

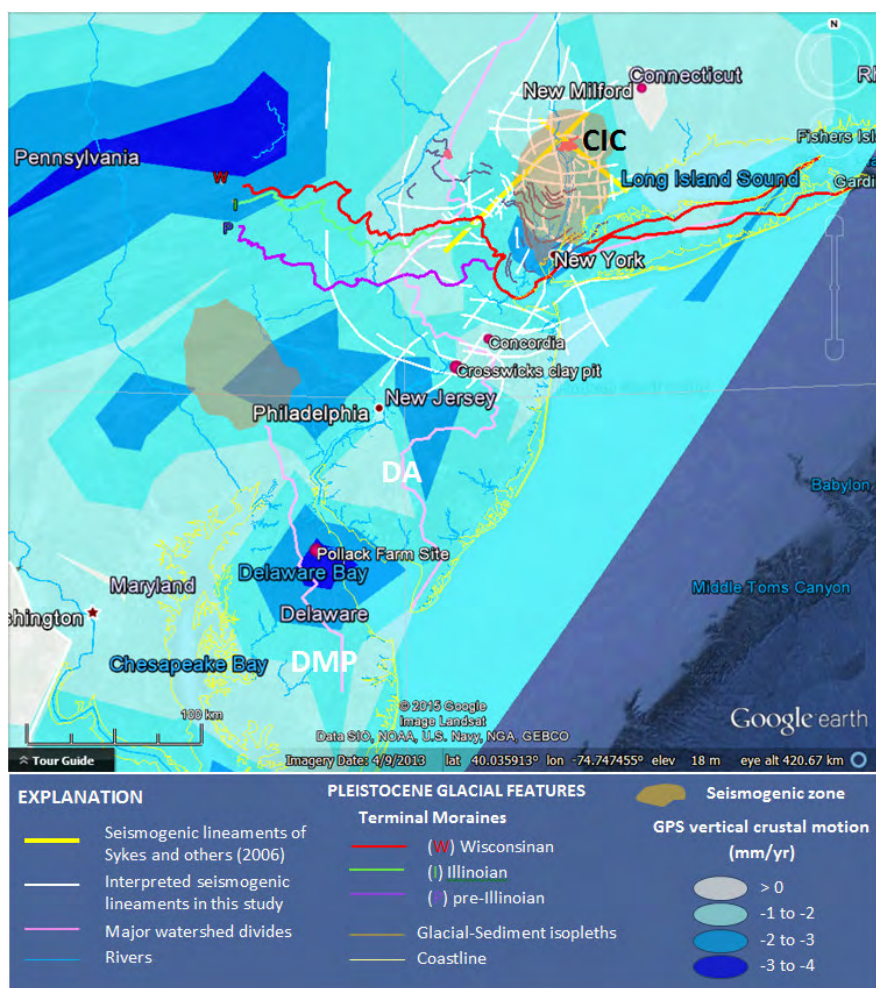
Neotectonics of the New York Recess

MEETING PROCEEDINGS AND FIELD GUIDE FOR THE 2015 CONFERENCE
OF THE GEOLOGICAL ASSOCIATION OF NEW JERSEY

EDITED BY

Gregory Charles Herman and Suzanne Macaoay Ferguson

NEW JERSEY GEOLOGICAL & WATER SURVEY PENNJERSEY ENVIRONMENTAL CONSULTING



GEOLOGICAL ASSOCIATION OF NEW JERSEY

XXXII ANNUAL CONFERENCE AND FIELD TRIP

OCTOBER 16-17, 2015, LAFAYETTE COLLEGE, EASTON, PENNSYLVANIA

Herman, G. C., 2015, Chapter 1: Teacher's Workshop; Teaching Earth science with Google Earth, in Herman, G. C., and Macaoay Ferguson, S., Neotectonics of the New York Recess: 32nd Annual proceedings and field guide of the Geological Association of New Jersey, Lafayette College, Easton, Pa., p. 1-16. (16.0 MB)

Contents

	Page
Preface	viii
Chapter 1. Teacher's Workshop: Teaching Earth Science with Google Earth	1
<i>Dr. Gregory Herman, NJ Geological & Water Survey</i>	
Chapter 2. Review of New York City bedrock with a focus on brittle structures	17
<i>Dr. Charles Merguerian, Duke Geological Laboratories, New York</i>	
Chapter 3. Re-Os isotope evidence an Early Tertiary episode of crustal faulting and sulfide-mineralization in Pennsylvania with probable ties to the Chesapeake Bay bolide impact in Maryland, USA	68
<i>Dr. Ryan Mathur, Juniata College</i>	
Chapter 4. Neotectonics of the New York Recess, USA	80
<i>Dr. Gregory Herman, NJ Geological & Water Survey</i>	
Presentation Abstract. Geomorphic paleogeodesy and intraplate deformation associated with the Mineral, VA earthquake and surrounding Central Virginia Seismic Zone (CVSZ).....	152
<i>Frank J. Pazzaglia and Helen, F. Malenda, Department of Earth and Environmental Sciences, Lehigh University</i>	
Keynote Speaker Abstract. The New Jersey Coastal Plain: A key to deciphering past, present, and future sea-level change	154
<i>Dr. Kenneth Miller, Rutgers University</i>	
Chapter 5. Field Guide	159
<i>Dr. Gregory Herman, NJ Geological & Water Survey</i>	
STOP 1. Eastern Concrete Crushed Stone Quarry	166
STOP 2. Mercer County Park	181
STOP 3: <i>Trap Rock Industries Moore's Station Plant</i>	193
STOP 4: <i>Delaware & Raritan Canal State Park Trail</i>	203

Chapter 1. Teachers Workshop: Teaching Earth Science with Google Earth

Gregory C. Herman, New Jersey Geological & Water Survey

The following exercises and methods are part of the laboratory component for an introductory geology class that I teach at the College of New Jersey. We use GE in 4 labs session during the semester to become familiar with the physical expression of land surface and how it works with raster (cell-based), point, polyline, and polygons themes. Please note that this workshop guide is designed for use with Windows PCs. User instructions for a Mac will be different as these exercises use both left- and right mouse buttons and the mouse wheel for program and viewing options. It isn't normal practice to have three button-access on a MAC mouse.

Google Earth KML Terminology:

- KML stands for Keyhole Markup Language (KML), an XML notation for expressing geographic annotation and visualization within Internet-based, two dimensional maps and three-dimensional (3D) Earth browsers (Wikipedia, 2012).
- KML is an international standard of the Open Geospatial Consortium. XML (Extensible Markup Language) is a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable (Wikipedia, 2012).
- KMZ is a compiled KML file, meaning that it has been encrypted in machine language and is not readily open or read in ordinary language or ASCII text editors.
- You can <File><Save> or <File Save As> from going to KMZ to a KML or vice versa.
- But if you want to manually edit the GE file, <Save As> a KML, then <Open> it using Microsoft (MS) Notepad or Wordpad, common ASCII text editing files for PCs.

Google Earth (GE) and mouse-wheel button interoperability

- A key GE viewing tool is to use the mouse for interactive viewing by <Pressing down>and <Holding> the middle button of your mouse after the cursor is positioned over the feature or area of interest, then moving the mouse with the zoom wheel depressed.
- Depressing and holding the mouse wheel down allows you tilt and rotate the view interactively.



EXERCISE 1: Explore geospatial themes for New Jersey using Google Earth

Copy and paste the following URL into your browser and <Enter>

http://www.impacttectonics.org/gcherman/downloads/PHY120C/LAB4_Google_Earth_1.kmz

This will download a KMZ containing some New Jersey geologic and topographic data that we will open for use in this exercise. This lab is the introductory Google Earth (GE) computer-laboratory session that I run as the first in a series of four GE sessions as part of my introduction to geology curriculum at the College of New Jersey.

You can start the session either by <double-clicking> on the download button upon completion of the download, or start Google Earth, click on the <File><Open> sequence in the Menu Bar (fig. 1), and open the KMZ in the downloads folder.

- The file will load into the GE Temporary folder:
- Upon loading the theme DO NOT TURN ON ALL LAYERS.

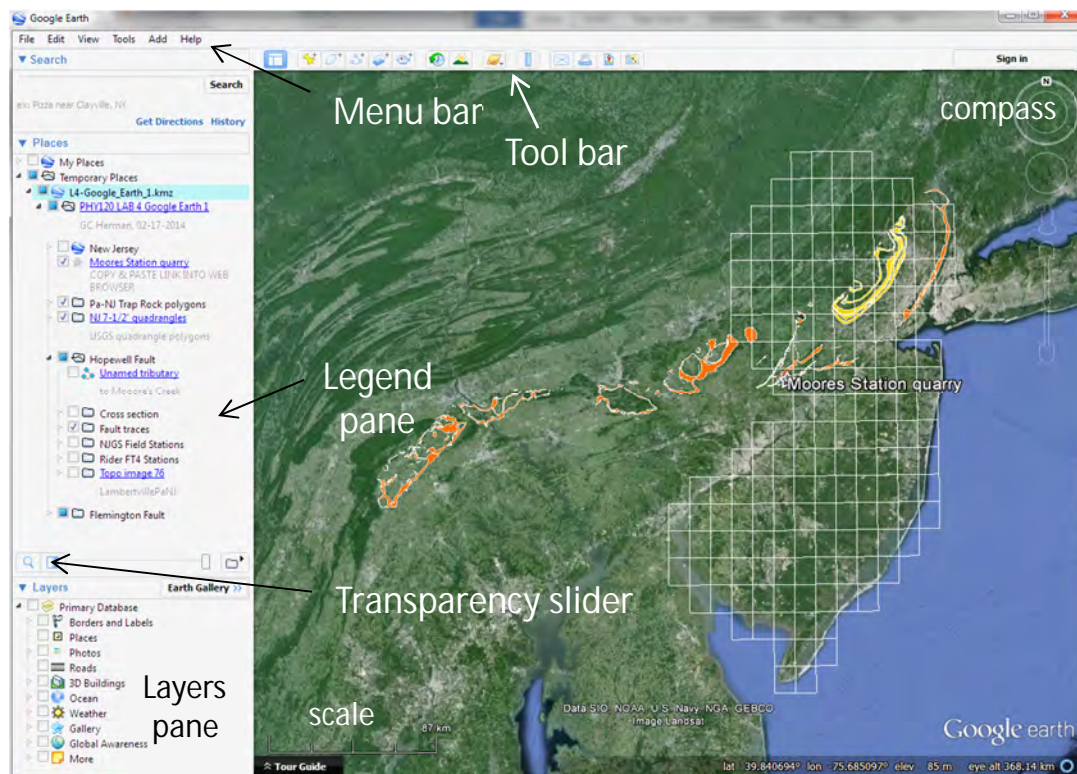
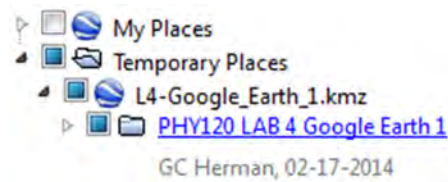


Figure 1. Default view upon opening TCNJ PHY120 Lab4 Google Earth.KMZ

- Be sure to minimize the Tour Guide at the bottom of the GE view and slide the Legend pane downward in order to maximize the space available in which to expand theme folders.
- With the newly loaded theme highlighted and active, grab it by clicking on it once with the mouse, and physically drag it into <My Places> in the Legend pane.
- Then <Right click> on the theme in the Legend pane and specify <Save><Save My Places> or <Save Place As> if you want to save it externally.
- A pop-up menu will prompt you for a location to <Save> the file for future use.
- Expand the theme folder by clicking on the *triangles* to view the theme content before deciding on an approach for *turning layers on and off* (making them visible – see right) →.
- This is a safe approach when downloading and using a file exceeding a couple megabytes size.

GE Legend controls

- ▶ • Expand the folder
- • Turn on/off layers
- 📁 • Object folder
- 🌐 • Compiled KMZ file of objects

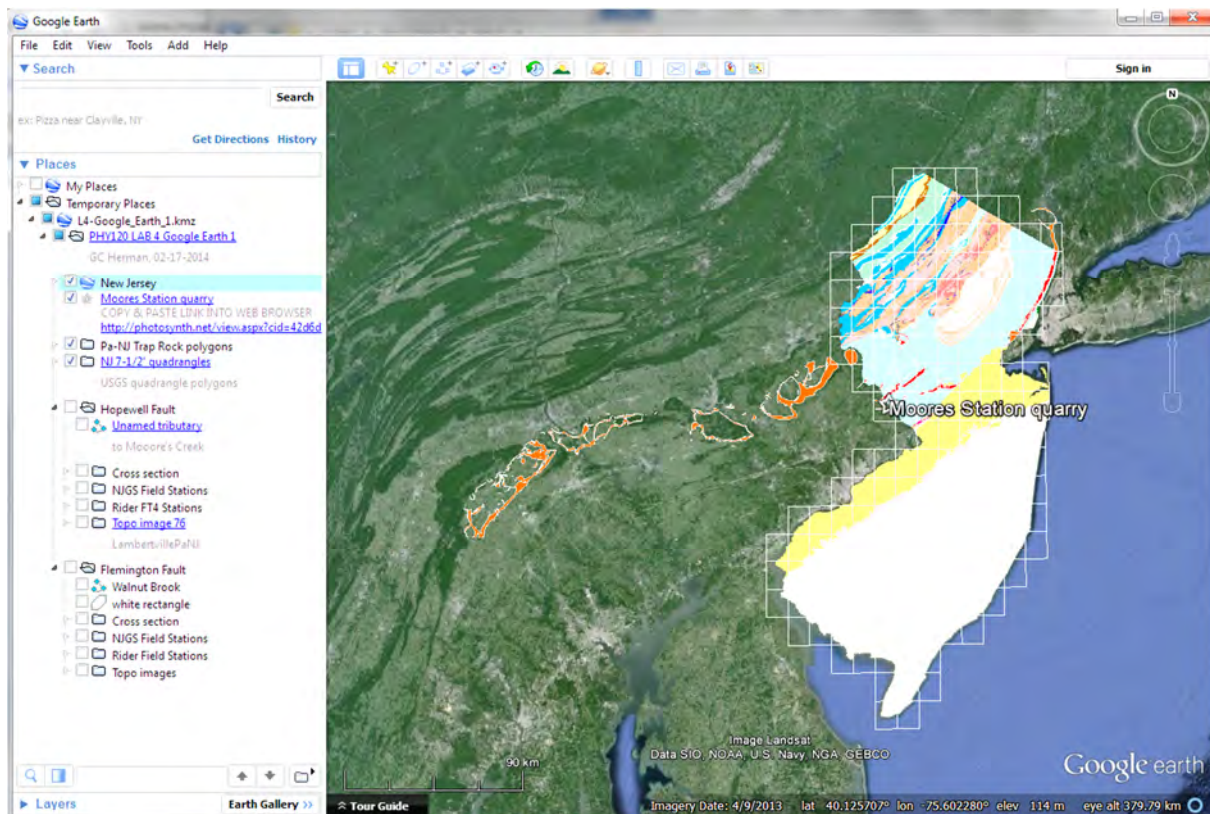


Figure 2. Expanded view showing the 1:100K USGS New Jersey bedrock geology by lithic groups. Note that the *Layers* pane is minimized at the bottom.

- Next, <double-click> on the Hopewell Fault folder

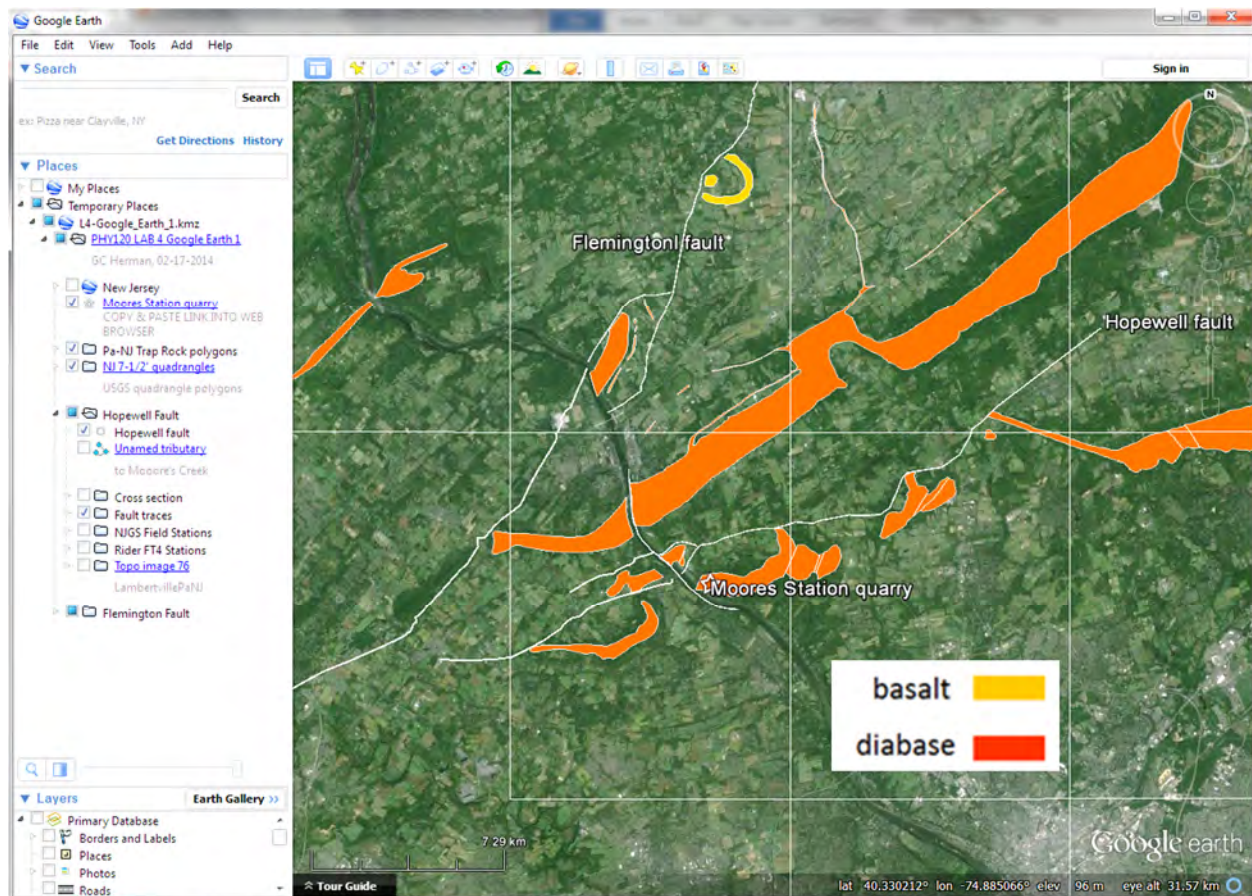


Figure 3. Default view after <double-clicking on the Hopewell Folder.

- The following view will zoom into focus.
- Note that in figure 3 above, the Layers pane has now been restored, but slid down and minimized so that only the Borders through Roads is visible. This maximizes the Places pane availability for displaying a theme's component folders while providing quick access to the built-in GE reference themes such as *Borders and Labels*, and *Roads*.
- Also, note that the Layers Pane has been slid down and minimized so that only the Borders through Roads are visible. This maximizes the Places pane availability for displaying a theme's component folders.

- <Single-left click> on the view to move it into the center of the view, and use the mouse wheel to zoom in to the quarry.
- Depress the mouse wheel and hold it down as you drag the mouse backward toward you to begin dynamically viewing the topography and geology polygon. Release the mouse wheel, <Left click> on the display again and drag it into a desired perspective.

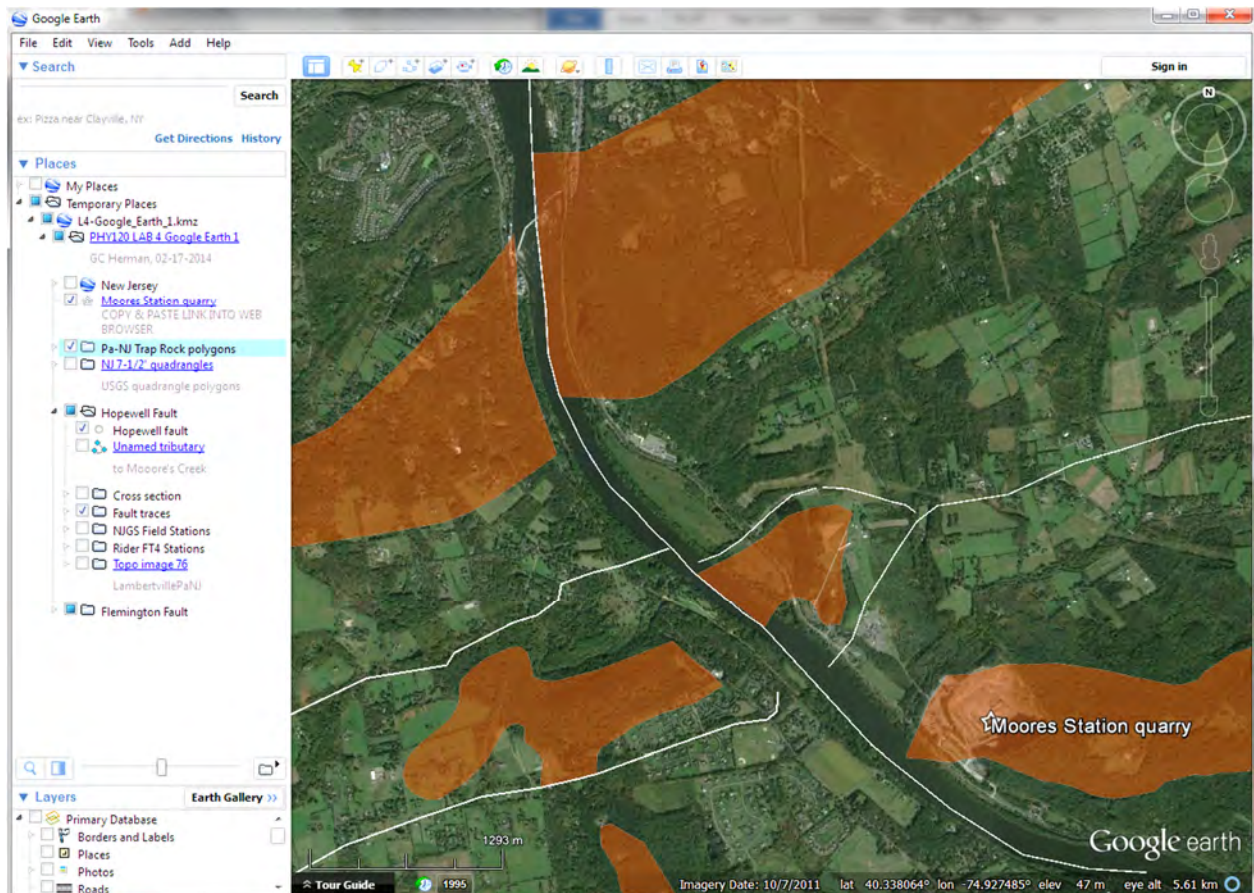


Figure 4. Scaled view after <double-clicking> on the Moores Station quarry placemark. Note that the Pa-NJ Trap Rock polygons folder is active, and that the transparency slider is set at about 50%, making it so that you can see the quarry under the Moores Station quarry placemark toward the bottom right.

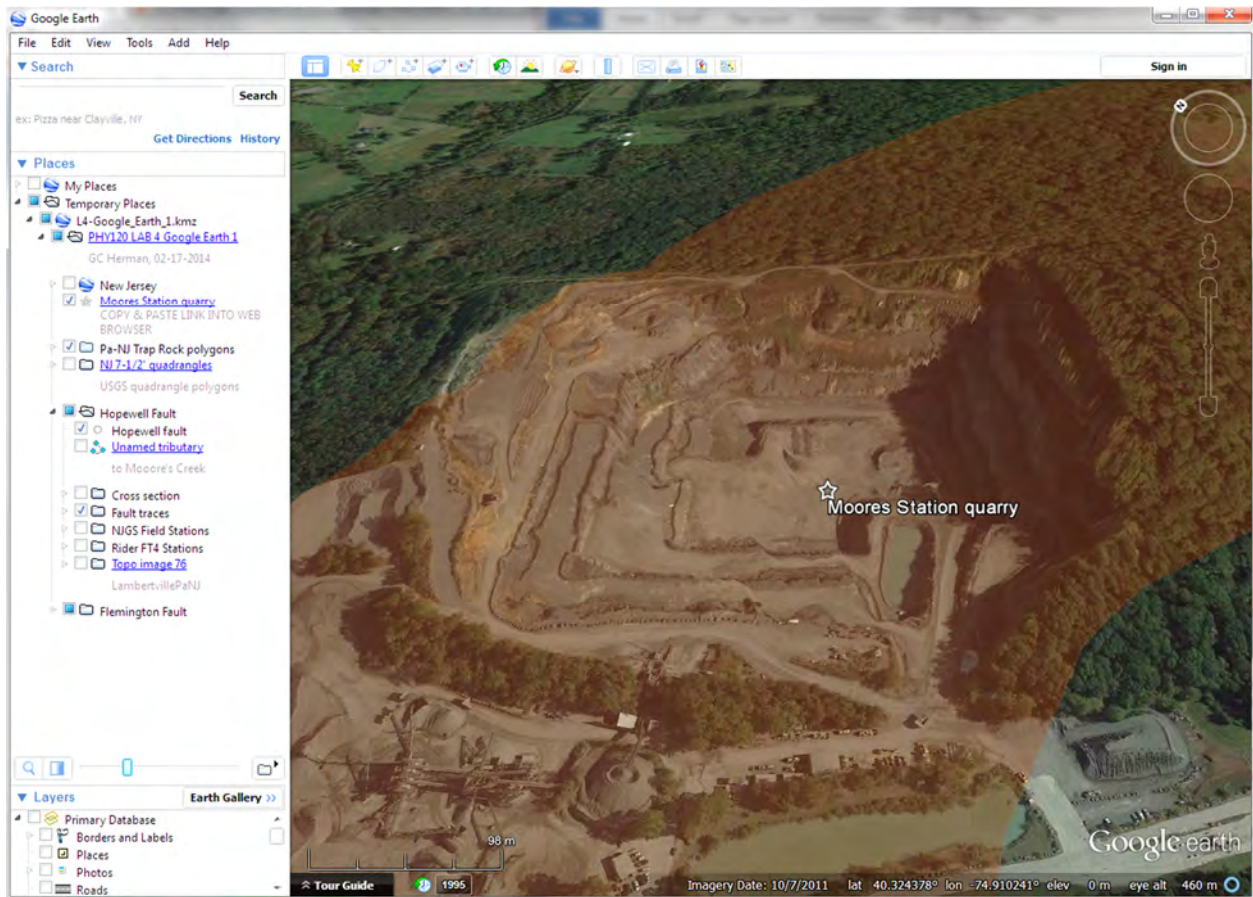


Figure 5. Oblique North-Northeast view of the Moores Station quarry after manually positioning. The Pa-NJ Trap Rock polygons theme is now about 70% transparent.

- <Single-left click>
- In the Legend pane, the balloon pops up in the view with a link to a Photosynth photo collage of the quarry.
- <Right-click<Copy Link> and paste this URL into an Internet browser like MS Explorer or Google Chrome. This will bring you to a Microsoft site that photo mosaics 2D photographic into 3D mosaics called Photosynth (fig. 8)..

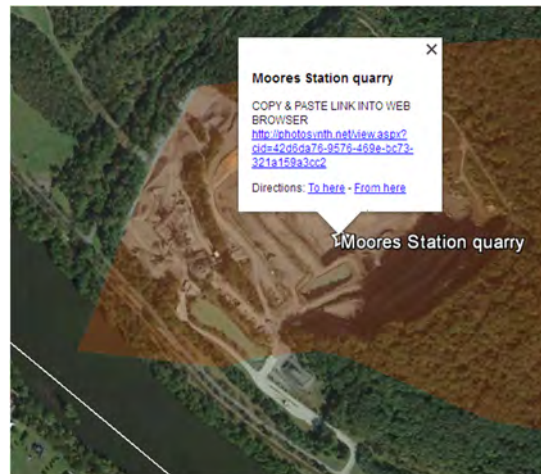


Figure 6. Balloon showing the URL for the MS Photosynth.

- You may get a prompt like this asking your permission for the rendering software to run in your browser.
- If you <Right-click><Run this program> and grant it permission and it works, you will have a view that you can pan and zoom through to see the quarry being worked.

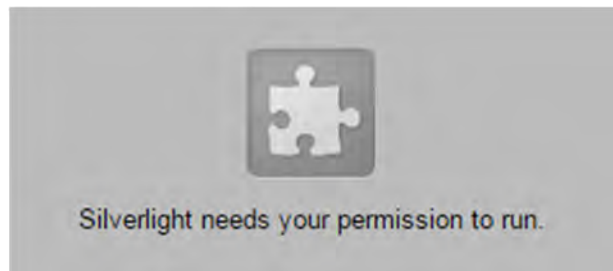


Figure 7. Microsoft Silverlight prompt to run.

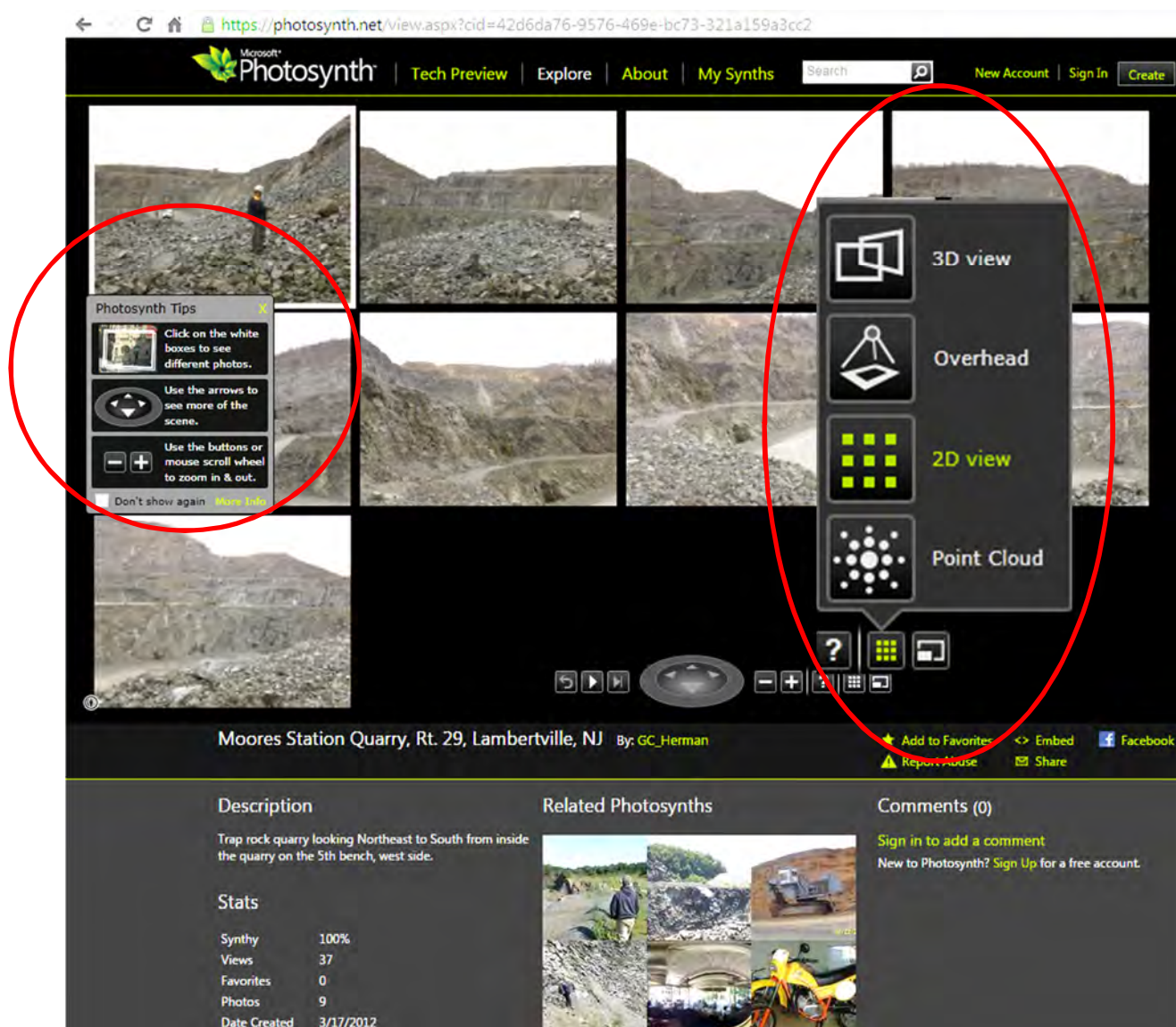


Figure 8. 2D view of the 9-photo mosaic. Note the Photosynth Tips dialog window middle left.

- Now turn on the Topo Image 76 theme and adjust its transparency to about 70%, as demonstrated below.

Figure 9. Bird's-eye view of the Moores Station quarry with part of the U.S. Geological Survey, Pa-NJ Lambertville 7-1/2' topographic quadrangle map as an image overlay set at about 70% transparent. The arrow points to the perspective shown in figure 10 below.

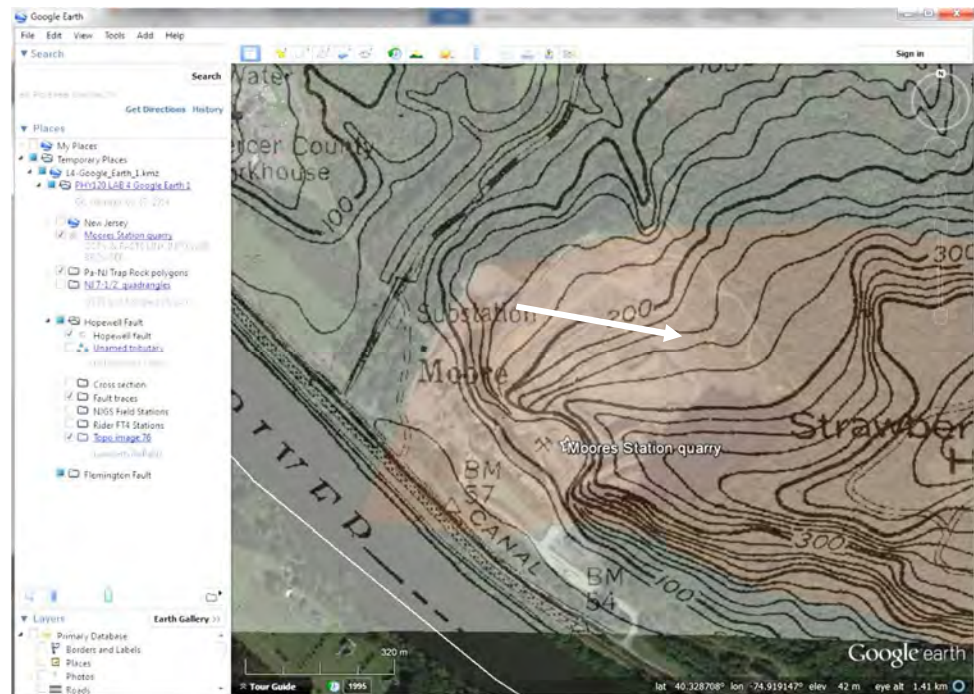
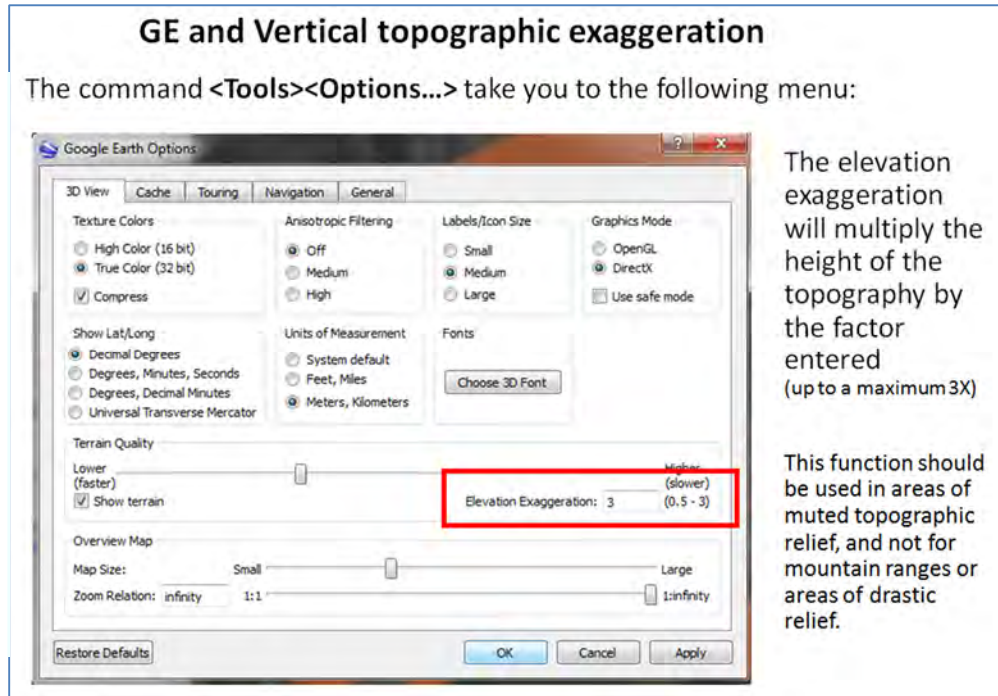


Figure 10. Photograph of quarry benches looking ESE along the viewpoint in figure 9.

- Now access the <Tools><Options> menu to change the vertical exaggeration to 3.0.

Figure 11.
This GE options window allows you to set the vertical exaggeration to anyone range of values from a minimum 0.5 and a maximum 3.0.



- The resulting display will look something like this:

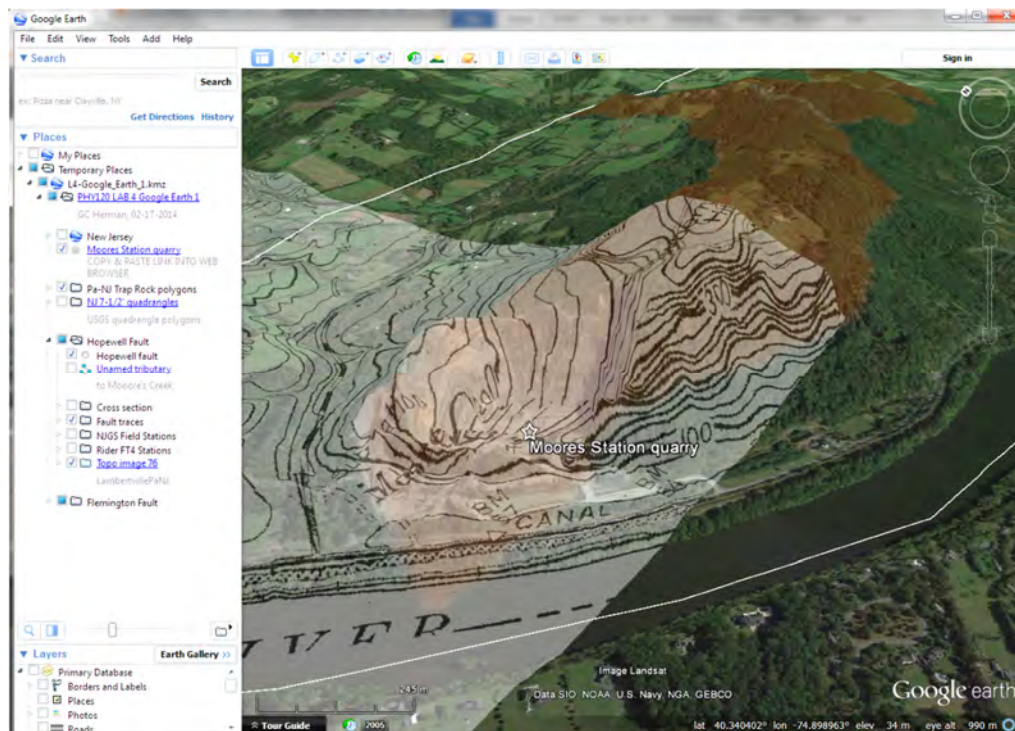


Figure 12.
Similar view of the Moore's Station quarry as for figure 8, but with the vertical exaggeration set at 3X.

- Interact with the display, zooming in and out and turning the view to see the exaggerated topographic perspective.

- The last part of this first exercise is to access the KMZ at this URL:

http://www.ngdc.noaa.gov/mgg/global/relief/ETOPO1/tiled/ice_surface/etopo1_ice_surface.kmz

- This opens the colored physiographic theme of the Earth pictured below:

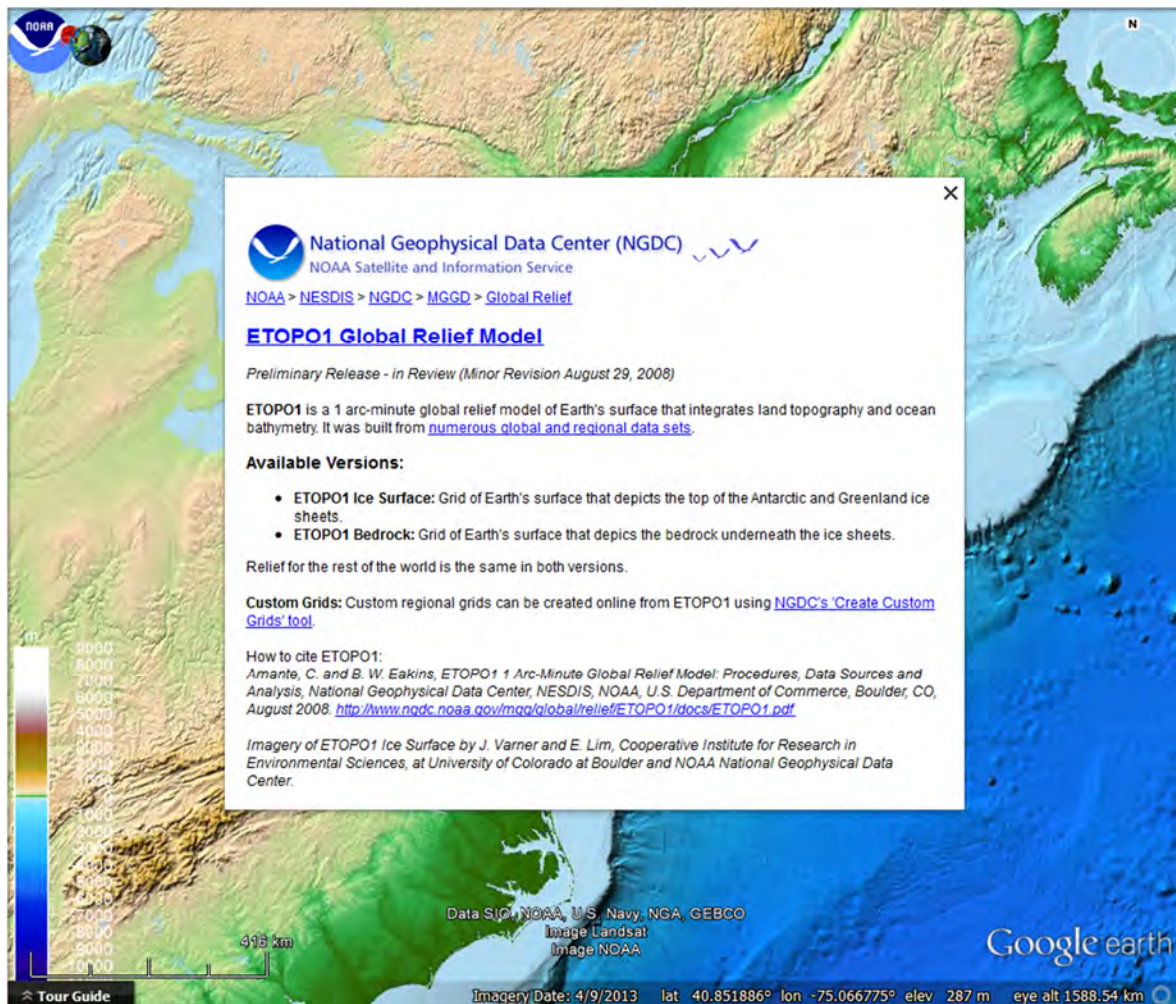



Figure 13. ETOPO1 Global Relief balloon that is displayed

<Left click> on the newly added  [ETOPO1 Ice Surface](#)

- Use this theme to explore the Andes and the Himalayas, Japan, and wherever on Earth.

EXERCISE 2: TCNJ LAB7_PA-NJ-NY_Glacial_Moraines.kmz (526 KB)

This exercise is the third of four GE labs run in the Physics 120C Introduction to Geology Laboratory. By this time, the students have developed a familiarity with raster imagery and coordinate-referenced points, lines, and polygons, and this lab functions to develop their skills in registering raster imagery for the purpose of extracting polyline-based geoscience themes. For this exercise, three images provide continuous base representation of the Pleistocene terminal moraines and glacial-sediment-thickness contours covering eastern Pennsylvania and western New Jersey (fig. 14). The opening view includes the three maps showing line traces of glacial morainic deposits or thickness isolines of glacial sediments in the New Jersey region. The maps include work by Witte and Germanoski, 2012; Stanford, 2010; and the USGS Geological Survey for Long Island (http://pubs.usgs.gov/of/2000/of00-243/pdf/fig1.pdf).

According to Stone and others (2002), Earth's glacial record shows that the Laurentide ice sheet reached New Jersey at least three times over the last two million years. The limits of these respective events are characterized by Witte and Germanoski (2012) from youngest to oldest in table 1.

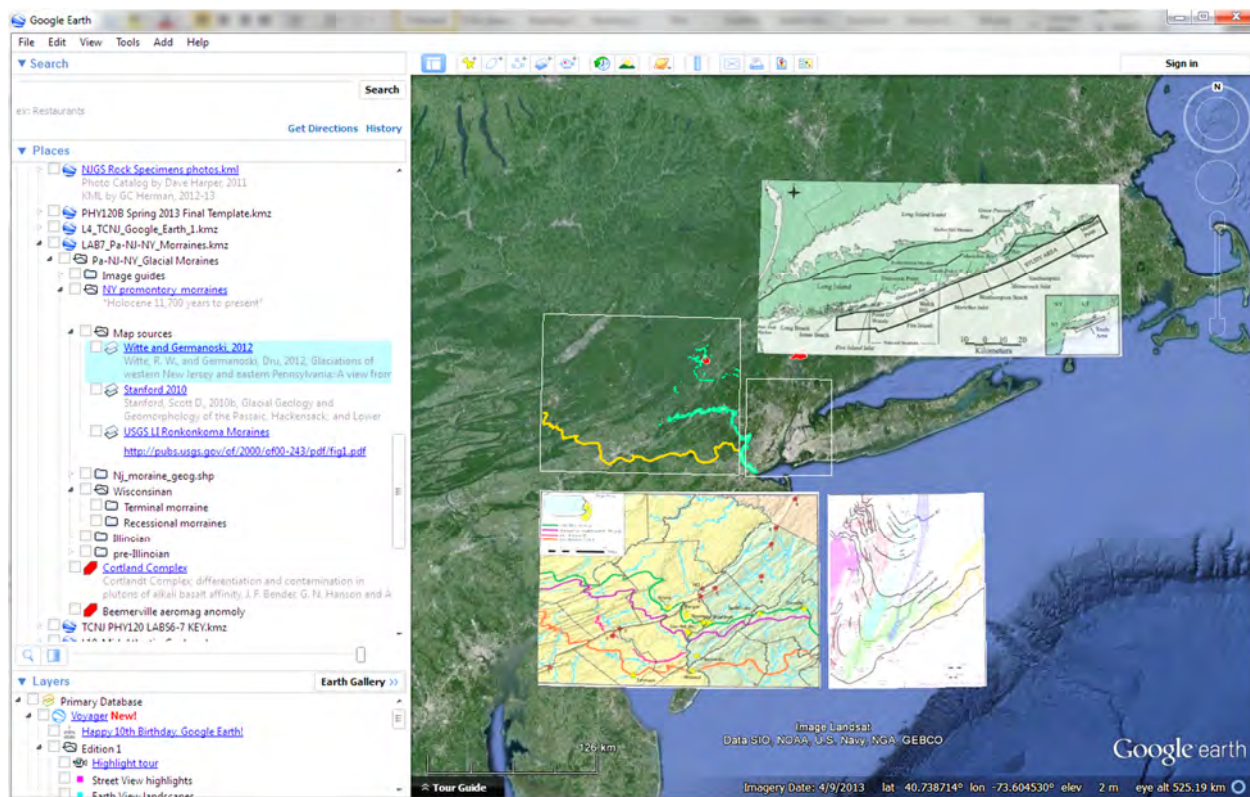


Figure 14. Opening view of TCNJ Lab 7.

Table 1. Pleistocene glacial stages and approximate ages in the NY Recess

<i>Moraines (Marine isotope age)</i>	<i>estimated glacial-culmination age of terminal deposits</i>
Holocene 11,700 years to present	
Late Wisconsinan (MIS 2)	~26 – 17.8 Kya
Oldest Late Illinoian or pre-Illinoian B (MIS 6 or 12)	~ 160 - 180 Kya
Two older pre-Illinoian (MIS 16 – 22)	~850 Kya – 2.01 Mya

According to Witte and Germanoski (2012), “Similar to New Jersey's oldest glacial deposits, those in Pennsylvania may represent more than one glaciation. There is some disagreement concerning the age of the older glaciations and number of pre-Illinoian glaciations, but there is a remarkable congruency between the glacial limits mapped on either side of the Delaware River. The youngest glacial deposits laid down during the Late Wisconsinan substage provide the clearest record of glaciation. The glacial record, indicated by the Illinoian and especially the pre-Illinoian deposits, is much less clear due to an extensive and complex periglacial and weathering history”.

The opening view in this exercise (fig. 13) includes three raster images that are preloaded in the KMZ along with two white boxes that the two lower images fit in. A third, upper image of Long Island requires matching of the coastline for georegistration. Orange polygons included in the KMZ are polygonal representations of morainic deposits in New Jersey from Stanford and others (2007), subsequently converted from an ESRI shapefile theme in to a KMZ file.

This exercise consists of two parts:

A) Register each image, and then

B) Manually digitize the positions of each moraine using the GE polyline tool



Part A) Georegister imagery in GE:

1) <Left click> on one of the images to activate it (it becomes highlighted in blue when active) as seen in figure 15 for the Witte and Germanoski (2012) image.

2) Once an image is active, then <Right-click> on the <Properties> menu option (bottom choice). This will place the image in editing mode and activate green handles to manipulate an

image (fig. 15). The different types of handles can be used to resize, stretch, rotate, or drag the image into position.

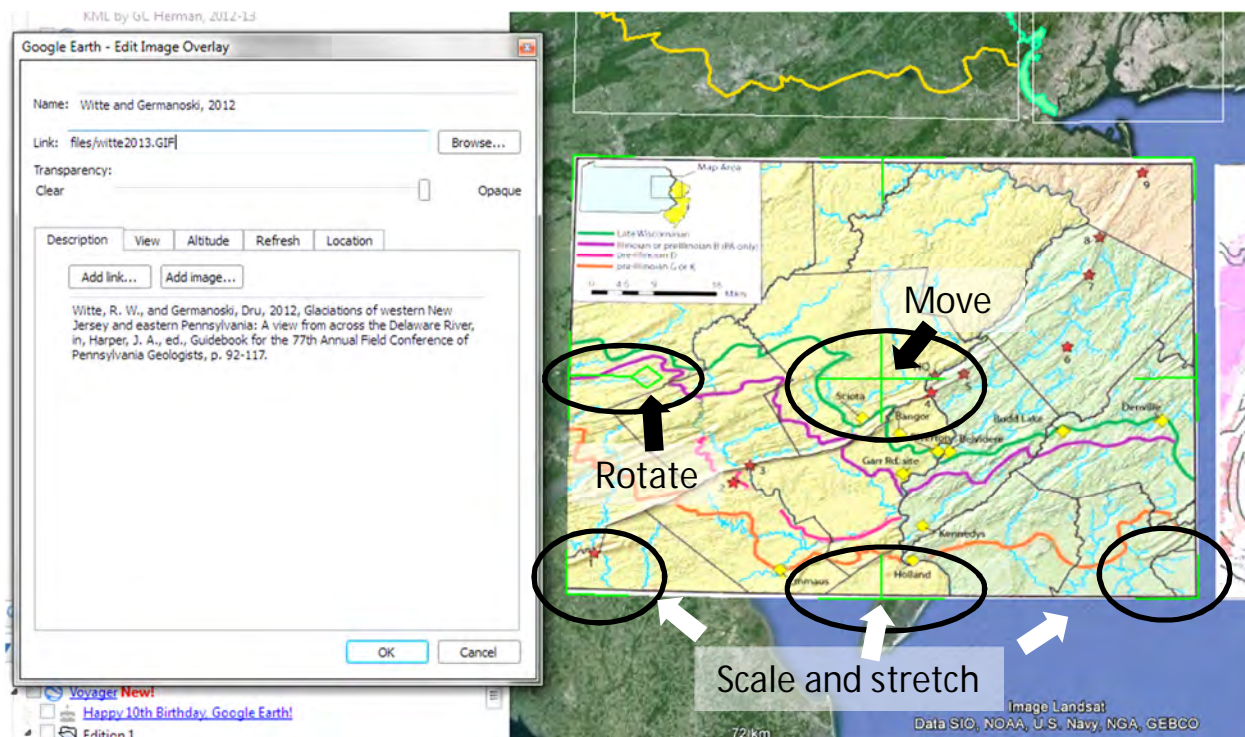


Figure 15. GE view of an image property-dialog box with the image in editing mode. Note the green handles that are used to manipulate the image, and the Transparency slider on the <Properties>< Edit Image Overlay> menu.

- 3) Once the correct position is attained, <Left click> <OK> in the Edit Image Overlay window
- 4) When registering the Long Island image, use the transparency slider to make the image semi-transparent in order to match the coastline on the image with that in GE.

Once each image is positioned, then the next step is to digitize the traces of the glacial moraines.

Part B) Digitize polyline traces of the moraines using the GE polyline tool

As seen in figure 14, the pre-Illinoian moraine has already been traced as a colored polyline and is useful for checking the alignment of the western geo-registered image. Also, the Wisconsinan terminal moraine in New Jersey (the southernmost green polygon) serves as a reference for continuing the trace of the Wisconsinan from eastern Pennsylvania through New Jersey.

To digitize a feature trace,

- 1) Activate the folder that is to receive a digital polyline, for example, before tracing the terminal moraine of Wisconsinan age, use the mouse to <Left click> the folder and highlight it before proceeding (like that in figure 14).

- 2) Next, <Left click> the polyline tool icon in the toolbar.



The mouse cursor becomes a symbol like this:

- 3) Next, position the mouse cursor over the starting point, then repeatedly <Left click> the mouse button as you move along the trace, clicking to place a vertex on the polyline trace.

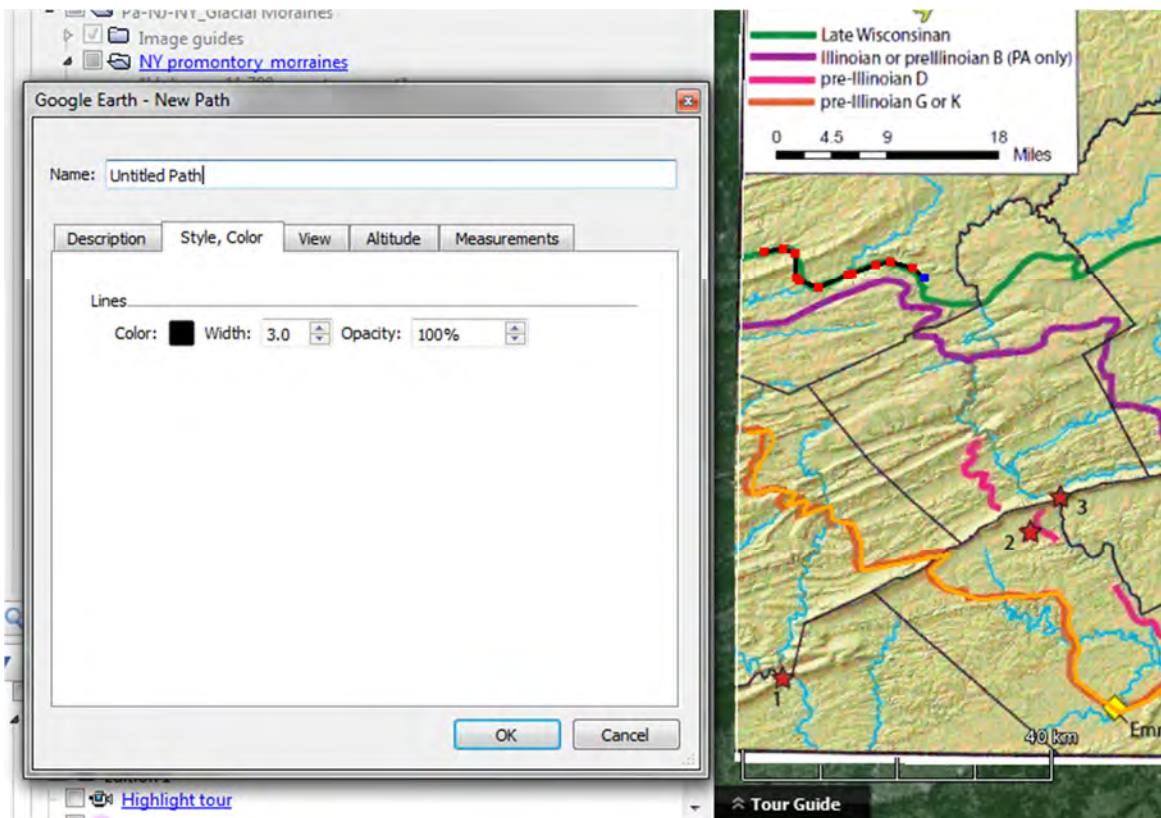


Figure 16. GE view of an image property-dialog box with the polyline in editing mode. Note the black line of Width 3.0 that is being digitized along the Wisconsinan moraine (beginning on the left and progressing to the right). Each small, red square is a polyline vertex that can be moved (using the left-mouse button) or deleted (using the right-mouse button)

Note: Once the digitizing environment is active, a feature-dialogue box opens with an <Untitled Path> reference name in the title box (fig. 16). Please type in the name of the feature that you will be digitizing. As long as this dialogue box remains open, you will be in the editing mode and can use the mouse as a digitizing tool to trace the feature line.

- 4) A <Right click> on a vertex will delete it as you want to refine the line.

Note. There are two modes of digitizing, by holding the left mouse-button down as you drag the mouse along, you can generate a smooth, continuous line that is densely populated with vertices. If you single click between mouse movements, then you can generate a polyline trace adding a single vertex at a time in controlled manner. The choice is yours, experiment using both approaches.

At any time, the dialog box for editing a polyline can be closed by clicking <OK>. To continue digitizing it, or to further edit it, simply <Right click> on the theme in the Legend pane, and continue editing it. Once the vertices are visible, you can select one with a <Right click> to move it (drag it when holding the mouse's left button, or delete it using the right button.)

The goal is to digitize a feature trace representing each of the terminal moraines, and a few of the sediment-thickness lines as part of a new KMZ file.

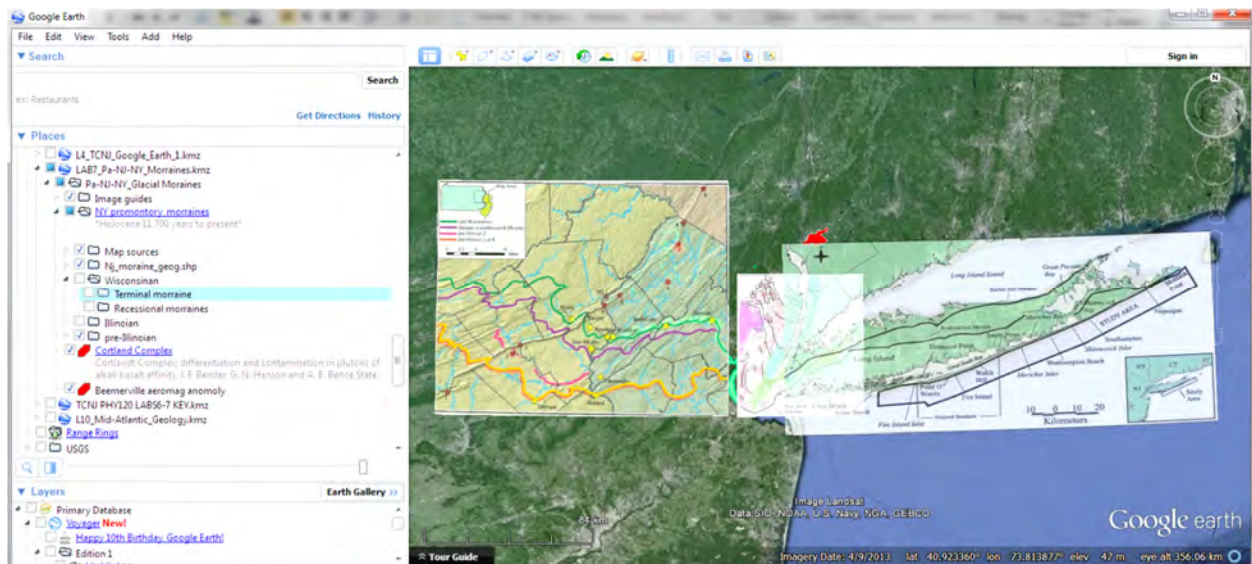


Figure 17. GE view of the correctly georegistered imagery before digitizing the glacial moraines .

Some very important tips:

- 1) Please <Save> your work periodically. GE crashes, and when it does, you will be sorry if you didn't save your work.
- 2) To save your work, <Left click> on the folder at its root (highest) level, then in the Menu Bar, <Left click> <File><Save><Save Place As> to save your work to a local hard drive, zip drive, or the cloud.

Alternatively, after highlighting the top-level folder, use the mouse button to use this shortcut: <Right click> <Save Place As>

- 3) *How it appears when you saved it last is how it will look when you open it next.*
- 4) It is also important to repeatedly save your work environment if you prefer by using this sequence of commands:

Menu Bar, <Left click> <File><Save><Save My Place>

to save your current work environment.

References

- Stone, B.D., Stanford, S. D., and Witte, R.W., 2002, Surficial geologic map of northern New Jersey. U.S. Geological Survey Miscellaneous Investigation Series Map, scale 1:100,000.
- Stanford, S. D., Pristas, R. S., Witte, R. W., 2007, Surficial geology of New Jersey: N. J. Geological Survey Digital Geodata Series DGS 07-2, scale 1:100,000.
- Witte, R. W., and Germanoski, D., 2012, Glaciations of western New Jersey and eastern Pennsylvania: A view from across the Delaware River, *in*, Harper, J. A., ed., Guidebook for the 77th Annual Field Conference of Pennsylvania Geologists, p. 92-117.