG

PROJECT: _____ BRIDGE: _____ Date: JULY, 1989
 ROUTE: TWP. RD. 557 Bored By: JOHN R. HAYDEN
 SEC. 89-01197-00-BR STA. STRUCTURE #3067 Checked By: GARY L. PULLEY
 COUNTY: WILLIAMSON

Boring No. 1-S
 Station 11' E OF EXIST. EAST ABUTMENT
 Offset 6-1/2' SO. OF CENTERLINE

Ground Surface	Elevation	N	1/4 L	(%)	Surface Water El. (IN CHANNEL)	Elevation	N	1/4 L	(%)
100.0	0				93.5	3	0.6S	23	
STIFF MOIST GREY CRUSHED STONE					Completion After 24 Hours				
97.5					93.3				
MED. MOIST TO V. MOIST BROWN SILT TO SILT LOAM A-4	4	-	-		MED. V. MOIST BROWN MOTTLED GREY SILT TO SILT LOAM A-4	5	0.3S	19	
BOTTOM OF HOLE = 44.6 FEET DURING DRILLING OPERATIONS IT APPEARED THAT FREE WATER WAS ENCOUNTERED AT 12.5 FEET.	-5				72.5				
93.0		2	0.5S	27	MED. V. MOIST DK. GREY SILTY CLAY A-6	2	0.7S	17	
MED. V. MOIST BROWN SILT LOAM A-4	3		0.6S	22	ELEV. TAKEN FROM EXISTING BRIDGE DECK - ASSUMED ELEV. 100.0 FEET...	1	0.7B	25	
90.5					68.0				
SOFT TO MED. V. MOIST BROWN MOTTLED GREY SILT TO SILT LOAM A-4	3		0.4S	19	MED. V. MOIST GREY SANDY CLAY LOAM A-4	2	0.6B	17	
88.0					65.5				
MED. V. MOIST BROWN MOTTLED GREY SANDY CLAY LOAM A-4	6		0.6S	17	STIFF V. MOIST GREY SANDY CLAY LOAM A-4	22	1.3S	15	
85.0	-15				62.5				
MED. V. MOIST BROWN MOTTLED GREY SILTY CLAY A-4	3		0.8S	32	V. DENSE MOIST GREY SANDSTONE	100 BLOWS	3"		
83.0					STRUCTURE LOCATION: SE 1/4, NE 1/4, SECTION 35, T9S, R2E, 3RD P.M., WILLIAMSON COUNTY, IL.	-40	100 BLOWS	1-17.2"	
SOFT V. MOIST BROWN MOTTLED GREY SILT TO SILT LOAM A-4	2		0.4B	22					
80.5									
STIFF V. MOIST BROWN MOT. GREY SILT TO SILT LOAM A-4	2		1.2S	26					
78.0					55.4				
SEE NEXT COLUMN					-45	100 BLOWS	1"		

N - Standard Penetration Test - Blows per foot to drive 2" O.D. Split Spoon Sampler 12" with 140# hammer falling 30".
 Qu - Unclassified Compressive Strength - t/sf
 w - Water Content - percentage
 Type failure:
 B - Bulge Failure
 S - Shear Failure
 E - Estimated Value

Engineering Properties of Equality Formation

- low strength ($Q_u < 1.0 \text{ tsf}$)
- low blow count ($N < 7$)
- high water content

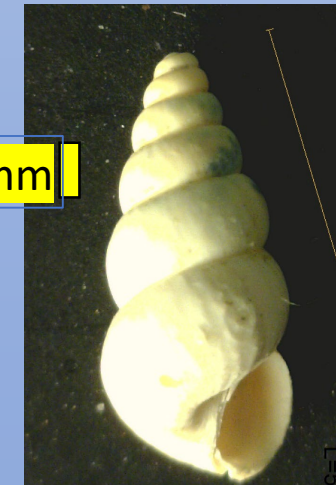


Hurst Section: glacial Lake Muddy



Equality Formation: near Hurst, Illinois

*Fossil amphibious
gastropod
(*Pomatiopsis lapidaria*)*



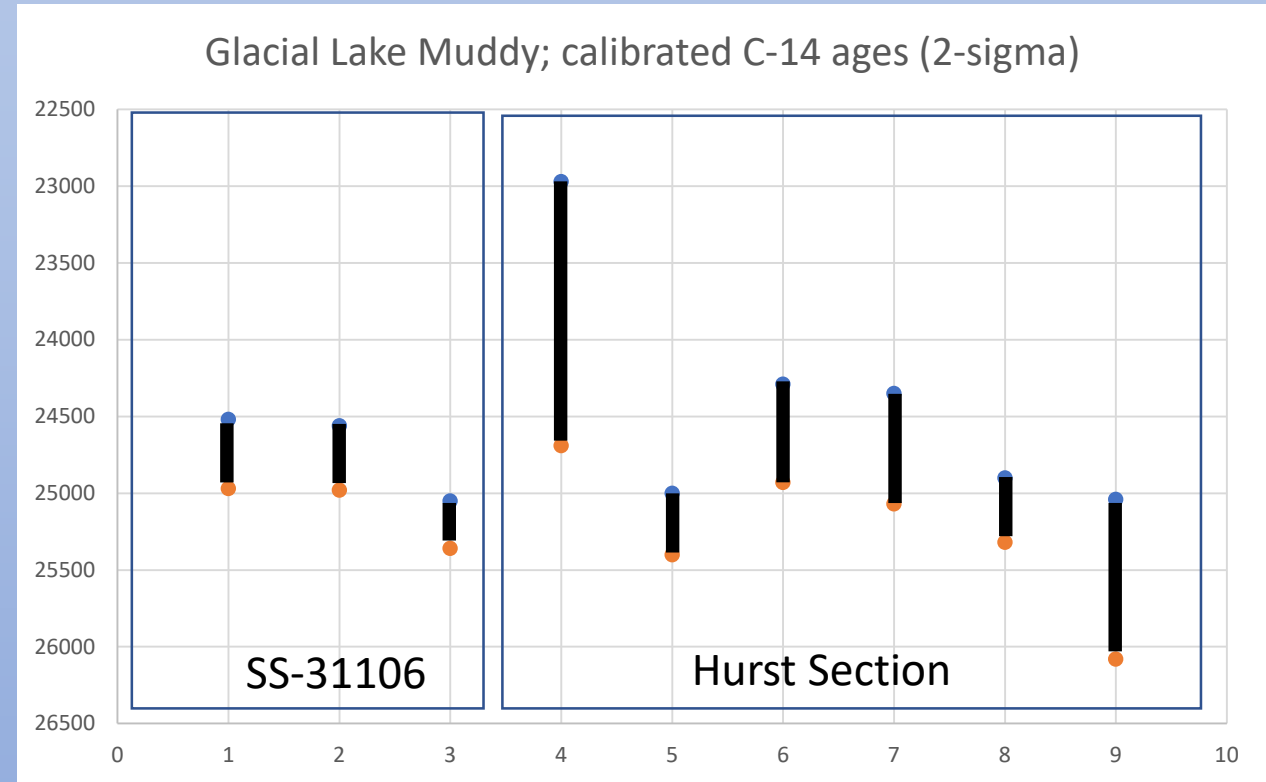
Pomatiopsis

AMPHIBIOUS

*- seasonal lakes
and floodplains*

Glacial Lake Muddy: AMS Radiocarbon Dating Results

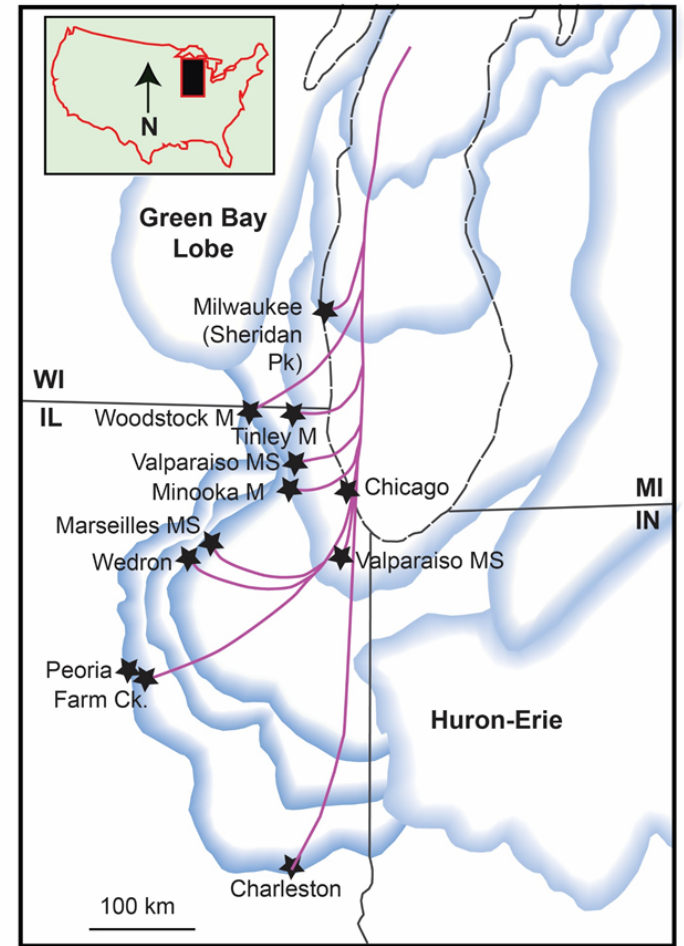
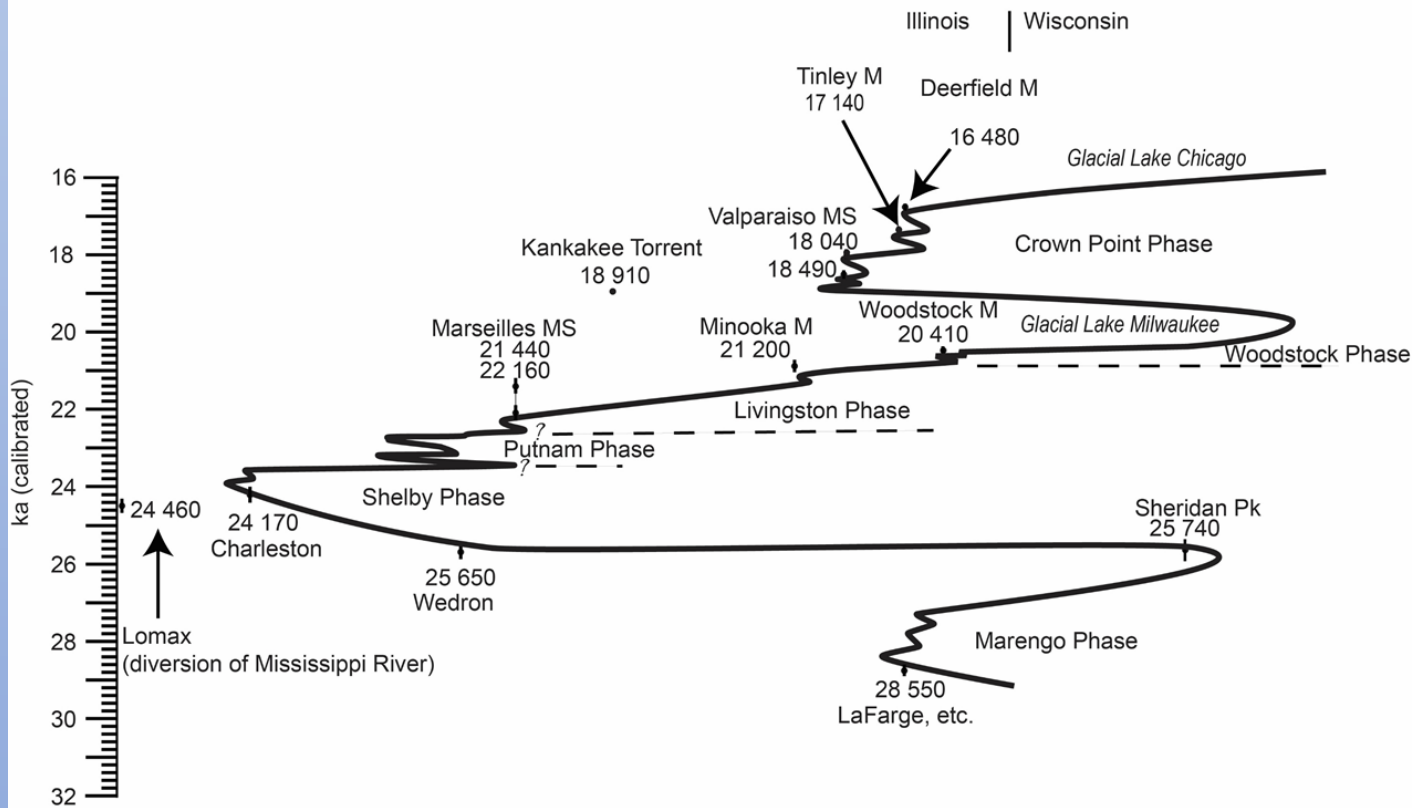
UCIA MS#	ISG S#	Site	Depth (ft)	Material	$\delta^{13}C$	\pm	RCYBP	\pm	Comments
237878	A5062	WLM-2f*	12	aquatic shell fragments	N.A	N.A	19790	360	small sample size
237879	A5063	WLM-2f*	17	two shells (Pomatiopsis lapidaria)	N.A	N.A	20910	80	
237880	A5064	WLM-2f*	18	shell (P. lapidaria)	N.A	N.A	20470	80	
237881	A5065	WLM-2f*	18	shells (P. lapidaria; Fossaria dalli)	N.A	N.A	20560	100	
237882	A5066	WLM-2f*	18	two shells (Pomatiopsis lapidaria)	N.A	N.A	20830	80	
237883	A5067	WLM-2f*	19	shells (Fossaria, Discus, Succineidae)	N.A	N.A	21350	270	small sample size
236386	A5000	SS-31106**	40-50	aquatic mollusk shell fragments	-9.7	0.1	20530	45	
236387	A5001	SS-31106**	70-80	Sphaerium (bivalve)	-9.2	0.1	20550	45	
236388	A5002	SS-31106**	80-90	aquatic mollusk shell fragments	-10.1	0.1	20920	50	



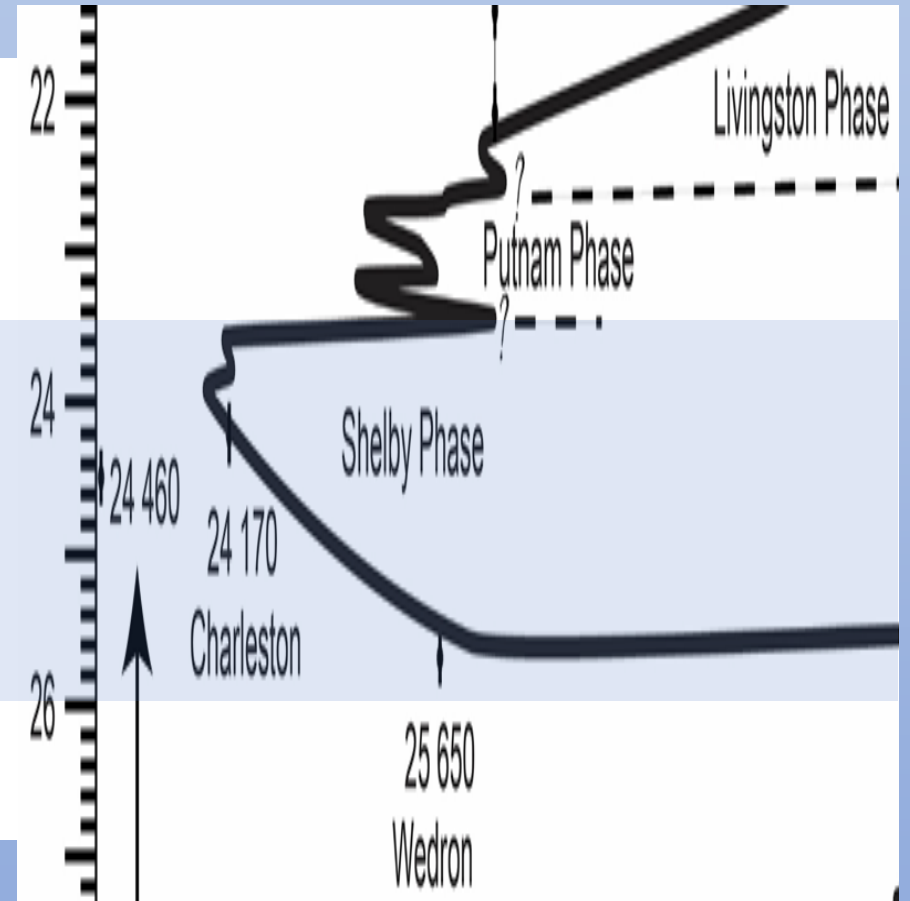
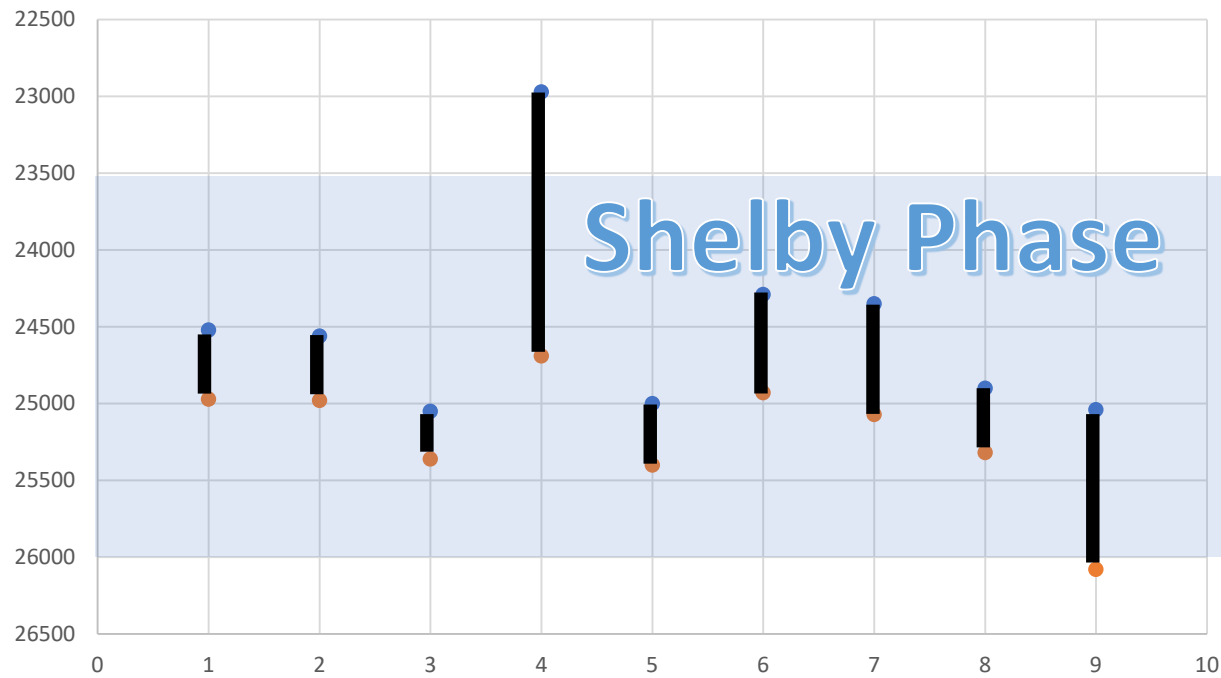
* WLM-2f is the HURST SECTION; (NE, Sect. 18, T8S, R1E); lat. 37.8298; long. -89.1359.

** SS # 31106 has an API # 121990212900 (NW, Sect. 3, T8S, R1E); lat. 37.8582; long. -89.0928.

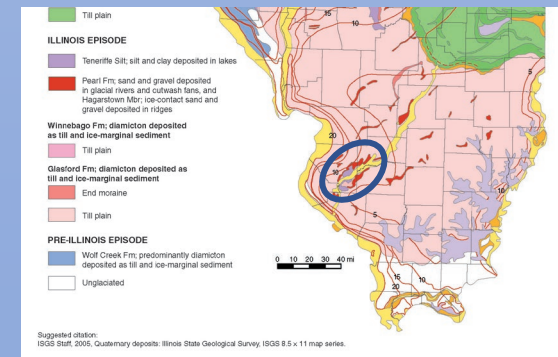
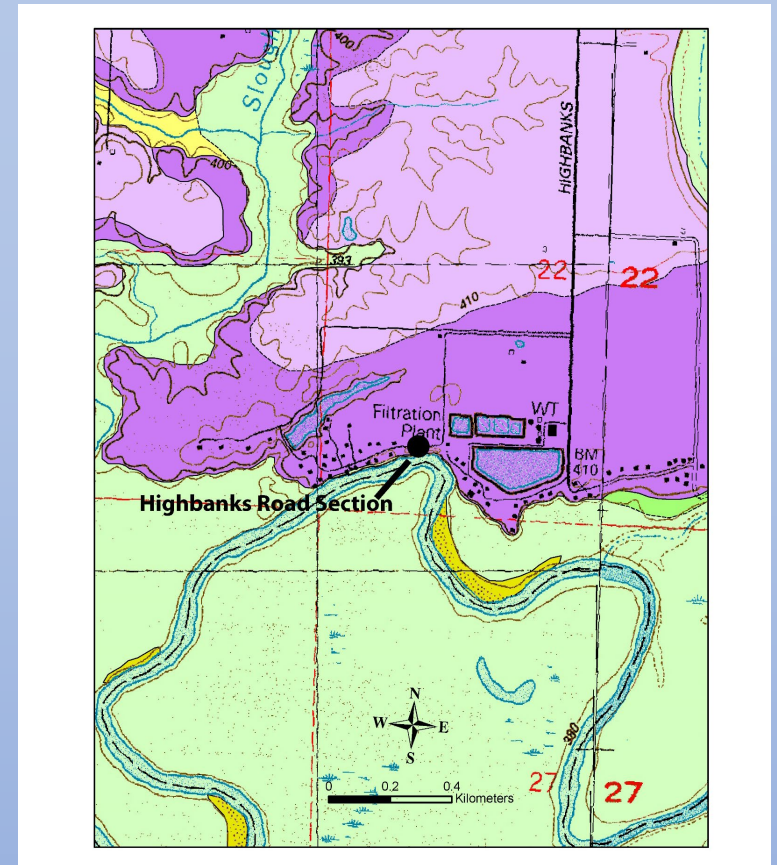
Wisconsin Episode Lake Michigan Lobe: TIME-DISTANCE DIAGRAM



Glacial Lake Muddy; Calibrated C-14 ages



Highbanks Road Section (glacial Lake Kaskaskia)

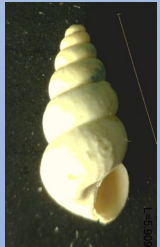


Highbanks Road Section (Midwest FOP 2011 field trip)



20.5 ka (C-14; *Stagnicola*)

24.7 cal ka



19.0 ka (C-14; *Stagnicola*)

22.8 cal ka

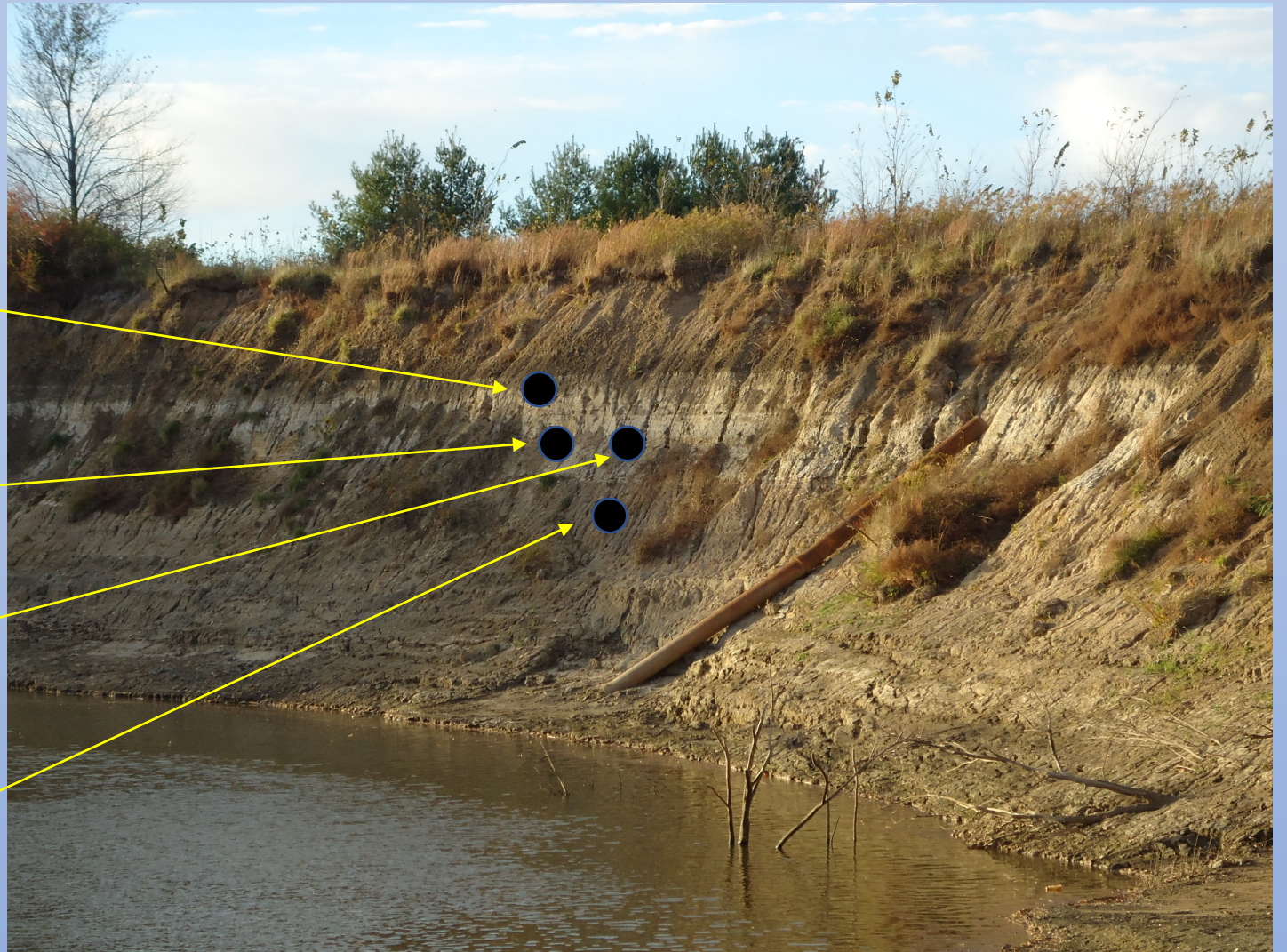
20.0 ka (C-14; *Pomatiopsis*)

24.0 cal ka



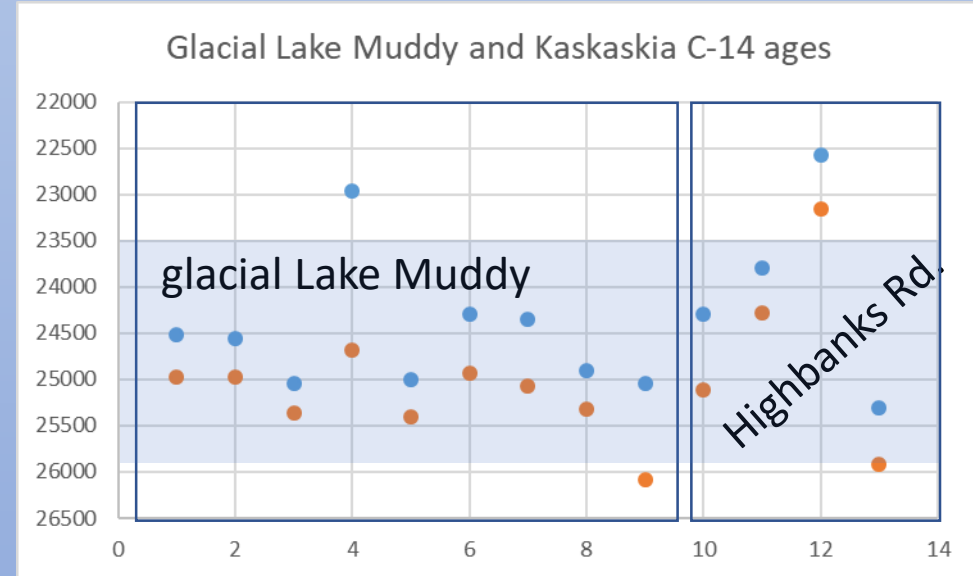
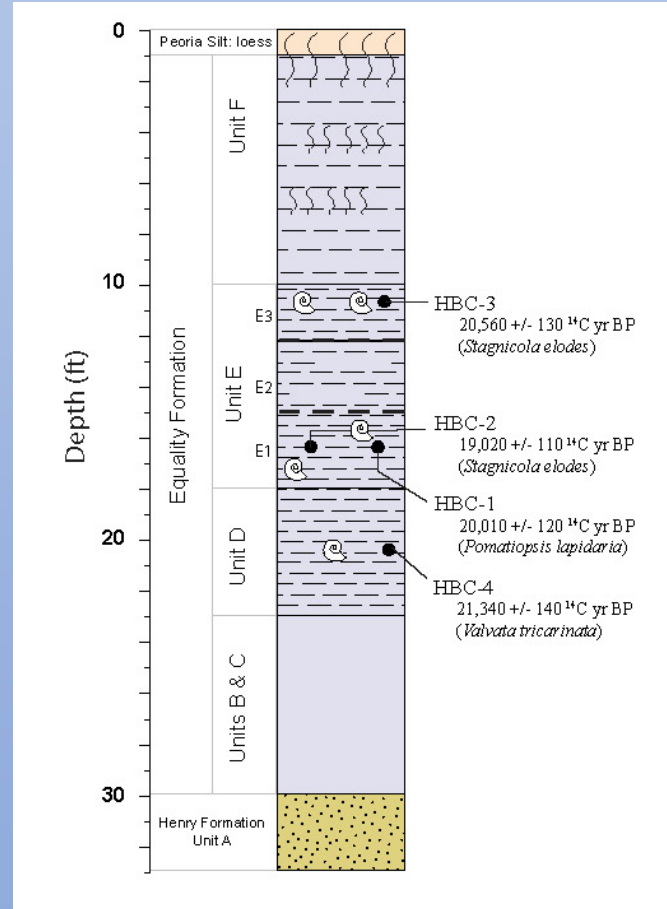
21.3 ka (C-14; *Valvata*)

25.6 cal ka



LGM ages for middle of section

Highbanks Road Section (glacial Lake Kaskaskia)

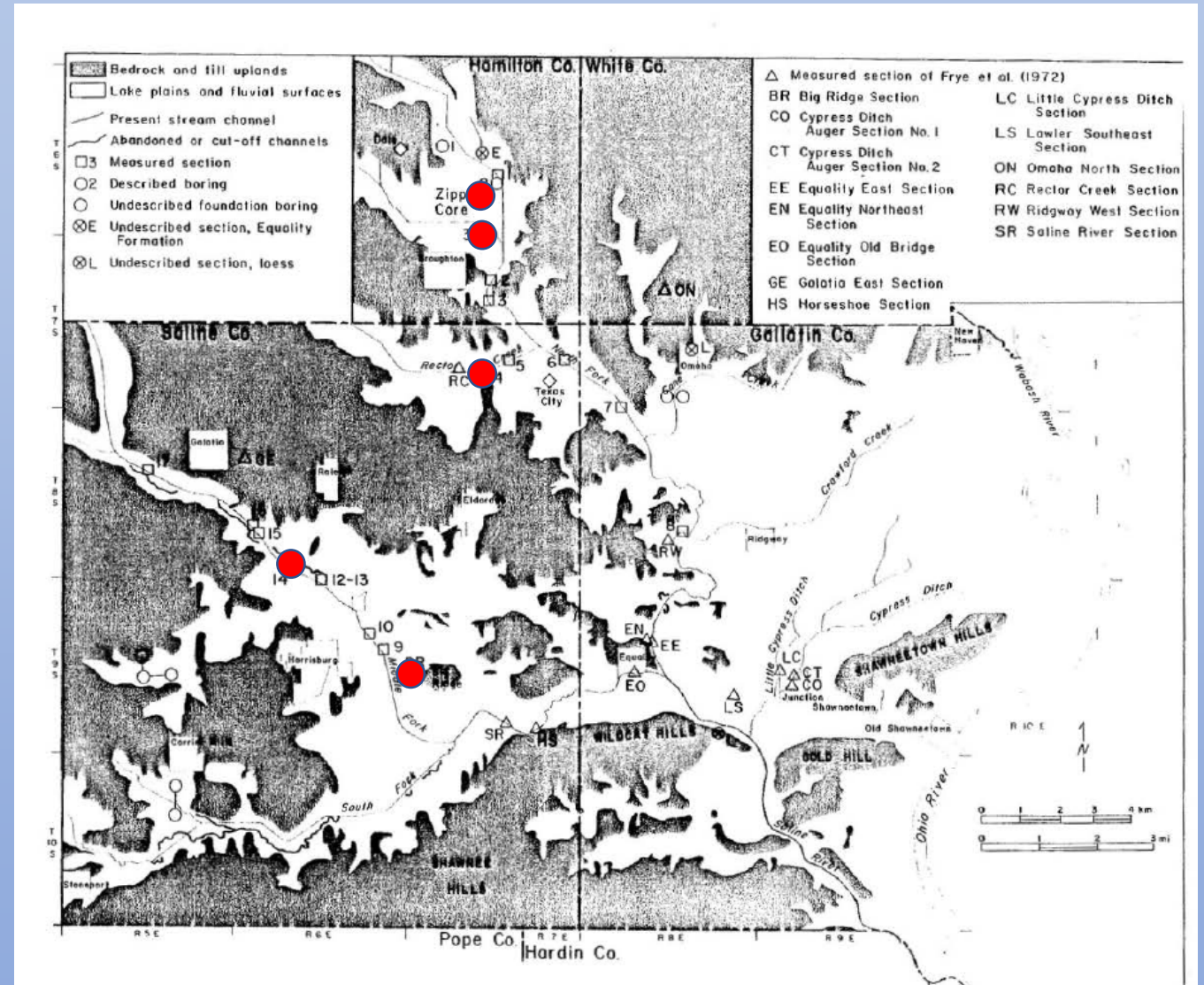
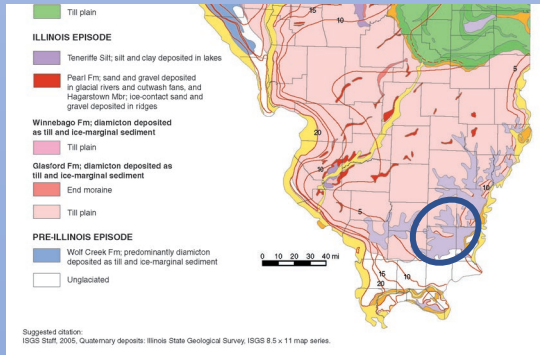
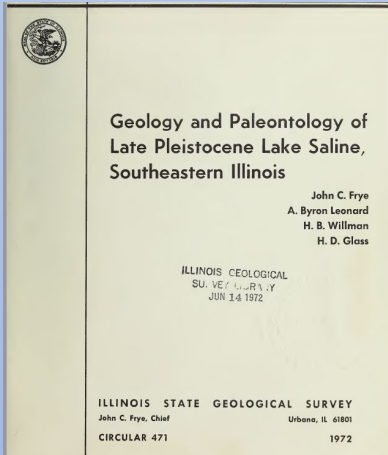


Glacial Lake Saline studies

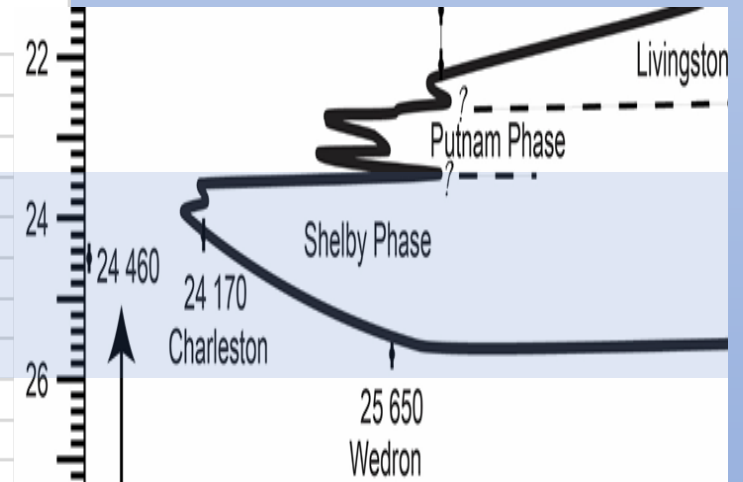
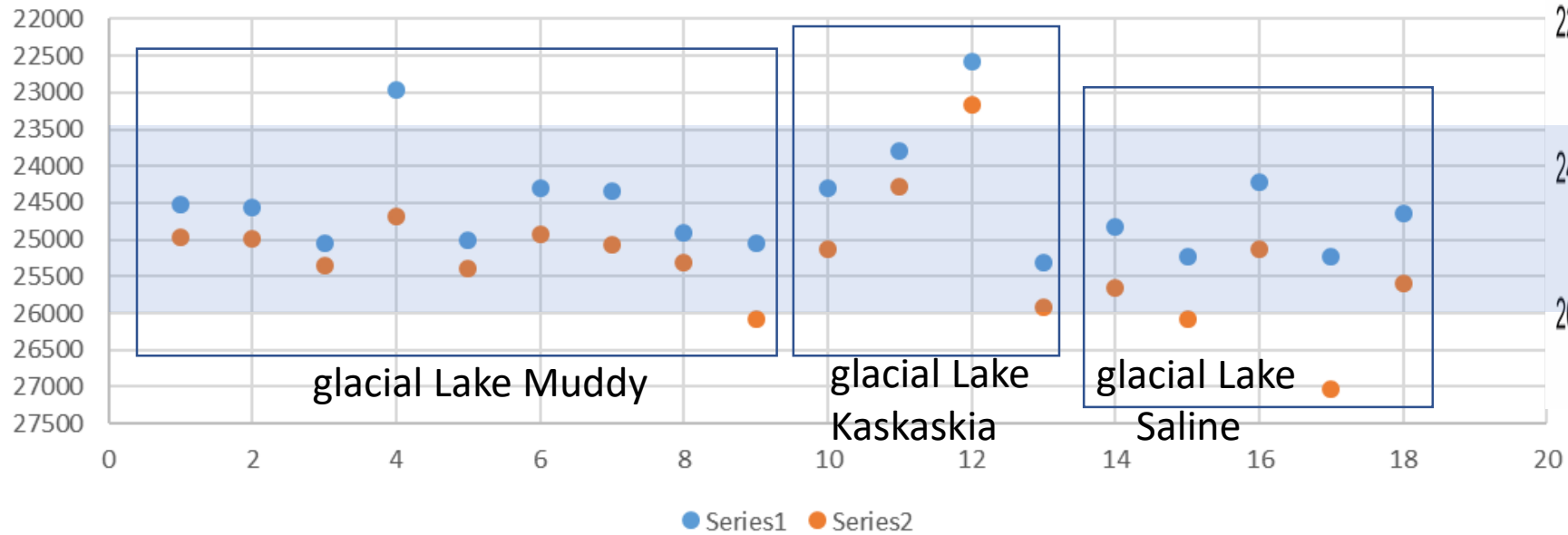
Frye et al., 1972

Heinrich, M.S., 1982

GEOMORPHOLOGY AND SEDIMENTOLOGY OF PLEISTOCENE LAKE SALINE, SOUTHERN ILLINOIS



Glacial Lake Muddy, Kaskaskia, and Saline C-14 ages





Quaternary Deposits

HUDSON EPISODE

Cahokia Fm; river sand, gravel, and silt

WISCONSIN EPISODE

Mason Group

Thickness of Peoria and Roxanna Silts; silt deposited as loess (5-ft contour interval)

Equality Fm; silt and clay deposited in lakes

Henry Fm; sand and gravel deposited in glacial rivers, outwash fans, beaches, and dunes

Wedron Group

(Tiskilwa, Lemont, and Wadsworth Fms) and Trafalgar Fm; diamicton deposited as till and ice-marginal sediment

End moraine

Till plain

ILLINOIS EPISODE

Teneriffe Silt; silt and clay deposited in lakes

Pearl Fm; sand and gravel deposited in glacial rivers and outwash fans, and Hagarstown Mbr; ice-contact sand and gravel deposited in ridges

Winnebago Fm; diamicton deposited as till and ice-marginal sediment

Till plain

Glasford Fm; diamicton deposited as till and ice-marginal sediment

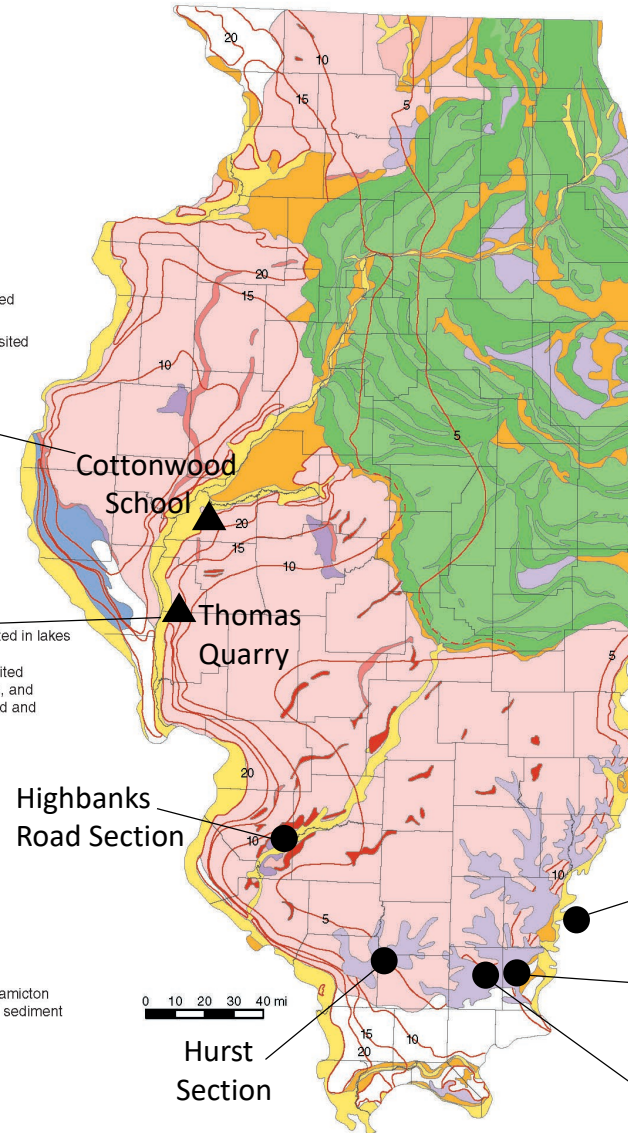
End moraine

Till plain

PRE-ILLINOIS EPISODE

Wolf Creek Fm; predominantly diamicton deposited as till and ice-marginal sediment

Unglaciated



Suggested citation:
ISGS Staff, 2005, Quaternary deposits: Illinois State Geological Survey, ISGS 8.5 x 11 map series.

Peoria Silt (LGM) Chronology

[Illinois Valley sourced loess]

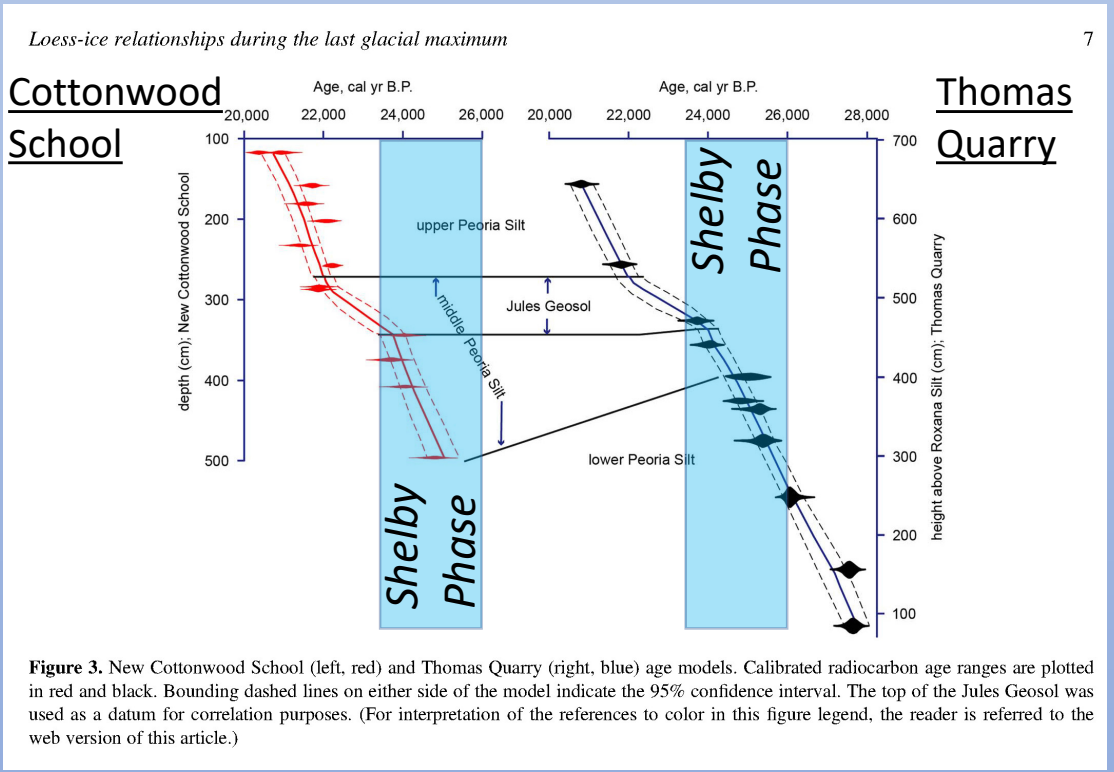
studied by Andy Nash (QR, 2018)

Beste-1 Core

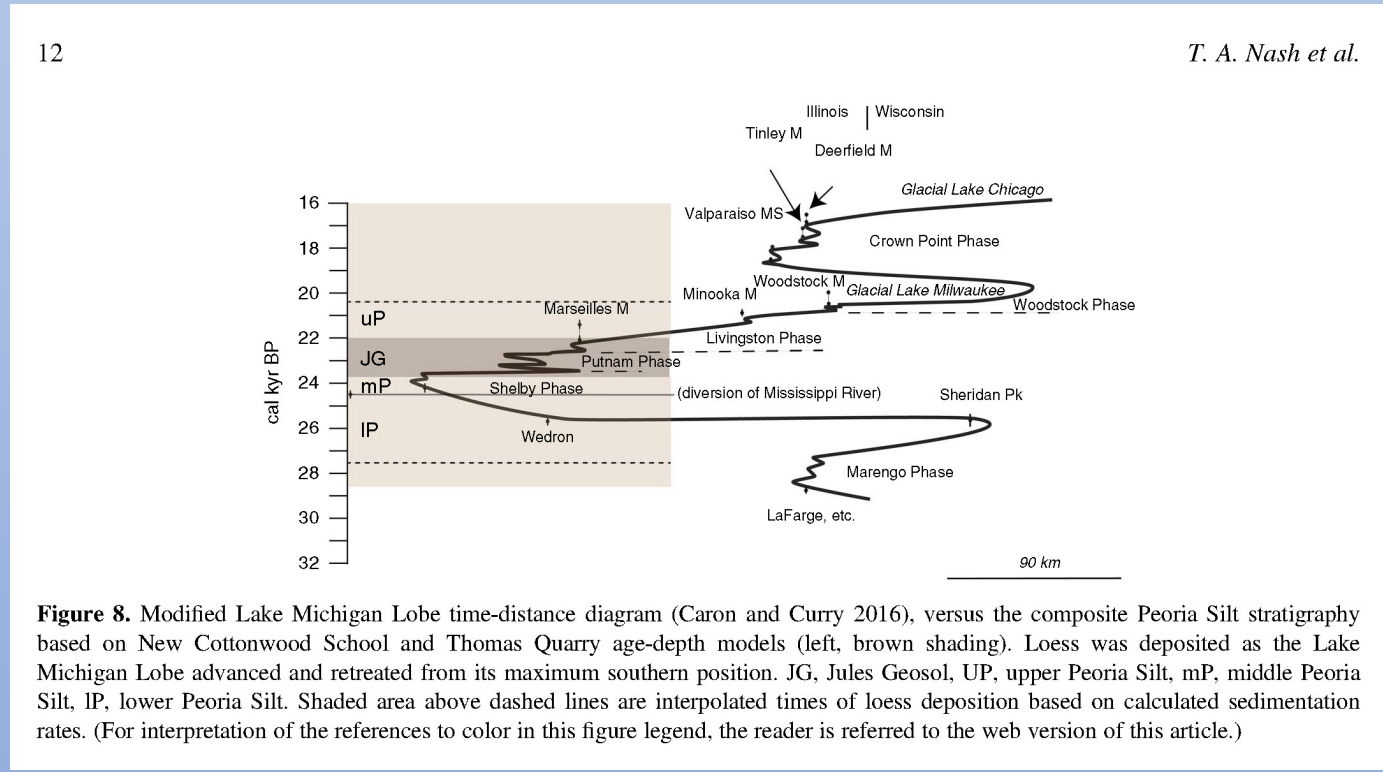
Little Cypress
Ditch

Big Ridge
Section

CORRELATIONS WITH RAPID LOESS SEDIMENTATION IN ILLINOIS (during LGM)

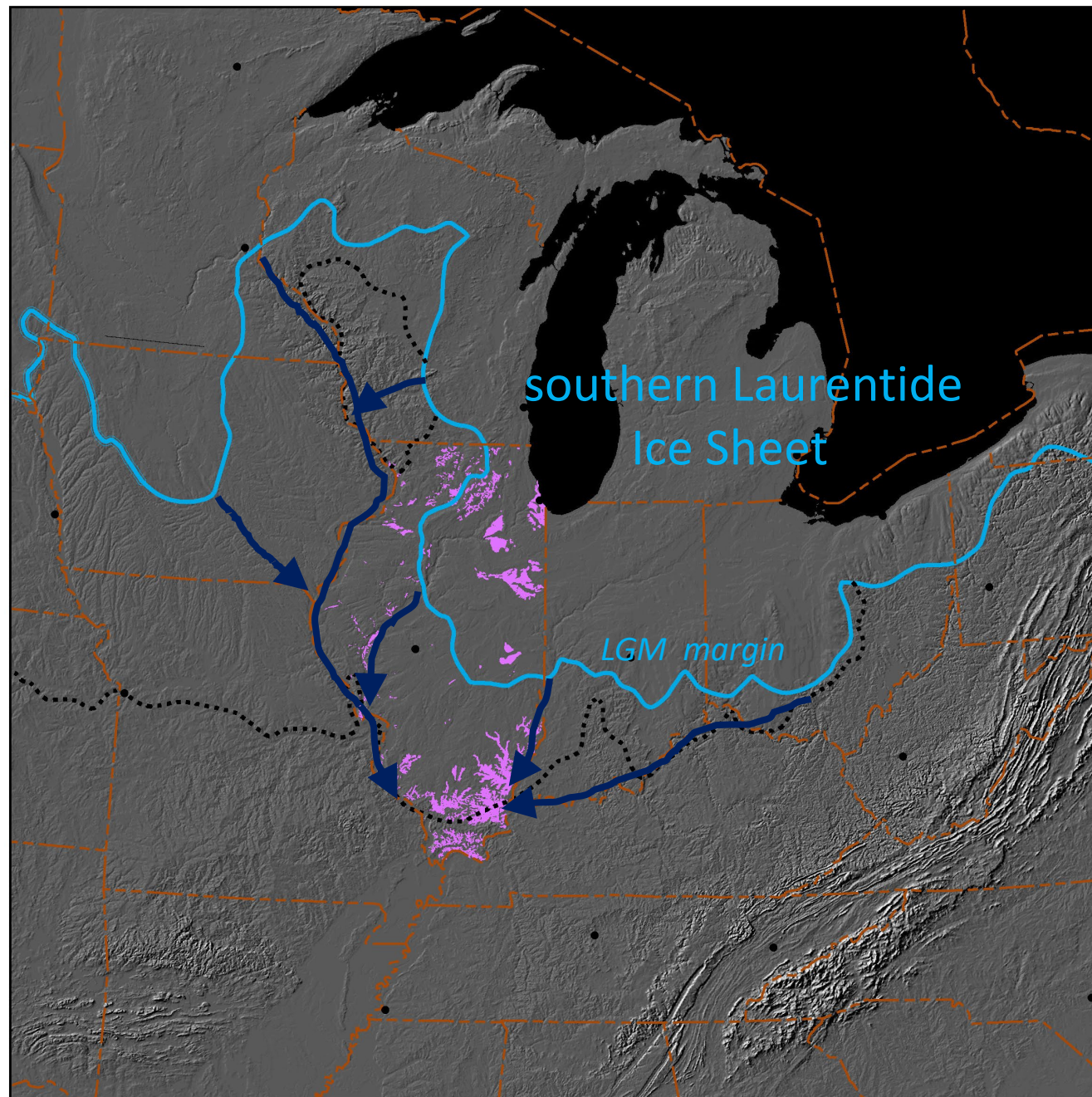


from Nash et al., 2018 (Illinois River Valley loess)



- rapid loess sedimentation during Shelby Phase (26 to 23.5 cal ka)
- reduction in sedimentation and formation of Jules Geosol immediately afterwards

accelerated
slackwater
lake
deposition
was
coincident
with **glacial
advance to
maximum
extent**, and
times of
**rapid loess
accumulation**



SUMMARY / CONCLUSIONS

- fossiliferous zones of slackwater lacustrine sediment represent times of rapid sedimentation in response to large valley aggradation
- at least 3 significant pulses of sedimentation (NOT UNIFORM) based on C-14 age groupings
 - 45 - 40 cal ka [MIS 3]
 - 26 – 23 cal ka [Shelby Phase, LGM] -- rapid aggradation
 - younger period [low terrace]



- accelerated slackwater deposition (Shelby Phase) is recorded from 3 glacial lakes (Kaskaskia, Muddy, and Saline)
- accelerated slackwater deposition is coincident with accelerated loess deposition and advance of Lake Michigan and Huron-Erie Lobes to maximal extents (e.g., Shelbyville Moraine)

