

# Glacial (and related) landforms

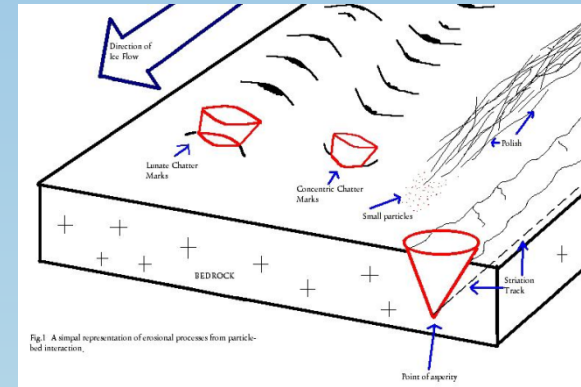
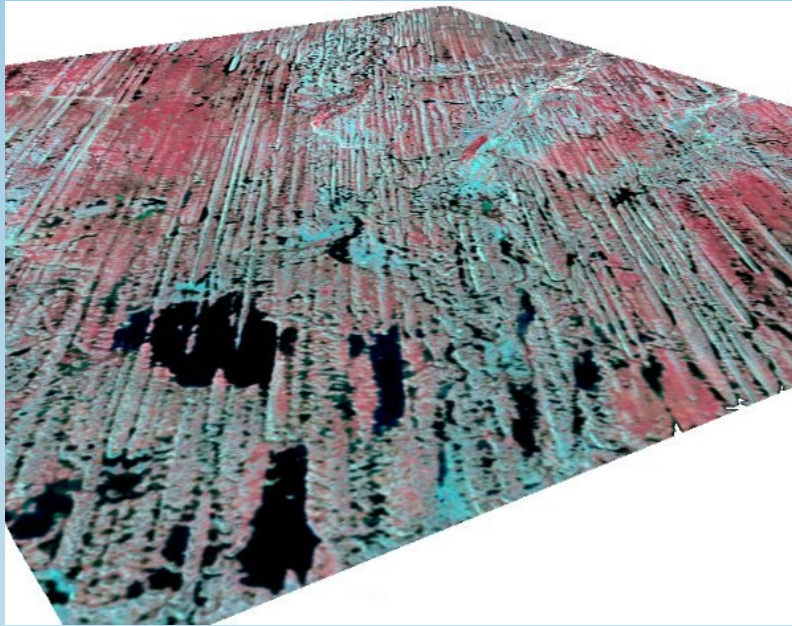


Fig. 1. A simple representation of erosional processes from particle-bed interaction.



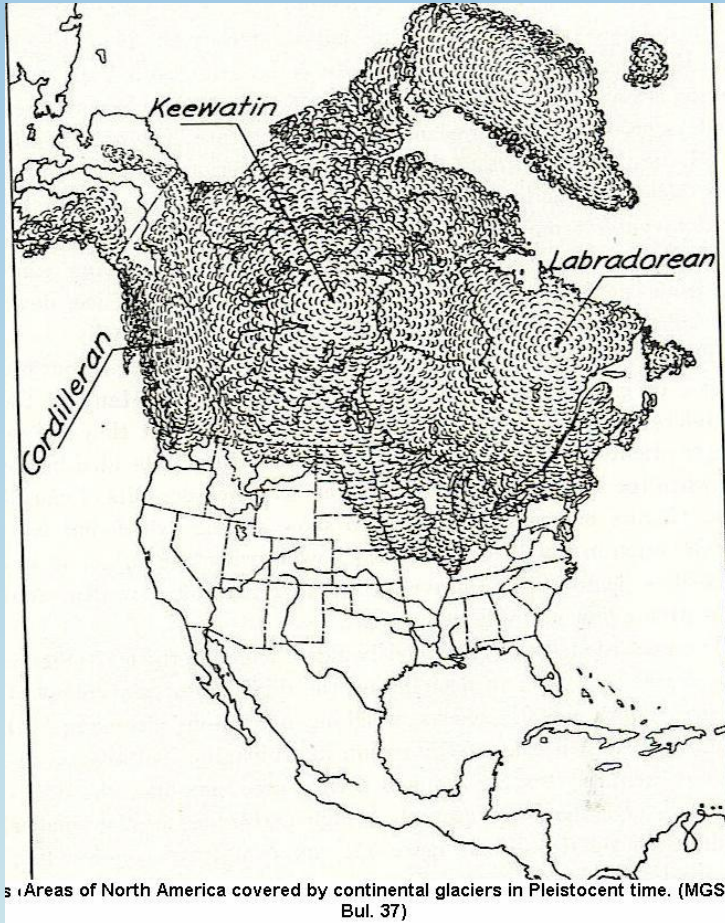
David A. Grimley, Illinois State Geological Survey,  
Prairie Research Institute, University of Illinois.  
[dgrimley@illinois.edu](mailto:dgrimley@illinois.edu) (217)-244-7324

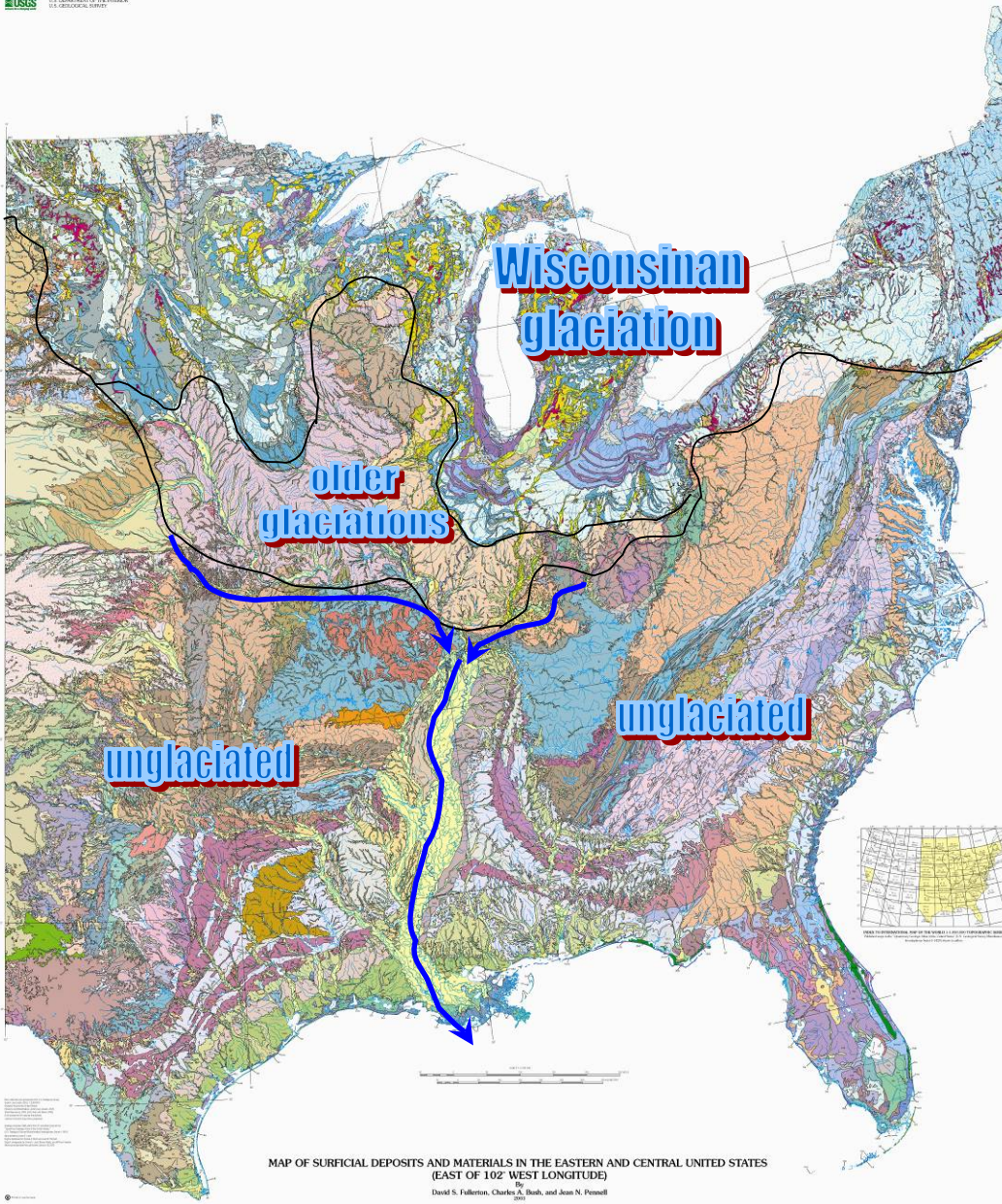


# Outline: Glacial (and related) landforms

- overview- Geomorphology: erosion vs. deposition
- mega-landforms ----
  1. glaciated vs. unglaciated
  2. Great Lakes
  3. megalineations
  4. large moraines
  5. mega stoss-lee features
  6. valley train systems
  7. large proglacial lakes (Aggasiz)
  8. marine terraces ?
- medium-landforms
  1. drumlins / flutes
  2. eskers
  3. kames and other ice-contact
  4. roche moutonees
  5. outwash plains and delta
  6. paleo-braid bars
- micro-landforms
  1. crag and tail
  2. hairpin erosion marks
  3. striations
  4. micro stoss-lee
  5. bullet stones

# Glaciation in North America





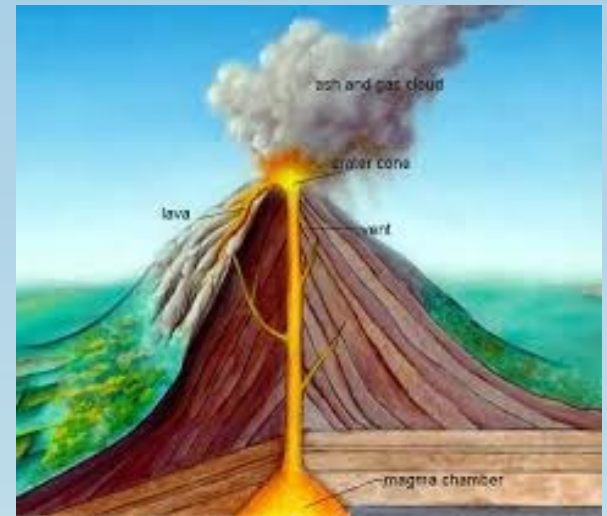
# Quaternary / Surficial Deposits in Eastern USA

- glacial lobes
- glacial meltwater drainage
- <http://www.youtube.com/watch?v=wbsURVgoRD0>
- <http://www.nature.com/nature/journal/v500/n7461/extref/nature12374-sv1.mov>  
(video of glacial retreat)

# concept of constructional (depositional) vs. destructional (erosional) landforms



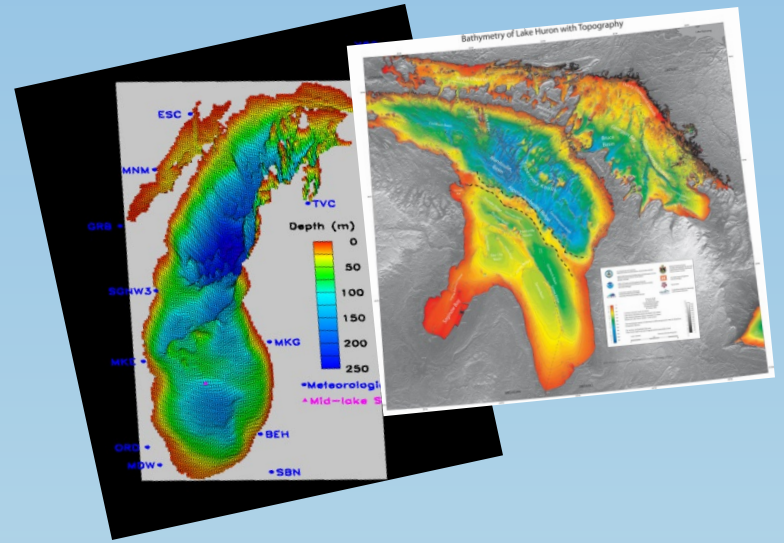
canyon --



volcano --



moraine



Lake Michigan and Huron bathymetry



esker



glacial grooves

# MEGA-SCALE LANDFORMS

## Great Lakes with Bathymetric Data



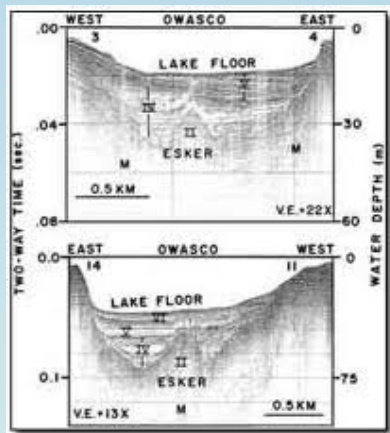
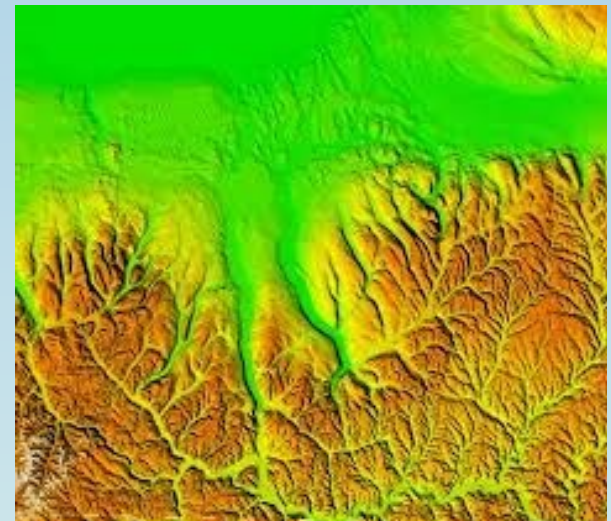
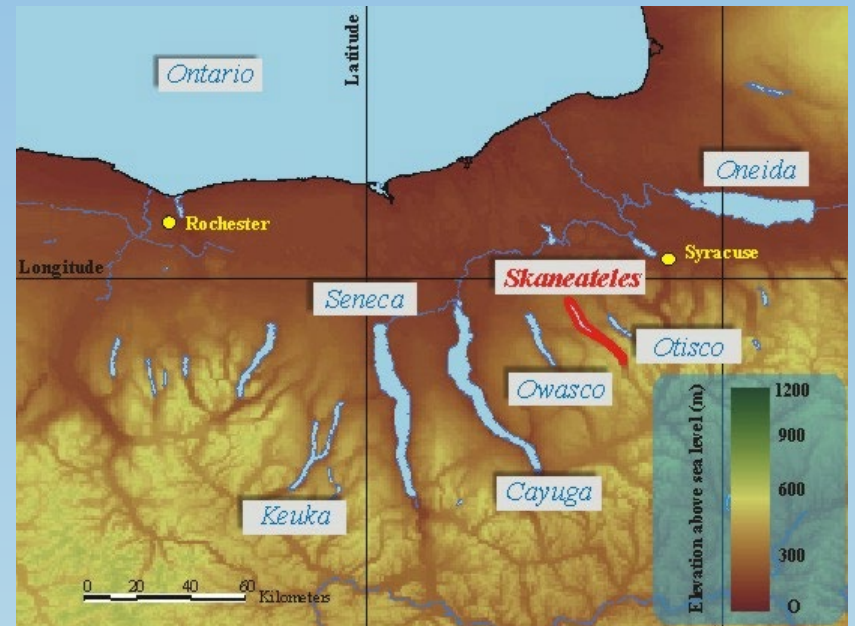


# Great Lakes, Feb. 2014



This image, acquired by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite, shows the Great Lakes on February 19, 2014, when ice covered 80.3 percent of the lakes. *Image Credit: Jeff Schmaltz, LANCE/EOSDIS MODIS Rapid Response Team, NASA*

# Finger Lakes



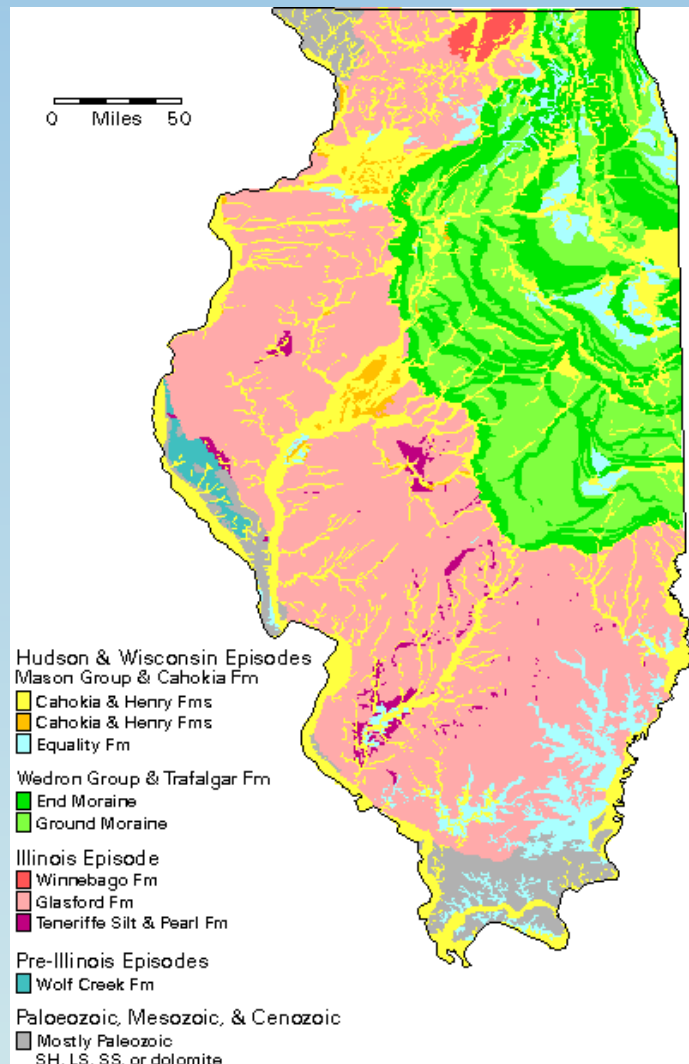
Copyright by BRADFORD WASHBURN

Subject: *Head of Susitna G.l.*

No. 27

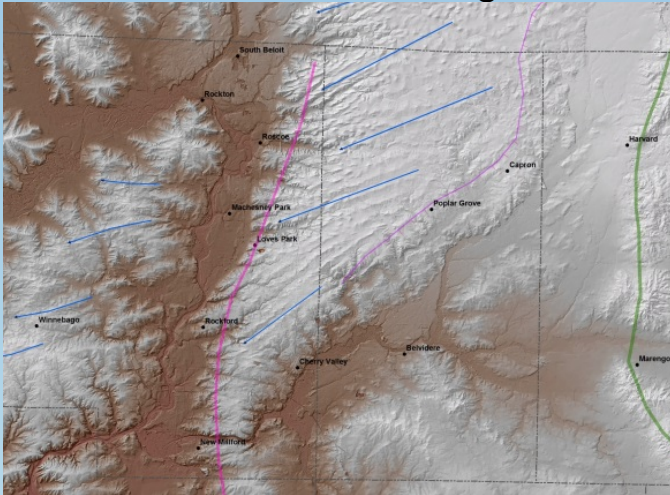


Origin and development of contorted medial  
terrains.

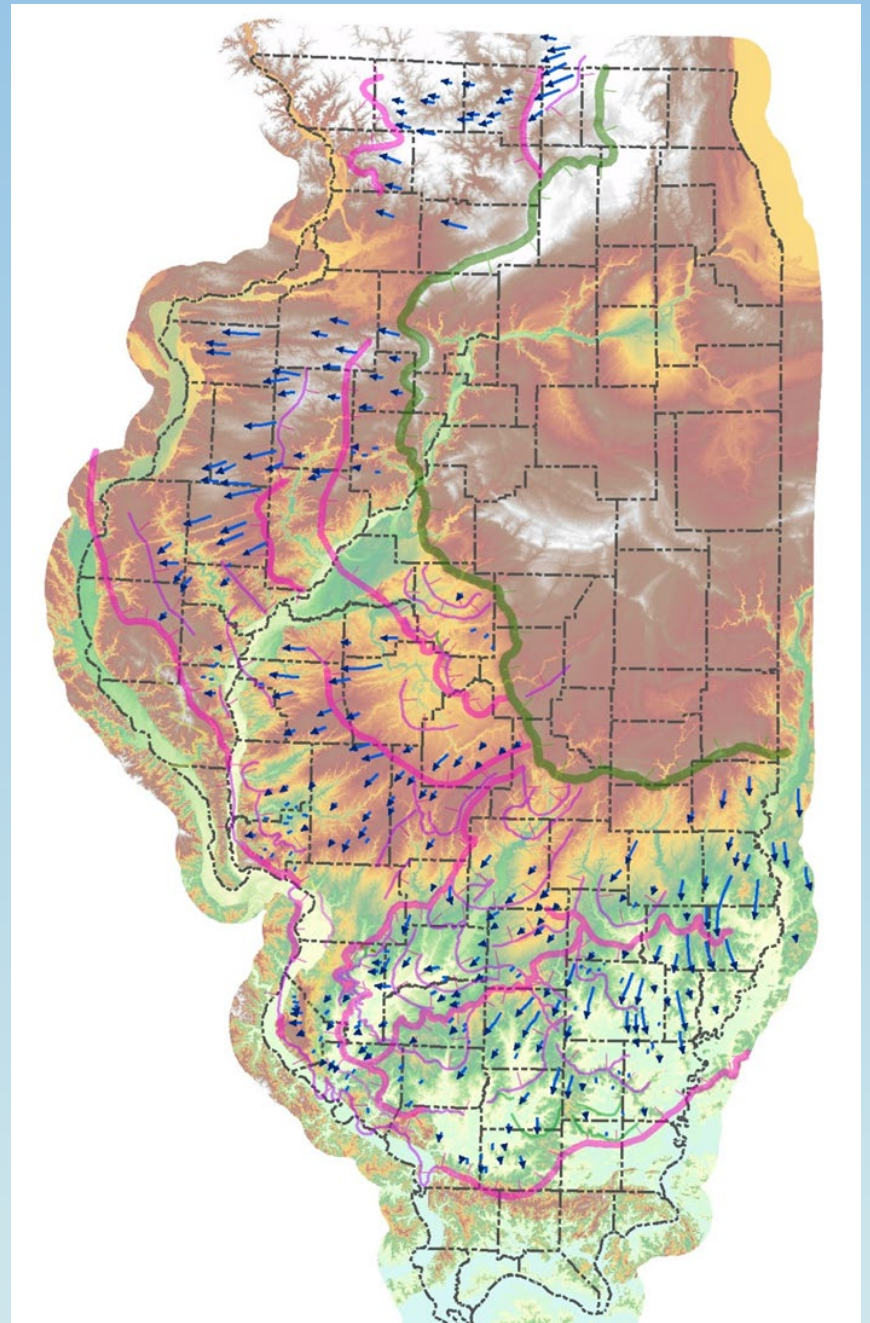
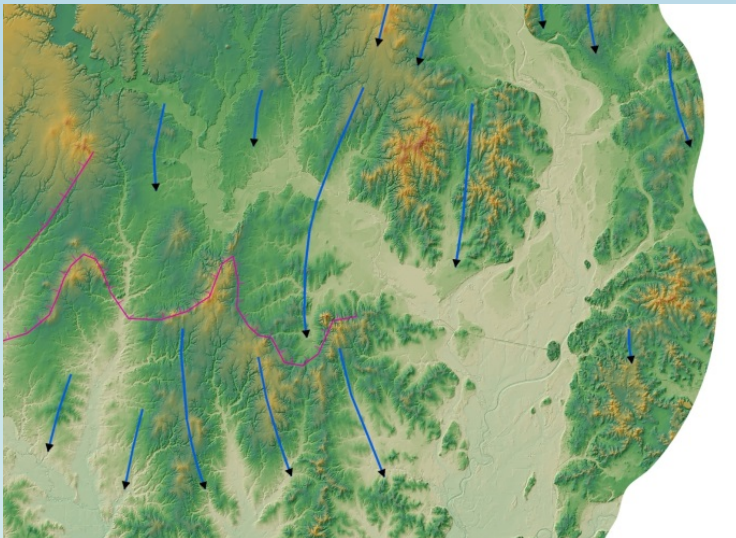


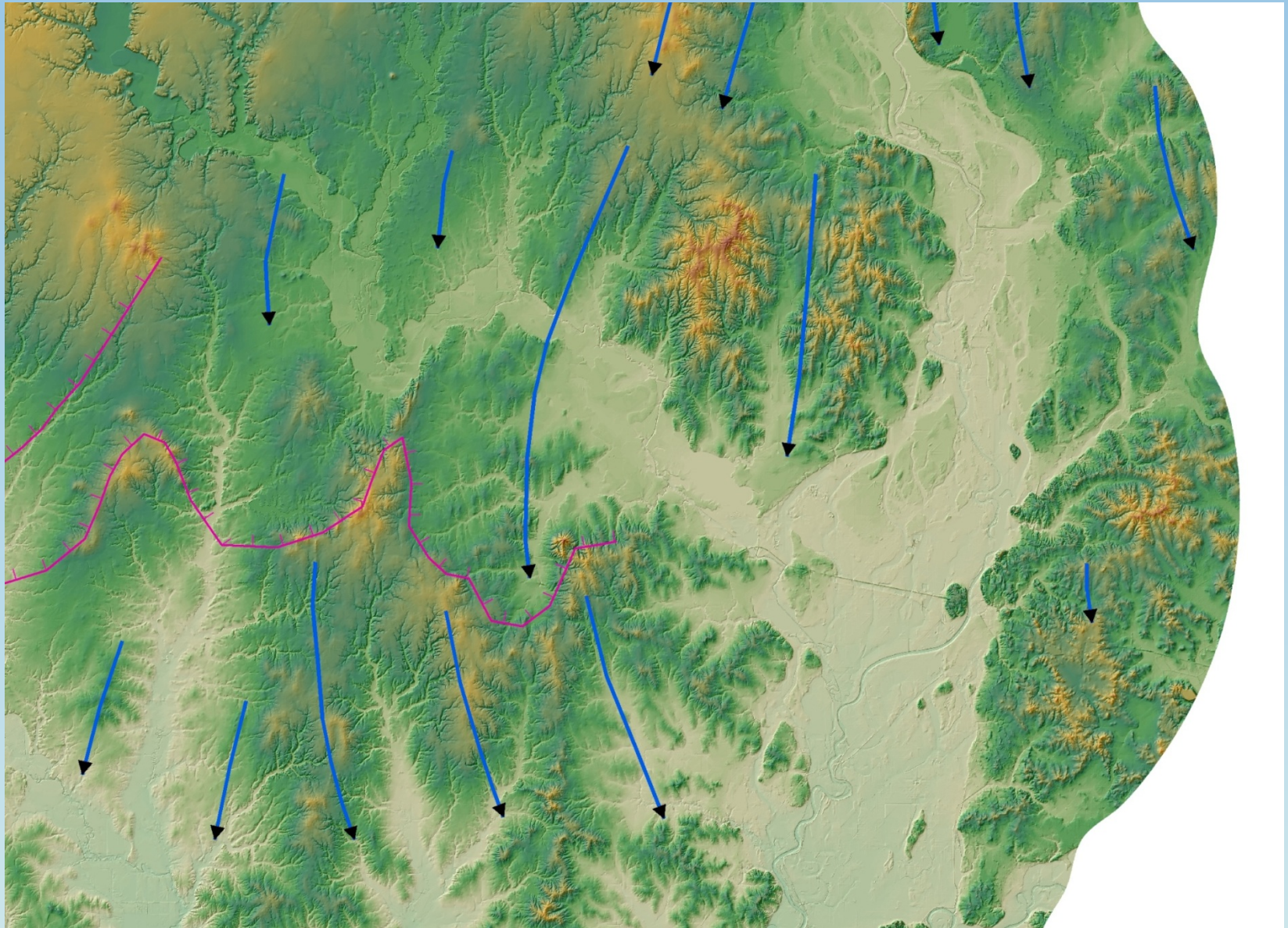
# Ice Flow Directional Indicators

Northern Illinois flutings



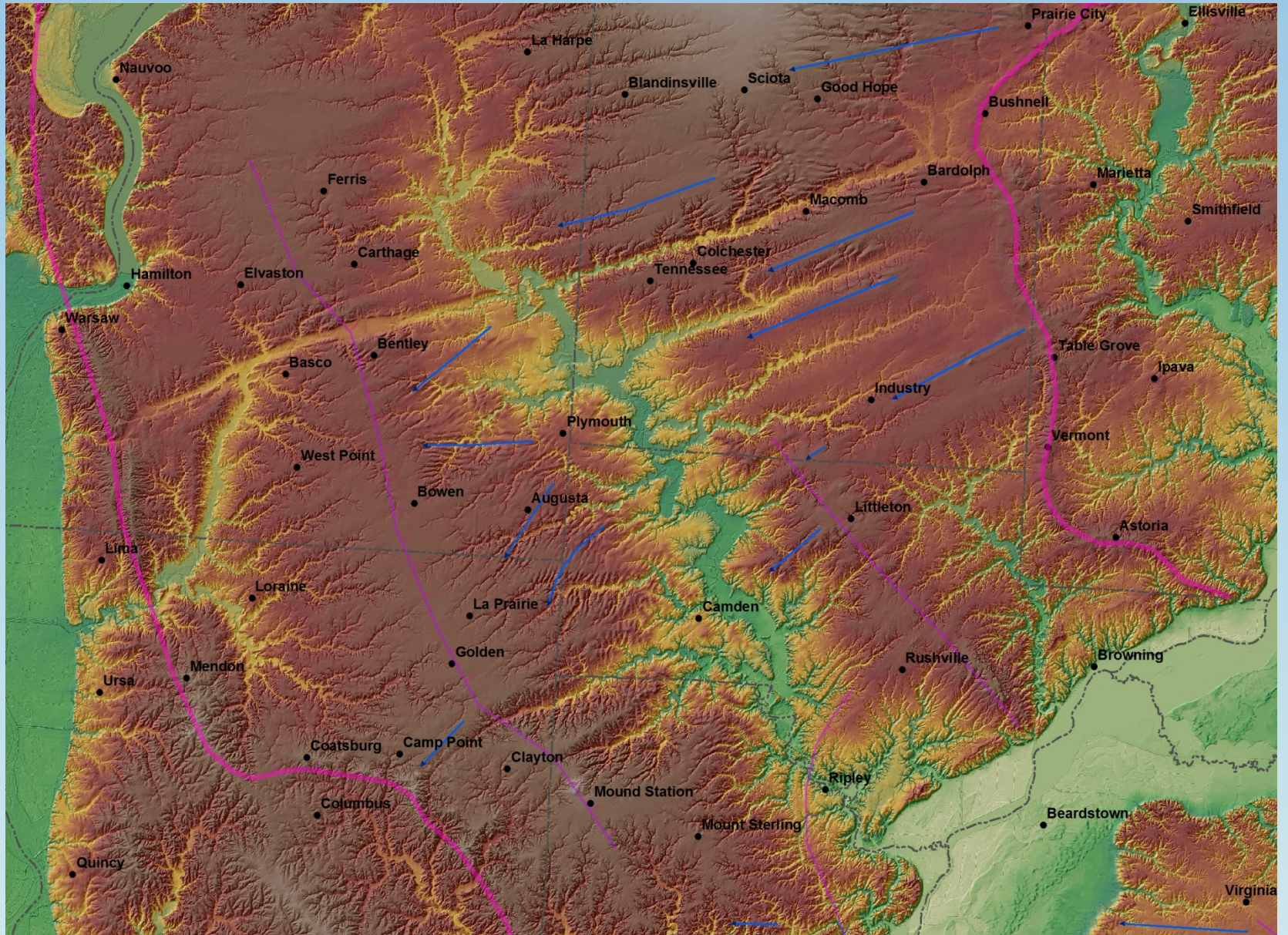
Mega-lineations on 10m DEM from southeastern Illinois



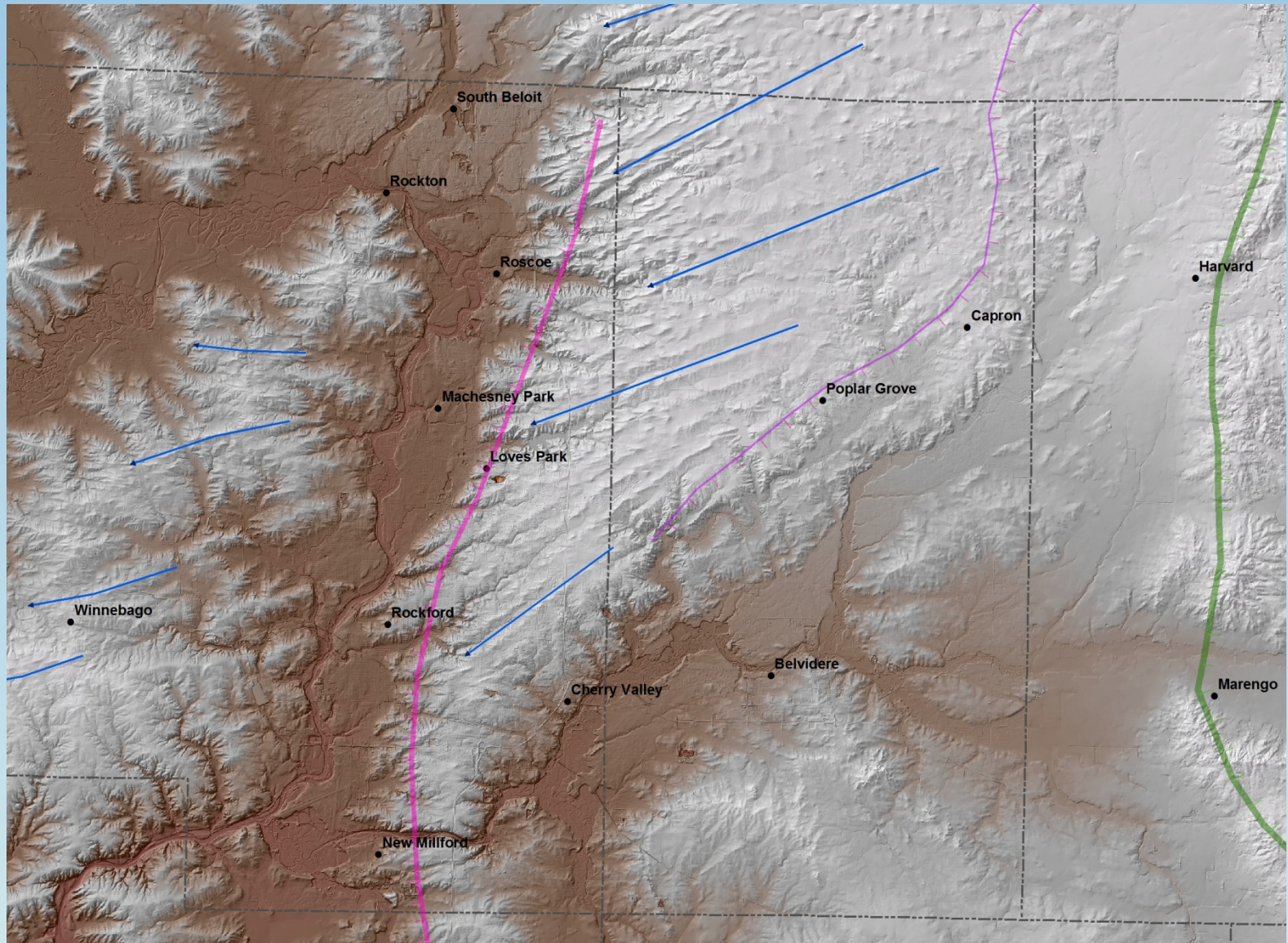


Mega-lineations on 10m DEM from southeastern Illinois

# Western Illinois lineations and areal scouring

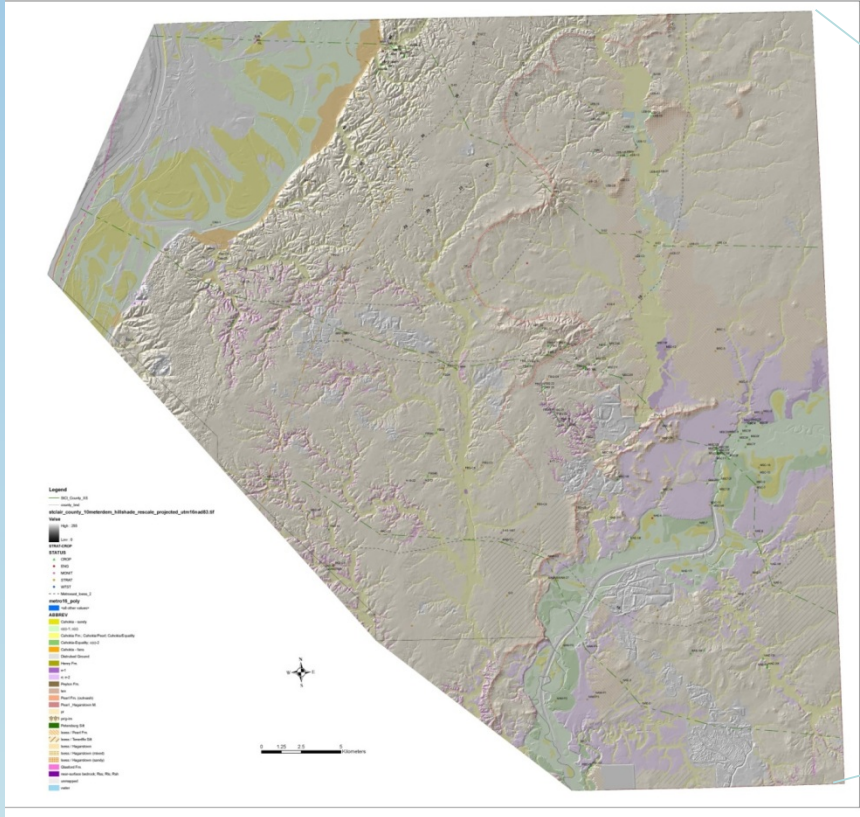


# Northern Illinois flutings

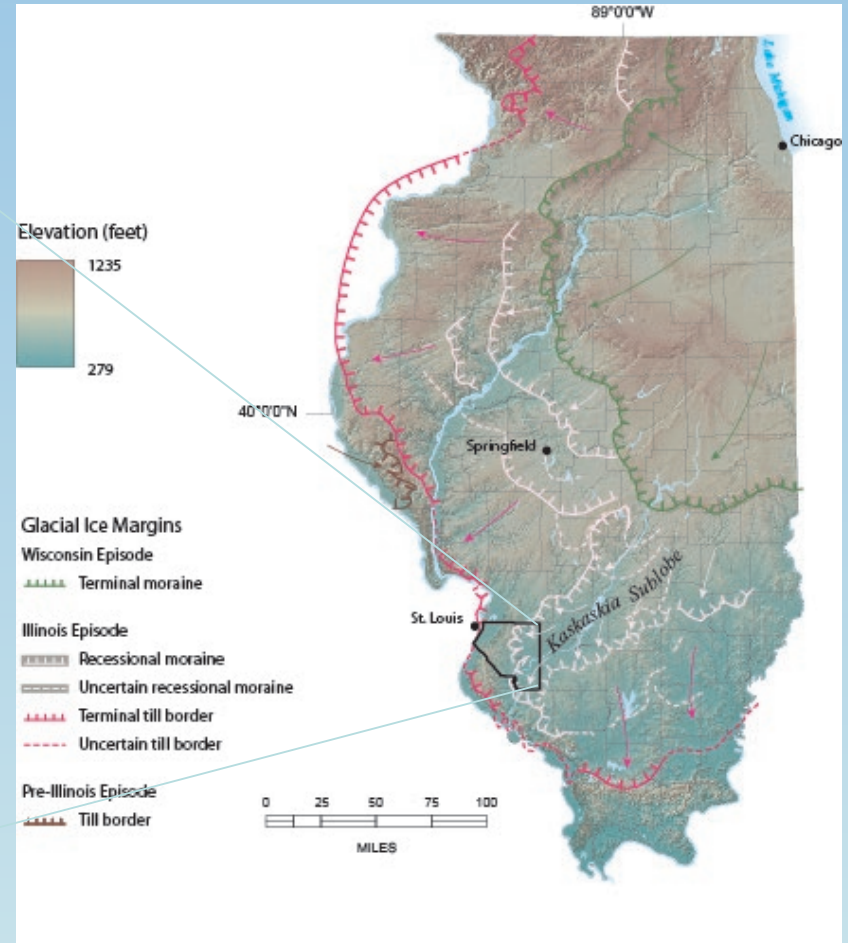




# Ice Margin Bulges and Sublobes

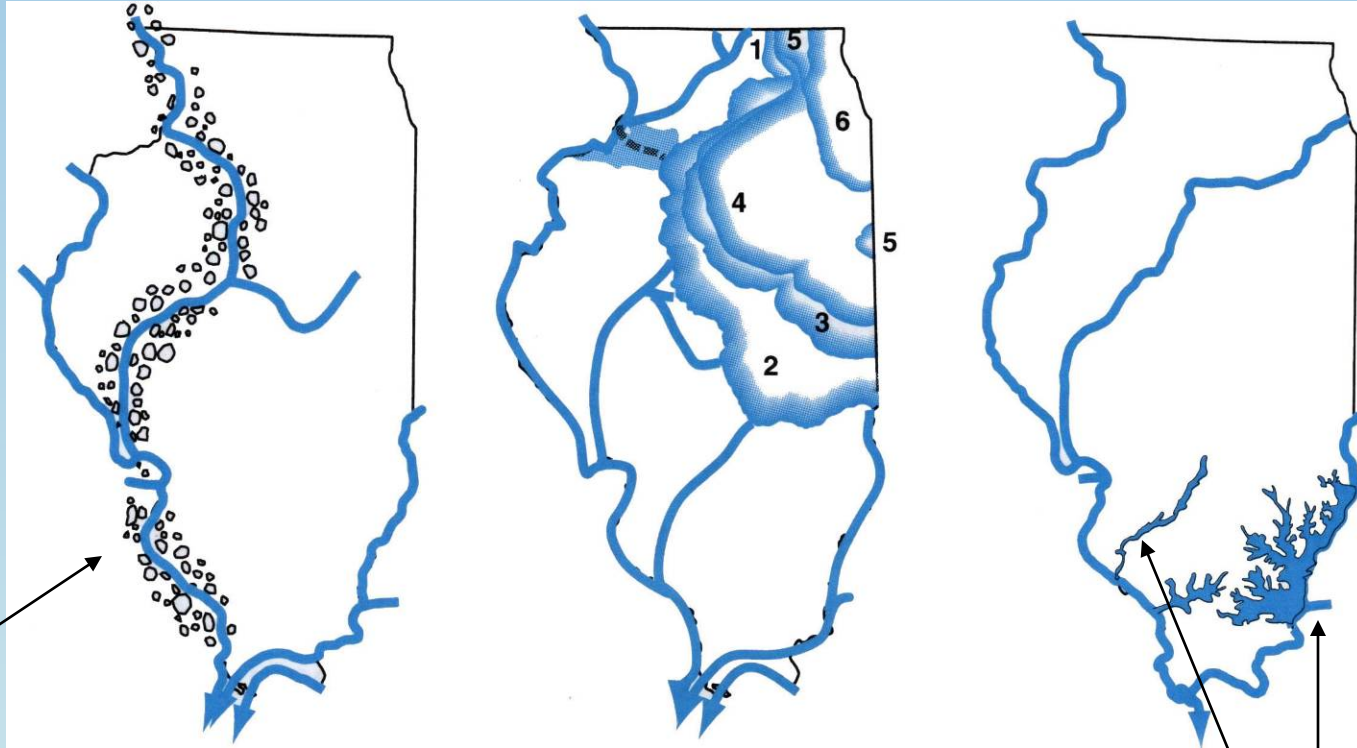


Recessional ice margin; St. Clair Co.



Grimley and Phillips, FOP 2011

# Wisconsin Episode (or Wisconsinan Stage)



outwash

pre-20,000

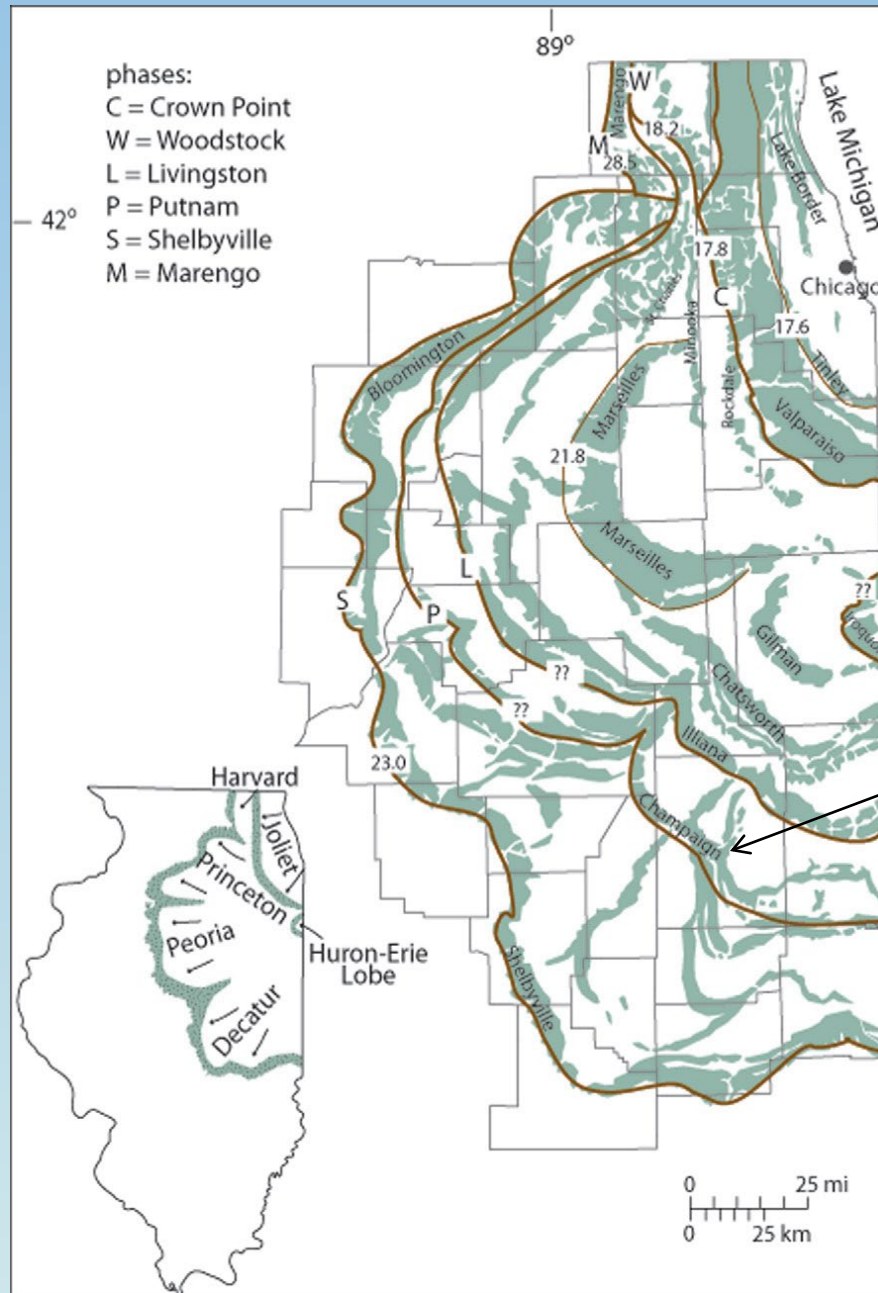
diversion of  
Mississippi R.

~ 55,000 to 12,000 years ago

slackwater  
lakes

# Moraine Ages

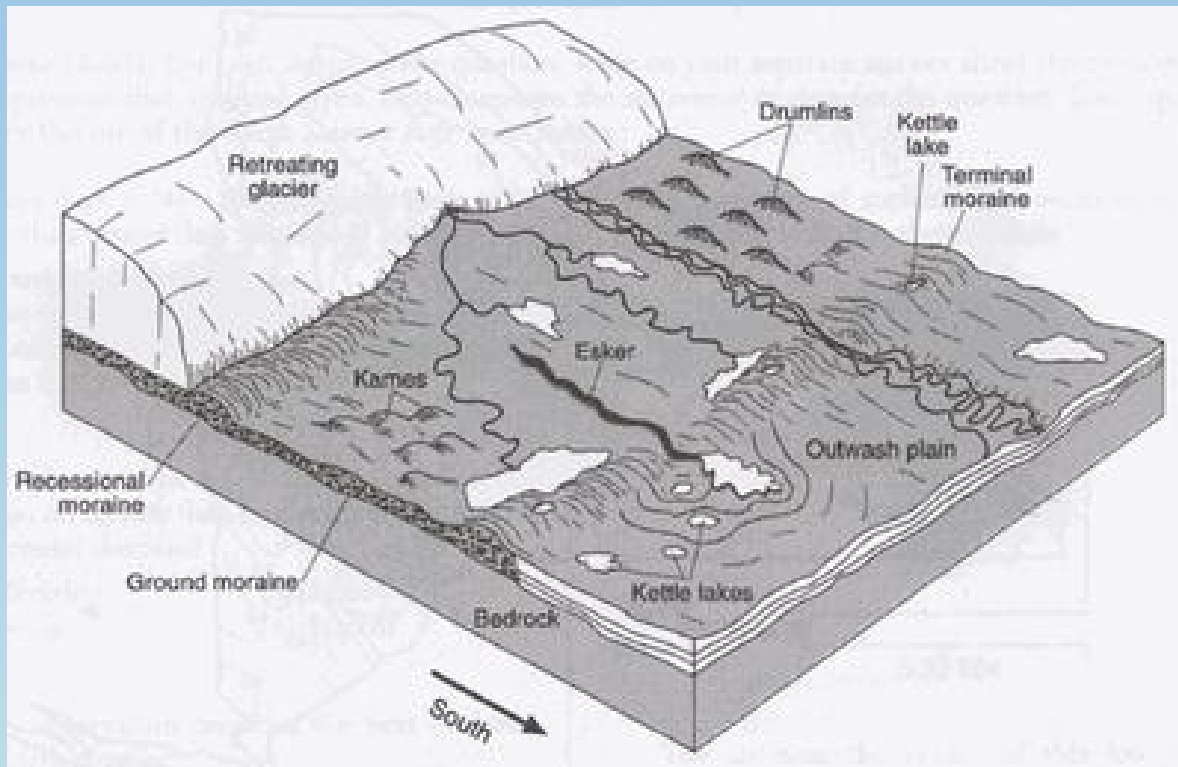
17,000 to  
28,000



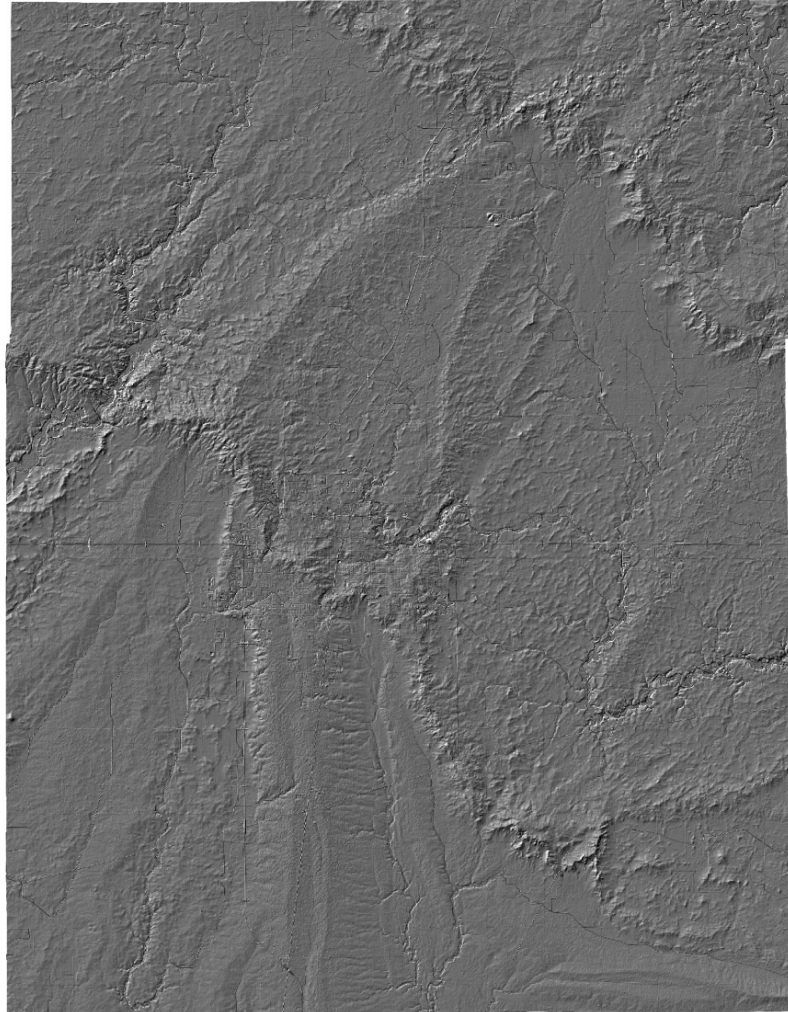
CU

- Google Maps or Bing Maps
- <http://www.bing.com/maps/>
- <http://www.google.com/maps>

# MEDIUM-SCALE LANDFORMS



# LiDAR image, Champaign County



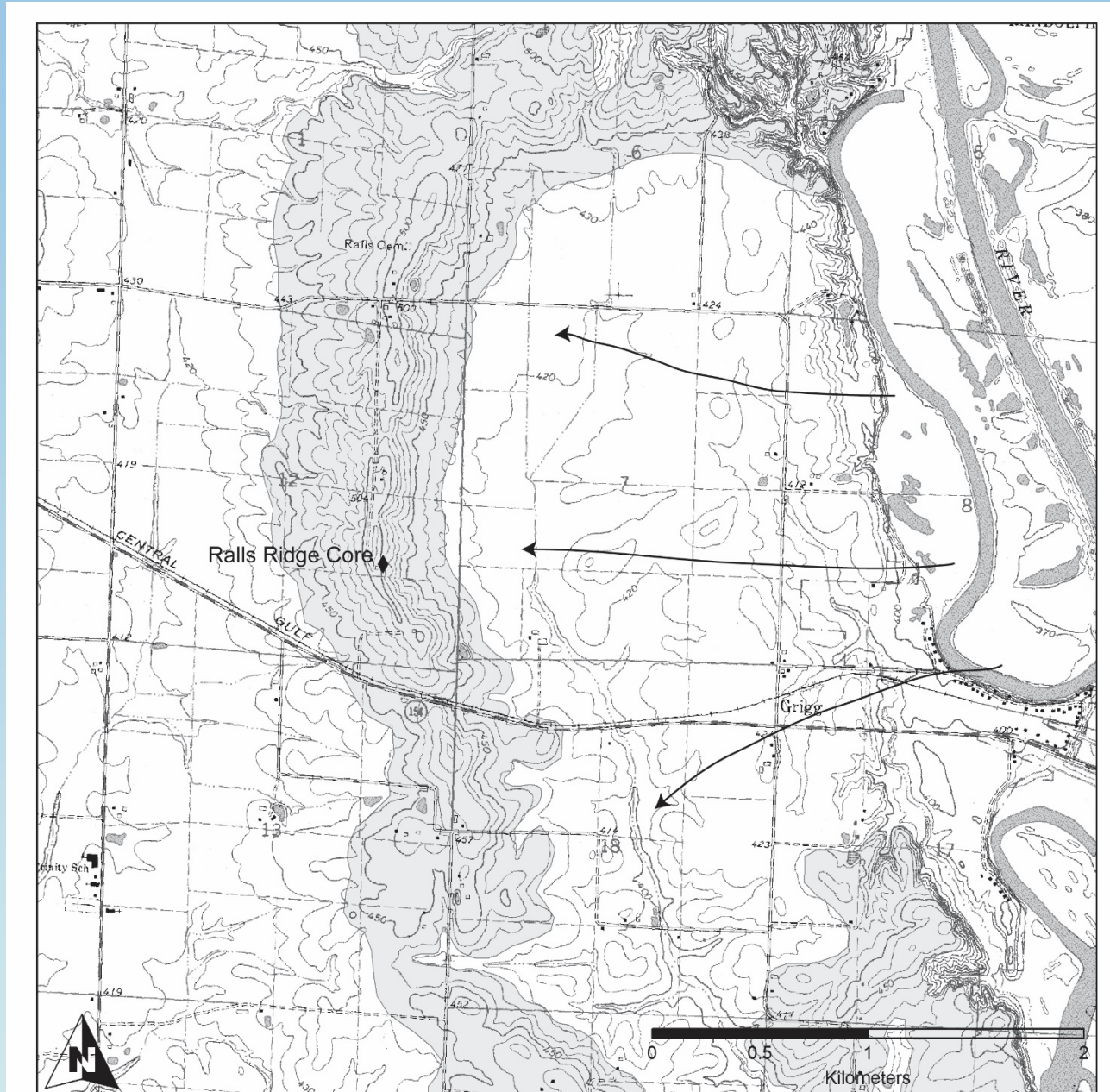
# Moraines.....



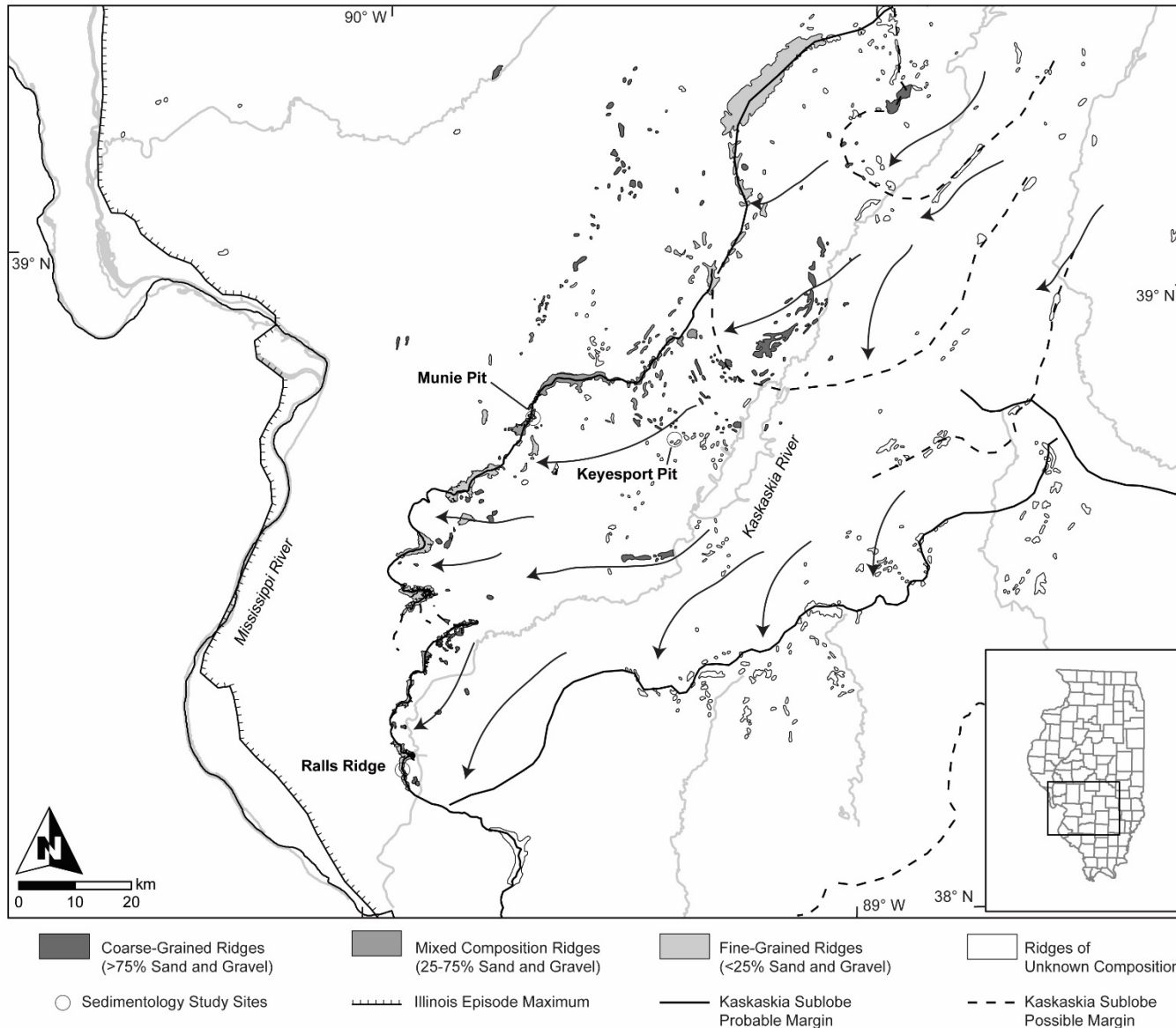
Ralls Ridge, Randolph Co., IL



# Topographic Map of a Moraine --- Southern Illinois



# Kaskaskia Ice Stream



Copyright by BRADFORD WASHBURN

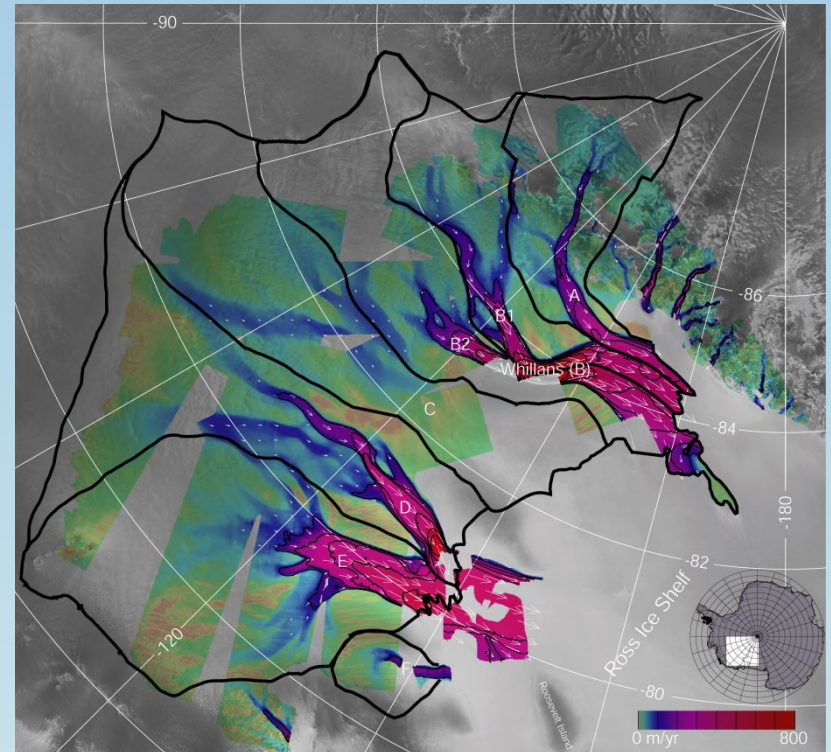
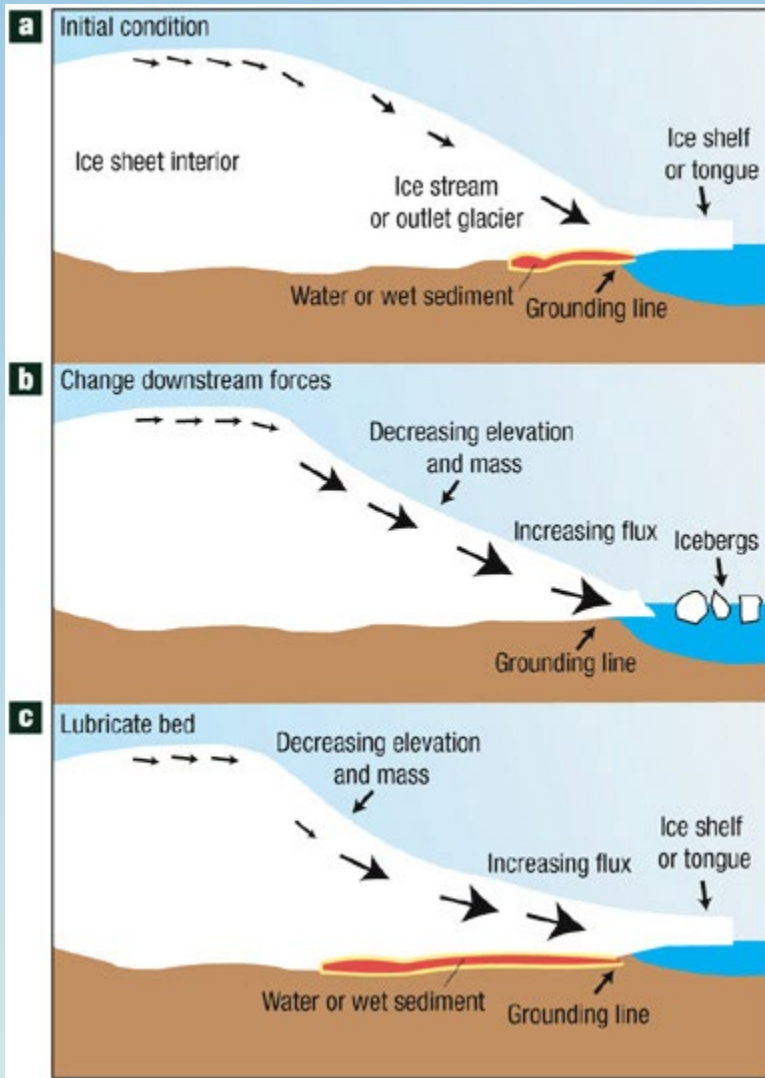
Subject: *Janus* glacier

No. 74

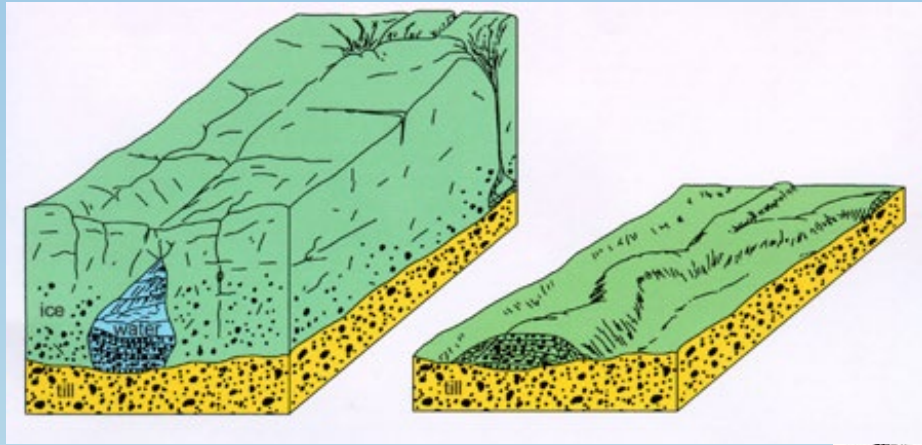


bulbous, crevassed front of a rapidly advancing glacier.

# Ice Streams

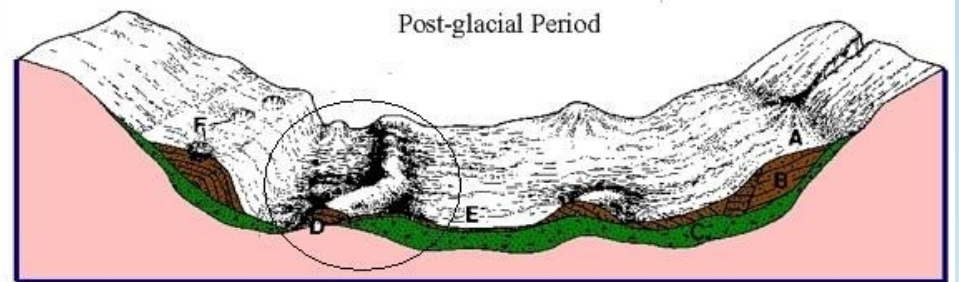
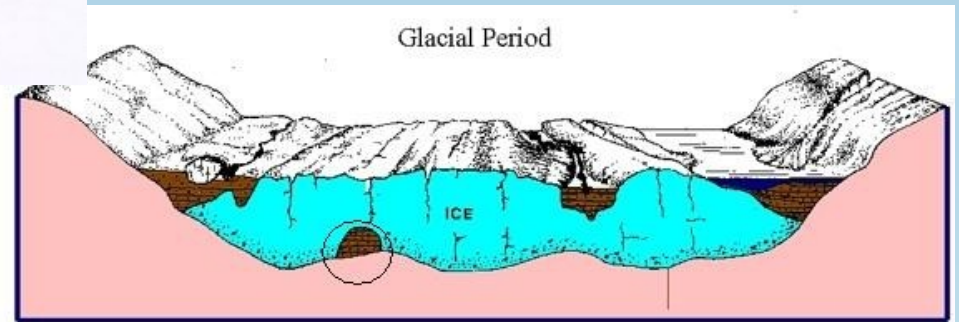


# Eskers - glacial



<http://www.youtube.com/watch?v=CVAPWfyoxK4>

<http://www.youtube.com/watch?v=wnQCi-rTJas>

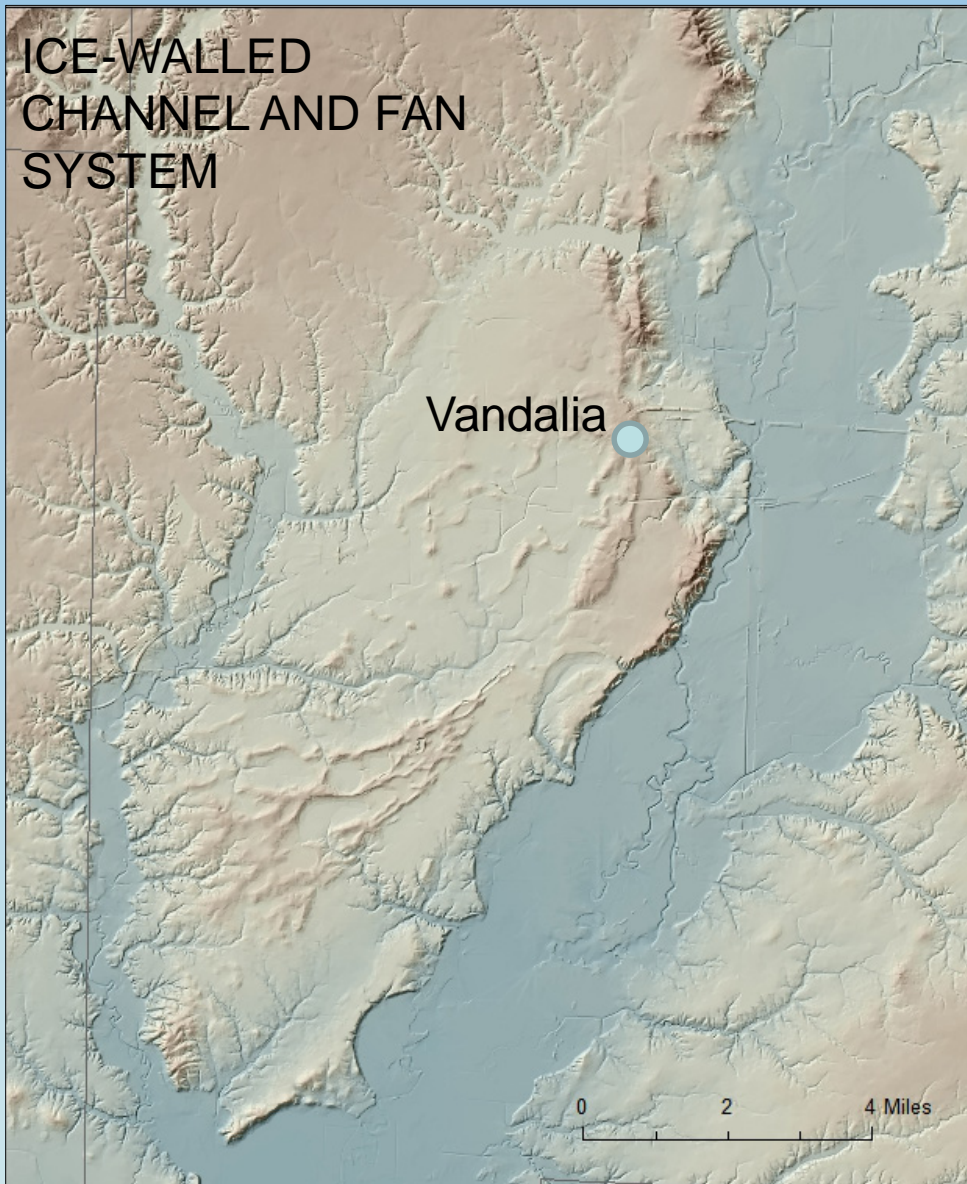




large esker in Manitoba



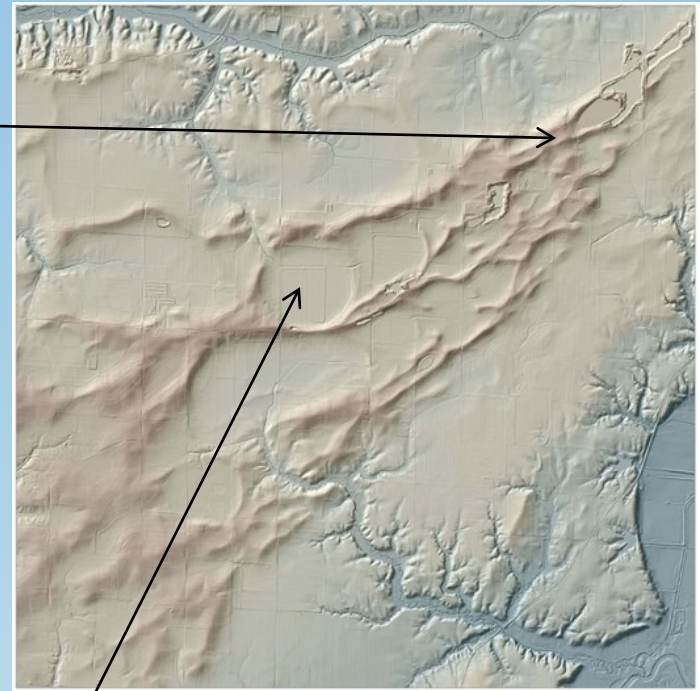
Eskers



(Fayette County)



Central Illinois Materials Pit



Ice-walled glacial meltwater fan ---



Pittsburg Basin



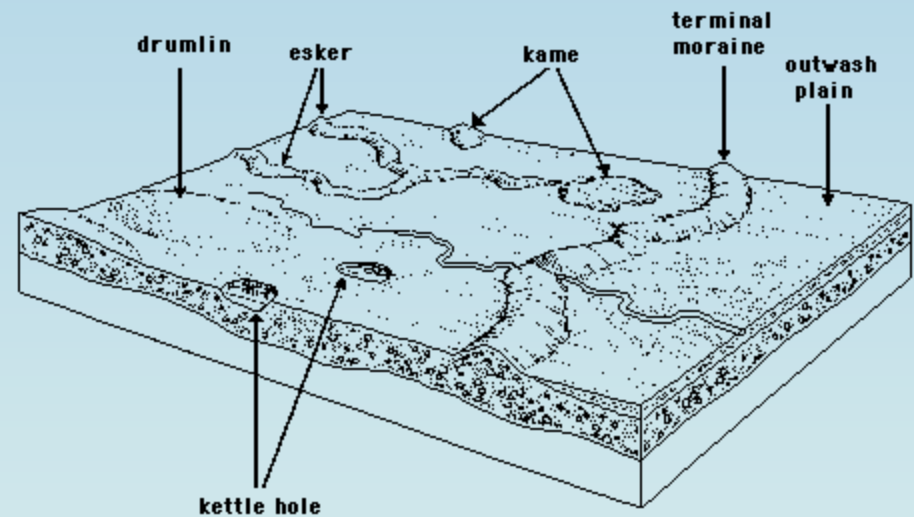
# Kames

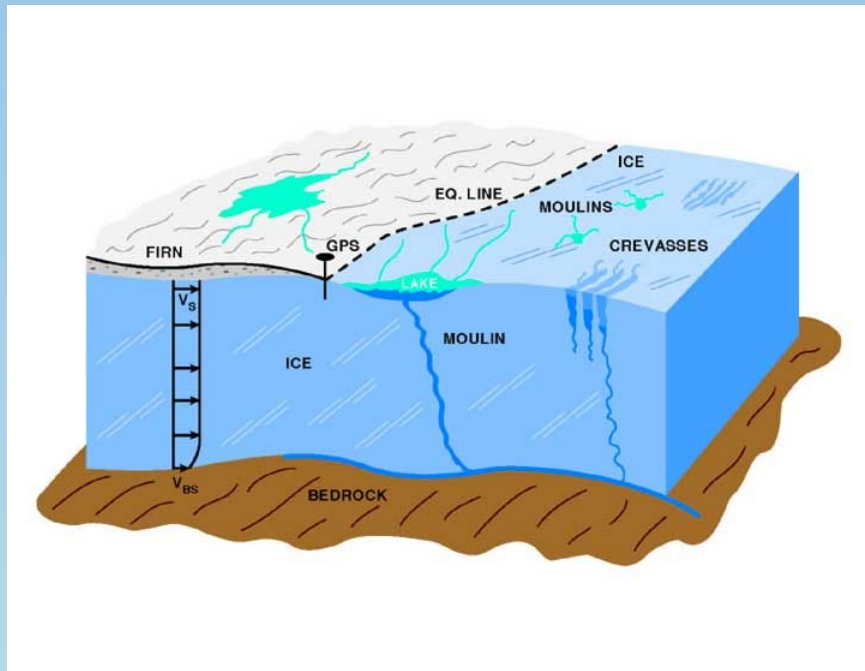


Monticello Rd. kame (Wisconsin)



near Sugar Grove, Kane Co., IL





Moulin ---→ moulin kame

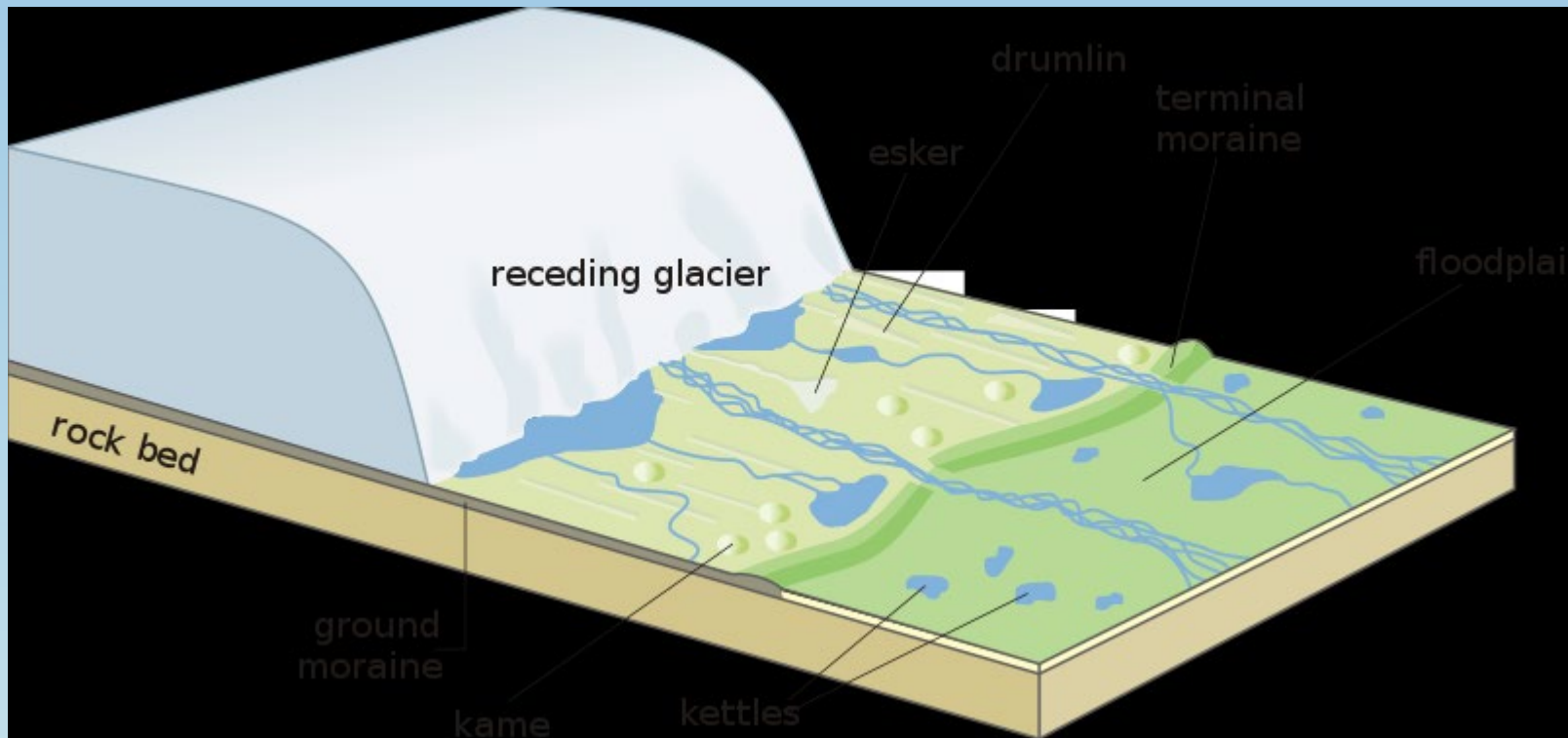
# Glacial ridges in south-central Illinois



Neudecker's Mountain, Madison County



Keyesport sand and gravel pit,  
Bond County



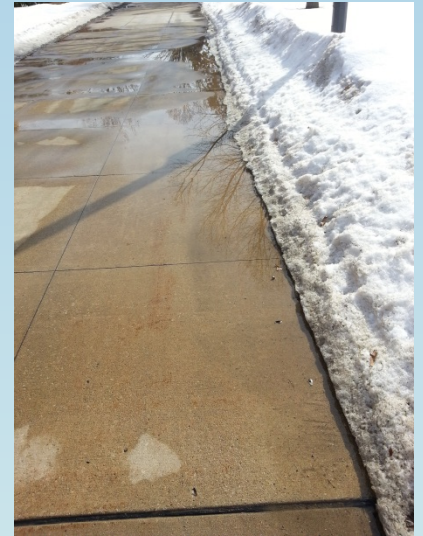
# Moraine blocked lakes

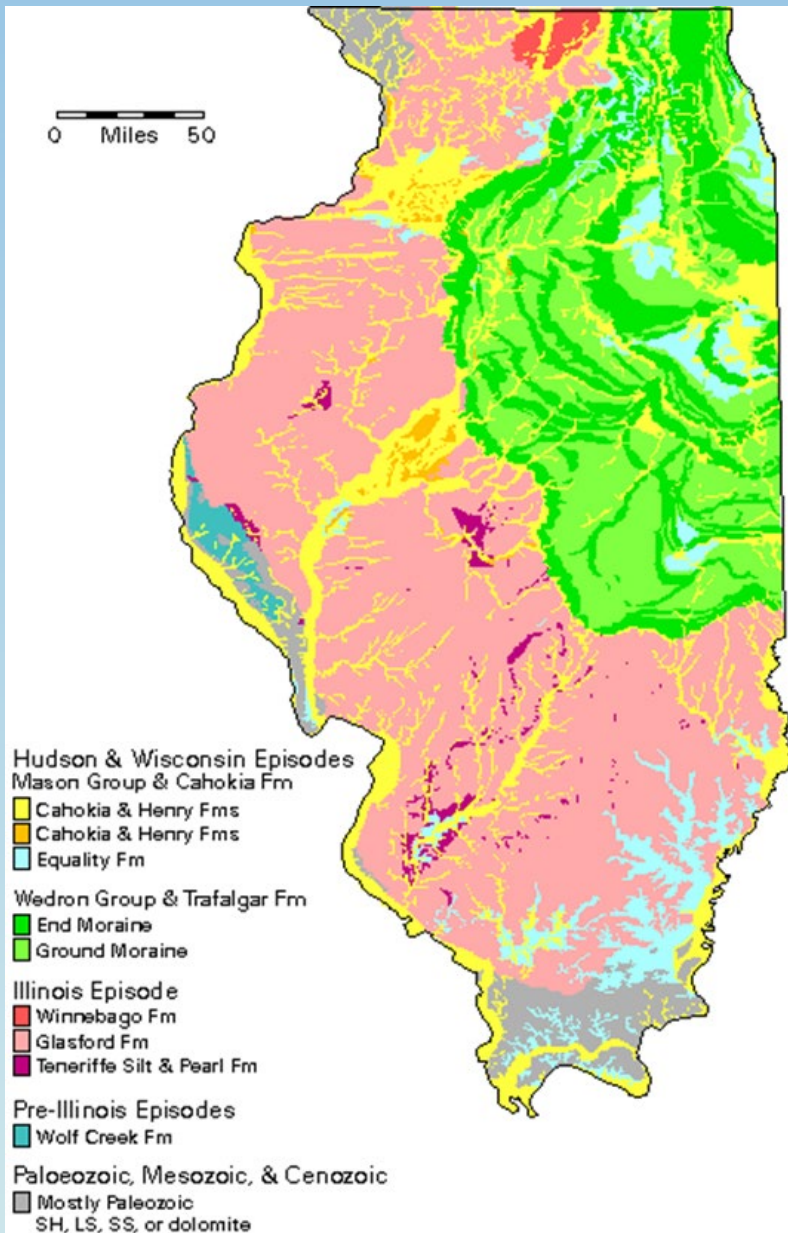


Glacial Lake Pingree --- near Pingree Grove, Kane County, IL

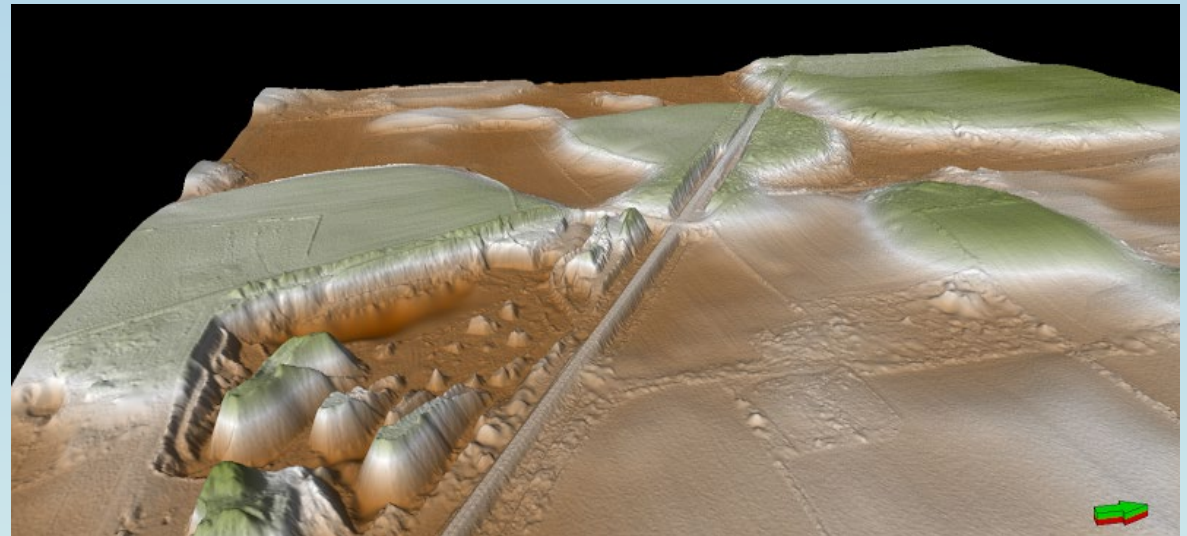
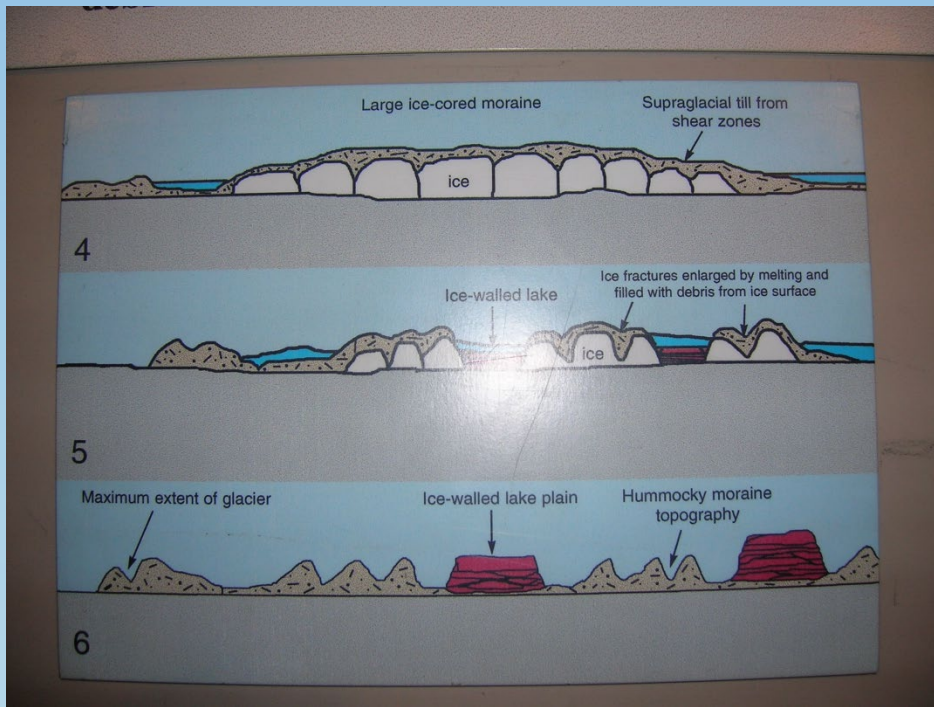


varved lake deposits





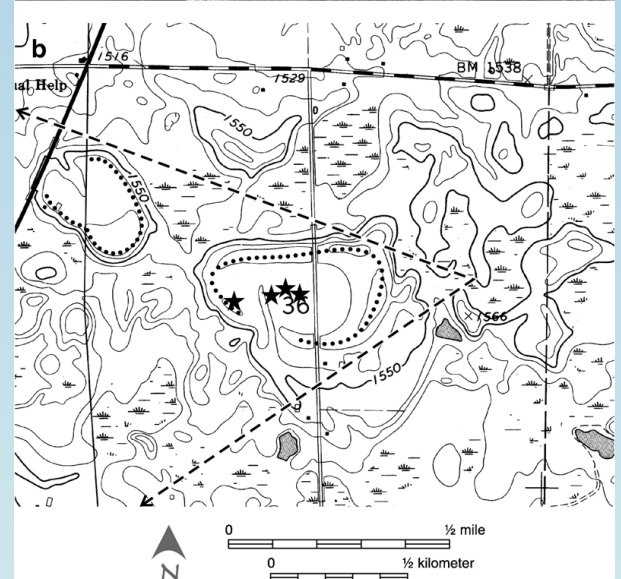
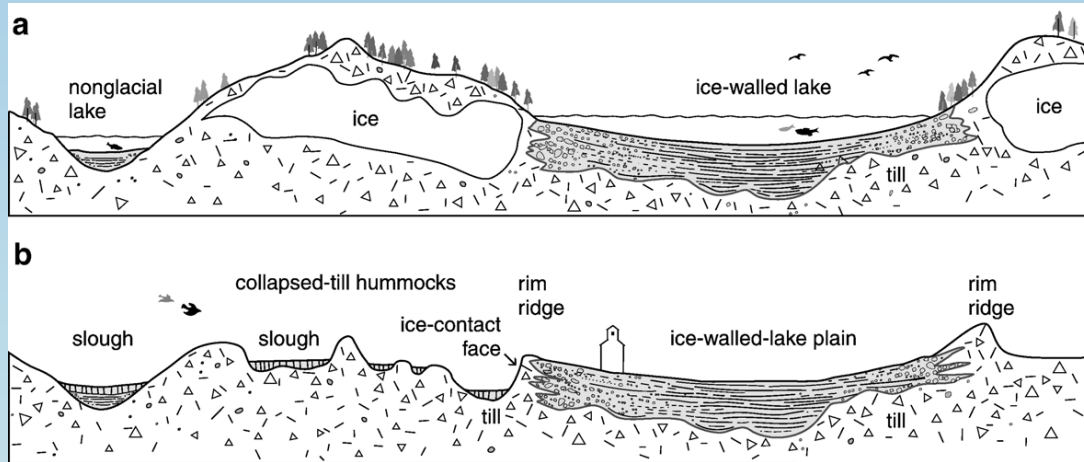
# ice-walled lakes



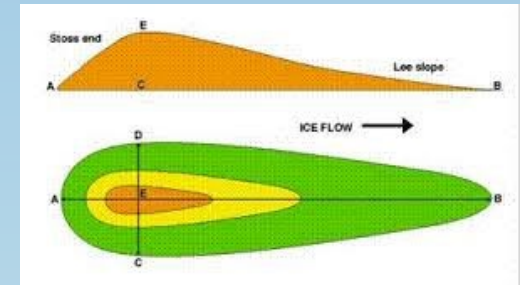
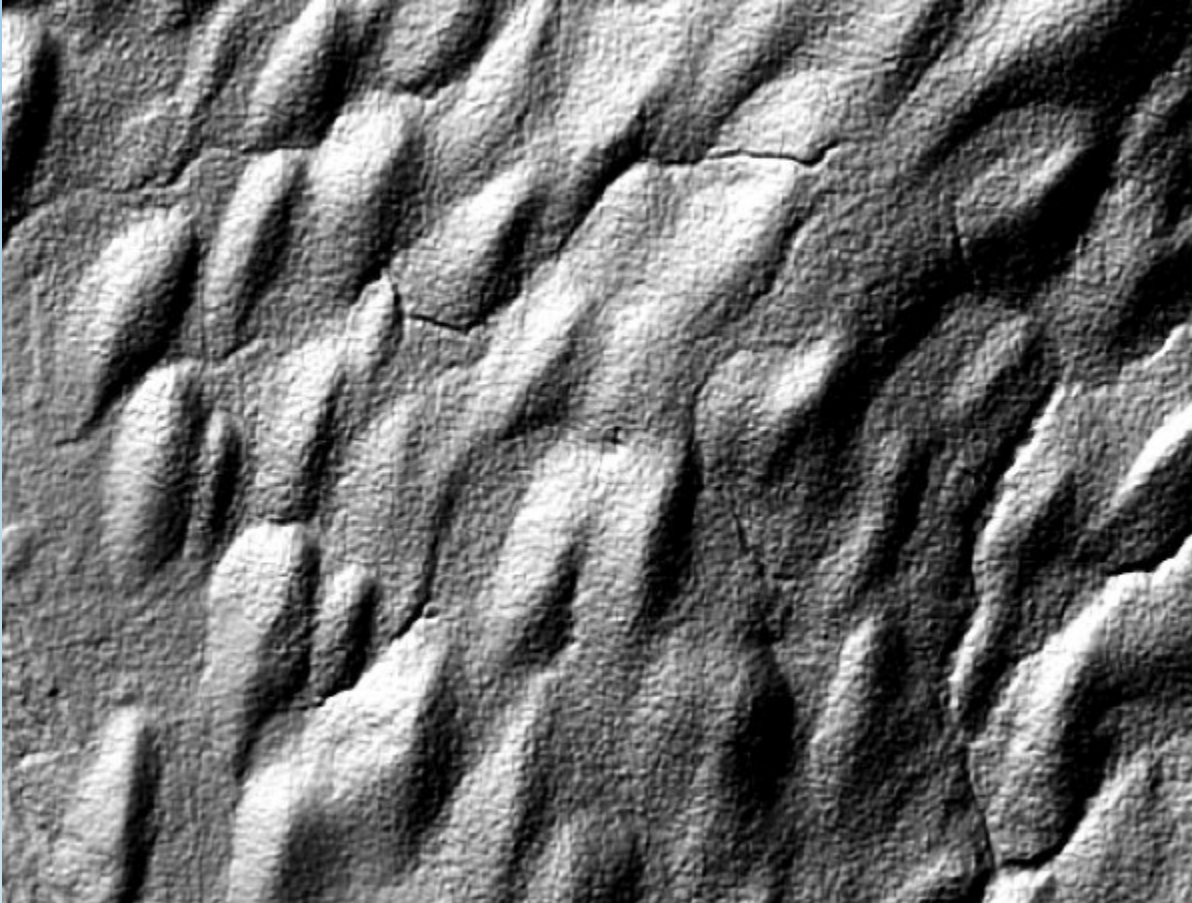
McHenry Co., IL



L. Clayton et al. / *Geomorphology* 97  
(2008) 237–248; Ice-walled-lake plains:  
Implications for the origin of hummocky  
glacial topography in middle North America

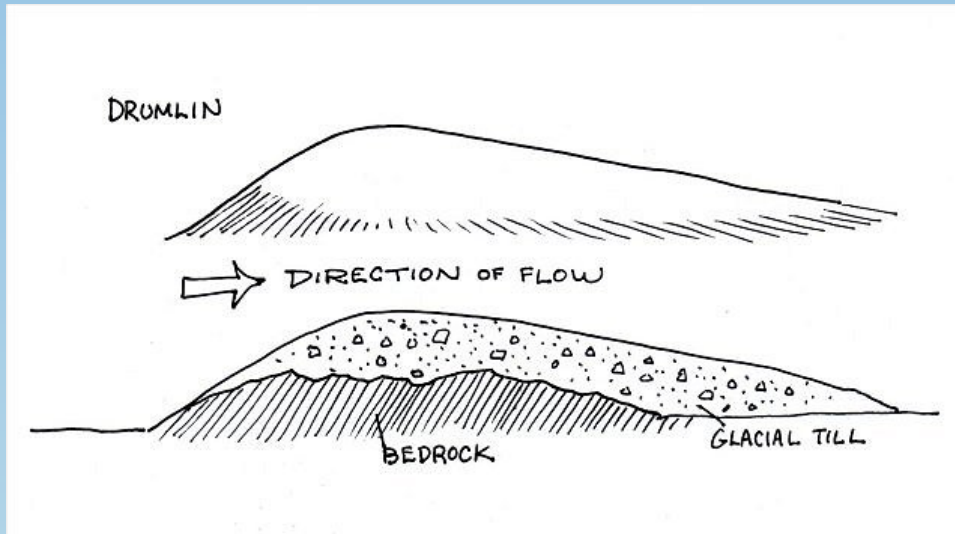


# Drumlins – streamlined hills

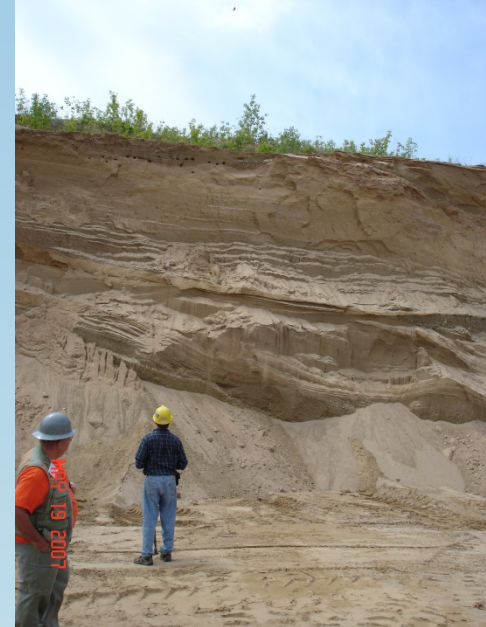


**DRUMLIN** An oval-shaped hill, largely composed of glacial drift, formed beneath a glacier or ice sheet and **aligned in the direction of ice flow**. They tend to be up to a few km long and up to 50 m in relief.

# Drumlins

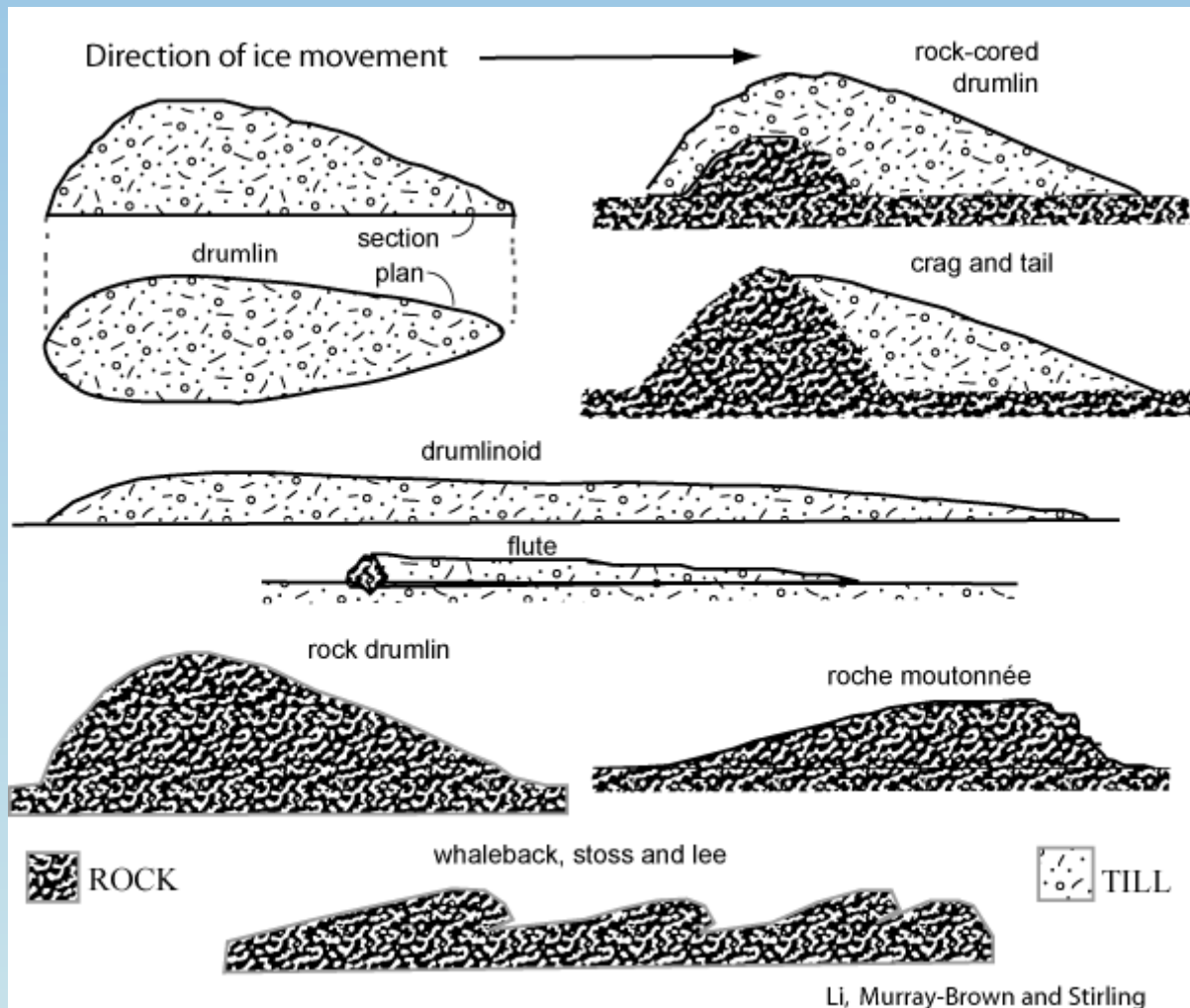


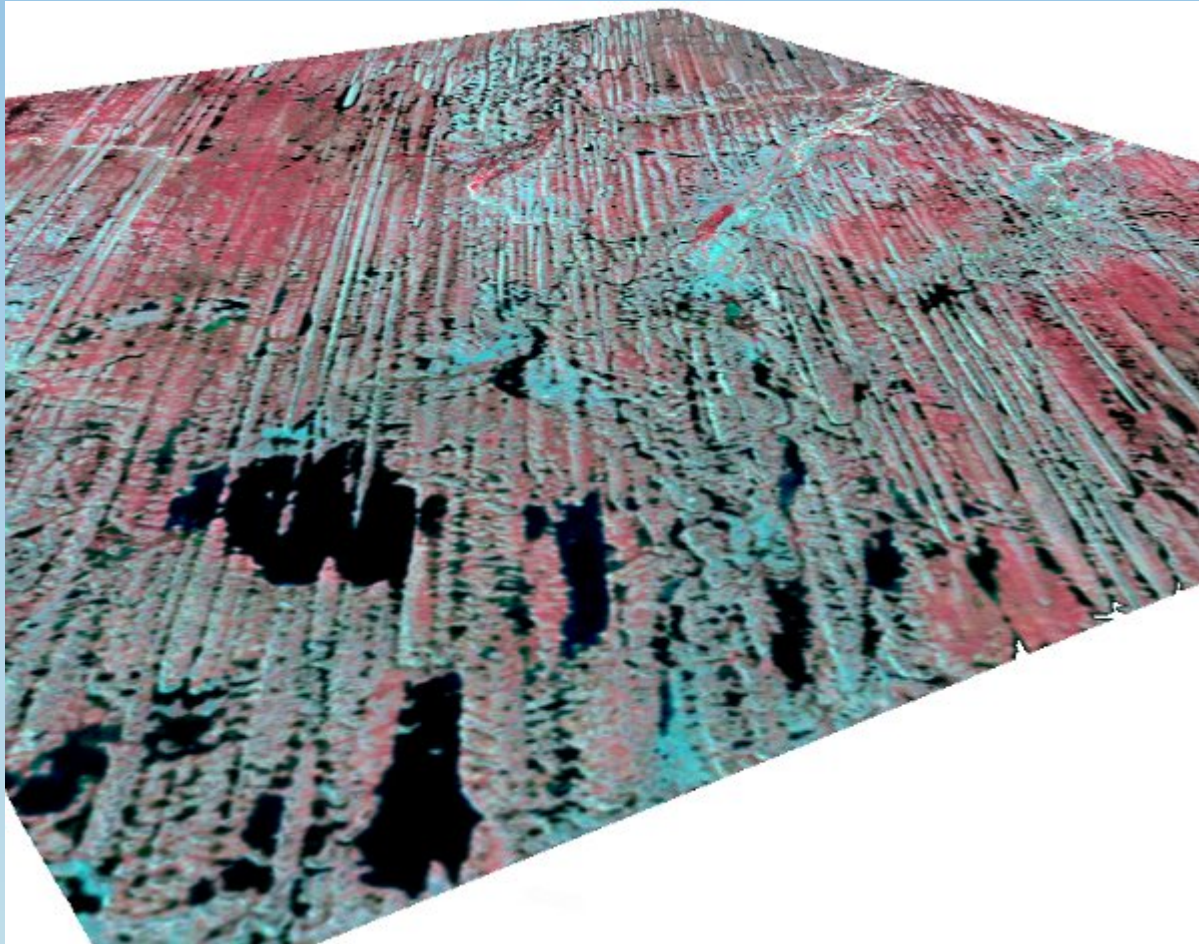
Drumlin in Alberta, Canada



Fluvial deposits in an elongated drumlin, WI







6 to 70 km long;  
megascale glacial  
lineations (flutings)

# Roche moutonnée

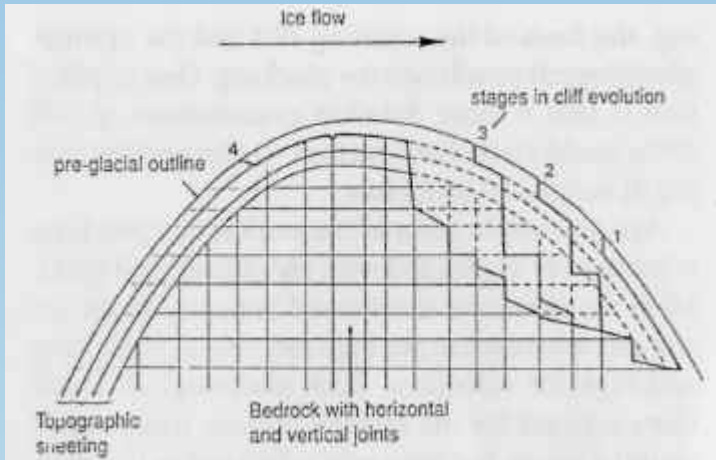


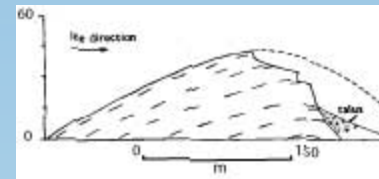
Fig. 11. A model of the evolution of roches moutonnées in Upper Deeside.

**Stage 1:** Lee side surface slabs removed, exploiting topographic sheeting.

**Stage 2:** Vertical faces migrate up ice with depth limited by depth of crack propagation.

**Stage 3:** Continued back wearing and successive cycles of deepening.

**Stage 4:** Staircase cliff. The top of the roche moutonnée may have been lowered by abrasion.



<http://www.prairie.illinois.edu/shilts/gallery/shilts-gallery-keyword.shtml>

Shilts Image Gallery

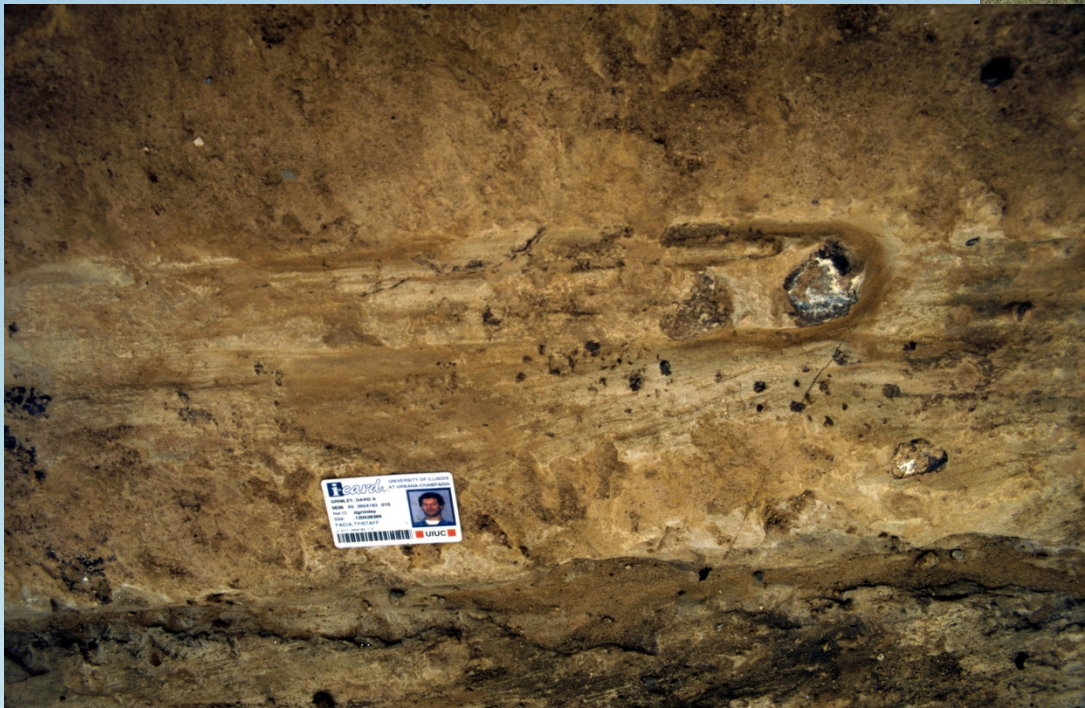


# Micro-landforms (features)

# Striations



*Lohr Quarry, Madison County, IL  
(Illinoian)*



hairpin erosion mark (Alton, IL)

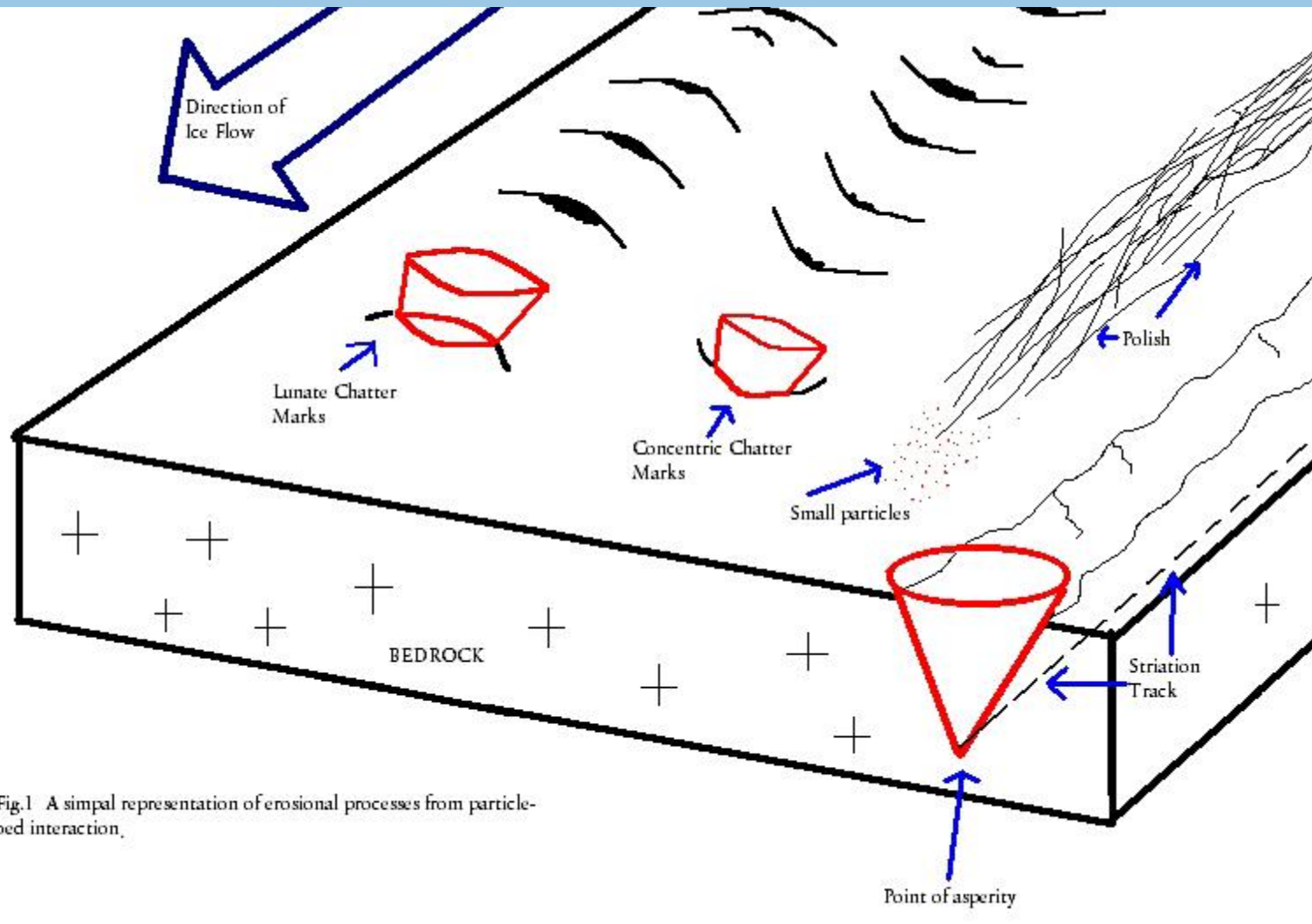


Fig.1 A simple representation of erosional processes from particle-bed interaction.



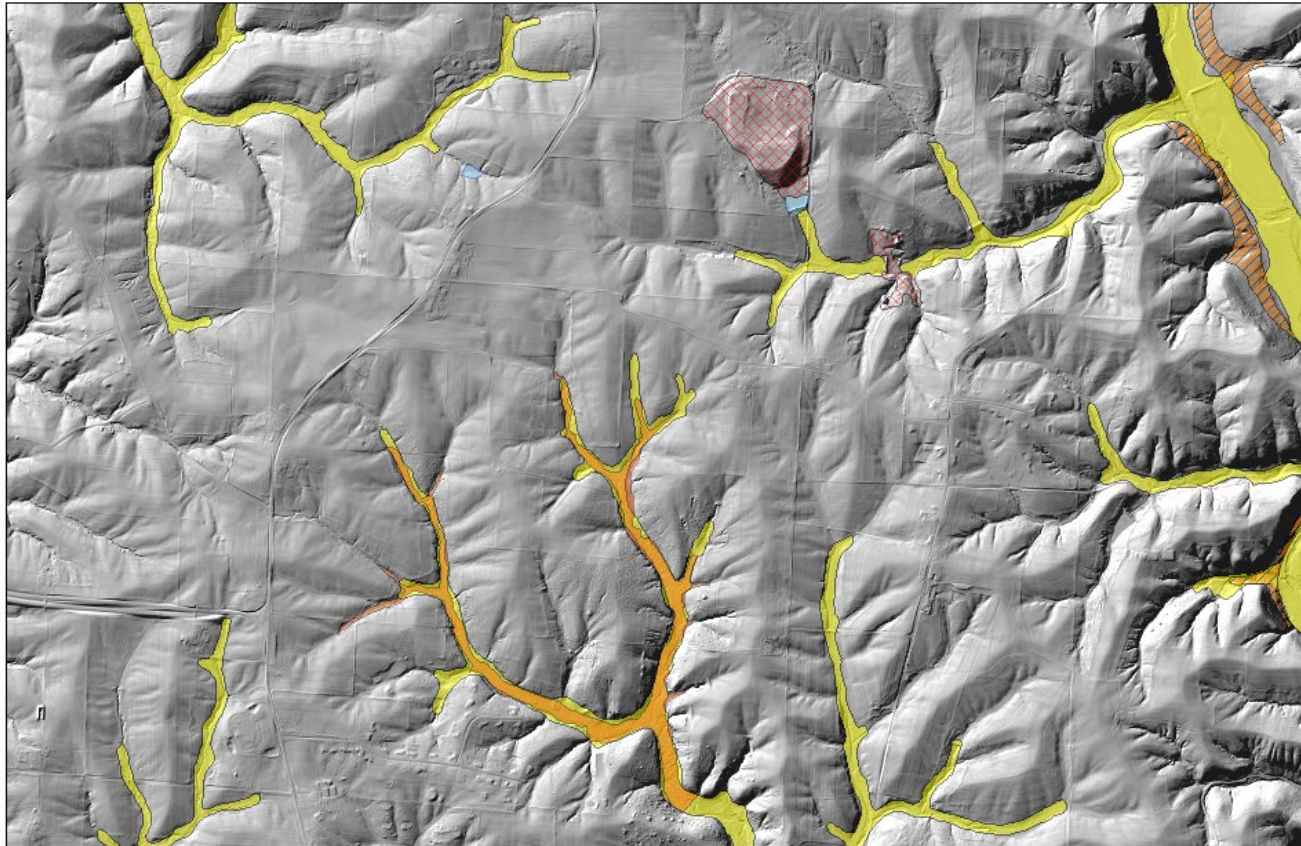
chatter mark



faceted and striated stone

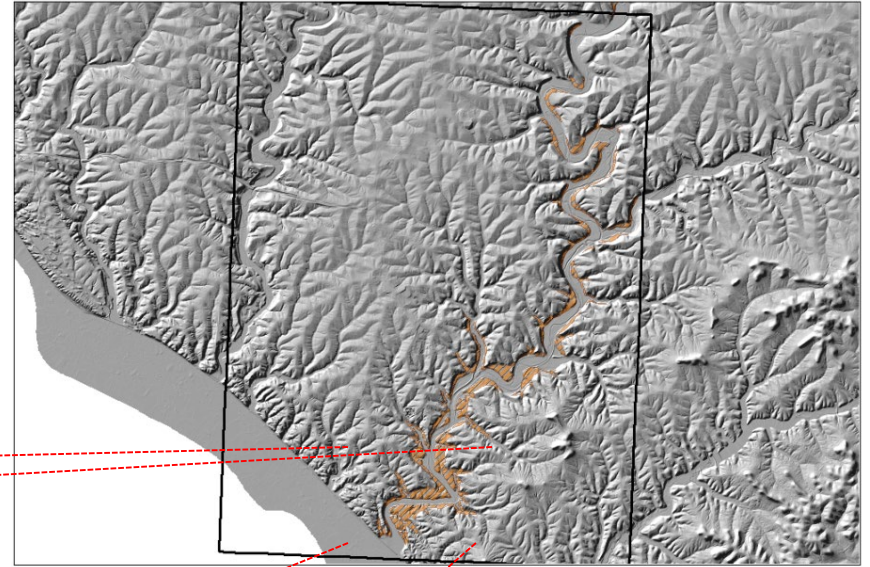
# LiDAR

# Alluvial deposit mapping (Cahokia Fm.) guided by LiDAR (Pius Weibel)

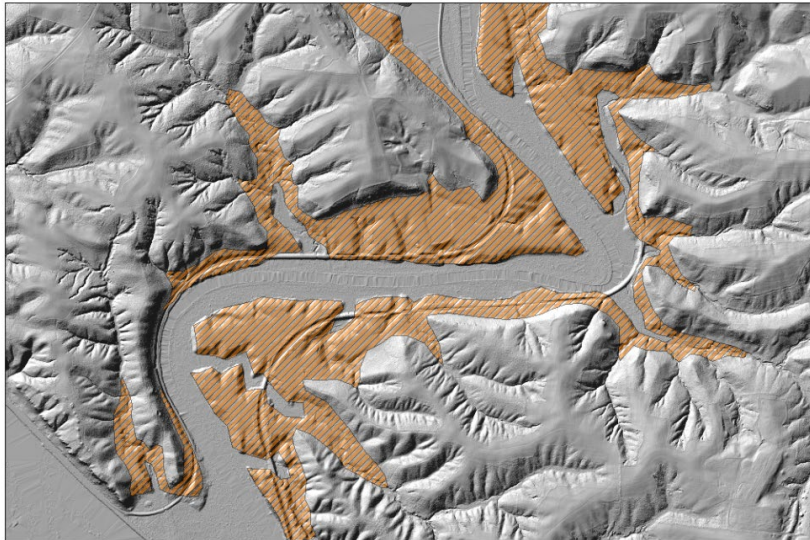


**Jo Daviess Co., Galena Quad**  
**28 Aug 2013**      **1:24,000**

# Terrace mapping guided by LiDAR (Pius Weibel)



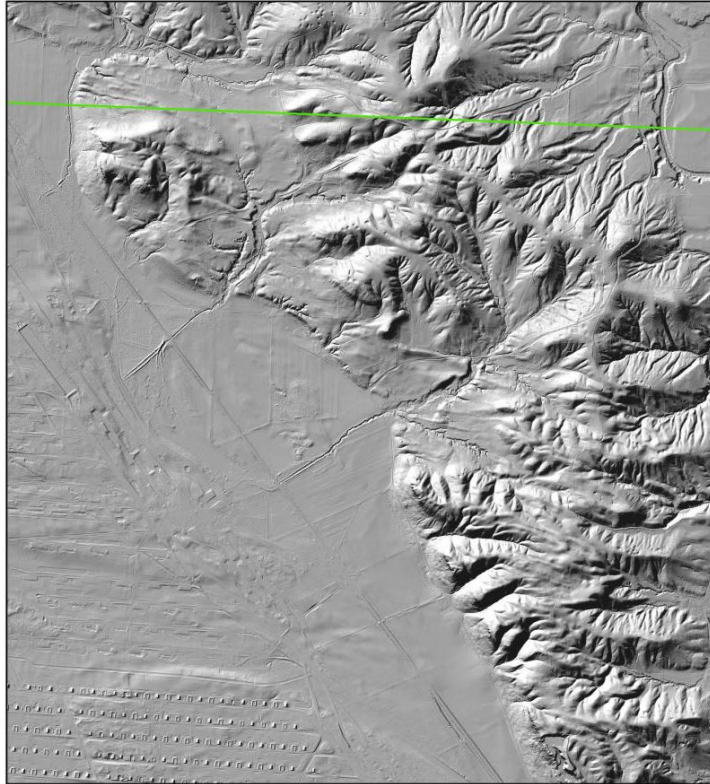
**Jo Daviess Co., Galena Quad**  
**30 Aug 2013**      **1:80,000**



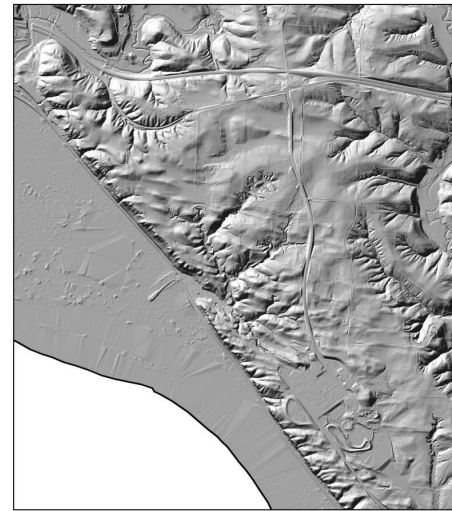
**Jo Daviess Co., Galena Quad**  
**29 Aug 2013**      **1:12,000**



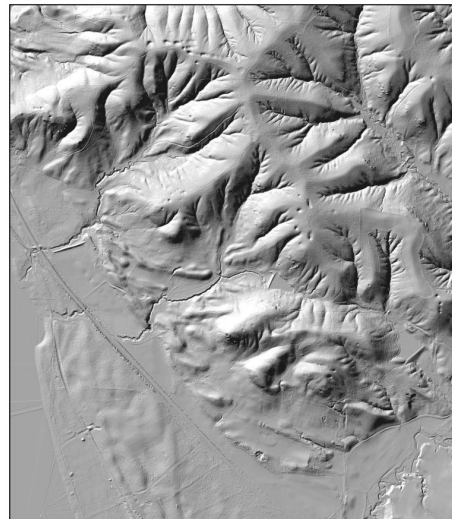
# Eolian features: Dunes, Yardangs



**Jo Daviess Co., Green Island Quad**



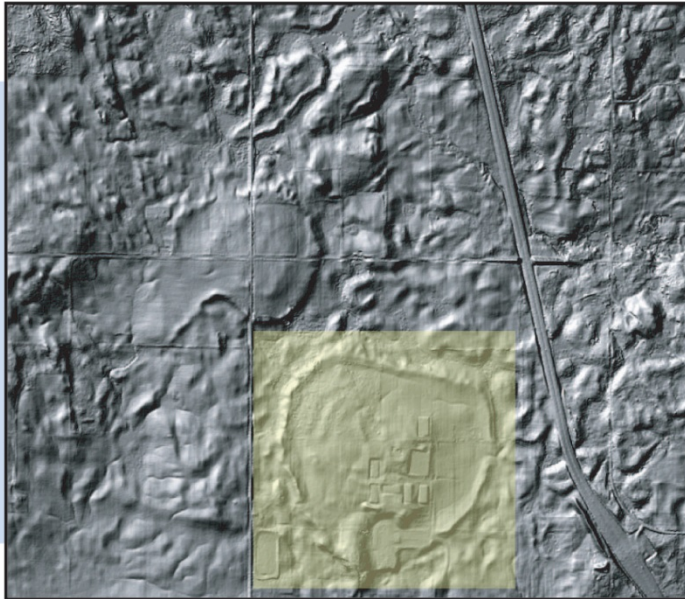
**Jo Daviess Co.. Menominee Quad**



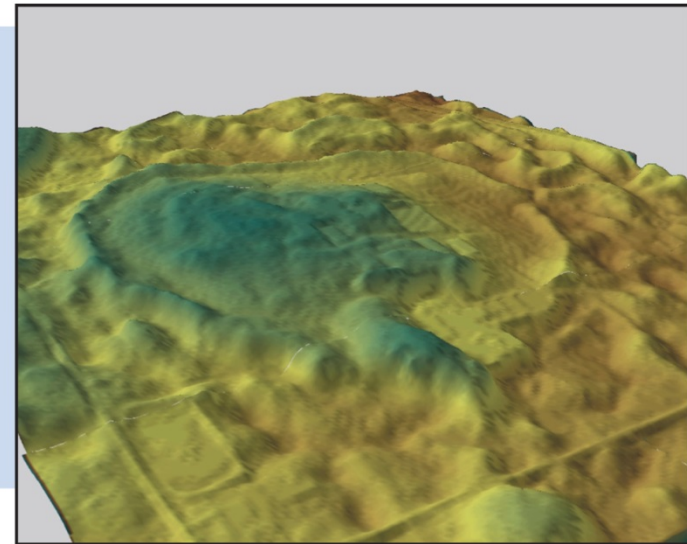
**Jo Daviess Co., Bellevue Quad**

# Ice-walled Lake Plains in Illinois

B. Brandon Curry, Michael E. Konen,  
Catherine H. Yansa, and Thomas V. Lowell

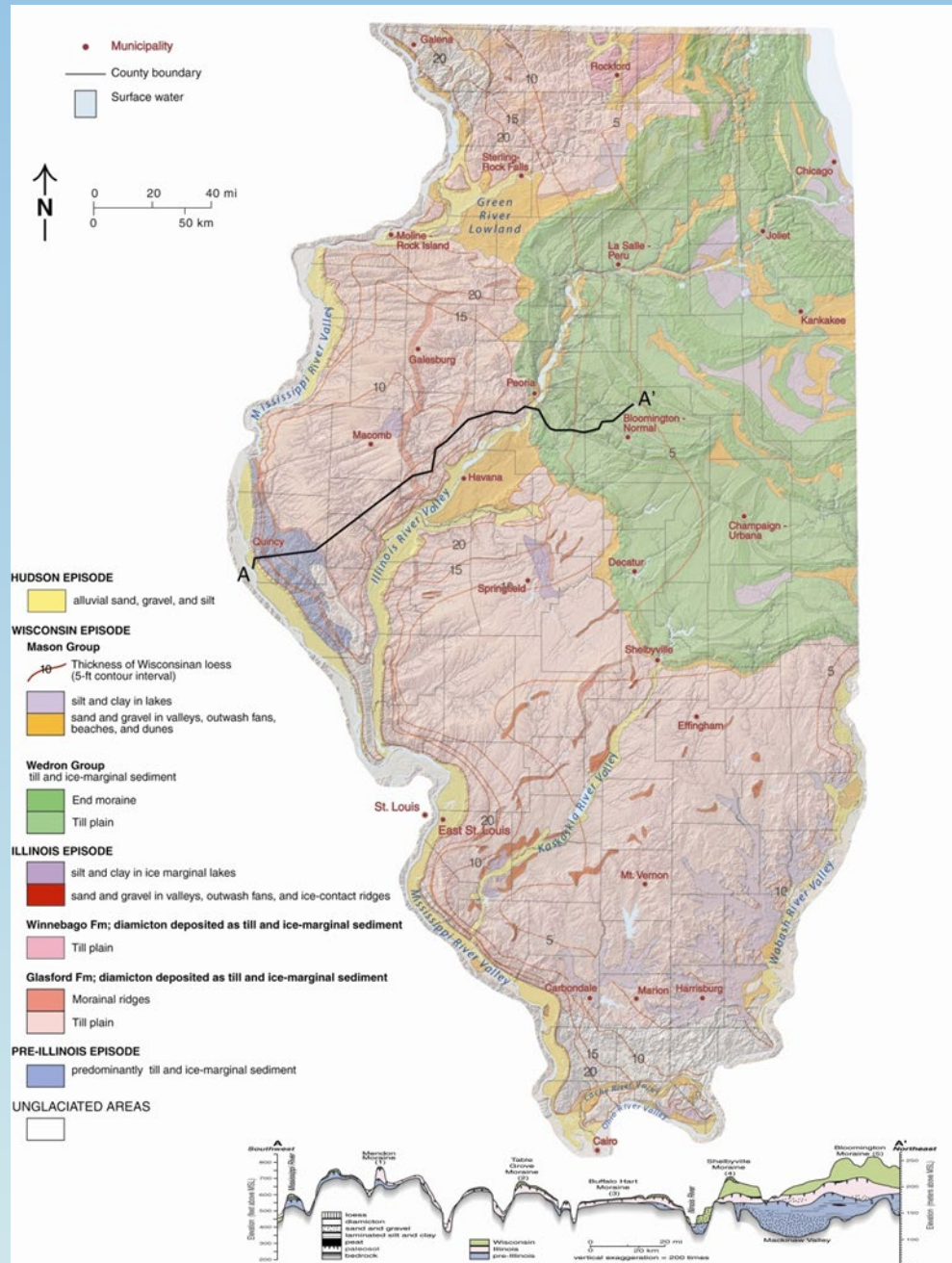


1) This shaded relief map shows ice-walled lake plains, flat-topped hills with ridges surrounding them, in Illinois.

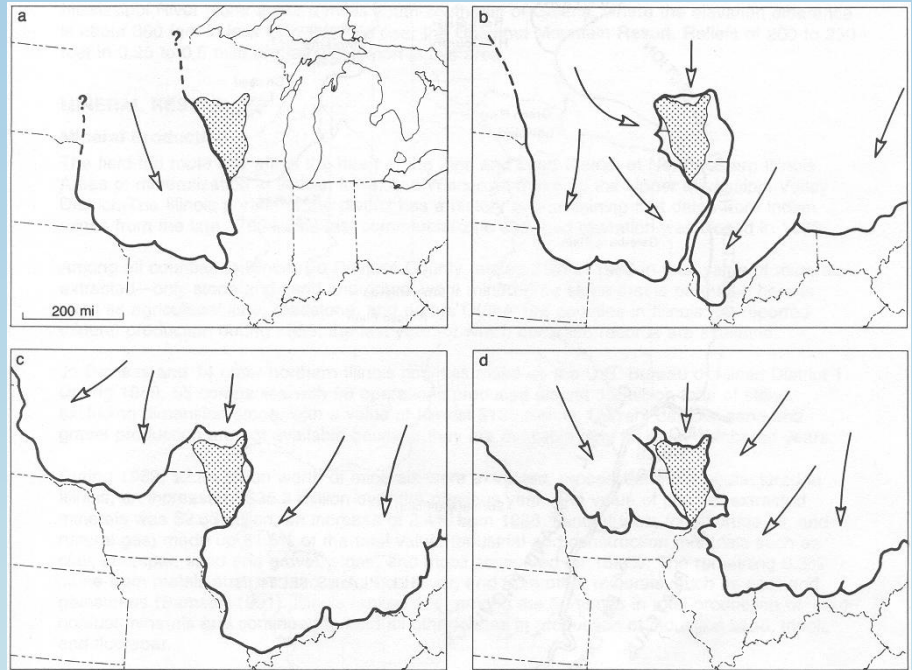
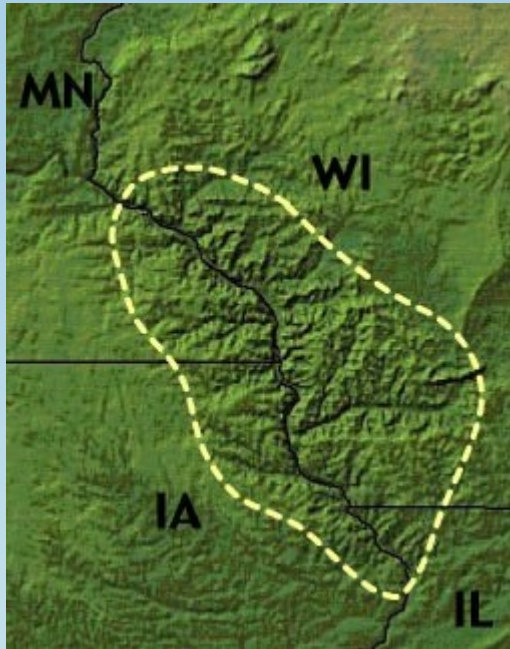


2) An oblique quasi-three-dimensional view of the largest ice-walled lake plain highlighted in Figure 1.

using landforms to help with surficial geologic mapping.....

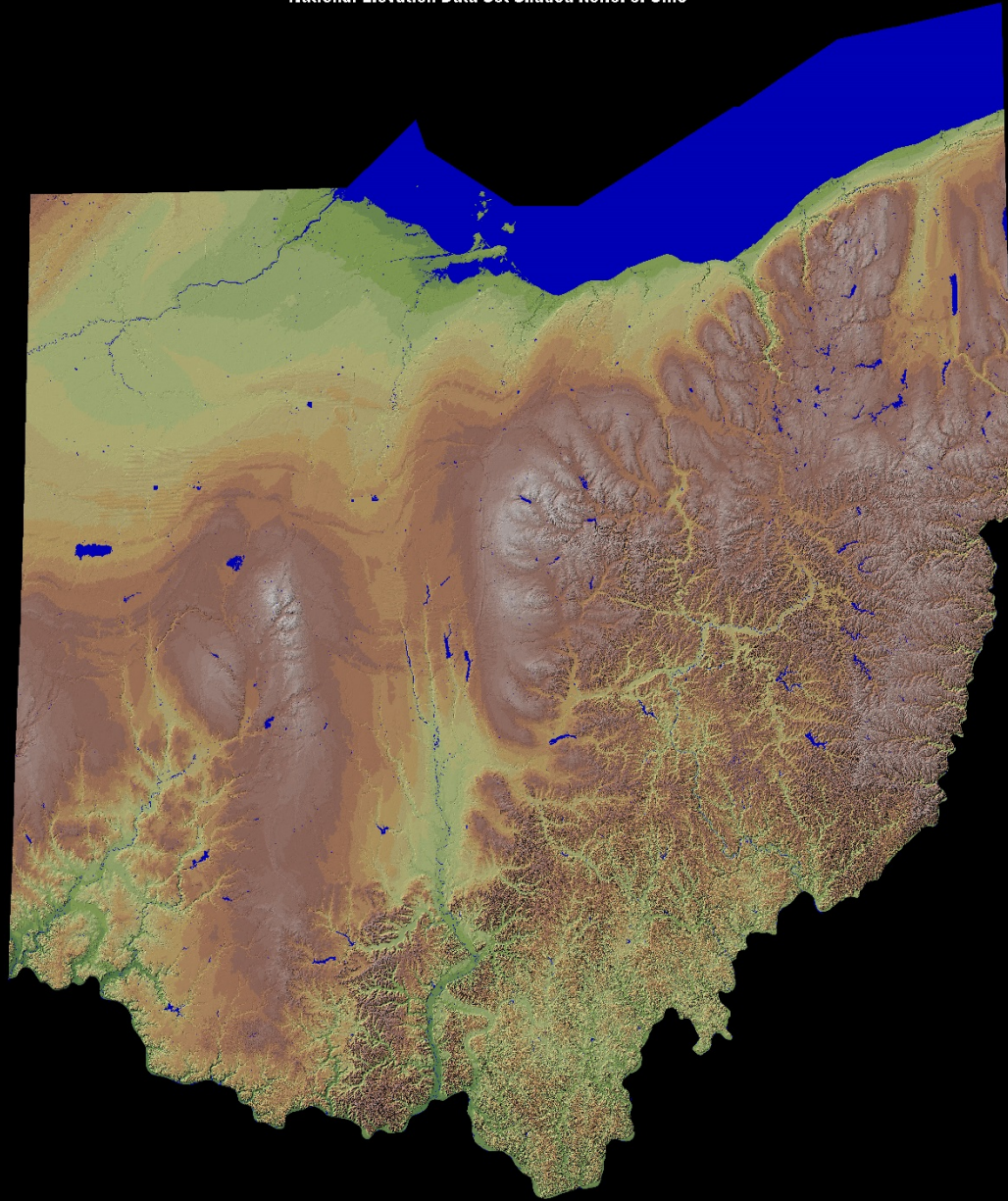


# Driftless Area Topography

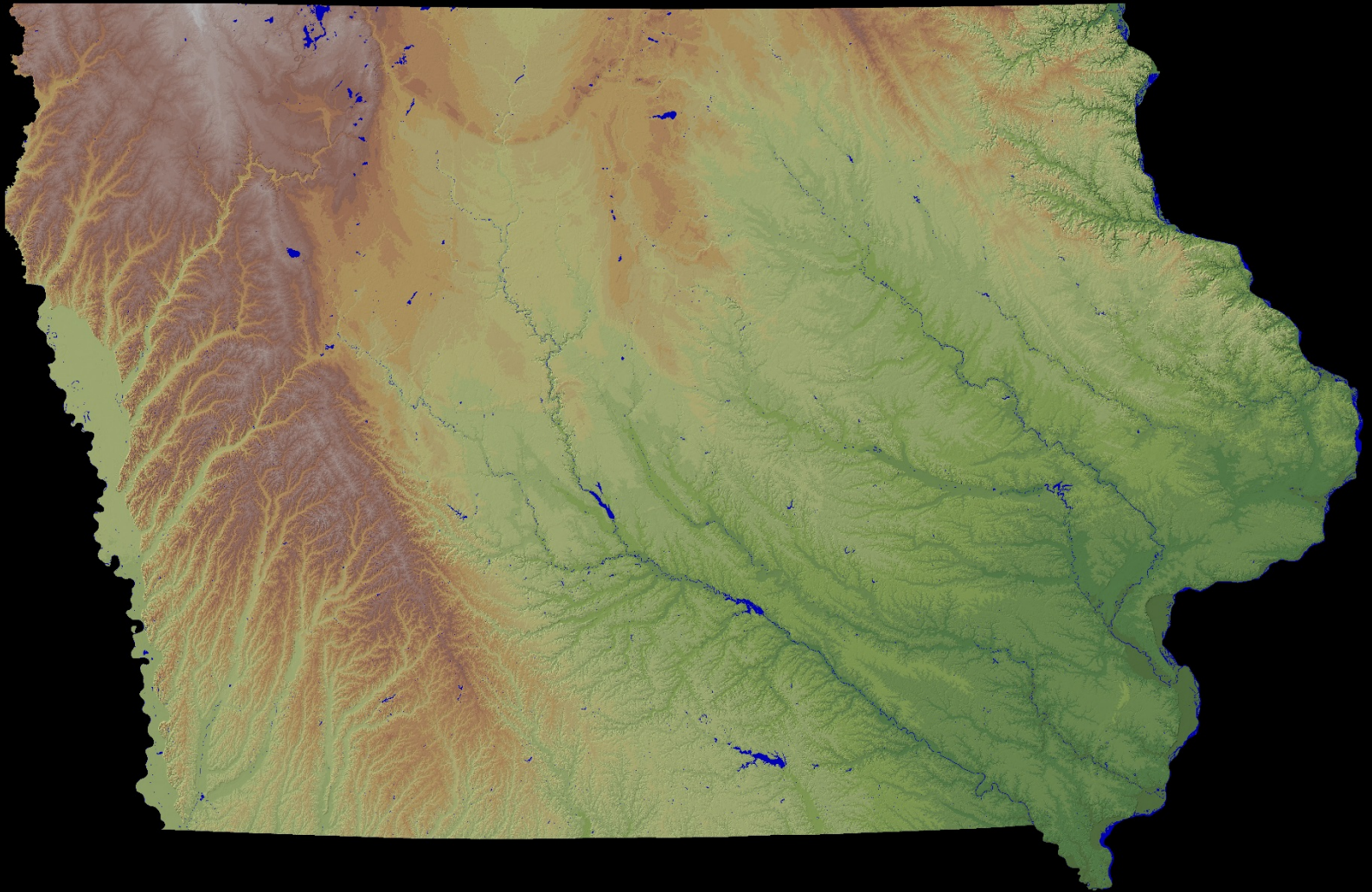




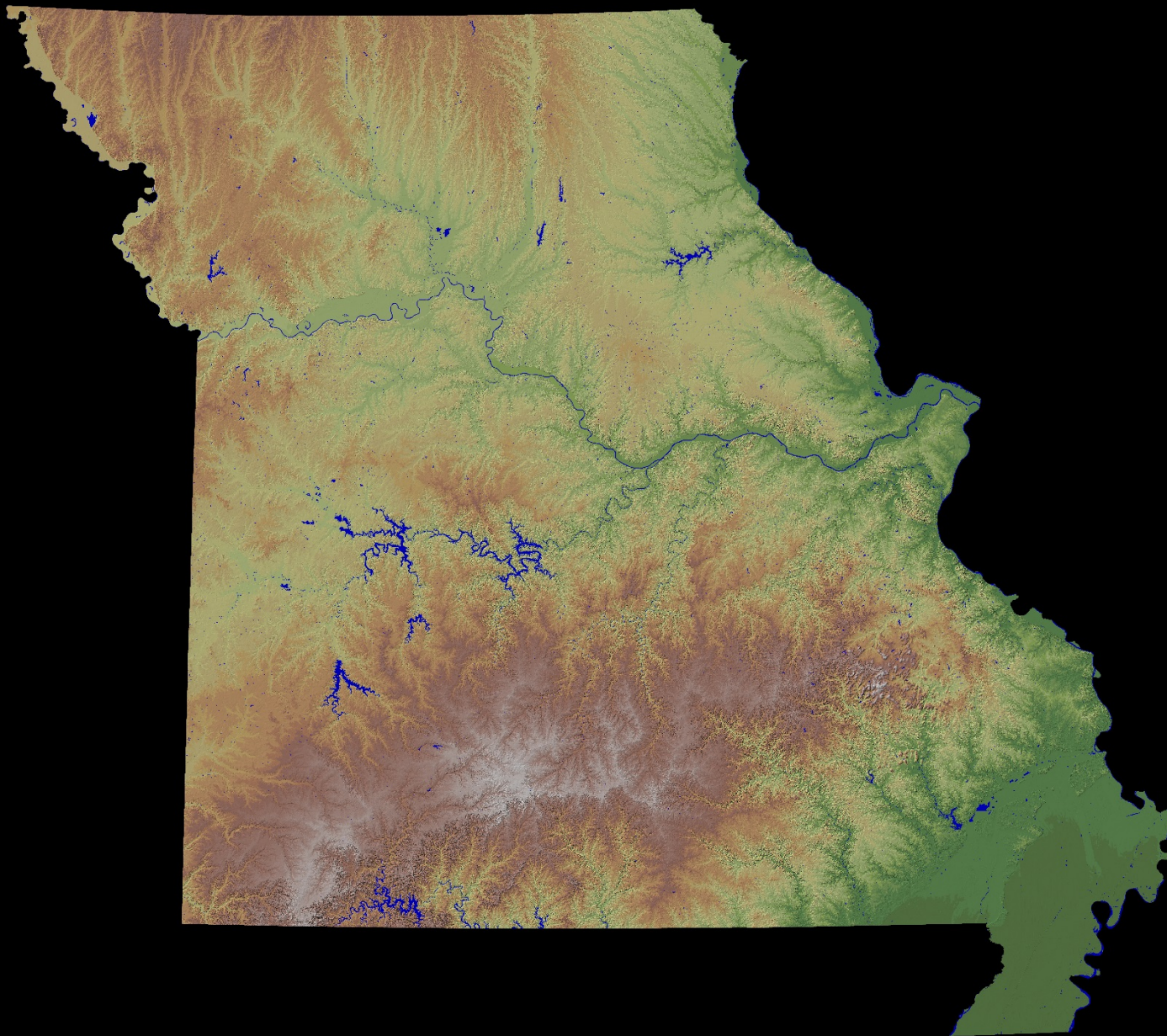
### National Elevation Data Set Shaded Relief of Ohio



## National Elevation Data Set Shaded Relief of Iowa

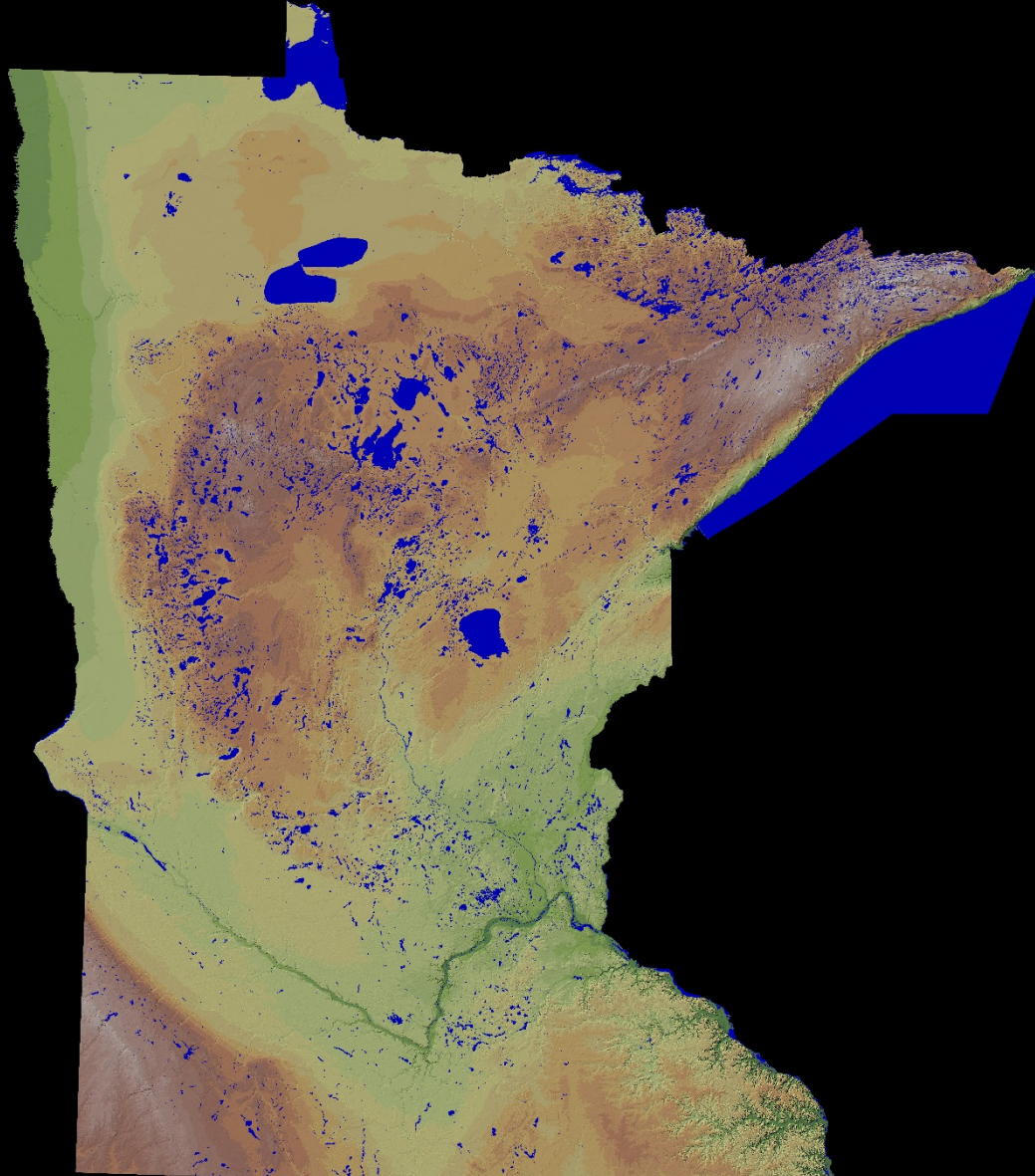


### National Elevation Data Set Shaded Relief of Missouri

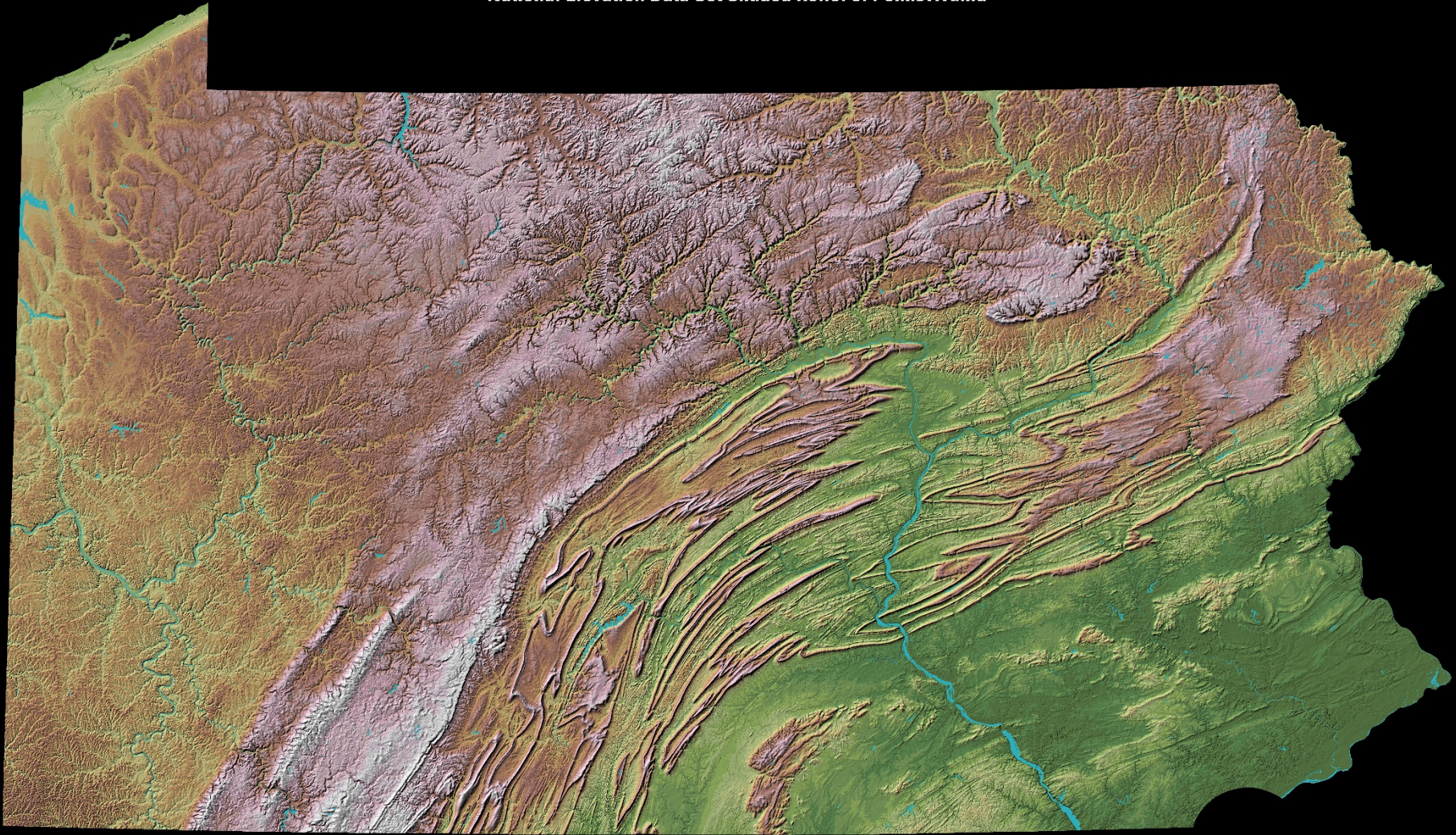




### National Elevation Data Set Shaded Relief of Minnesota



## National Elevation Data Set Shaded Relief of Pennsylvania



## National Elevation Data Set Shaded Relief of Illinois

