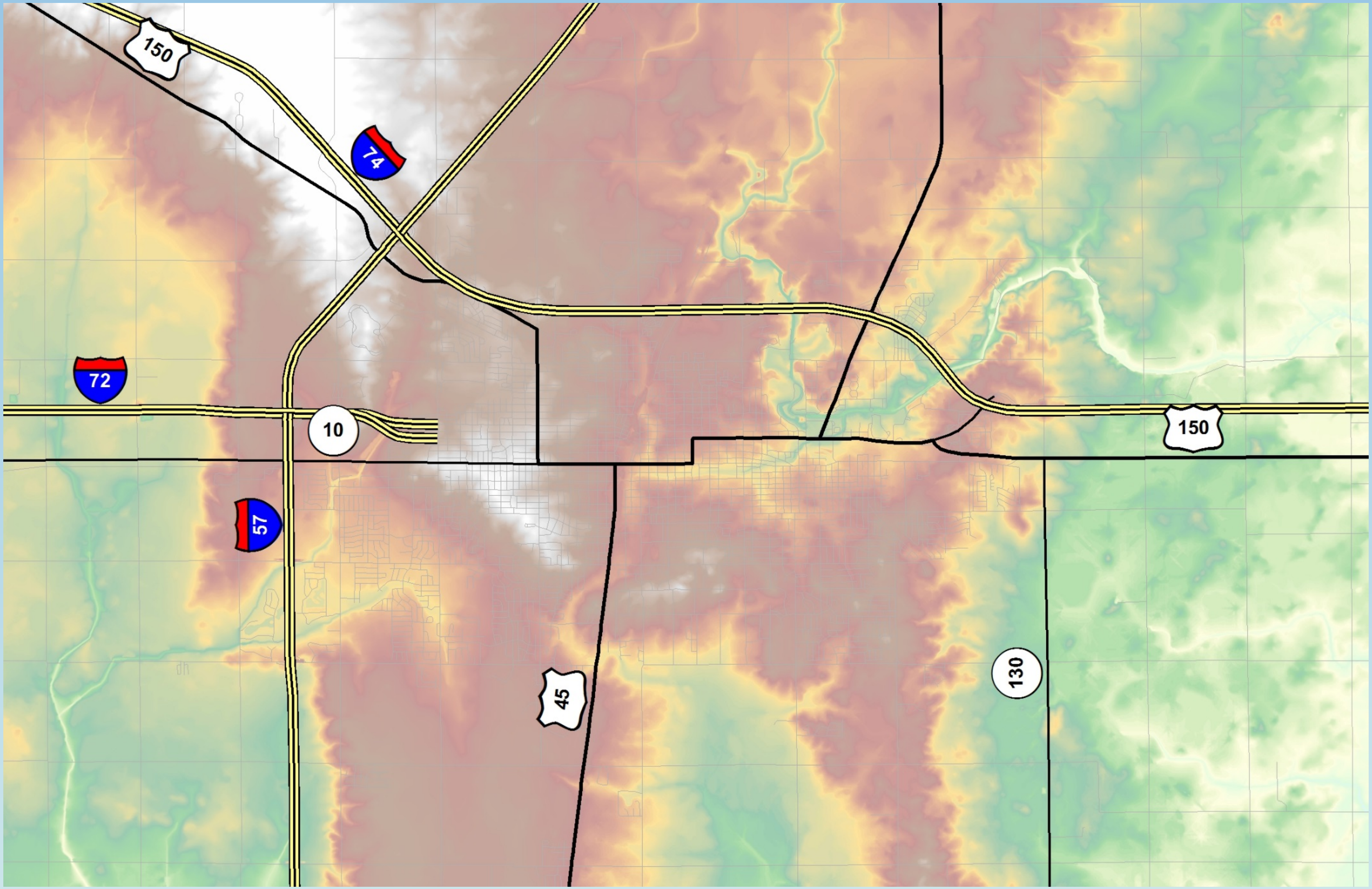
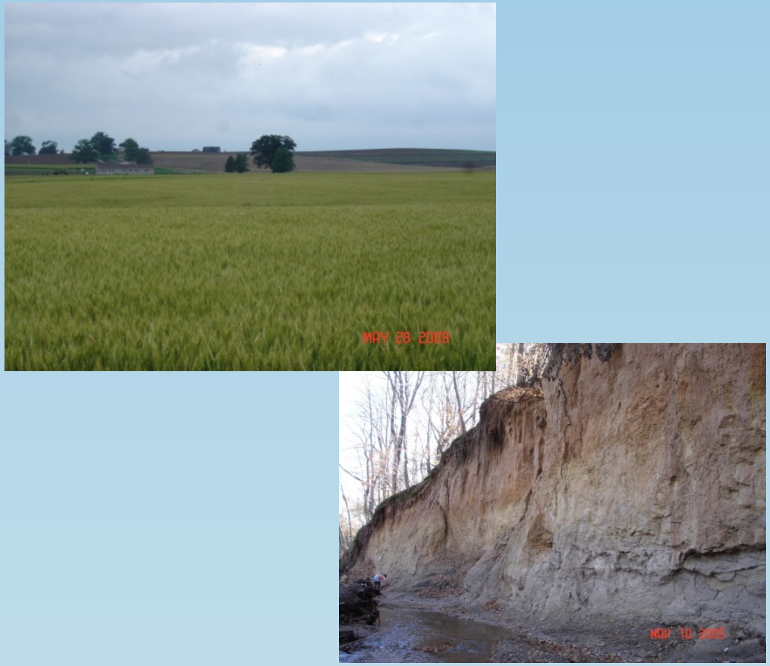


Champaign-Urbana DEM (digital elevation map)

Causes of Pleistocene glaciation; early discovery and evidence



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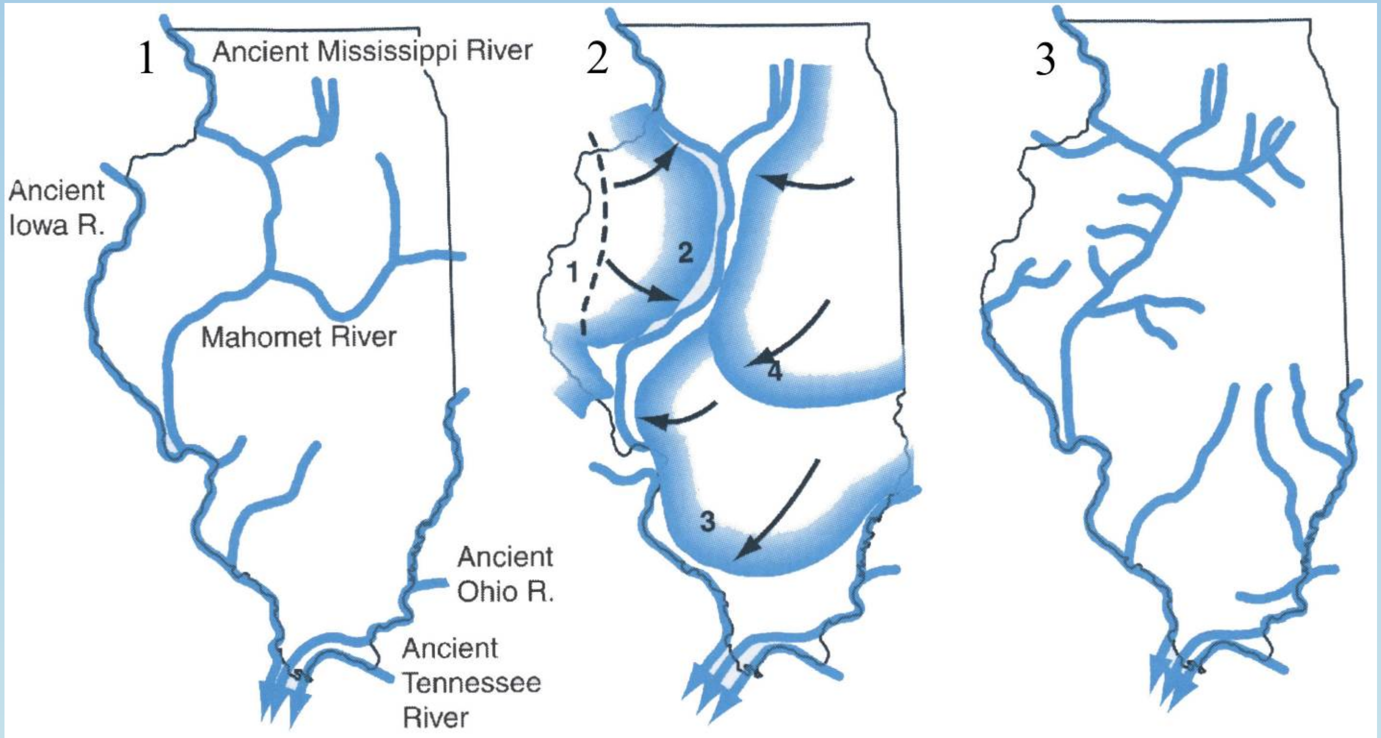
ILLINOIS STATE
GEOLOGICAL SURVEY
PRAIRIE RESEARCH INSTITUTE

- Finish Week 1 (pre-Illinoian / maps)
- Causes of Glaciations
- Early Discovery and Evidence

pre-Illinois Episode



~ 800,000 to 420,000 years ago (mid-Pleistocene)

pre-Illinoian deposits

Paddock Creek Section, Prairietown 7.5’ Quadrangle, Madison Co., IL

pre-Illinoian till

Banner till ---- Ames Quadrangle (AMS-2), Randolph County

pre-Illinoian deposits

Robbins Core, St. Clair County, IL

Wisconsinan loess

Sangamon Geosol (interglacial soil)

Illinoian till

Petersburg Silt (Illinoian)

Yarmouth Geosol (interglacial soil)

Banner Formation (glacial till)

Harkness Silt (lacustrine and loess)

Canteen Member (preglacial alluvium)

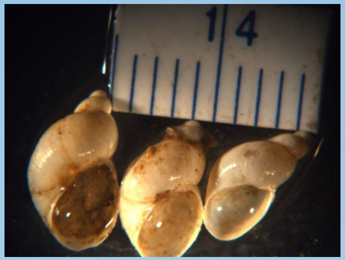
bedrock

PRE-ILLINOIAN

Amino Acid Geochronology: Robbins Core --- St. Clair County, IL

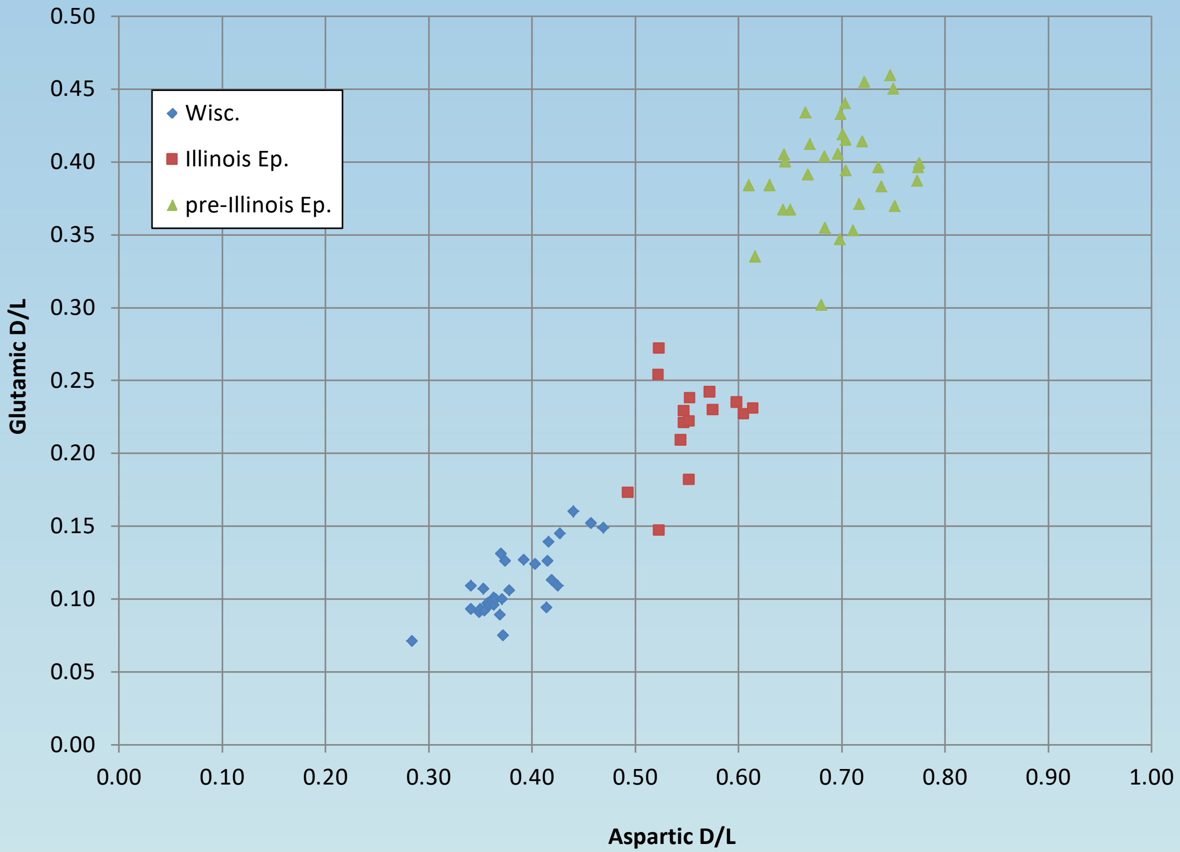
Petersburg Silt (immediately below Illinoian till; 82 ft.); aquatic-amphibious fauna

Harkness Silt (immediately below pre-Illinoian till; 144 ft.); terrestrial fauna

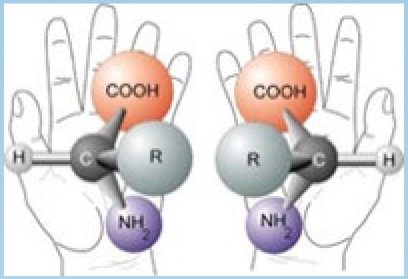


Amino acid geochronology

Succinea only



from various sites in central and southern Illinois



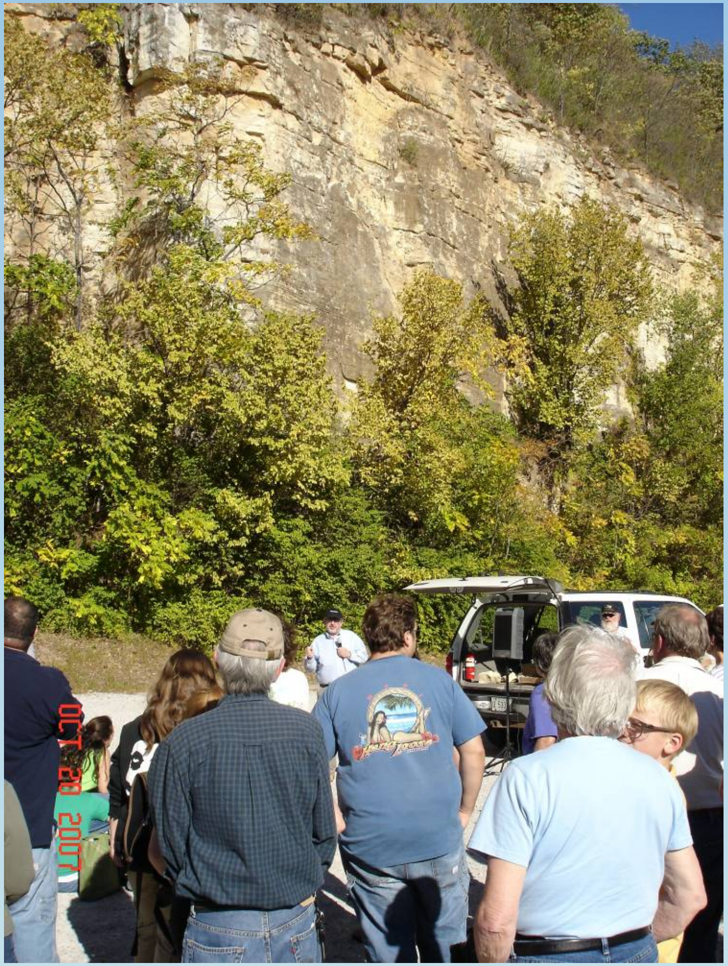
***amino acid racemization**: diagenetic interconversion of L-amino acids to their D-isomeric configurations;*

- *Rate of conversion is a function of **time** and **temperature history***
- *Can give an estimate of age within a geographic area*

-- data from Dr. Rick Oches, Bentley University

Bedrock Exposures in Unglaciated or Thin Drift Areas

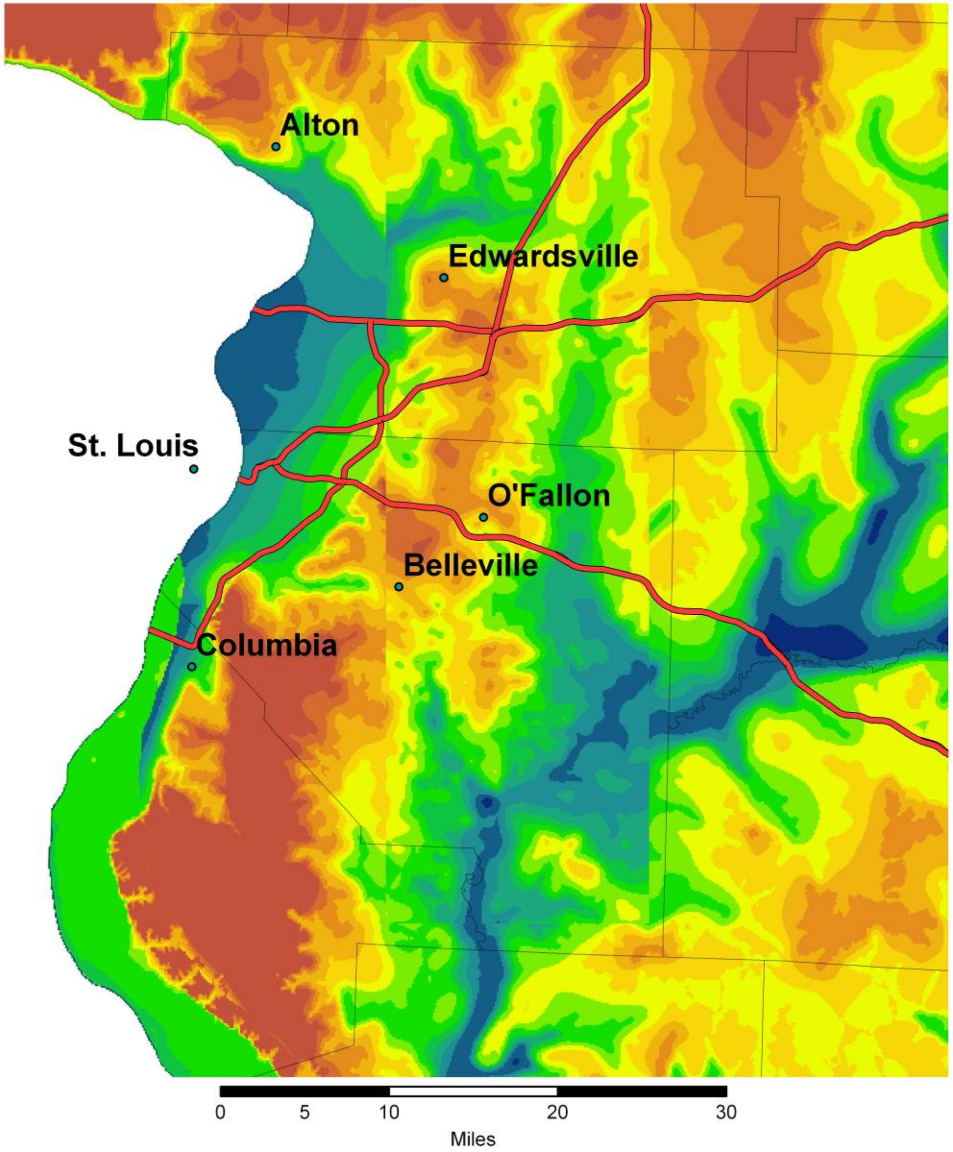
near Ames, Randolph County IL

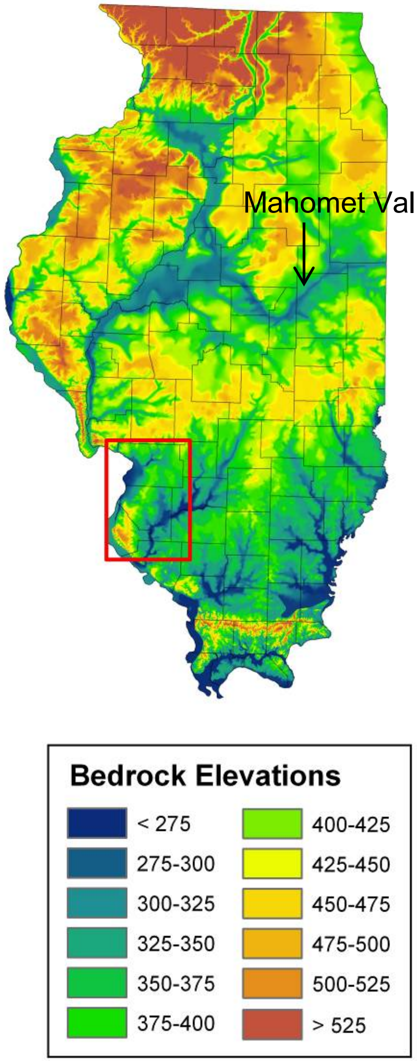


Grafton, Jersey County IL

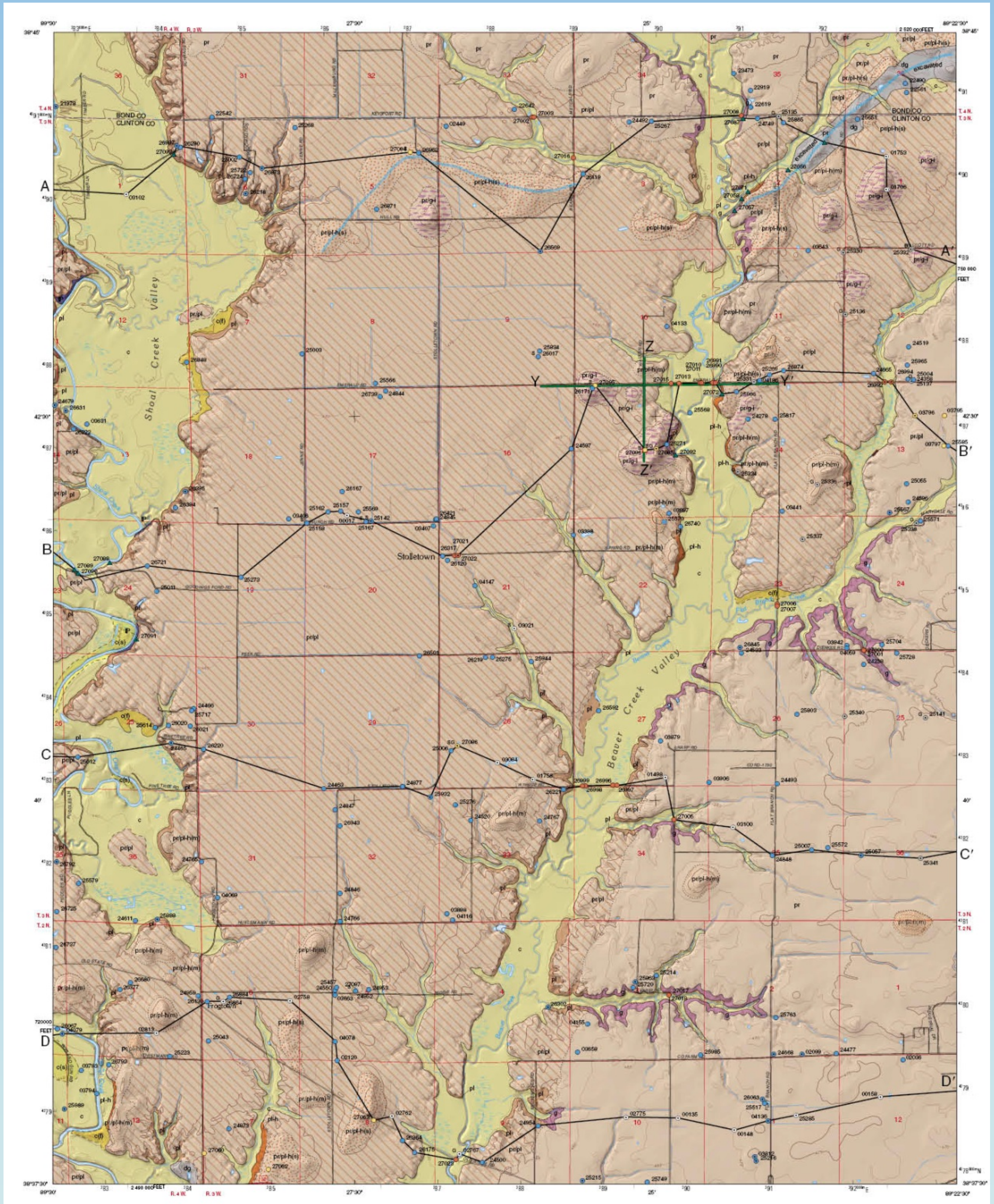
Maps and Cross-Sections

Bedrock Surface Topography (below Q deposits)



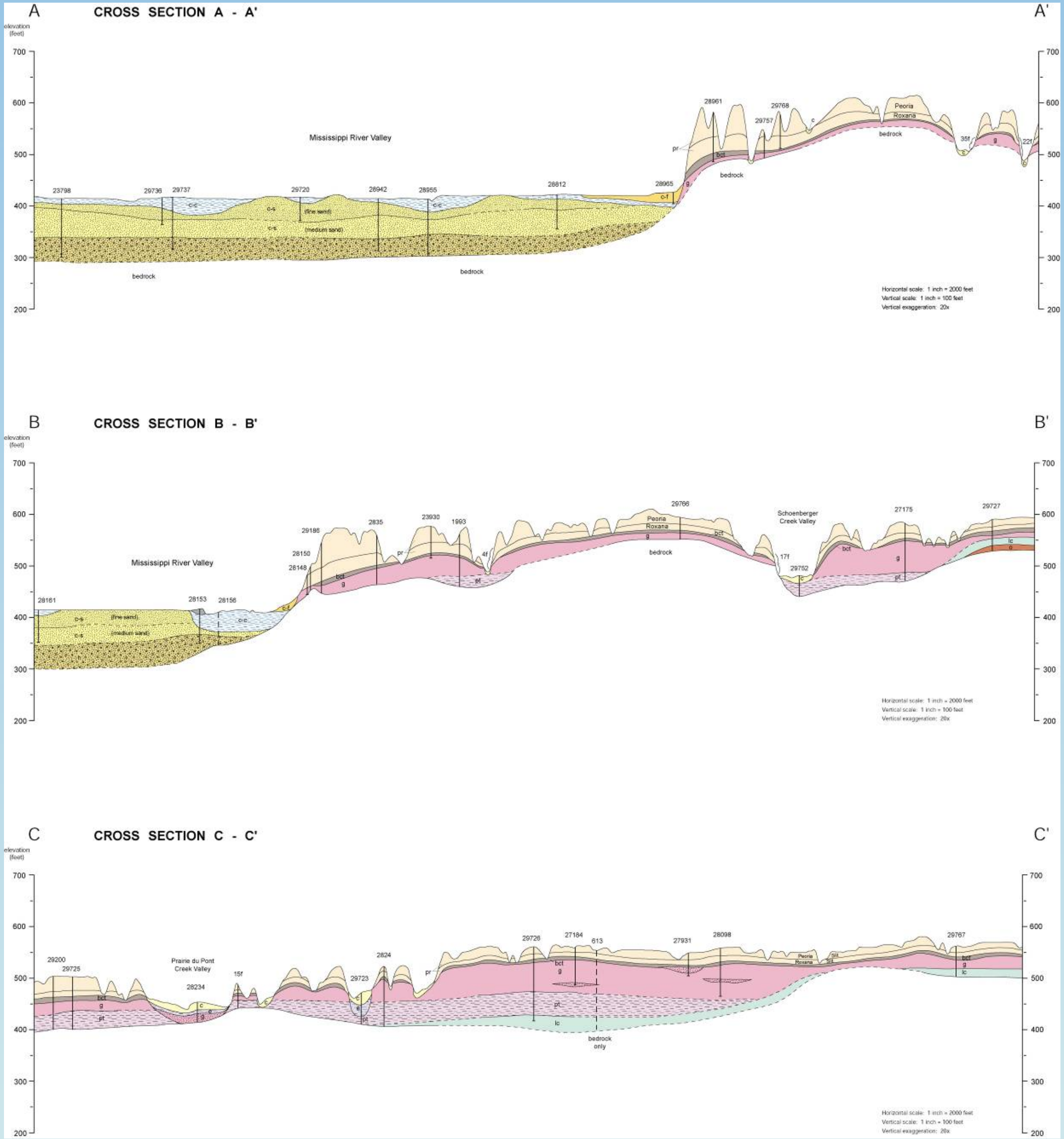


legend for SW Illinois map



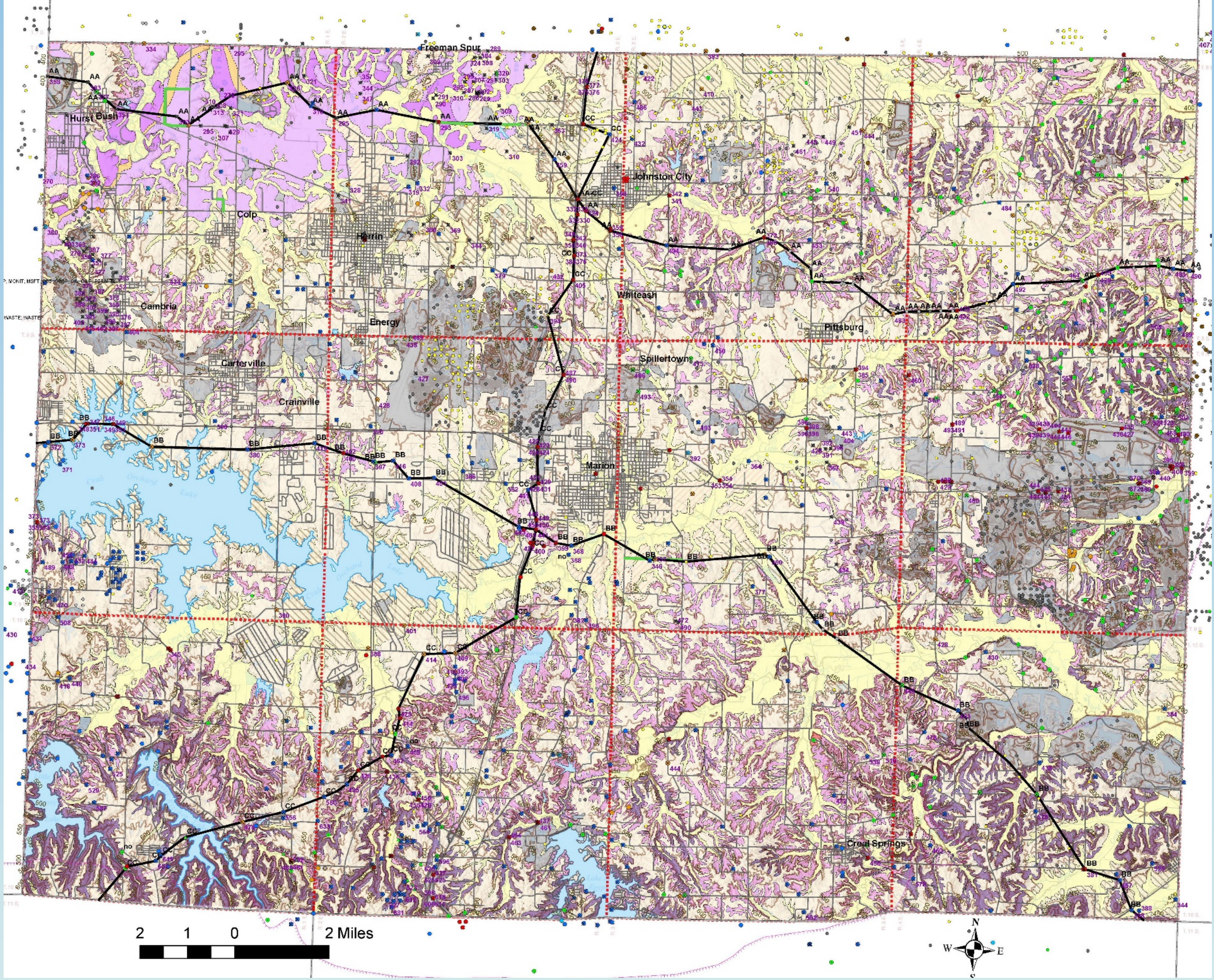
Maps of Surficial (Quaternary) Geology

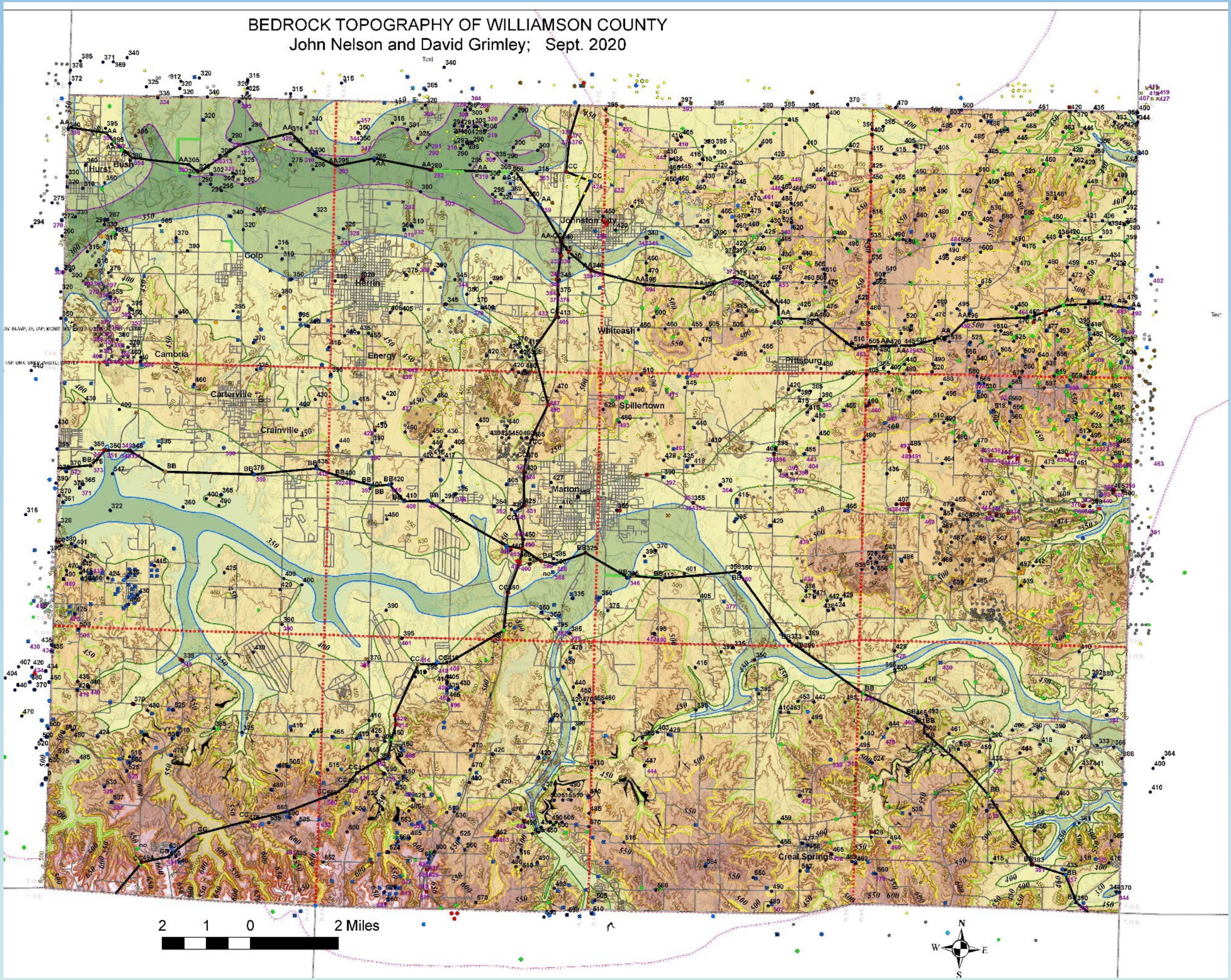
Cross-Sections of Quaternary Deposits



SURFICIAL GEOLOGY OF WILLIAMSON COUNTY

David Grimley, Leon Follmer and John Nelson; Sept. 2020





BEDROCK TOPOGRAPHY OF WILLIAMSON COUNTY

John Nelson and David Grimley; Sept. 2020

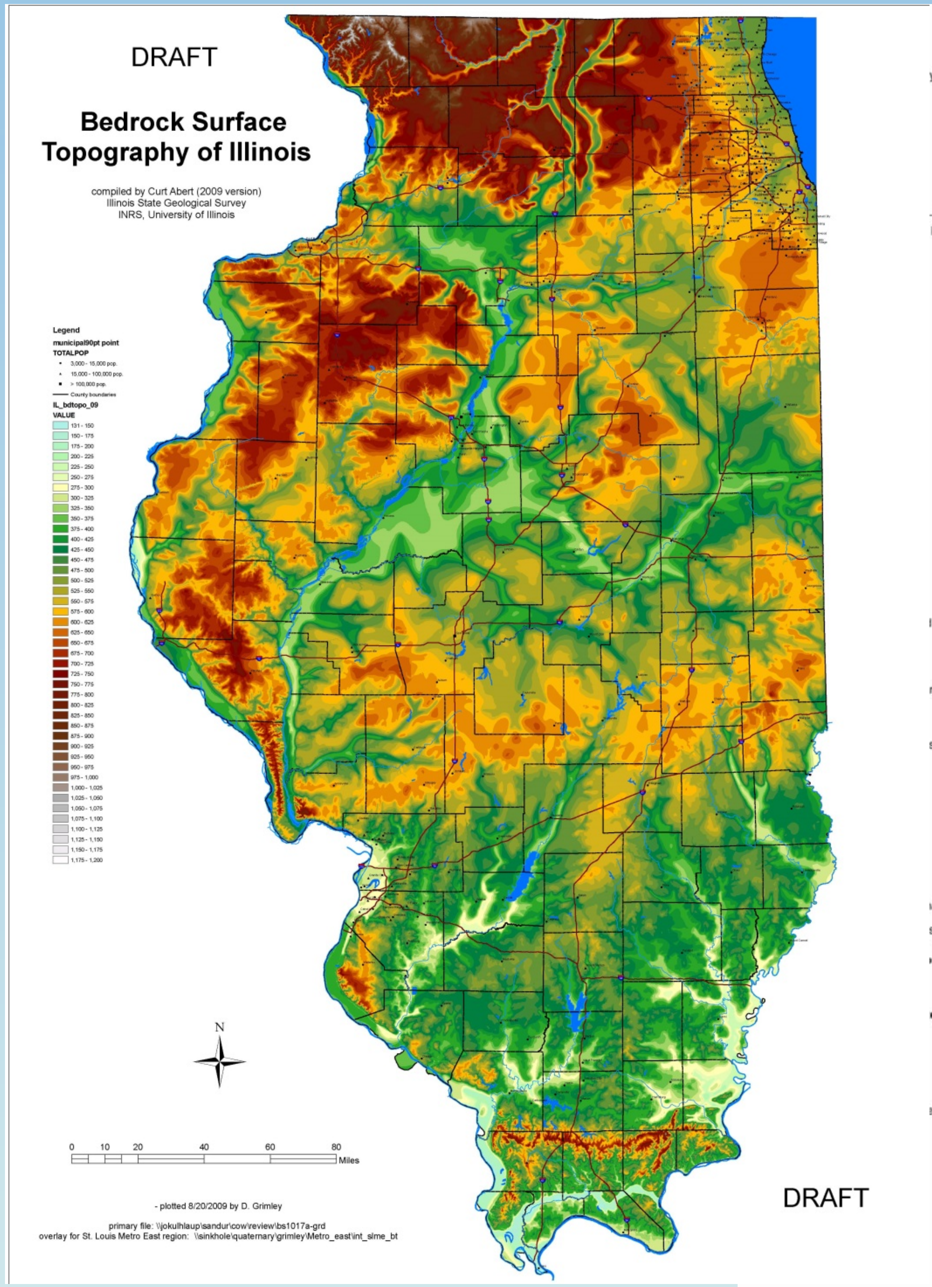
Principal Surficial Mapping Units: St. Louis Metro East Area

Unit	**Material**	**Color / Sed.**	**Paleon-tology**	**Comp./ Mineralogy**	**Eng. Props.**	**Distri-bution**	**Origin**	**Age**
Cahokia Fm.	Clay, silt, sand (mapped separately)	**Fines upward**	Deciduous wood	Leached of carbonates	Soft (low Qu); high w%	Meand. stream patters	Alluvium	Post-glacial
Equality Fm.	Silty clay, silt, fine sand	Crudely strat;grey -tan-pink	Spruce wood ; ostracodes	High expandables	**Low Qu (< 1.5);** **w 20-30 %**	Large trib. valleys and terraces	Lake sediment	Wisconsin Episode
Henry Fm.	**Sand and gravel**	Stratified	Spruce wood	Calcareous		Mississippi Valley; braided	Outwash	Wisconsin Episode
Peoria Silt	Silt	Massive Tan	Terrestrial gastropods; Mammoth	Dolomitic, high expandables	Low Qu and blow count	Uplands	Loess	Wisconsin Episode
Roxana Silt	Silt	Massive **Pinkish**	Terrestrial gastropods **(*Allogona*)**	Rel. high expandables and kaolinite	Low Qu and blow count	Uplands	Loess	Wisconsin Episode
Glasford Fm.	**Loamy diamicton** (some sand)	Tan to grey	Incorporated fossils	High dolomite, 40-60 % illite	**Qu > 1.5** **w 15-22 %**	Uplands and trib. valleys	Till and ice marginal	Illinois Episode
Peters-burg Silt	Silt to silty clay loam	Crudely strat. Tan to grey	Spruce wood; aquatic and terrestrial gastropods (***Pomatiopsis***)	Generally similar to Glasford	Moderate Qu and w	Buried valleys	Lake sediment and loess	Illinois Episode
Banner Fm.	**Silty clay loam diamicton** (some sand)	Orange – brown to grey	Incorporated fossils	High calcite and expandables	**Qu > 1.5** **w 20-26 %**	Buried valleys	Till and ice marginal	pre-Illinois Episode

Sangamon Geosol

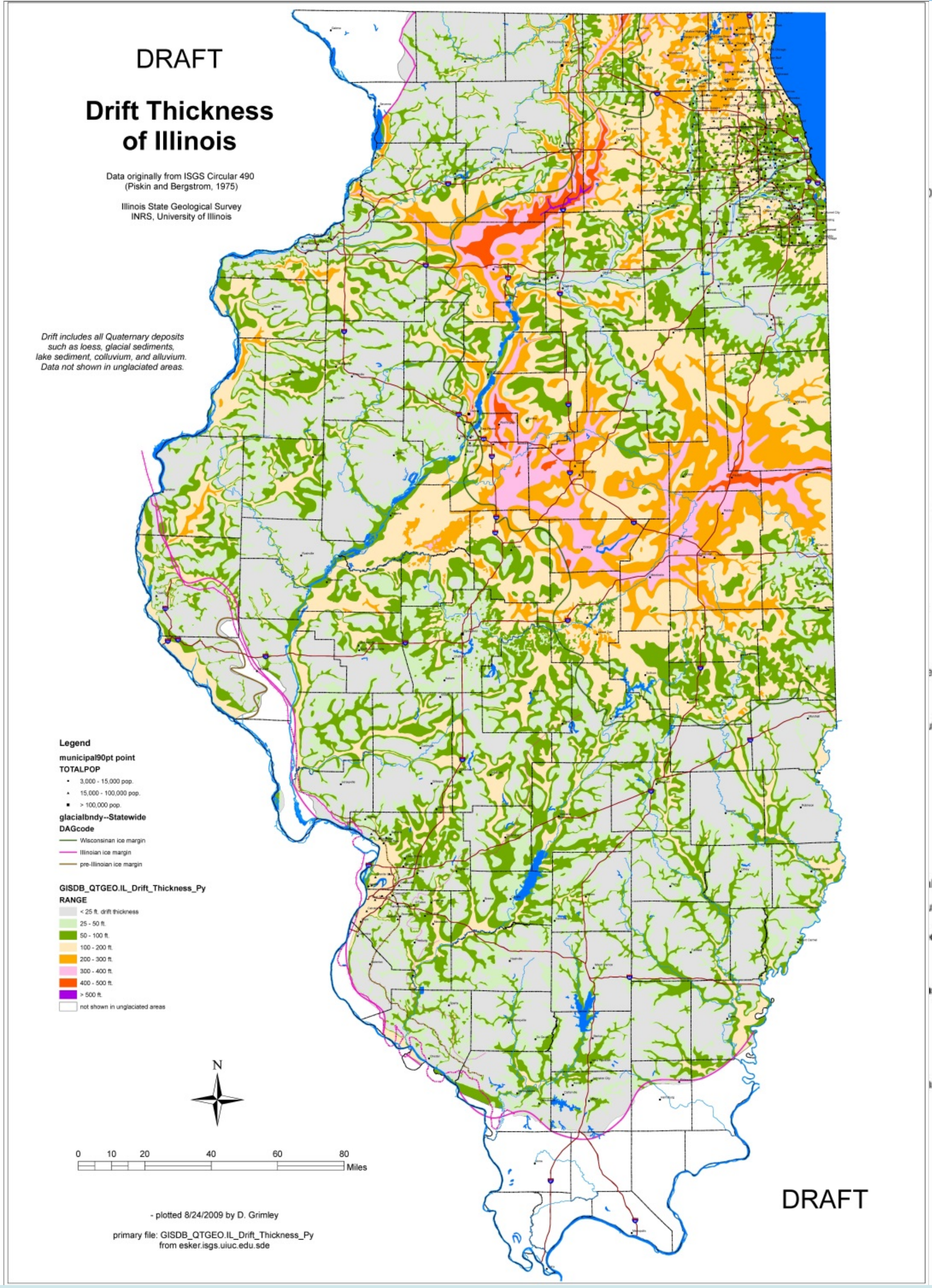
Yarmouth Geosol

Bedtopo Map

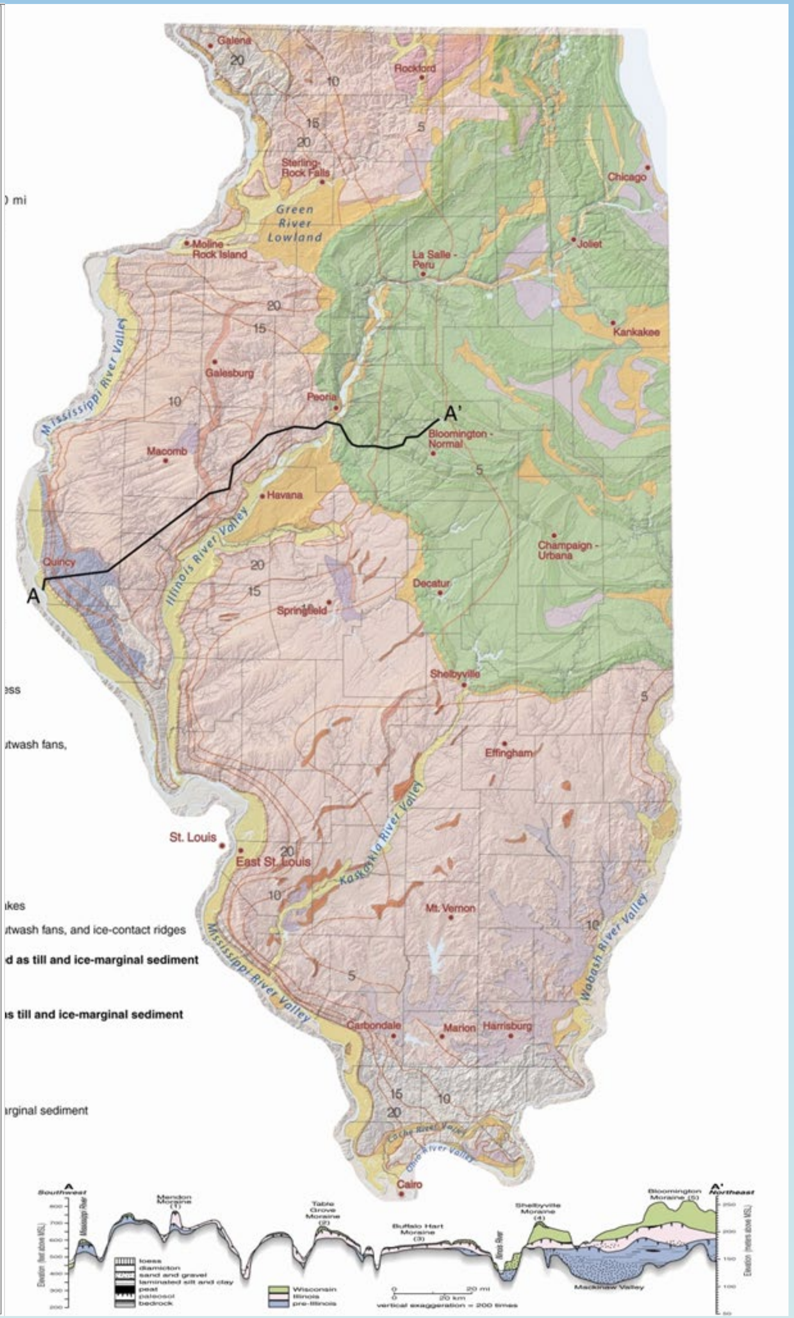


Quaternary Deposit Map

Thickness of Quaternary Deposits

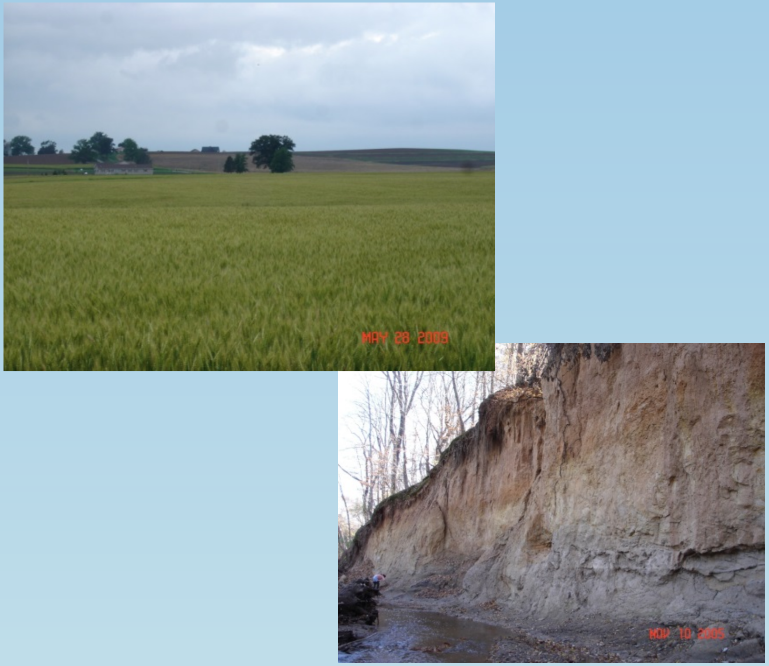


Quaternary Deposit Map



Questions ?

Causes of Pleistocene glaciation; early discovery and evidence



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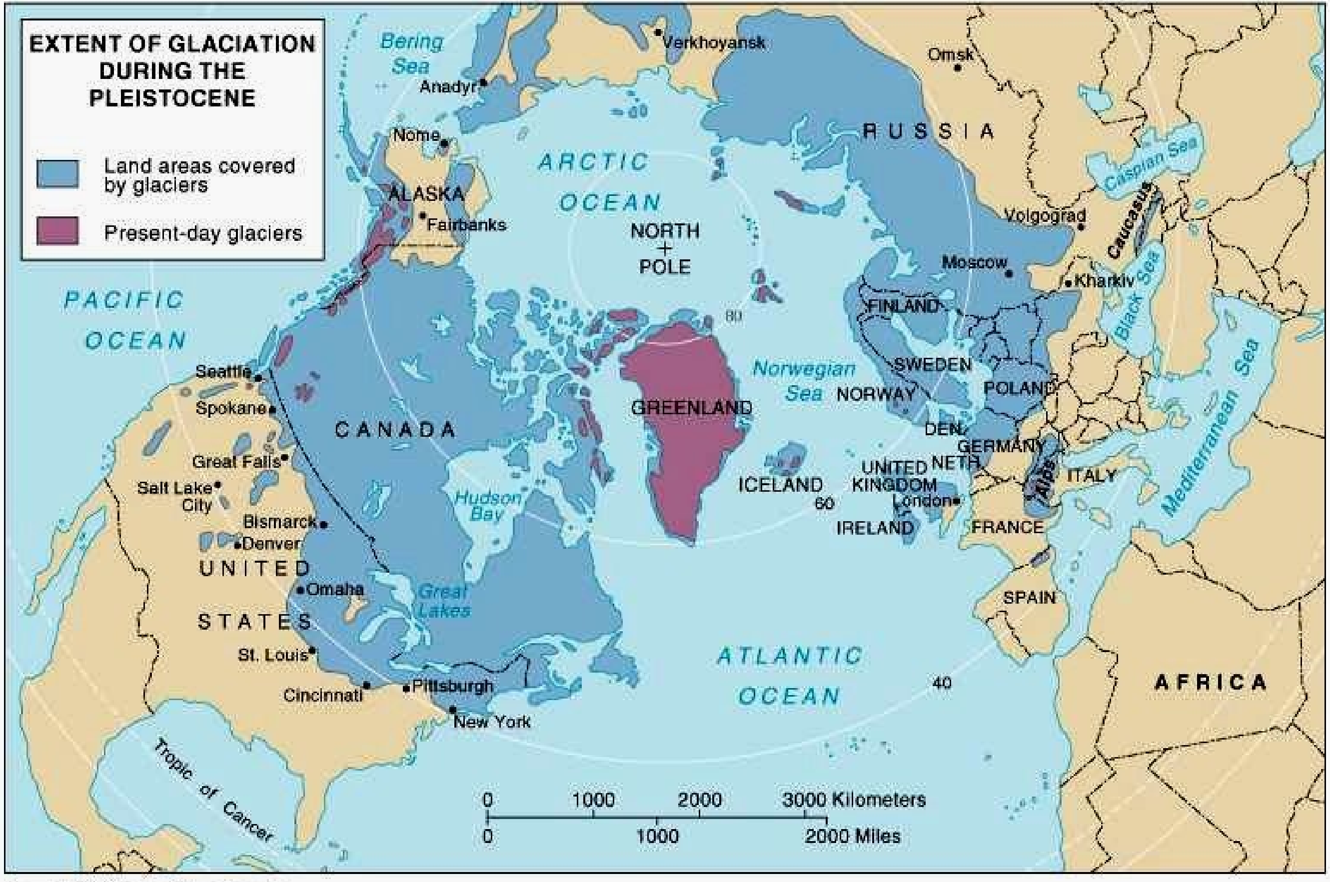
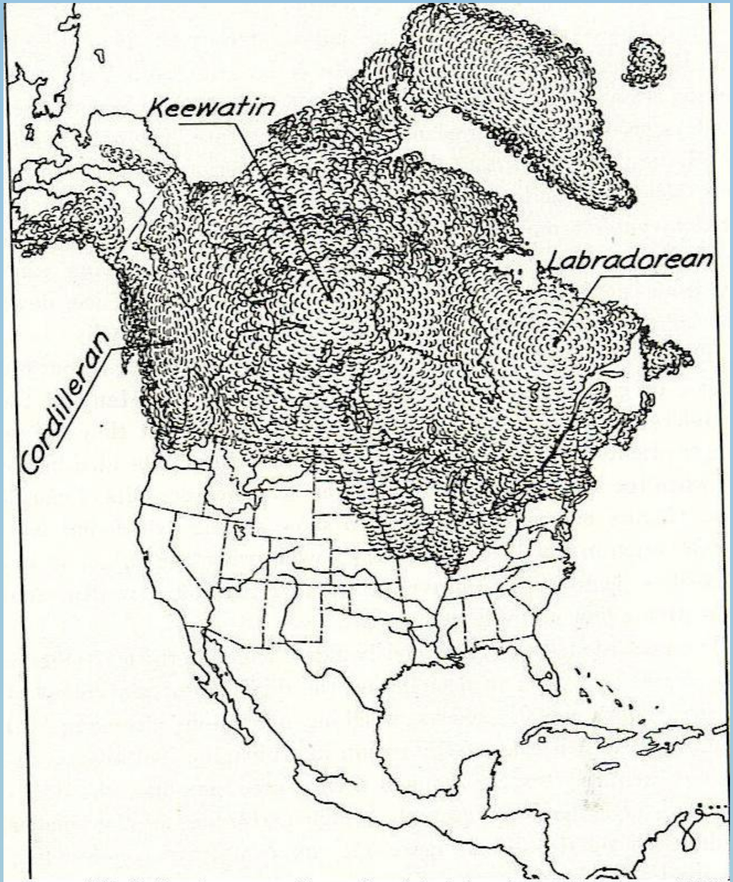
Map of Pleistocene Glaciation in Northern Hemisphere

(how do we know the extent of glaciation ?; why did it happen ?)



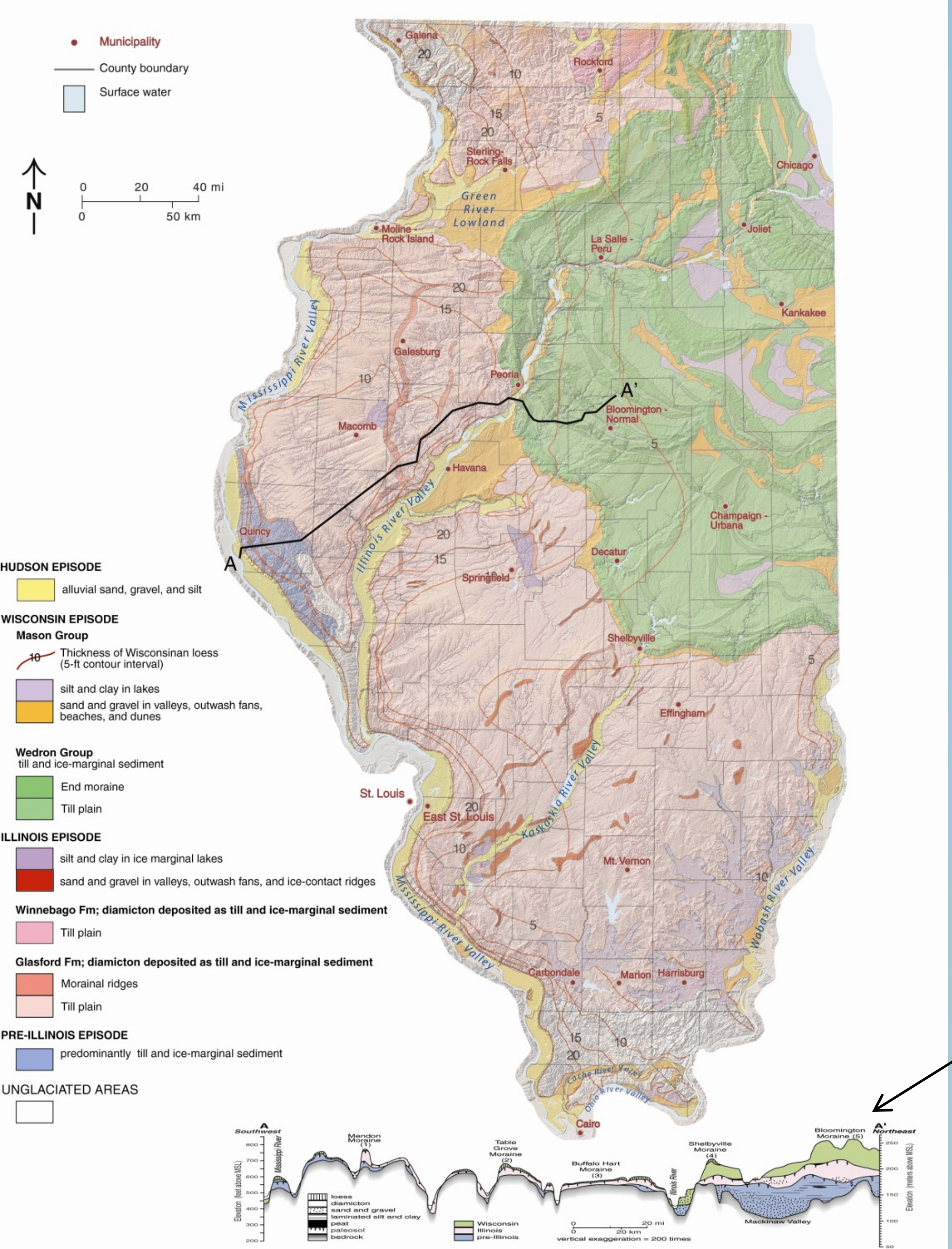
http://www.roebuckclasses.com/105/regions/namer/namericaphys/physnamer.htm

North American Glaciation

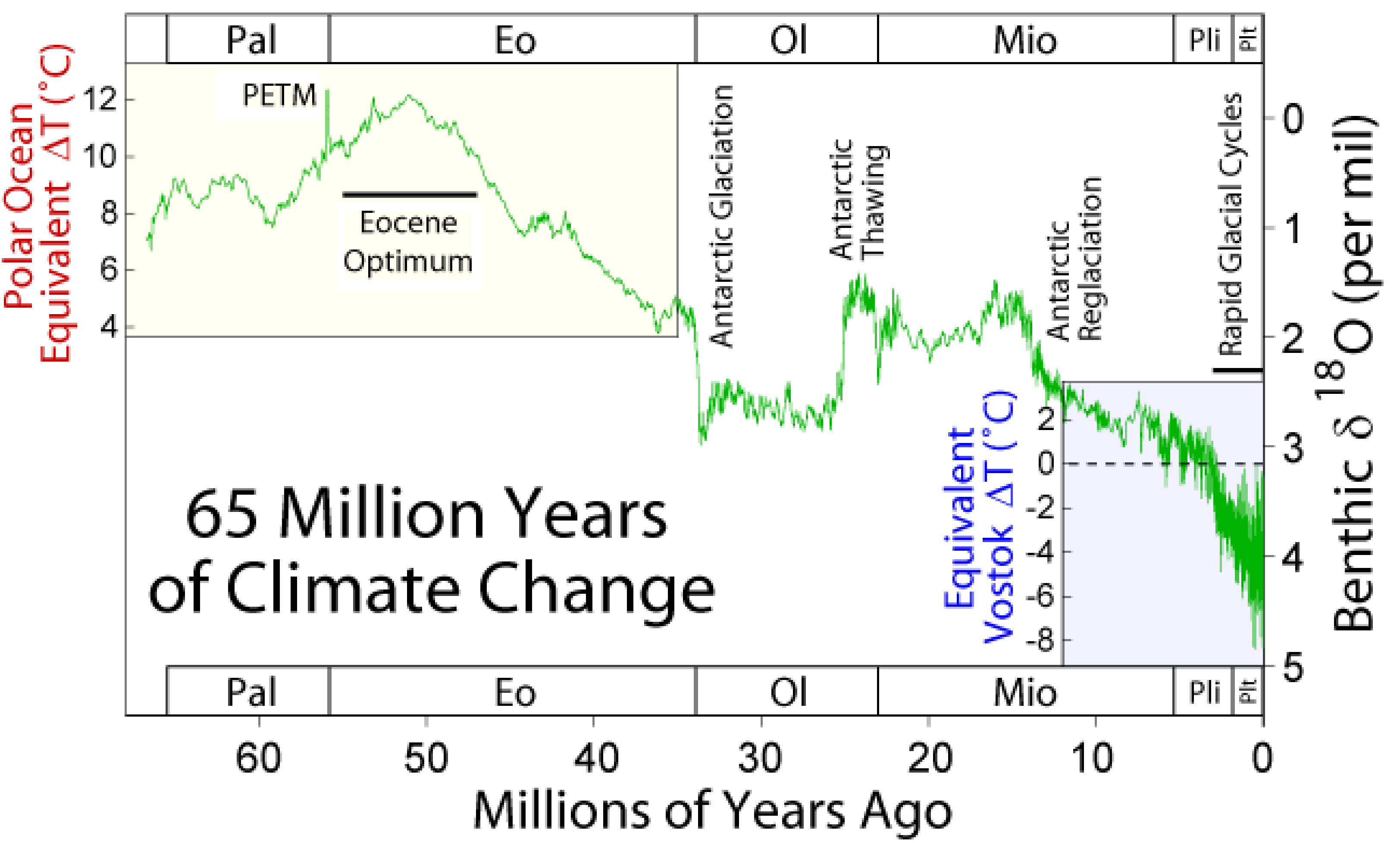


Areas of North America covered by continental glaciers in Pleistocent time. (MGS
Bul. 37)

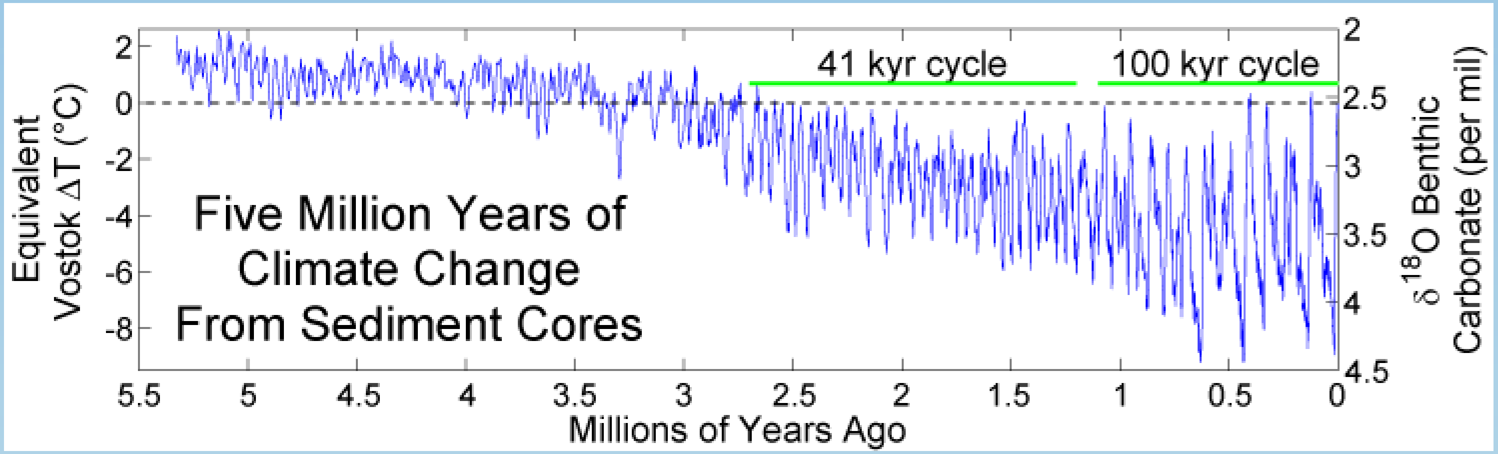
- Southernmost extent of Pleistocene continental glaciation in N. Hemisphere



cross section


65 Million Years
of Climate Change
Pal
Eo
Ol
Mio
Pli
Plt
PETM
Eocene
Optimum
Antarctic Glaciation
Antarctic
Thawing
Antarctic
Reglaciation
Rapid Glacial Cycles
Polar Ocean
Equivalent ΔT (°C)
12
10
8
6
4
Equivalent
Vostok ΔT (°C)
2
0
-2
-4
-6
-8
Benthic δ18O (per mil)
0
1
2
3
4
5
60
50
40
30
20
10
0
Millions of Years Ago

Pliocene-Pleistocene records



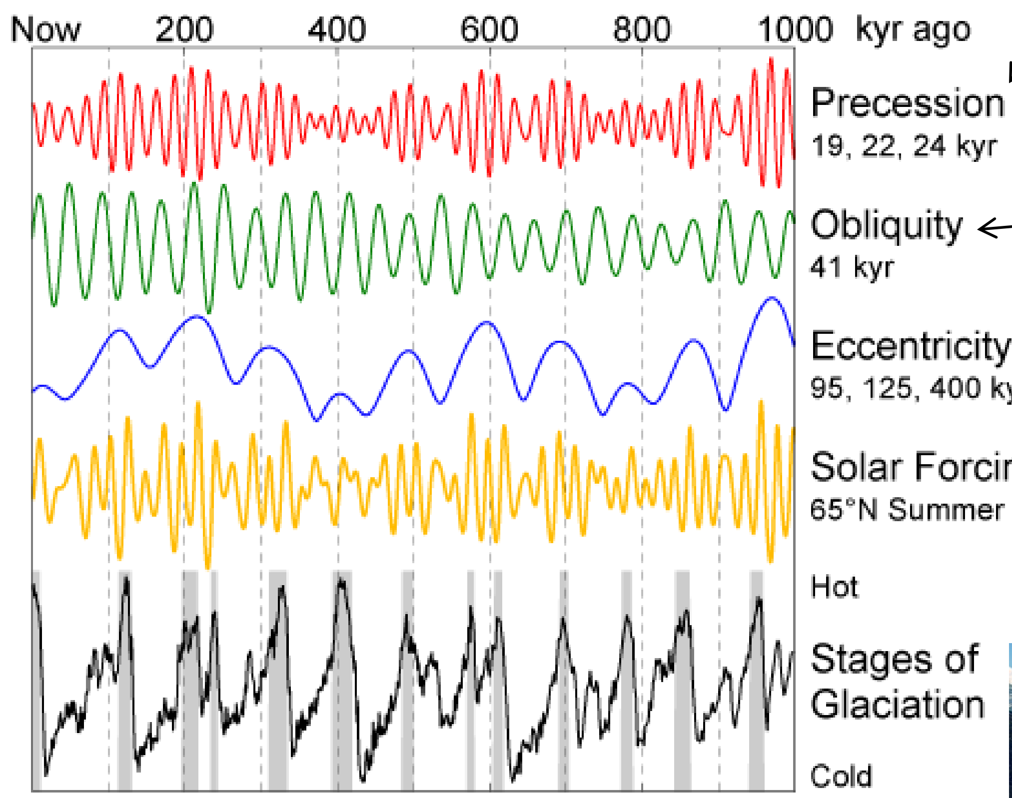
from Lisiecki and Raymo (2005); constructed by combining measurements from 57 globally distributed deep sea sediment cores.

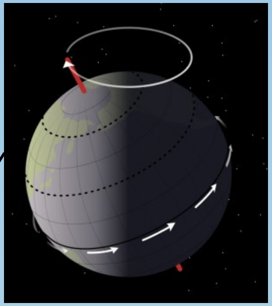
Significant growth of ice sheets did not begin in Greenland and North America until approximately 3 My ago, following the formation of the Isthmus of Panama by continental drift. This ushered in an era of rapidly cycling glacials and interglacials.

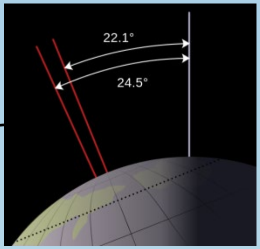
The two strongest orbital cycles (obliquity, 41 kyr and precession, 26 kyr) probably do drive changes in ice volume. The data in the figure have been fitted to these periods and also to the longer, much weaker 100 kyr eccentricity cycle. Over the past ~1 million years there have been a number of very strong glacial maxima and minima, spaced by 80,000 - 120,000 years, but evidence for orbital forcing is less secure. The ~100 kyr cycle may be controlled by some other as yet unknown mechanism.

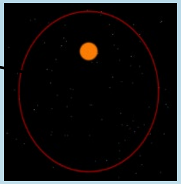
Astronomical (Milankovitch) Cycles

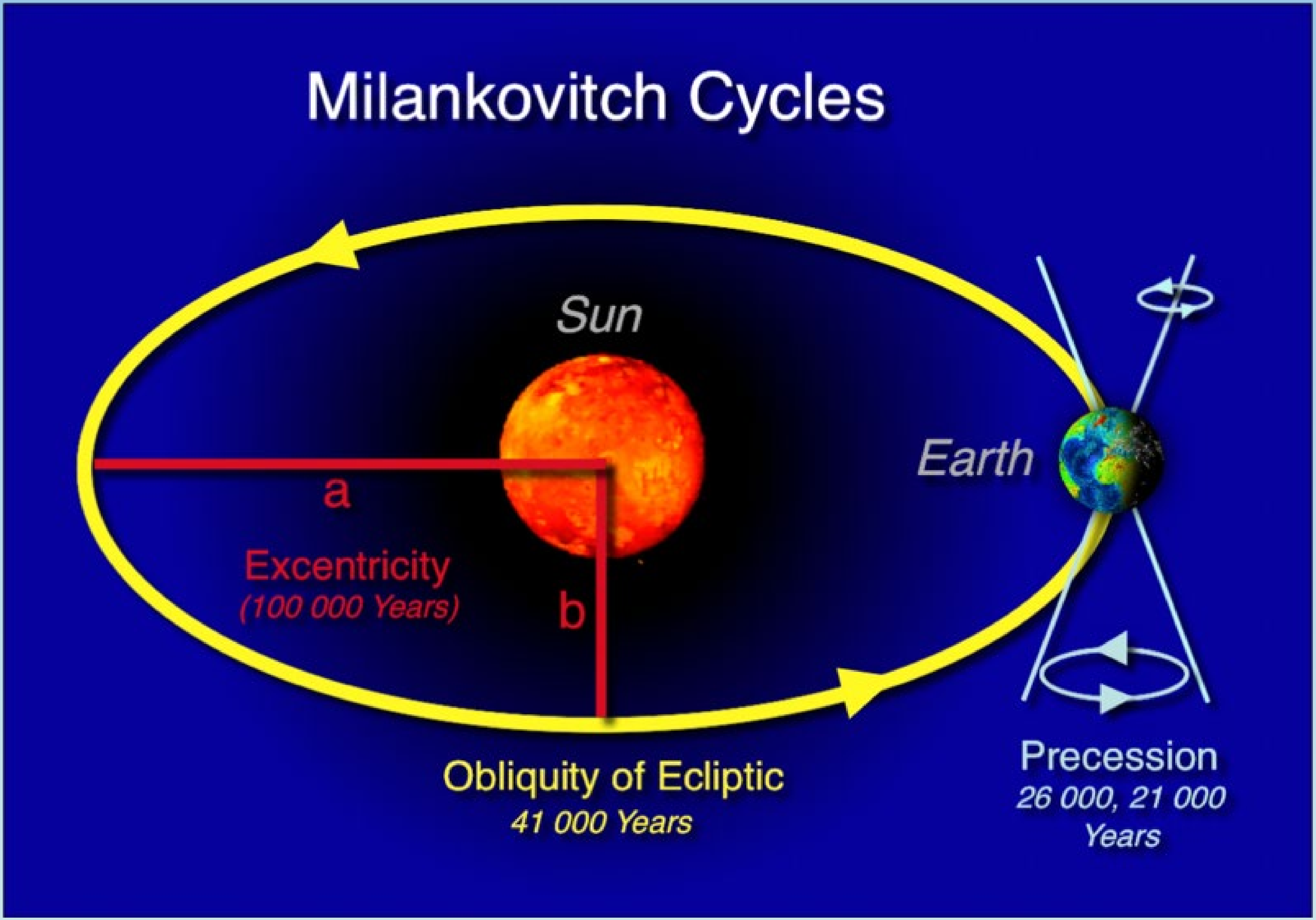
https://www.youtube.com/watch?v=iA788usYNWA



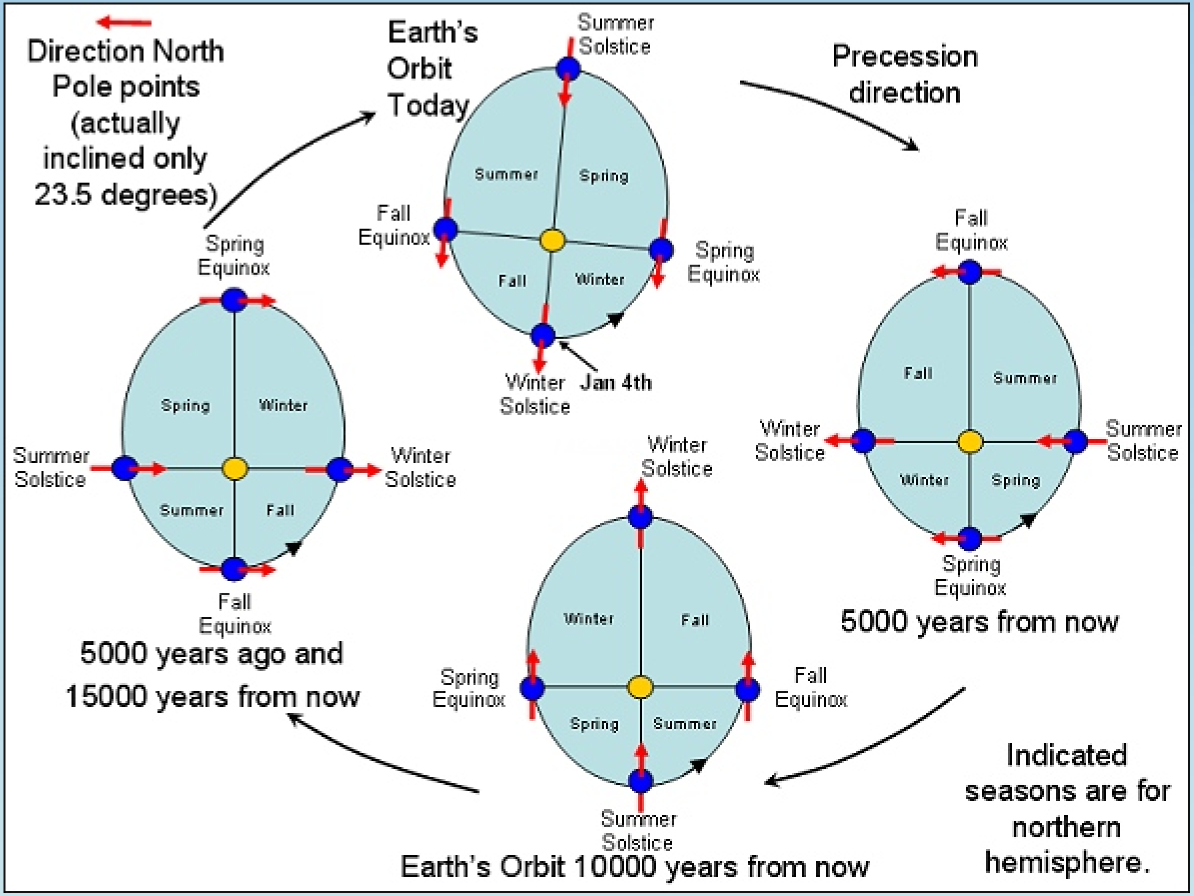


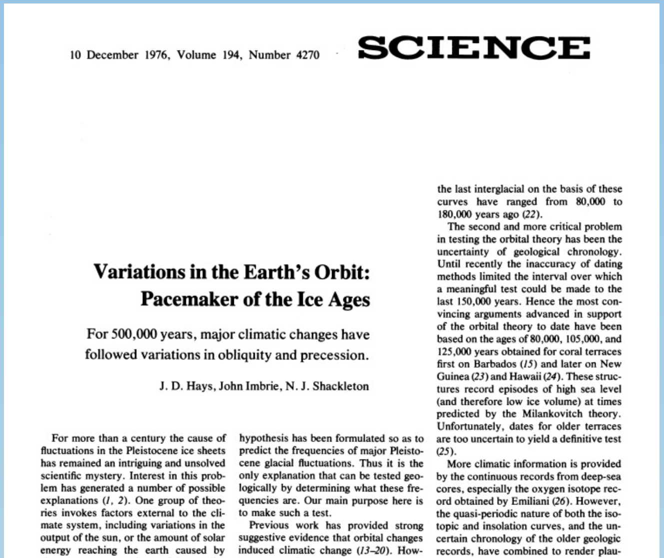





Milankovitch Cycles
Sun
Earth
a
b
Excentricity
(100 000 Years)
Obliquity of Ecliptic
41 000 Years
Precession
26 000, 21 000
Years

Precession effects





10 December 1976, Volume 194, Number 4270 **SCIENCE**

Variations in the Earth's Orbit: Pacemaker of the Ice Ages

For 500,000 years, major climatic changes have followed variations in obliquity and precession.

J. D. Hays, John Imbrie, N. J. Shackleton

For more than a century the cause of fluctuations in the Pleistocene ice sheets has remained an intriguing and unsolved scientific mystery. Interest in this problem has generated a number of possible explanations (*1, 2*). One group of theories invokes factors external to the climate system, including variations in the output of the sun, or the amount of solar energy reaching the earth caused by changing concentrations of interstellar
dust (*3*); the seasonal and latitudina
tribution of incoming radiation caus
changes in the earth's orbital geor
(*4*); the volcanic dust content of the
sphere (*5*); and the earth's magnetic
(*6*). Other theories are based on int
elements of the system believed to
response times sufficiently long to
fluctuations in the range 10^4 to 10^6 y
Such features include the growth
decay of ice sheets (*7*), the surging
Antarctic ice sheet (*8*); the ice cov
the Arctic Ocean (*9*); the distributi
carbon dioxide between atmospher
ocean (*10*); and the deep circulati
the ocean (*11*). Additionally, it has
argued that as an almost intran
system, climate could alternate bet
different states on an appropriate
scale without the intervention of an
ternal stimulus or internal time con
(*12*).

Among these ideas, only the o

hypothesis has been formulated so as to predict the frequencies of major Pleistocene glacial fluctuations. Thus it is the only explanation that can be tested geologically by determining what these frequencies are. Our main purpose here is to make such a test.

Previous work has provided strong suggestive evidence that orbital changes induced climatic change (*13–20*). However, two primary obstacles have led to

the last interglacial on the basis of these curves have ranged from 80,000 to 180,000 years ago (*22*).

The second and more critical problem in testing the orbital theory has been the uncertainty of geological chronology. Until recently the inaccuracy of dating methods limited the interval over which a meaningful test could be made to the last 150,000 years. Hence the most convincing arguments advanced in support of the orbital theory to date have been based on the ages of 80,000, 105,000, and 125,000 years obtained for coral terraces first on Barbados (*15*) and later on New Guinea (*23*) and Hawaii (*24*). These structures record episodes of high sea level (and therefore low ice volume) at times predicted by the Milankovitch theory. Unfortunately, dates for older terraces are too uncertain to yield a definitive test (*25*).

More climatic information is provided by the continuous records from deep-sea cores, especially the oxygen isotope record obtained by Emiliani (*26*). However, the quasi-periodic nature of both the isotopic and insolation curves, and the uncertain chronology of the older geologic records, have combined to render plausible different astronomical interpre-

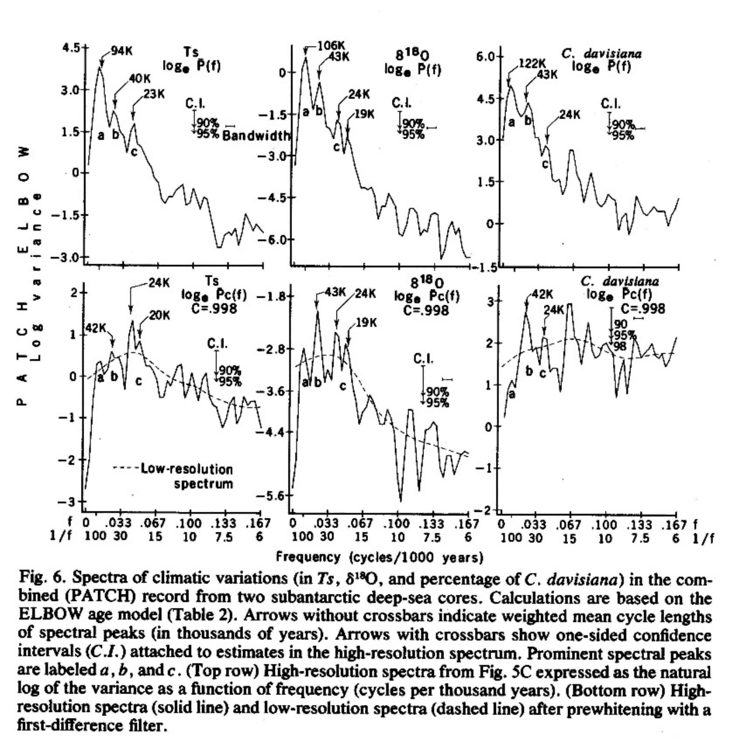


Fig. 6. Spectra of climatic variations (in *Ts*, δ¹⁸O, and percentage of *C. davisiana*) in the combined (PATCH) record from two subantarctic deep-sea cores. Calculations are based on the ELBOW age model (Table 2). Arrows without crossbars indicate weighted mean cycle lengths of spectral peaks (in thousands of years). Arrows with crossbars show one-sided confidence intervals (*C.I.*) attached to estimates in the high-resolution spectrum. Prominent spectral peaks are labeled *a*, *b*, and *c*. (Top row) High-resolution spectra from Fig. 5C expressed as the natural log of the variance as a function of frequency (cycles per thousand years). (Bottom row) High-resolution spectra (solid line) and low-resolution spectra (dashed line) after prewhitening with a first-difference filter.

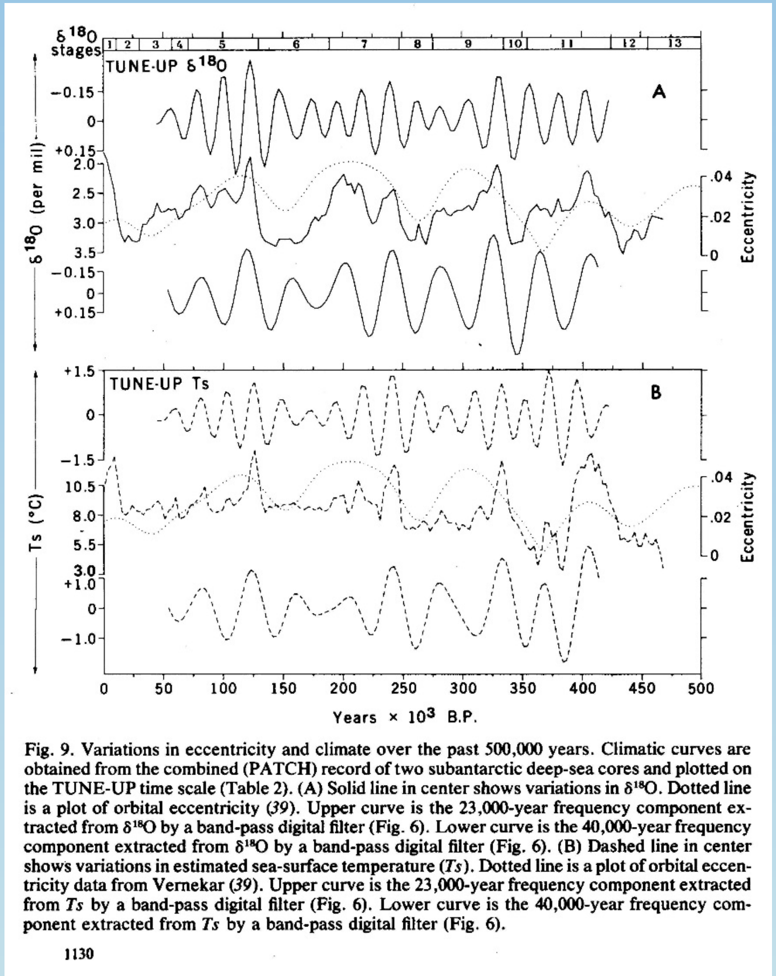
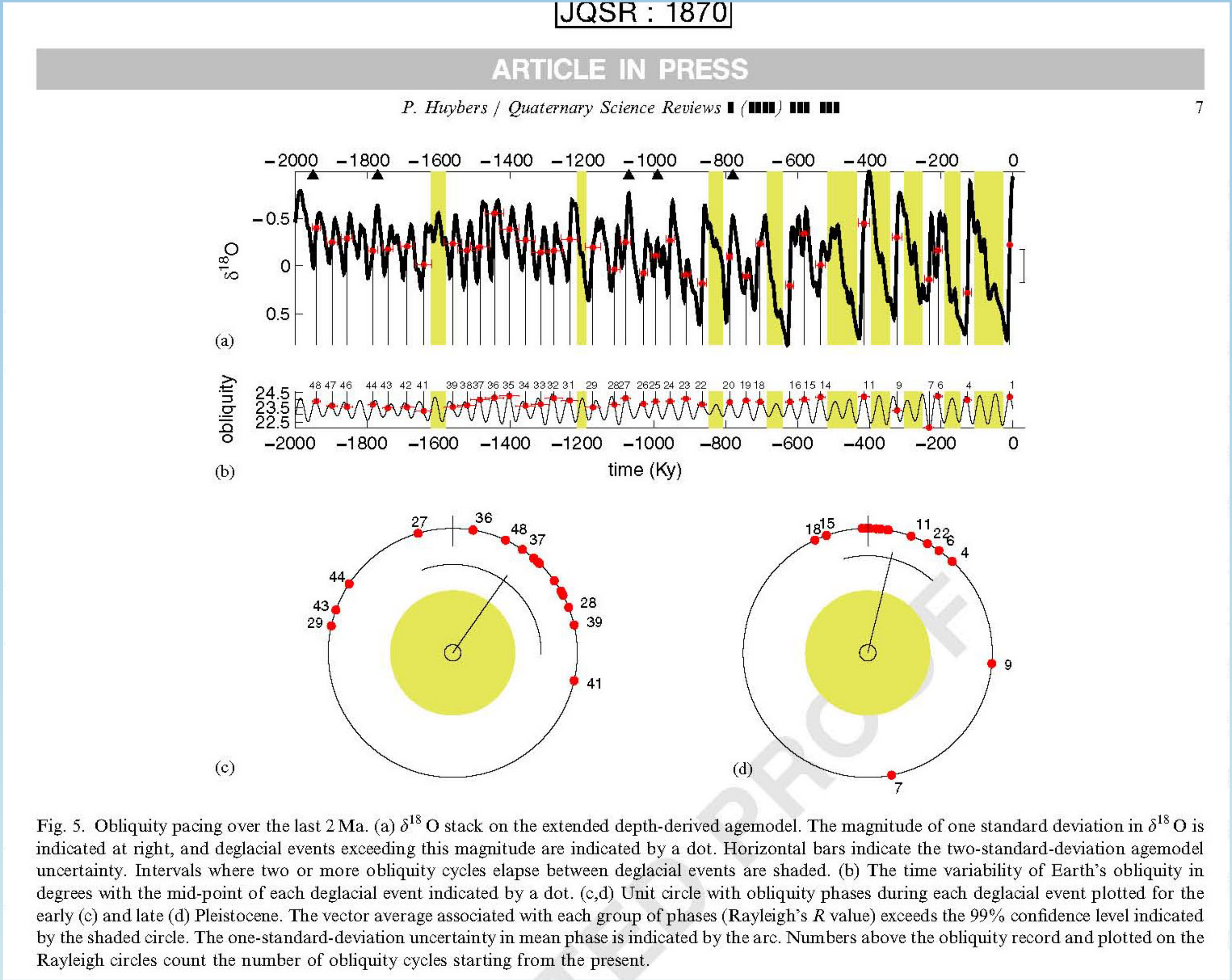


Fig. 9. Variations in eccentricity and climate over the past 500,000 years. Climatic curves are obtained from the combined (PATCH) record of two subantarctic deep-sea cores and plotted on the TUNE-UP time scale (Table 2). (A) Solid line in center shows variations in δ¹⁸O. Dotted line is a plot of orbital eccentricity (*39*). Upper curve is the 23,000-year frequency component extracted from δ¹⁸O by a band-pass digital filter (Fig. 6). Lower curve is the 40,000-year frequency component extracted from δ¹⁸O by a band-pass digital filter (Fig. 6). (B) Dashed line in center shows variations in estimated sea-surface temperature (*Ts*). Dotted line is a plot of orbital eccentricity data from Vernekar (*39*). Upper curve is the 23,000-year frequency component extracted from *Ts* by a band-pass digital filter (Fig. 6). Lower curve is the 40,000-year frequency component extracted from *Ts* by a band-pass digital filter (Fig. 6).

Hays, Imbrie, and Shackleton, 1976 (evidence for Milankovitch cycles)

Obliquity Dominant ? (Huybers, 2006)



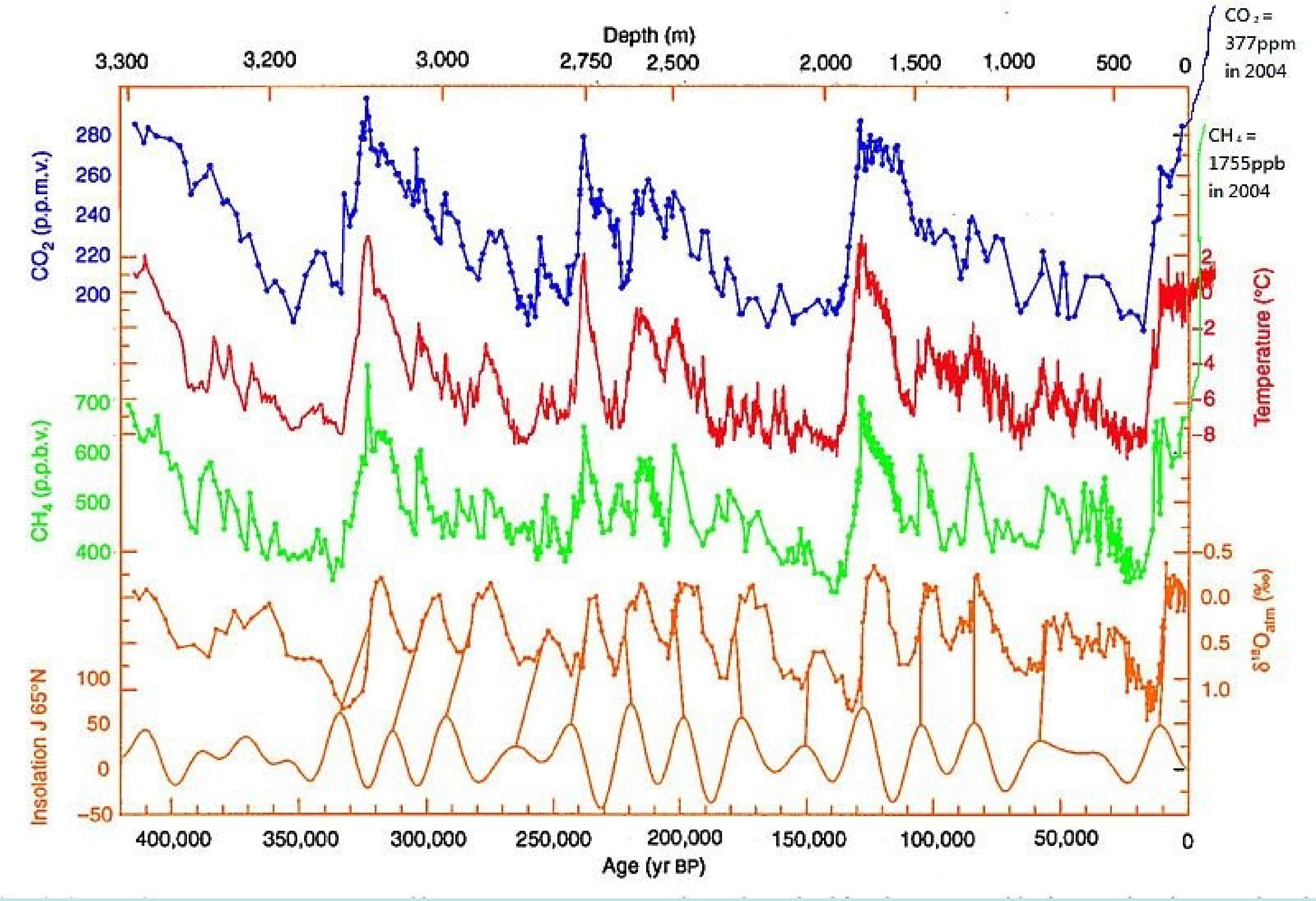
JQSR : 1870

ARTICLE IN PRESS

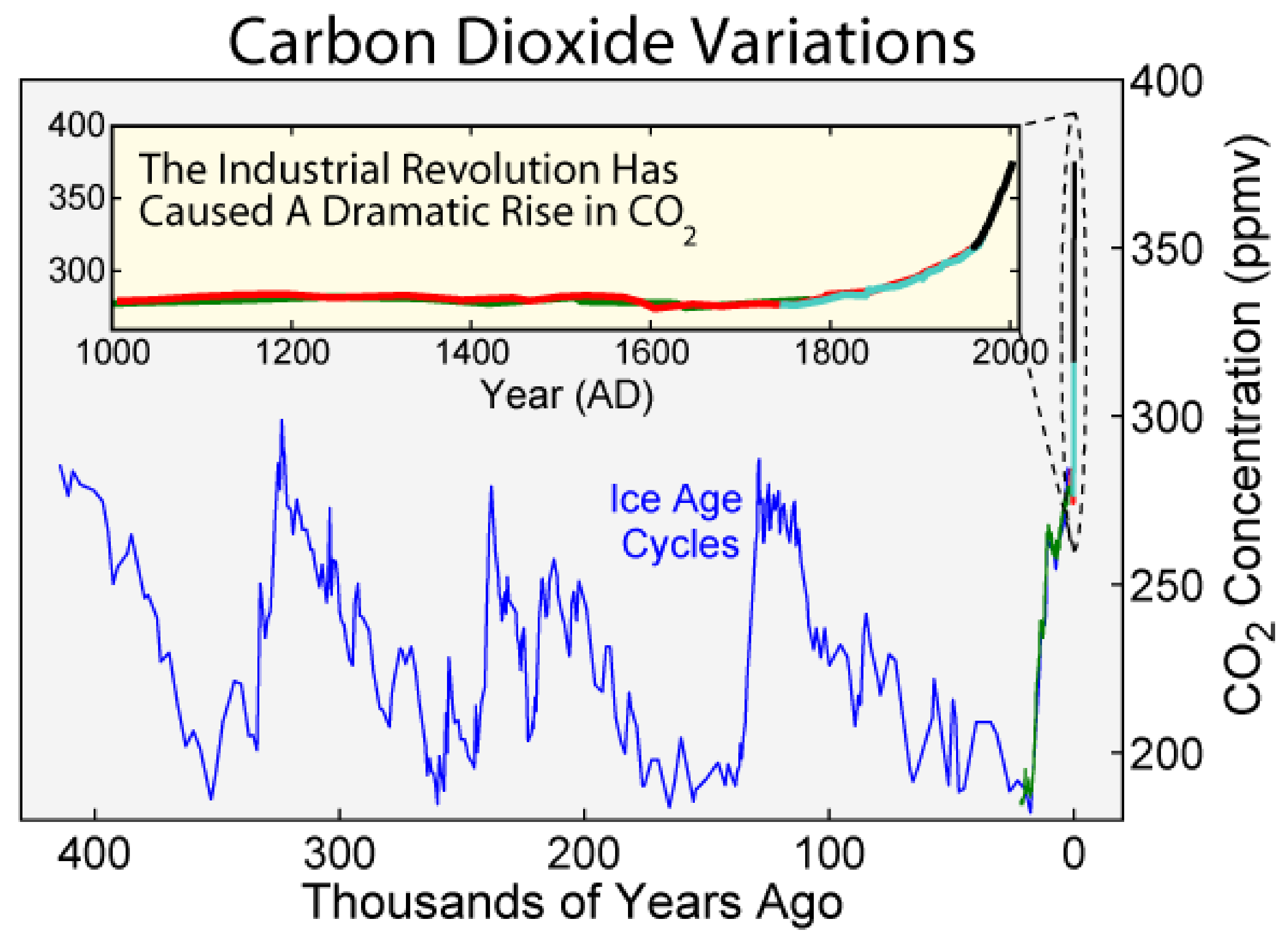
P. Huybers / Quaternary Science Reviews ▮ (▮▮▮▮) ▮▮▮–▮▮▮ 7

Fig. 5. Obliquity pacing over the last 2 Ma. (a) $\delta^{18}O$ stack on the extended depth-derived agemodel. The magnitude of one standard deviation in $\delta^{18}O$ is indicated at right, and deglacial events exceeding this magnitude are indicated by a dot. Horizontal bars indicate the two-standard-deviation agemodel uncertainty. Intervals where two or more obliquity cycles elapse between deglacial events are shaded. (b) The time variability of Earth's obliquity in degrees with the mid-point of each deglacial event indicated by a dot. (c,d) Unit circle with obliquity phases during each deglacial event plotted for the early (c) and late (d) Pleistocene. The vector average associated with each group of phases (Rayleigh's R value) exceeds the 99% confidence level indicated by the shaded circle. The one-standard-deviation uncertainty in mean phase is indicated by the arc. Numbers above the obliquity record and plotted on the Rayleigh circles count the number of obliquity cycles starting from the present.

Vostok 420 ka Ice Core Record

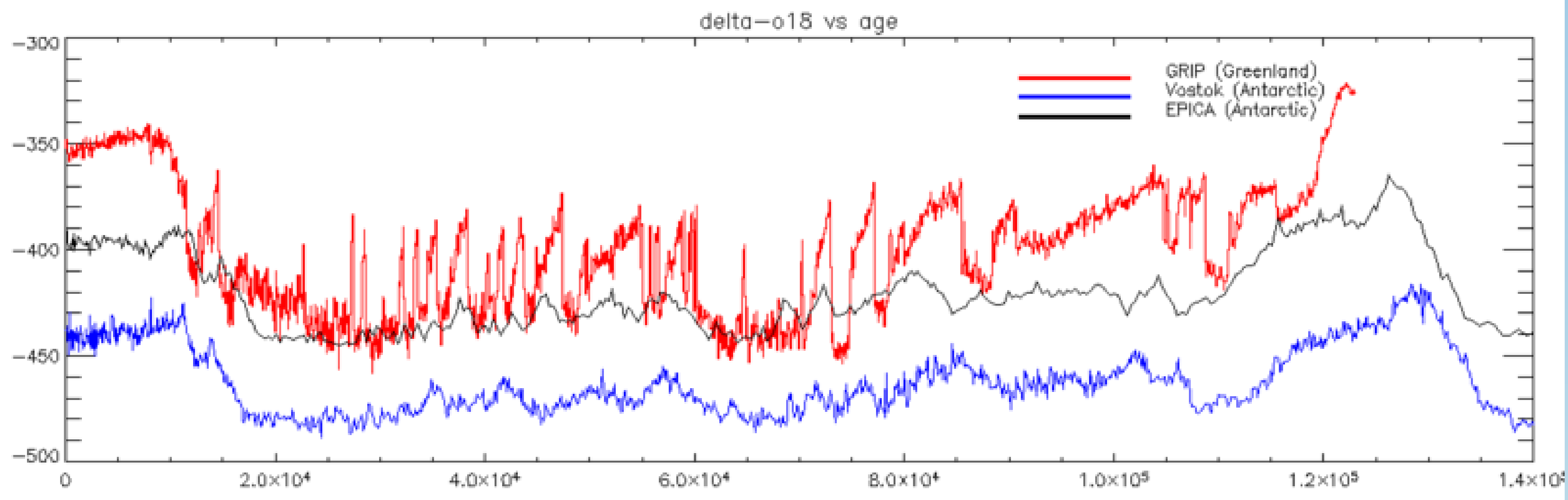


420,000 years of ice core data from Vostok, Antarctica research station. Current period is at left. From bottom to top: * Solar variation at 65°N due toen:Milankovitch cycles (connected to ^{18}O). * ^{18}O isotope of oxygen. * Levels of methane (CH_4). * Relative temperature. * Levels of carbon dioxide (CO_2). From top to bottom: * Levels of carbon dioxide (CO_2). * Relative temperature. * Levels of methane (CH_4). * ^{18}O isotope of oxygen. * Solar variation at 65°N due to en:Milankovitch cycles (connected to ^{18}O).



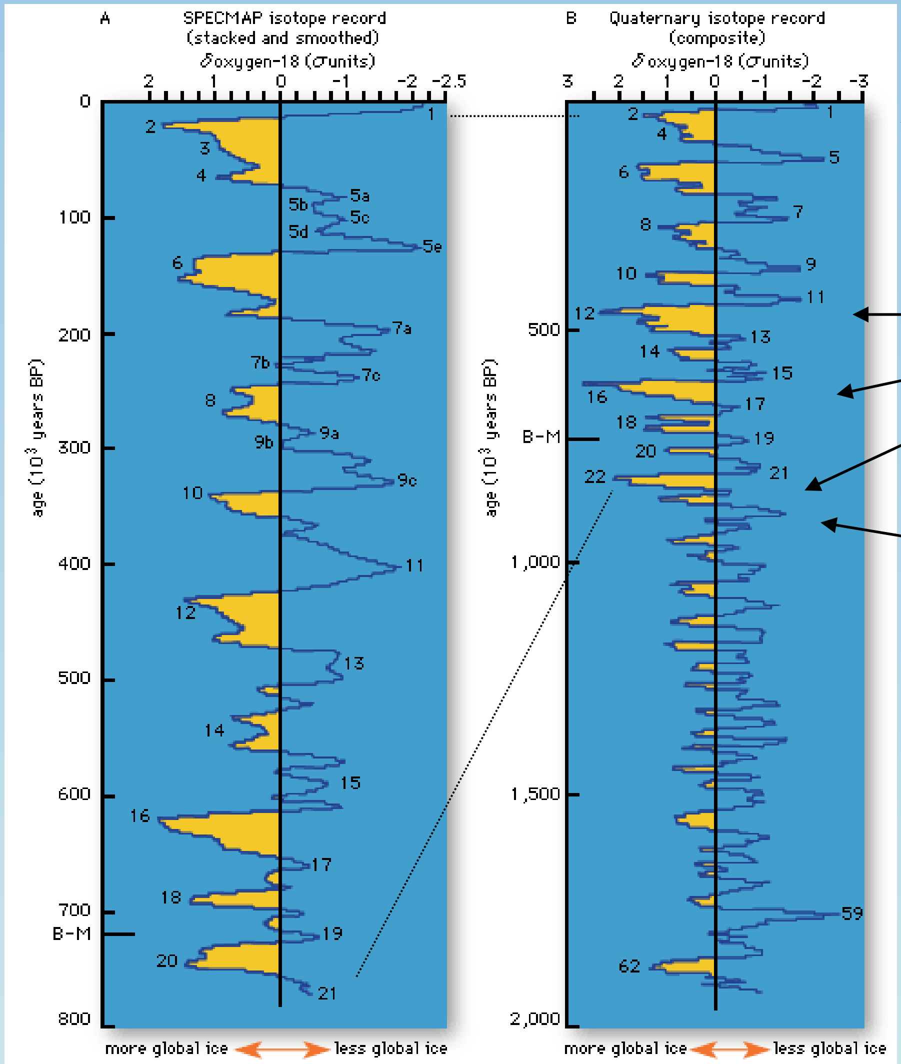
- Milankovitch cycles also influence the carbon cycle, which in turn feeds back into the glacial system.
- Since the Industrial Revolution, the burning of fossil fuels has caused a dramatic increase of CO_2 in the atmosphere, reaching levels unprecedented in the last 400 thousand years. This increase has been implicated as a primary cause of global warming.

Ice core records (Greenland, Antarctica)



* Similarities and differences between Greenland and Antarctica records.

Global Ice Volume Record



(A) The SPECMAP (Spectral Mapping Project) record based on five low- and middle-latitude deep-sea cores and (B) a composite record of four cores from the equatorial Pacific, the Caribbean, and the North Atlantic. Isotopic stages and substages are indicated; B-M shows the level of Brunhes-Matuyama reversal.

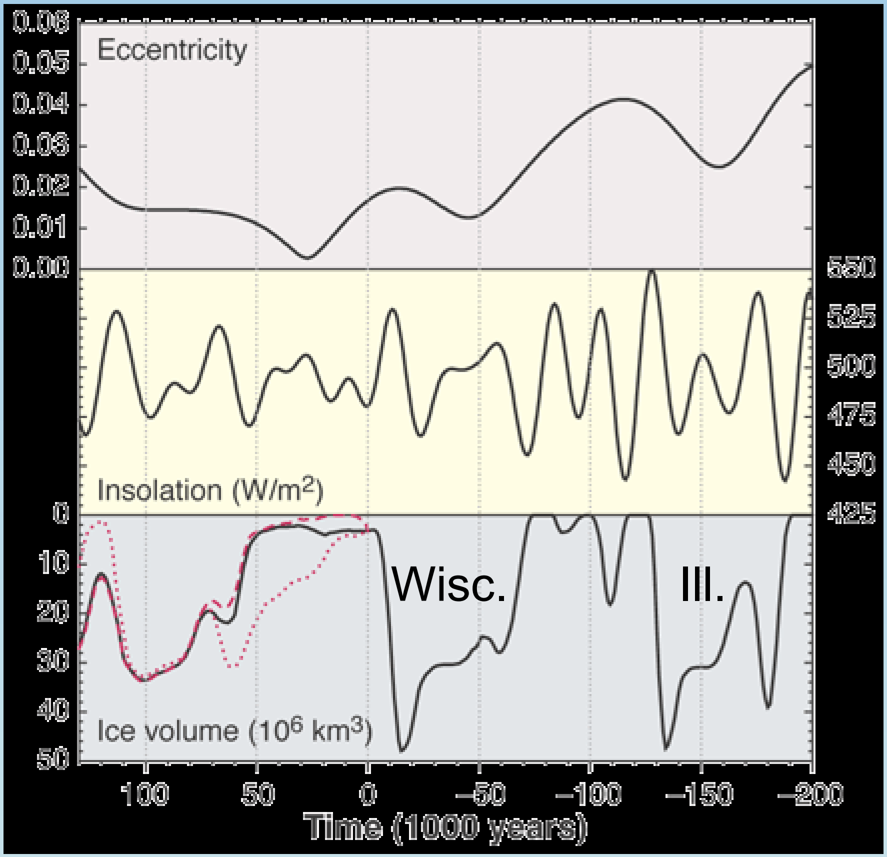
Wisconsinan glaciation

Illinoian glaciation

pre-Illinoian glaciations

initiation of high amplitude changes in global ice volume ~ 800 ka

Exceptionally Long Interglacial Ahead? **A. Berger**, **M. F. Loutre*** Science 23 August 2002: Vol. 297 no. 5585 pp. 1287-1288



Long-term variations of eccentricity (**top**), June insolation at 65°N (**middle**), and simulated Northern Hemisphere ice volume (increasing downward) (**bottom**) for 200,000 years before the present to 130,000 from now. Time is negative in the past and positive in the future. For the future, three CO_2 scenarios were used: last glacial-interglacial values (solid line), a human-induced concentration of 750 ppmv (dashed line), and a constant concentration of 210 ppmv (dotted line). Simulation results from (13, 15); eccentricity and insolation from (19).

future

past

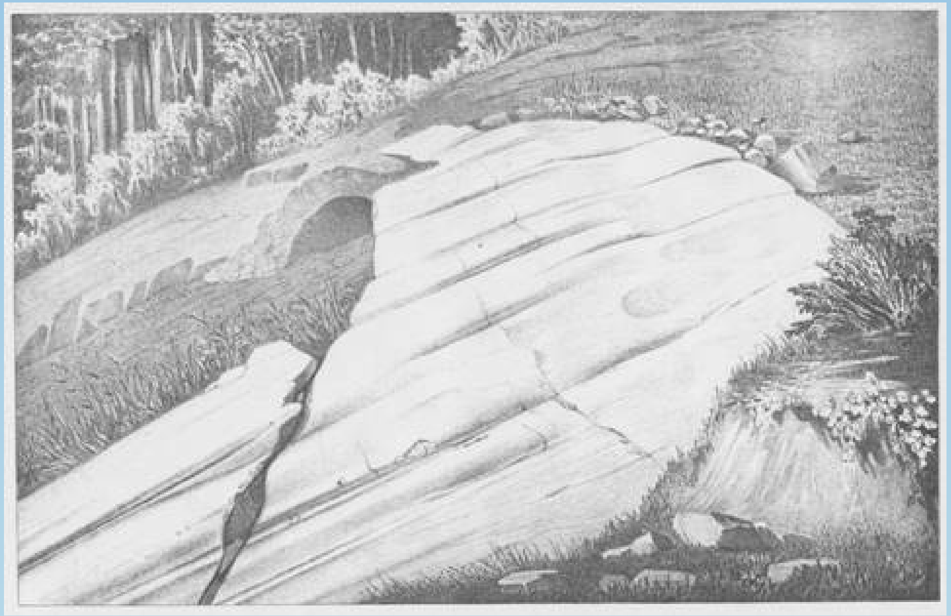
Questions ?

Early Discovery and Evidence of Glaciation

Louis Aggasiz --- first to formally propose past ice ages existed (1837)

Aletsch Glacier, Switzerland

Glacial grooves and striations



"After having obtained in Switzerland the most conclusive proofs, that at a former period the glaciers were of much greater extent than at present, nay, that they had covered the whole country, and had transported the erratic blocks to the places where these are now found, it was my wish to examine a country where glaciers are no longer met with, but in which they might formerly have existed. I therefore directed my attention to Scotland . . . (Agassiz Letter to The Scotsman newspaper, October 6, 1840)

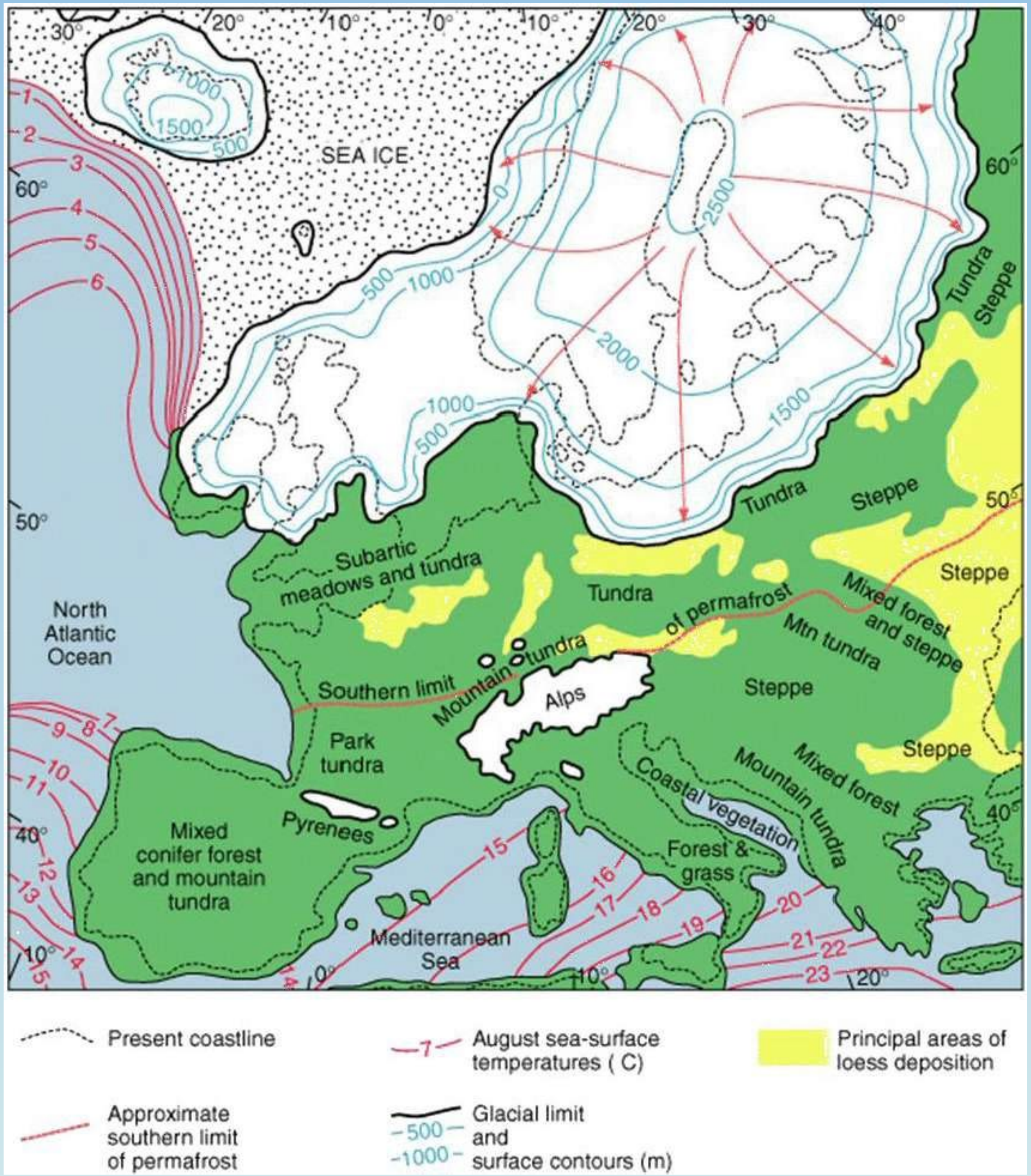
"If the analogy of the facts which he has observed in Scotland, Ireland, and the north of England, with those in Switzerland, be correct, then it must be admitted that not only glaciers once existed in the British Islands, but that large sheets *(nappes)* of ice covered all the surface." (Agassiz, 1840)

Pegmatite on schist in Central Park, Manhattan

erratic boulder in Scotland

Glacial landforms (constructional)

View of terminal moraine from a glacier which descended from the hills to the right of the area pictured. One of several moraines described by Buckland (1841) after he, together with Agassiz, first recognized evidence of glaciation in the British Isles (Fall of 1840). Near Thornhill, north of Dumphries, Scotland. http://www.grisda.org/origins/09028.htm



Extent of the continental ice sheet that covered northern Europe 20 000 years ago, and summer sea-surface temperatures.

Central Europe had a climate comparable to northern Siberia, and southern Europe was forested.

http://donsmaps.com/grottevache.html

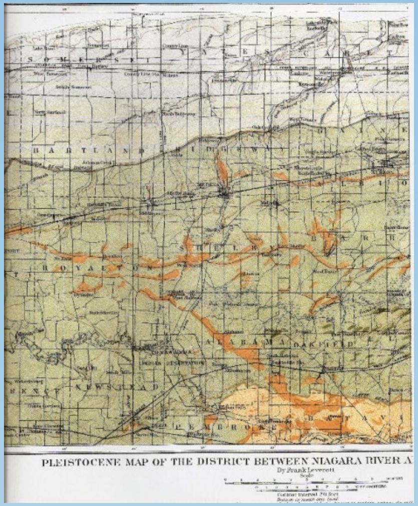
First Glacial Map of N. America (1894)

T.C. Chamberlain

recognized buried soils
and multiple glaciations

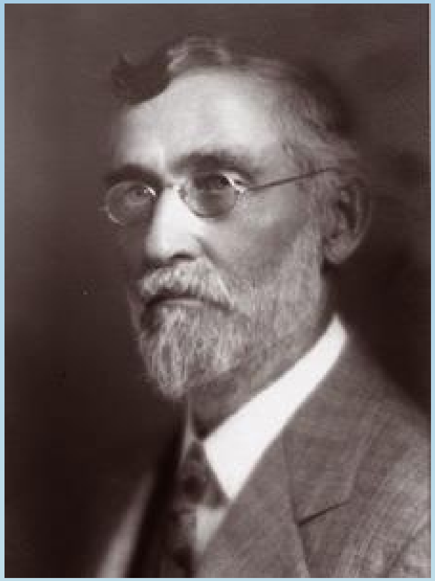
detailed Map of Green Bay Lobe glaciation in Wisconsin (1882)

MAP OF THE GREEN BAY LOOP OF THE TERMINAL MORAINE OF THE SECOND GLACIAL EPOCH



glacial
(Pleistocene) map
in western NY

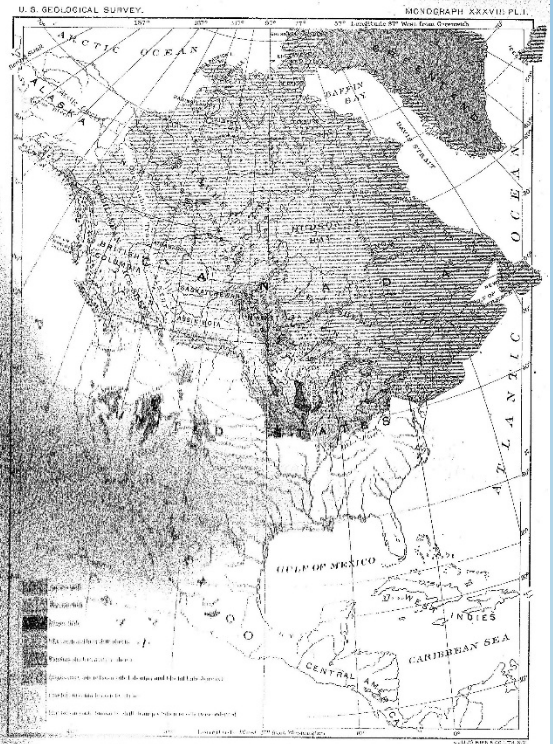
Frank Leverett



Frank Leverett (USGS),
with George Kay (Iowa)
and Paul MacClintock
(Illinois) in Iowa

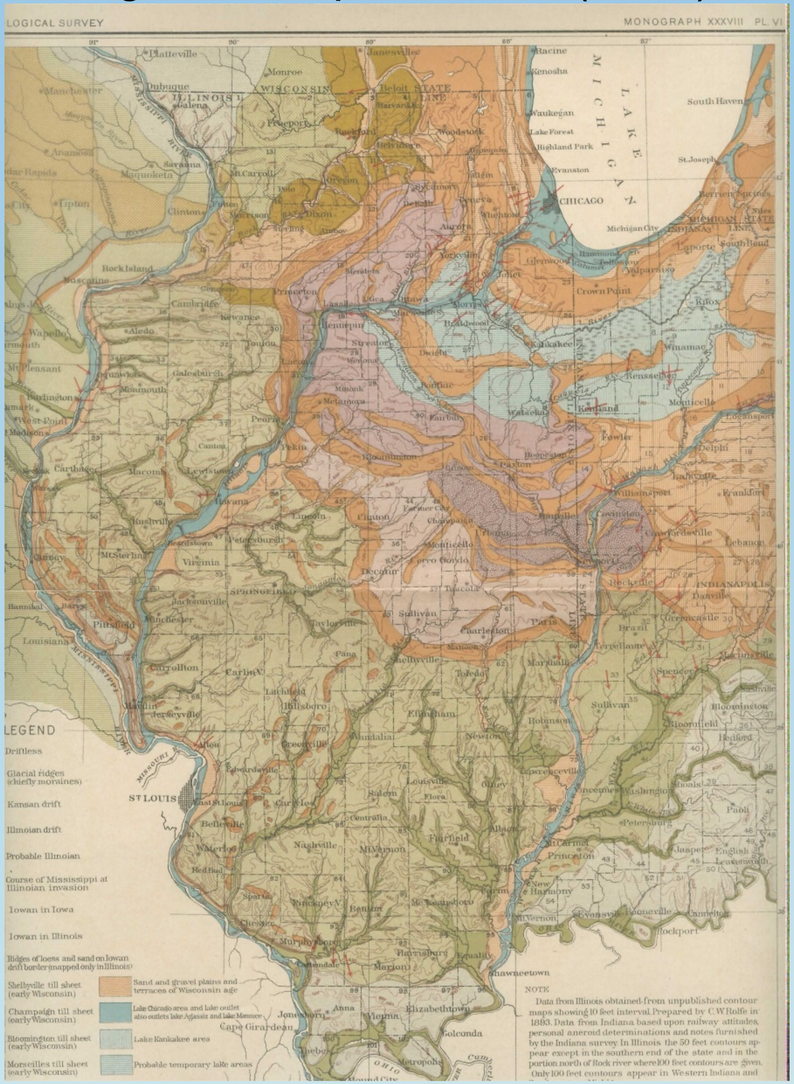
NORTH AMERICA

Leverett 1898



MAP OF THE GLACIATED AREA OF NORTH AMERICA.
(Modified from Upham's map Plate XVI Monograph XXV)
BY FRANK LEVERETT
1898
Scale, about [illegible] miles to an inch

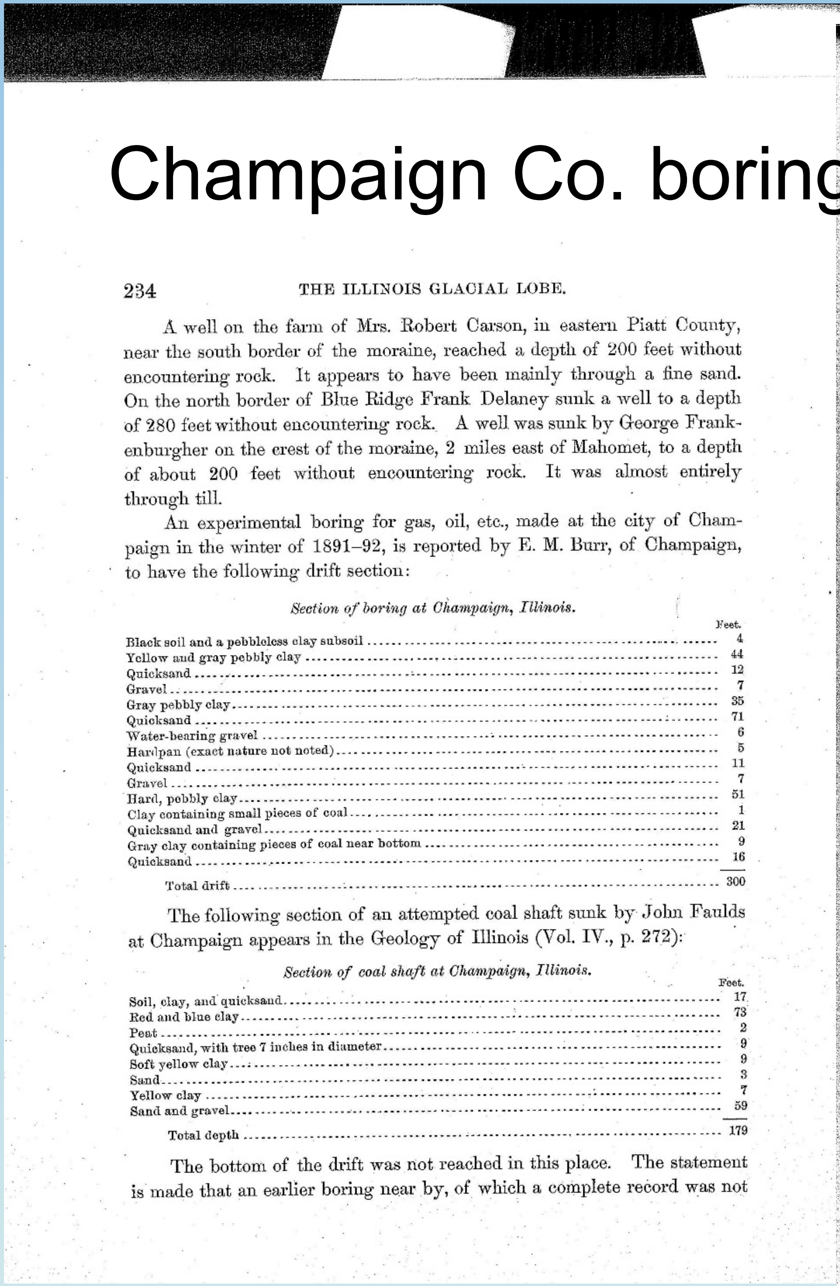
glacial map of Illinois (1898)



NOTE

Data from Illinois obtained from unpublished contour maps showing 10 feet interval. Prepared by C.W. Rolfe in 1893. Data from Indiana based upon railway attitudes, personal aneroid determinations and notes furnished by the Indiana survey. In Illinois the 50 feet contours appear except in the southern end of the state and in the portion north of Rock river where 100 feet contours are given. Only 100 feet contours appear in Western Indiana and

Champaign Co. boring records (Leverett, 1899)



A well on the farm of Mrs. Robert Carson, in eastern Piatt County, near the south border of the moraine, reached a depth of 200 feet without encountering rock. It appears to have been mainly through a fine sand. On the north border of Blue Ridge Frank Delaney sunk a well to a depth of 280 feet without encountering rock. A well was sunk by George Frankenburgher on the crest of the moraine, 2 miles east of Mahomet, to a depth of about 200 feet without encountering rock. It was almost entirely through till.

An experimental boring for gas, oil, etc., made at the city of Champaign in the winter of 1891–92, is reported by E. M. Burr, of Champaign, to have the following drift section:

Section of boring at Champaign, Illinois.

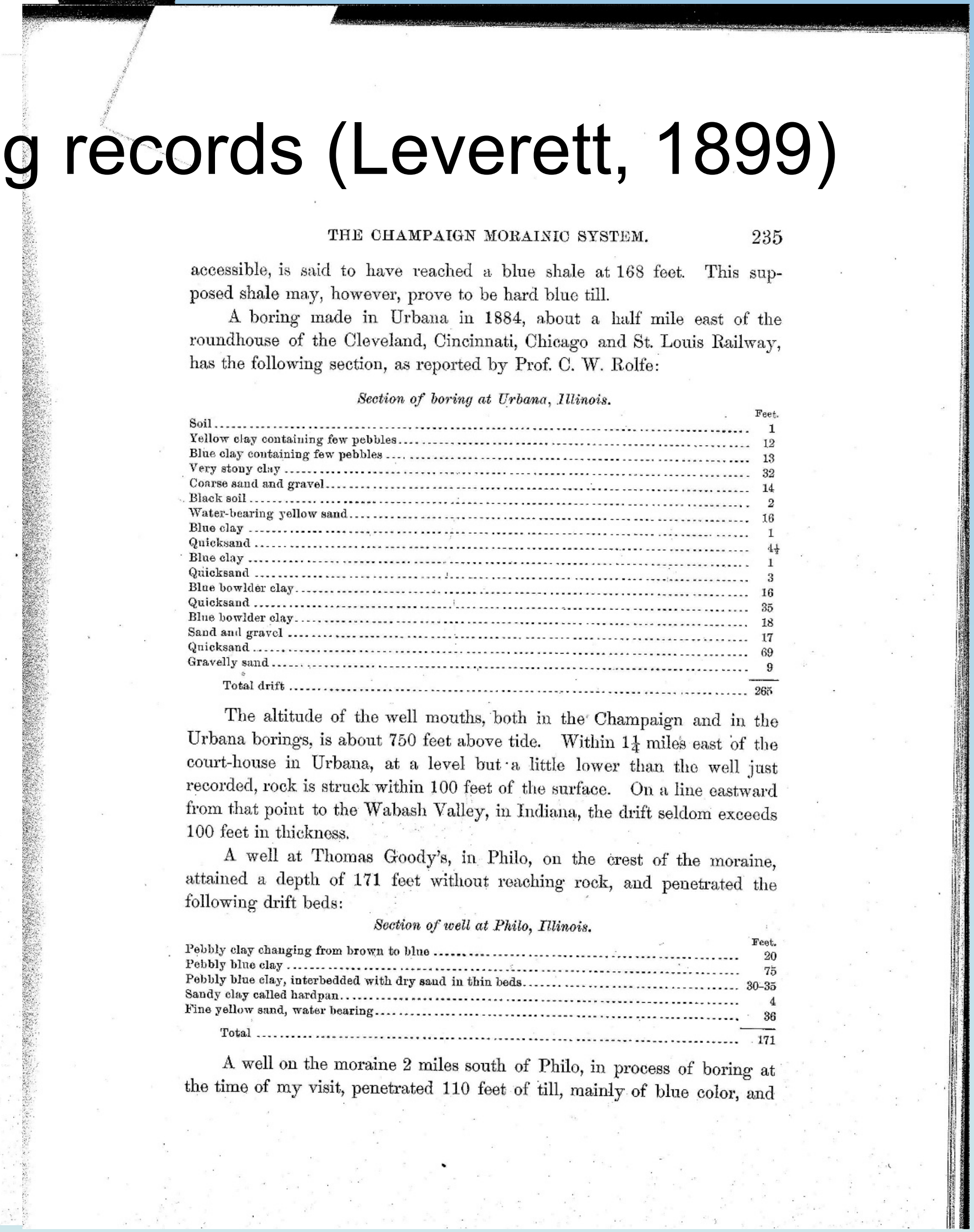
	Feet.
Black soil and a pebbleless clay subsoil	4
Yellow and gray pebbly clay	44
Quicksand	12
Gravel	7
Gray pebbly clay	35
Quicksand	71
Water-bearing gravel	6
Hardpan (exact nature not noted)	5
Quicksand	11
Gravel	7
Hard, pebbly clay	51
Clay containing small pieces of coal	1
Quicksand and gravel	21
Gray clay containing pieces of coal near bottom	9
Quicksand	16
Total drift	300

The following section of an attempted coal shaft sunk by John Faulds at Champaign appears in the Geology of Illinois (Vol. IV., p. 272):

Section of coal shaft at Champaign, Illinois.

	Feet.
Soil, clay, and quicksand	17
Red and blue clay	73
Peat	2
Quicksand, with tree 7 inches in diameter	9
Soft yellow clay	9
Sand	3
Yellow clay	7
Sand and gravel	59
Total depth	179

The bottom of the drift was not reached in this place. The statement is made that an earlier boring near by, of which a complete record was not



accessible, is said to have reached a blue shale at 168 feet. This supposed shale may, however, prove to be hard blue till.

A boring made in Urbana in 1884, about a half mile east of the roundhouse of the Cleveland, Cincinnati, Chicago and St. Louis Railway, has the following section, as reported by Prof. C. W. Rolfe:

Section of boring at Urbana, Illinois.

	Feet.
Soil	1
Yellow clay containing few pebbles	12
Blue clay containing few pebbles	13
Very stony clay	32
Coarse sand and gravel	14
Black soil	2
Water-bearing yellow sand	16
Blue clay	1
Quicksand	4½
Blue clay	1
Quicksand	3
Blue bowlder clay	16
Quicksand	35
Blue bowlder clay	18
Sand and gravel	17
Quicksand	69
Gravelly sand	9
Total drift	265

The altitude of the well mouths, both in the Champaign and in the Urbana borings, is about 750 feet above tide. Within 1¼ miles east of the court-house in Urbana, at a level but a little lower than the well just recorded, rock is struck within 100 feet of the surface. On a line eastward from that point to the Wabash Valley, in Indiana, the drift seldom exceeds 100 feet in thickness.

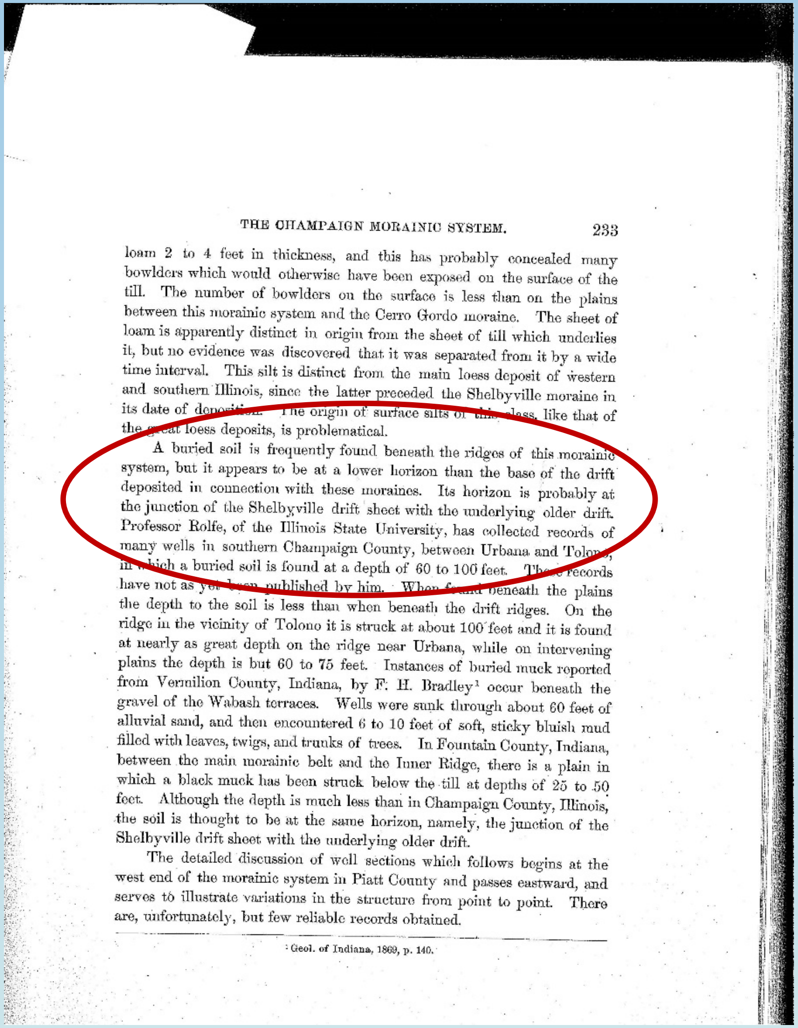
A well at Thomas Goody's, in Philo, on the crest of the moraine, attained a depth of 171 feet without reaching rock, and penetrated the following drift beds:

Section of well at Philo, Illinois.

	Feet.
Pebbly clay changing from brown to blue	20
Pebbly blue clay	75
Pebbly blue clay, interbedded with dry sand in thin beds	30–35
Sandy clay called hardpan	4
Fine yellow sand, water bearing	36
Total	171

A well on the moraine 2 miles south of Philo, in process of boring at the time of my visit, penetrated 110 feet of till, mainly of blue color, and

buried soils recognized (Leverett – 1899)



loam 2 to 4 feet in thickness, and this has probably concealed many bowlders which would otherwise have been exposed on the surface of the till. The number of bowlders on the surface is less than on the plains between this morainic system and the Cerro Gordo moraine. The sheet of loam is apparently distinct in origin from the sheet of till which underlies it, but no evidence was discovered that it was separated from it by a wide time interval. This silt is distinct from the main loess deposit of western and southern Illinois, since the latter preceded the Shelbyville moraine in its date of deposition. The origin of surface silts of this class, like that of the great loess deposits, is problematical.

A buried soil is frequently found beneath the ridges of this morainic system, but it appears to be at a lower horizon than the base of the drift deposited in connection with these moraines. Its horizon is probably at the junction of the Shelbyville drift sheet with the underlying older drift. Professor Rolfe, of the Illinois State University, has collected records of many wells in southern Champaign County, between Urbana and Tolono, in which a buried soil is found at a depth of 60 to 100 feet. These records have not as yet been published by him. When found beneath the plains the depth to the soil is less than when beneath the drift ridges. On the ridge in the vicinity of Tolono it is struck at about 100 feet and it is found at nearly as great depth on the ridge near Urbana, while on intervening plains the depth is but 60 to 75 feet. Instances of buried muck reported from Vermilion County, Indiana, by F. H. Bradley[1] occur beneath the gravel of the Wabash terraces. Wells were sunk through about 60 feet of alluvial sand, and then encountered 6 to 10 feet of soft, sticky bluish mud filled with leaves, twigs, and trunks of trees. In Fountain County, Indiana, between the main morainic belt and the Inner Ridge, there is a plain in which a black muck has been struck below the till at depths of 25 to 50 feet. Although the depth is much less than in Champaign County, Illinois, the soil is thought to be at the same horizon, namely, the junction of the Shelbyville drift sheet with the underlying older drift.

The detailed discussion of well sections which follows begins at the west end of the morainic system in Piatt County and passes eastward, and serves to illustrate variations in the structure from point to point. There are, unfortunately, but few reliable records obtained.

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[1] Geol. of Indiana, 1869, p. 140.

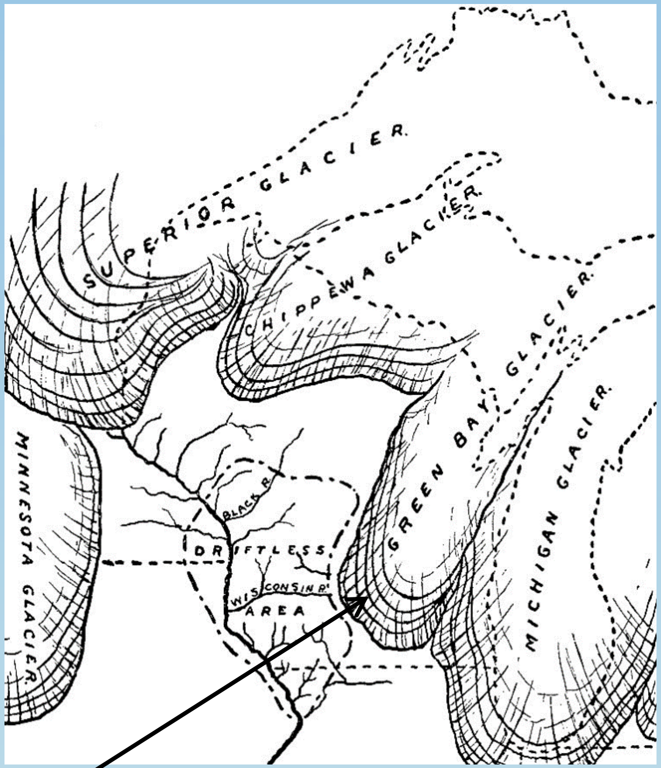
Kelley’s Island Ohio, glacial grooves

western part of Lake Erie

http://www.hollianneholmes.com/glacialgr
oves/

Drumlins – Ice directional indicators

southern Green Bay Lobe (WI)



Evidence for Glaciation

Glacial Erratic

Jefferson County, IL

ROB KANTER: ENVIRONMENTAL ALMANAC

Rock's story includes long journey by glacier

In some parts of the world, a 100-ton boulder composed of pink granite is an unremarkable thing, but that's not the case in the Prairie State.

So when scientists with the Illinois State Geological Survey in Champaign were contacted last year by Mike Waite of Jefferson County with photographs of such a beast, they made a point of going to see it when another job brought them to the area.

The boulder Waite showed them now rests in a creek bottom, about half a mile's walk from the house where he and his wife, Sarah, live, on property that has been in her family since 1918. It measures approximately 22 feet by 10 feet by 11 feet, which makes it the biggest rock of its kind in the state, at least as far as anyone concerned knows.

Its kind is "glacial erratic": "Erratic" because it is unlike any rock that occurs near the Earth's surface where it lies, and "glacial" because a glacier is the only force powerful enough to have put it there.

Sarah Waite's family has enjoyed Illinois' largest glacial erratic as a curiosity for as long as anyone can remember; her mother, who was born in 1926, recalled being taken to it as a child. They name it the "Elephant Rock" because up until recent years only a part of it protruded from the ground, and that part reminded them of an elephant lying on its side. Since the 1930s they have gathered at Elephant Rock for family photos, in a group that now includes up to 35 people.

The full size of the "Elephant Rock" became clear only when the meandering of the nearby creek scoured away the soil around it, allowing it to roll down into its present position.

Where did the Elephant Rock originate? Probably somewhere in northeastern Ontario, according to David Grimley, one of the ISGS geologists who went to look at it. That area is part of what geologists call the Canadian Shield, a vast region of igneous and metamorphic rock that occurs near the surface in the area surrounding Hudson Bay, an area where granite like that comprising the Elephant Rock may be found.

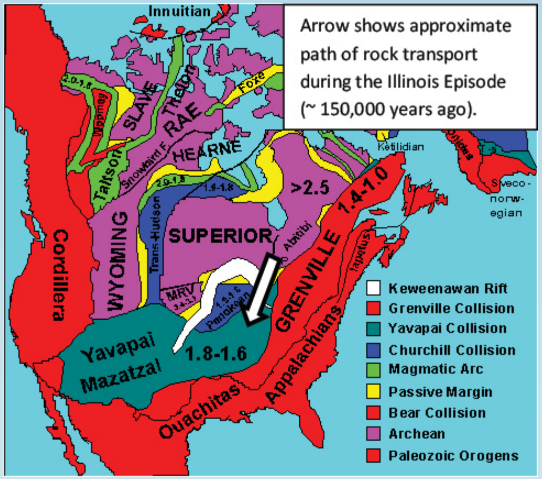
Imagine that. A 100-ton boulder riding as much as a thousand miles on top of or inside a vast sheet of ice, passing right by us on its way to the southern part of the state. The farthest south any glacier ever advanced in the Northern Hemisphere was only 50 miles beyond where the Elephant Rock landed, so it traveled just about as far as it possibly could have.

Grimley pointed out that geologists understand something about the timing of the Elephant Rock's journey, too, since the last glaciers that could have moved it extended into southern Illinois some 150,000 years ago.

Unfortunately, the Elephant Rock is not situated where people can go see it for themselves, but Sarah Waite pointed out to me there is an accessible natural attraction nearby. It is the state's largest flowering dogwood tree, certified by the Illinois Big Tree Registry, which grows in the Union Chapel Cemetery, about seven miles east of the town of Dix.

Closer to home, the University of Illinois Institute of Natural Resource Sustainability, of which the ISGS is a division, will host its annual expo, Naturally Illinois, on Friday and Saturday of this week. The expo will feature more than 50 science-based exhibits, hands-on activities and demonstrations for all ages. Visitors to the expo will have the opportunity to interact with scientists who work on cutting-edge research and solutions to natural and cultural resource issues.

Rob Kanter is a senior writer with the Environmental Change Institute. Environmental Almanac is supported in part by the UI Office of Sustainability and can be heard on WILL-AM 580 at 4:45 and 6:45 p.m. Thursdays.



Arrow shows approximate path of rock transport during the Illinois Episode (~ 150,000 years ago).

Minerals/ Exotic Rocks in glacial sediments

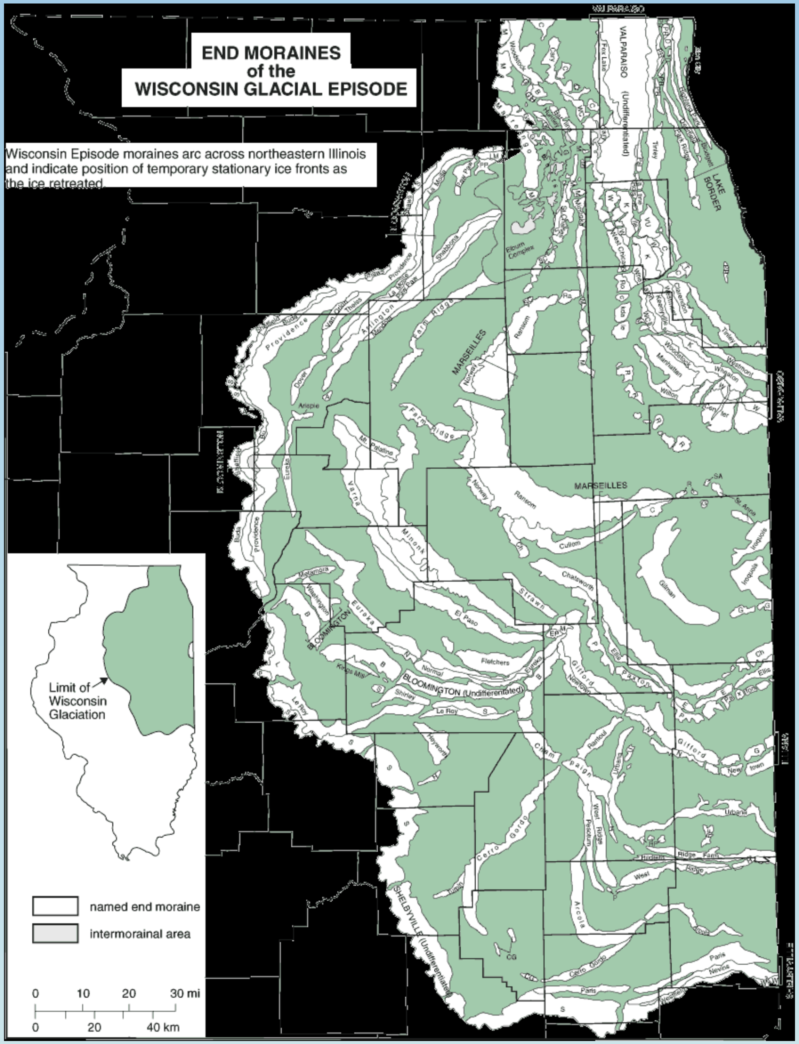
http://www.isgs.illinois.edu/outreach/geology-resources/conglomerate?width=600&height=400

http://www.isgs.illinois.edu/outreach/geology-resources/omar?width=600&height=400

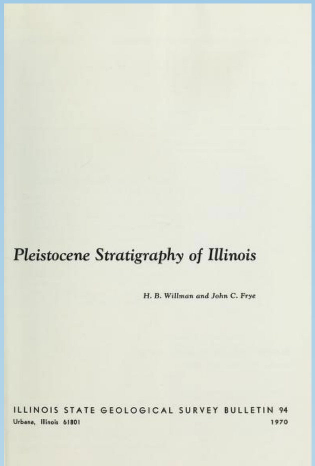
http://www.isgs.illinois.edu/outreach/geology-resources/tillites?width=600&height=400

http://www.isgs.illinois.edu/sites/isgs/files/images/outreach-images/belcher.gif

H.B. Willman and J.C. Frye, 1970



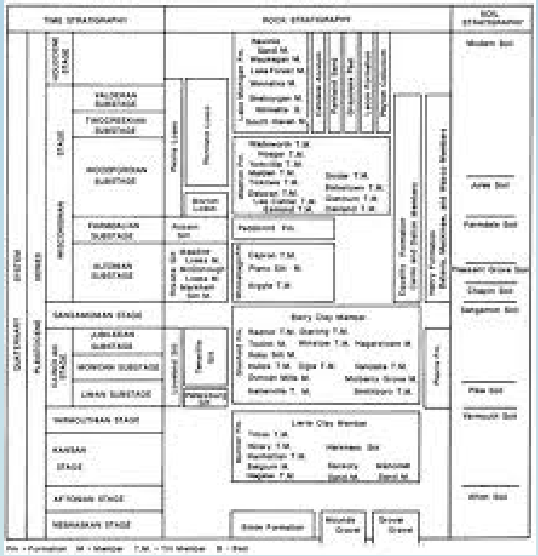
Wisconsin Episode moraines arc across northeastern Illinois and indicate position of temporary stationary ice fronts as the ice retreated.



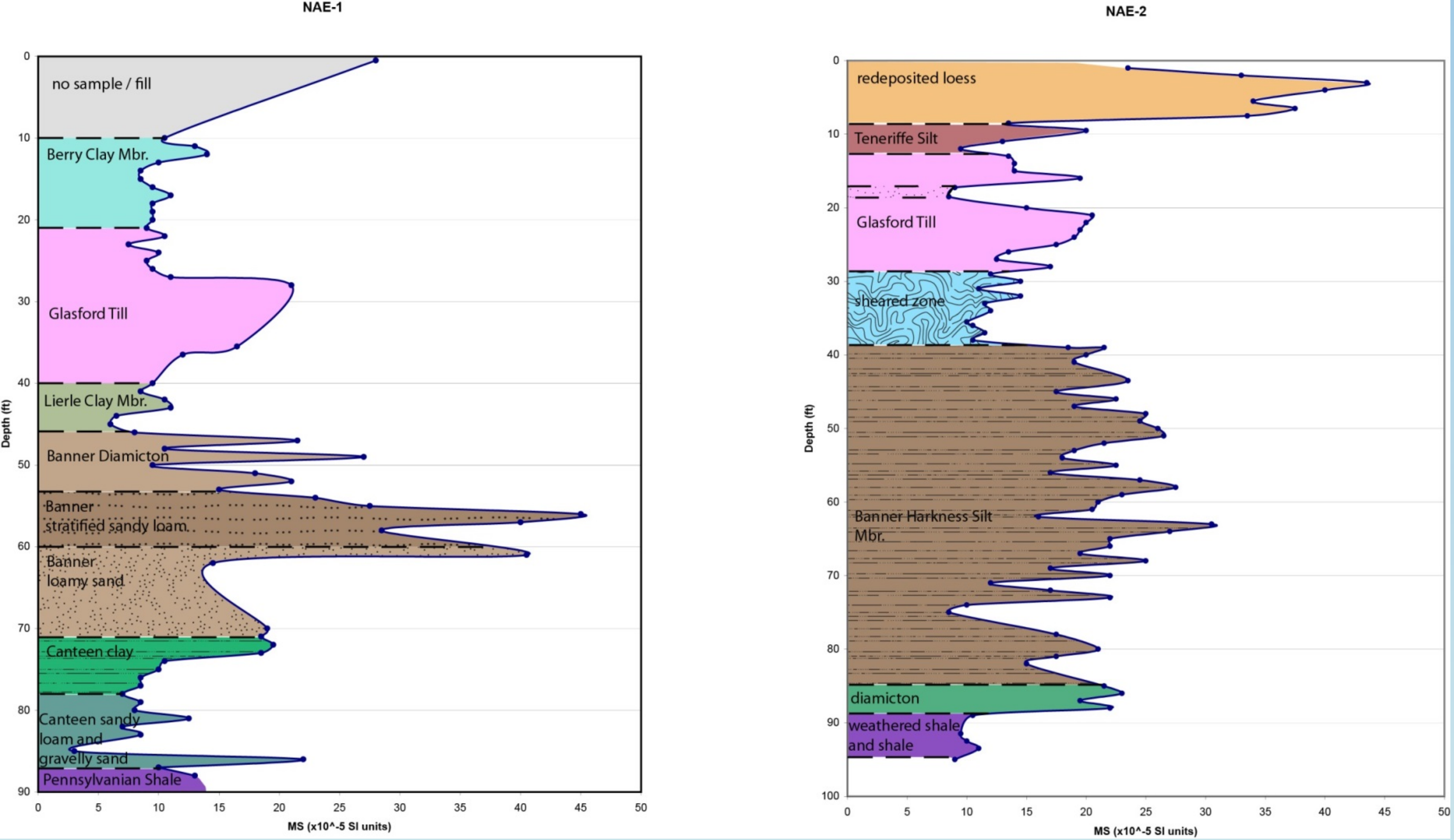
Pleistocene Stratigraphy of Illinois

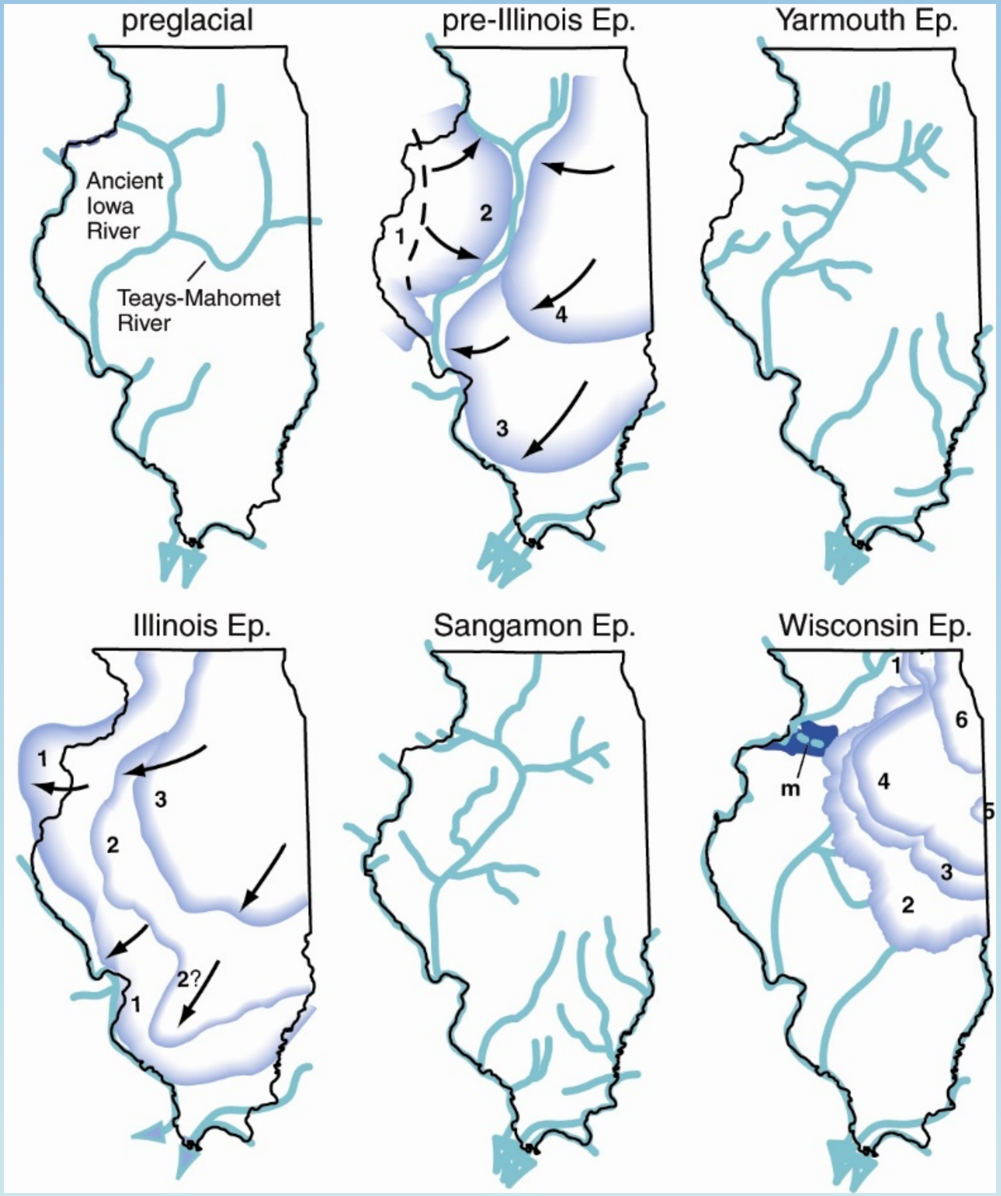
H. B. Willman and John C. Frye

ILLINOIS STATE GEOLOGICAL SURVEY BULLETIN 94
Urbana, Illinois 61801 1970



Mineral/Magnetic Signatures in Glacial Sediment




preglacial
Ancient Iowa River
Teays-Mahomet River
pre-Illinois Ep.
1
2
4
3
Yarmouth Ep.
Illinois Ep.
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2?
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Sangamon Ep.
Wisconsin Ep.
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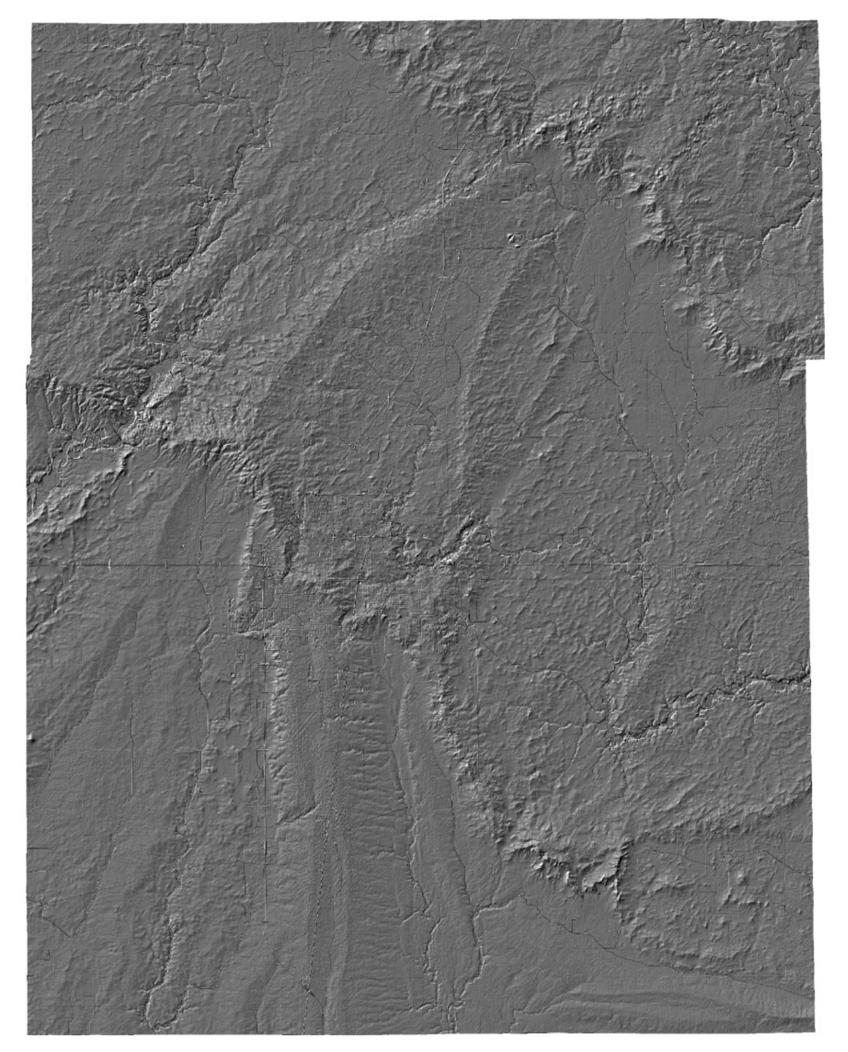
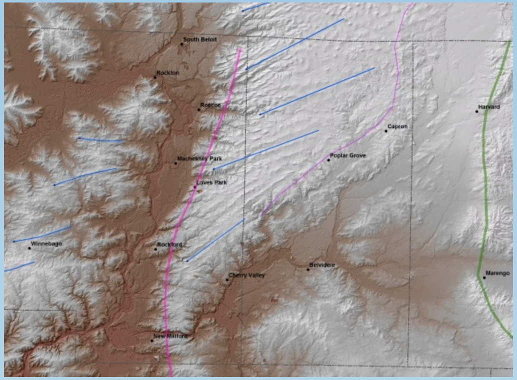
LiDAR image, Champaign County



Ice Flow Directional Indicators

Northern Illinois flutings



Mega-lineations on
10m DEM from
southeastern Illinois