what is GIS (and why should I care)?

lecture 3

overview

what is GIS? how can it be used? timeline of mapping and data visualization

1. **GIS: timeline**
2. **example: geology**
3. **example: map vs use**
4. **example: Borges**

cover image: Every river in the US, Nelson Minar, 2013 (accessed through TreeHugger.com)

> "GIS is a technological field that incorporates geographical features with tabular data in order to map, analyze, and assess real-world problems."

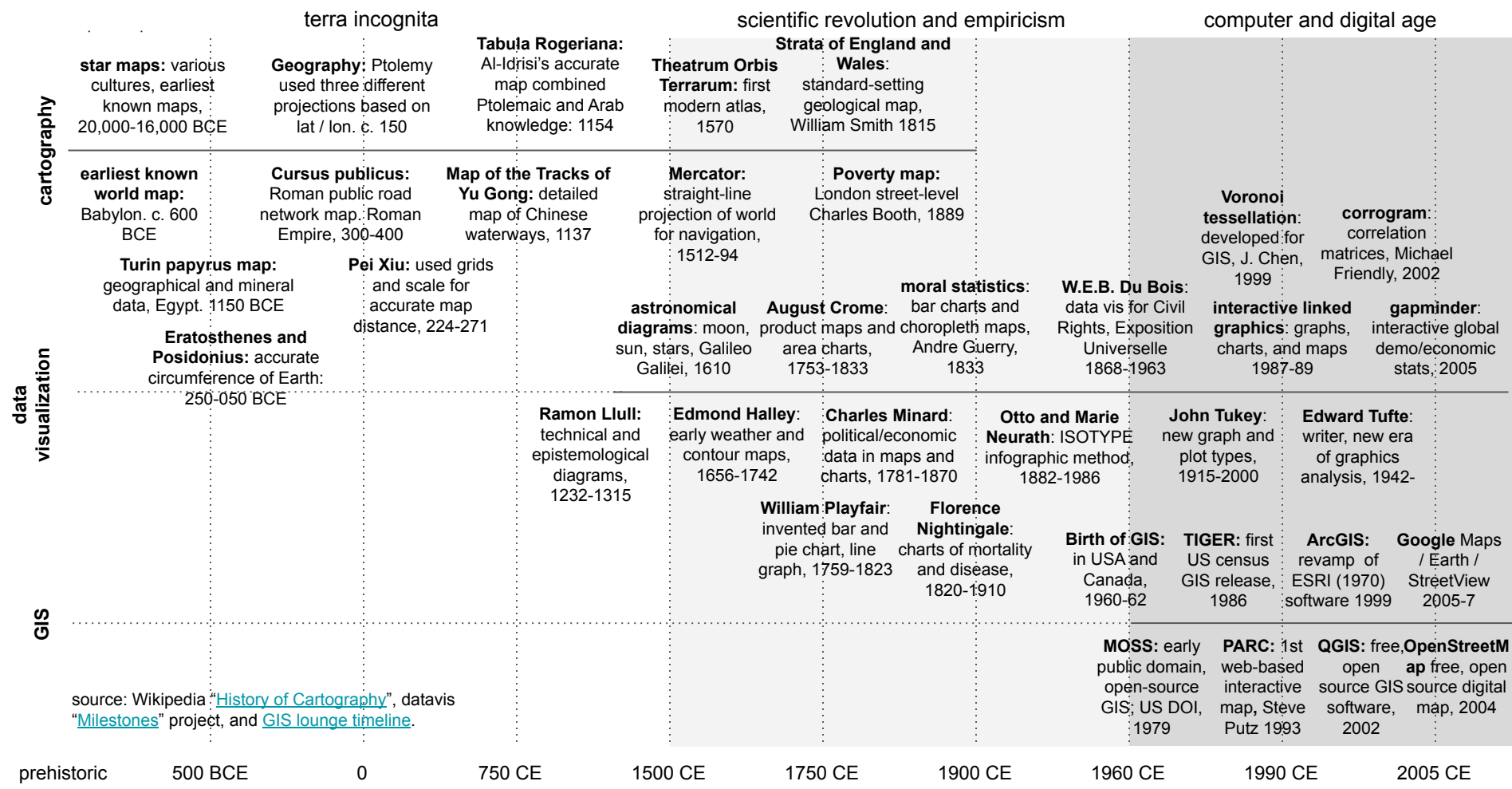
- GIS lounge

GIS (geographic information system) is a combination of data science and cartography.

> "A map is not the actual territory…. An ideal map would contain the map of the map, the map of the map of the map, etc., endlessly…. We may call this characteristic self-reflexiveness."

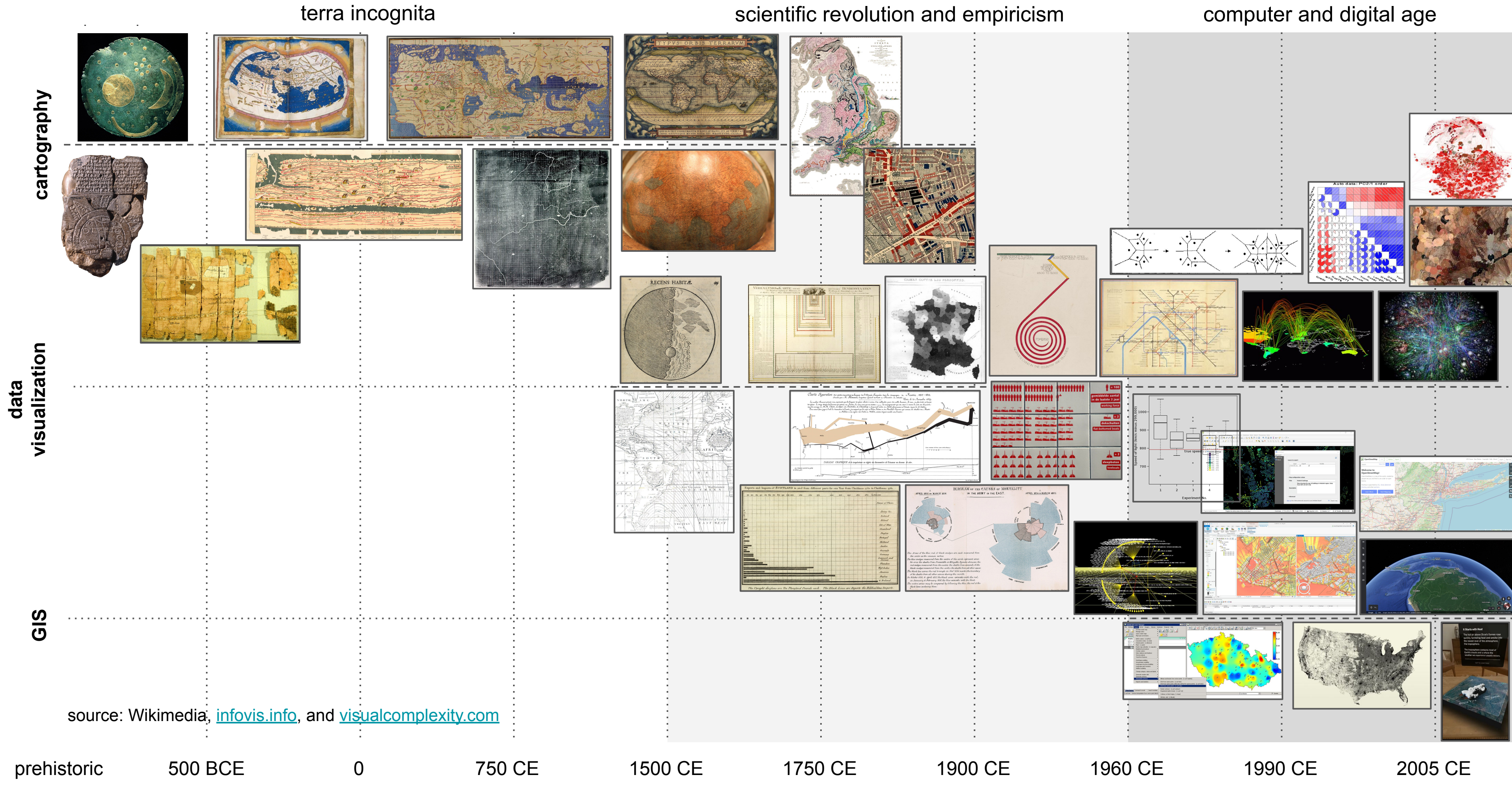
- *Science and Sanity*, Alfred Korzybski (1933)

Timeline (N.T.S); Miro Board link: https://miro.com/app/board/uXjVObgYhtM=/?share_link_id=436879265861



source: Wikipedia "History of Cartography", datavis "Milestones" project, and GIS lounge timeline.

Timeline (N.T.S); Miro Board link: https://miro.com/app/board/uXjVObgYhtM=/?share_link_id=436879265861



source: Wikimedia, infovis.info, and visualcomplexity.com

“The earliest known maps are of the stars, not the earth.”
(wikipedia, “History of Cartography”)

Nebra Sky Disc: oldest known map of the cosmos. c. 1600 BCE

1000 years later…

earliest known world map: Babylon. c. 600 BCE

500 years later…

Tabula Rogeriana: Al-Idrisi’s accurate map combined Ptolemaic and Arab knowledge. 1154

420 years later…

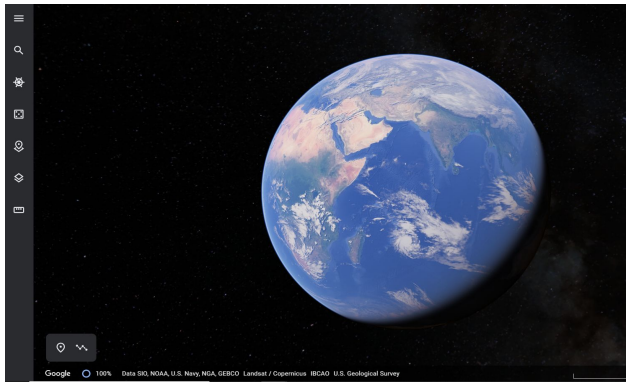
Theatrum Orbis Terrarum: first modern atlas, 1570

310 years later…

Extent of the British Empire: 1886

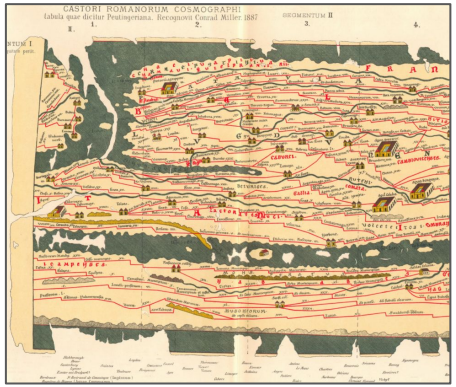
150 years later…

Google Earth: digital, scalable online globe including street-level data for every city in the world, 2022



Turin papyrus map: geographical and mineral data, Egypt. 1150 BCE

1500 years later…



Cursus publicus: Roman public road network map. Roman Empire, 300-400

800 years later…

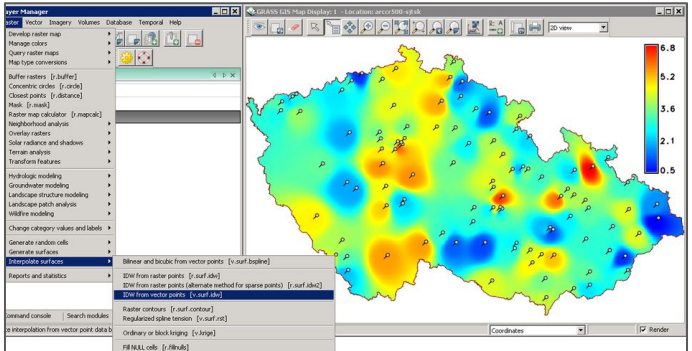
Map of the Tracks of Yu Gong: detailed map of Chinese waterways, 1137

700 years later…

Strata of England and Wales: standard-setting geological map, William Smith 1815

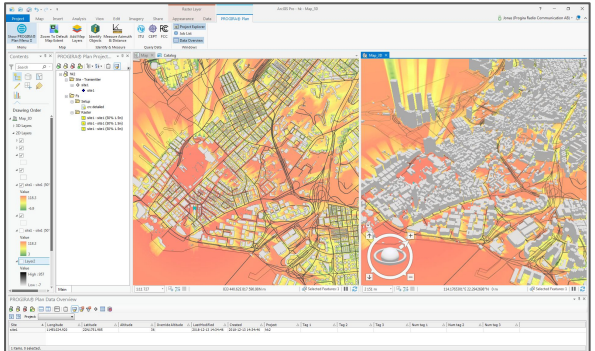
150 years later…

GRASS: descendent of MOSS; early public domain, open-source GIS; USACE, 1982 (image: early 2000s GUI)



17 years later…

ArcGIS: revamp of ESRI software, 1999 (image: mid 2010s GUI)

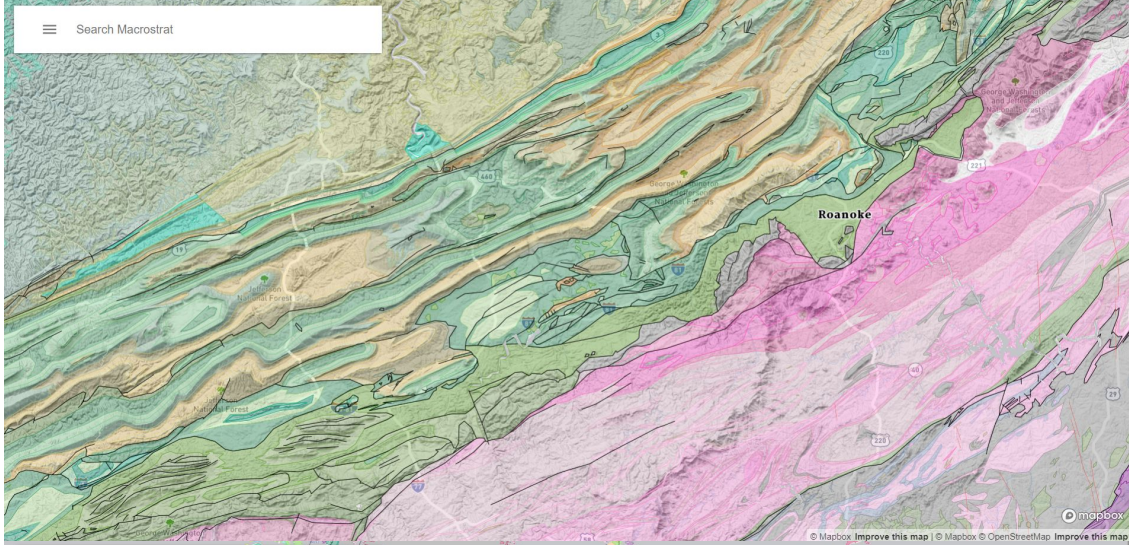


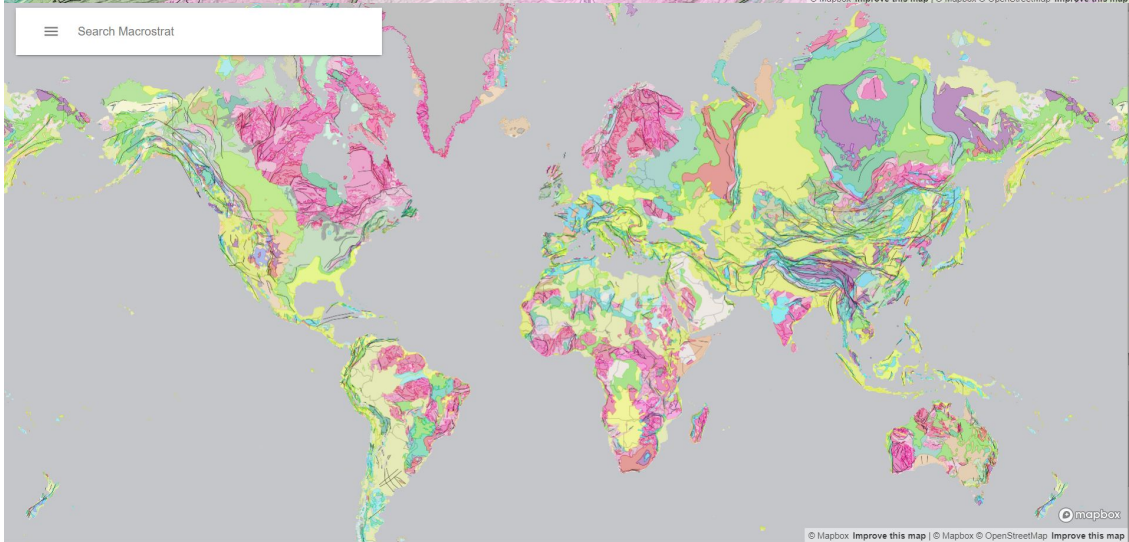
20 years later…

New York Times augmented reality storytelling, 2021

above: Strata of England and Wales: standard-setting geological map, William Smith 1815

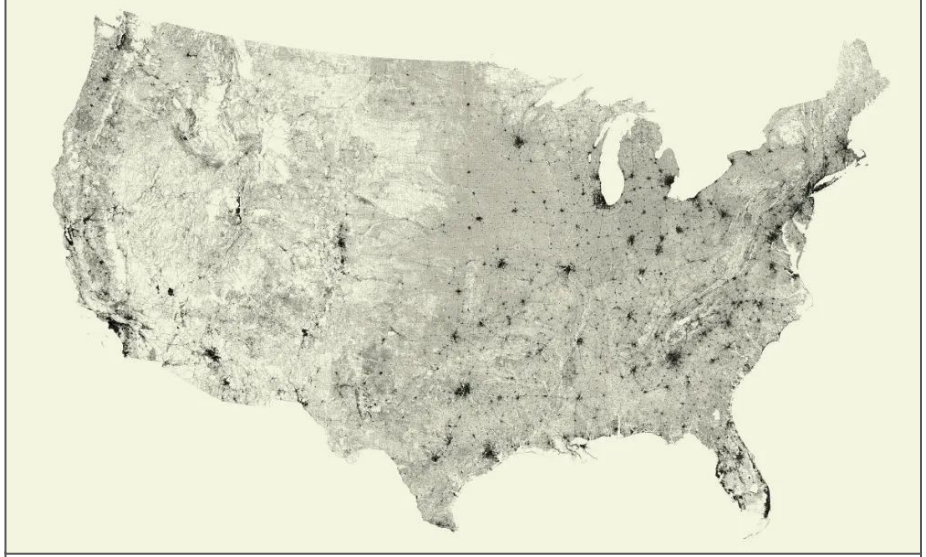
right: [Macrostat](#) interactive geological map





Compared with the “Tracks of Yu Gong” map from China, 1137, the “Every river in the US” and “Every road in the US” maps from nearly 900 years later celebrate the density of data over practical use.

Map of the Tracks of Yu Gong: detailed map of Chinese waterways, 1137



Every road in the US:
FATHOM, c. 2013

Every river in the US:
Nelson Minar, 2013

On Exactitude in Science (Jorge Luis Borges)
from Collected Fictions, translated by Andrew Hurley

. …In that Empire, the Art of Cartography attained such Perfection that the map of a single Province occupied the entirety of a City, and the map of the Empire, the entirety of a Province. In time, those Unconscionable Maps no longer satisfied, and the Cartographers Guilds struck a Map of the Empire whose size was that of the Empire, and which coincided point for point with it. The following Generations, who were not so fond of the Study of Cartography as their Forebears had been, saw that that vast Map was Useless, and not without some Pitilessness was it, that they delivered it up to the Inclemencies of Sun and Winters. In the Deserts of the West, still today, there are Tattered Ruins of that Map, inhabited by Animals and Beggars; in all the Land there is no other Relic of the Disciplines of Geography.

—Suarez Miranda,Viajes devarones prudentes, Libro IV,Cap. XLV, Lerida, 1658

In this short story, Borges describes a map which perfectly reproduces the state of an empire in geographic totality. However, this map does not mention including any people.

What does it mean to include people in a map?

What would it mean to perfectly recreate both a nation's geographical AND demographic state?

How far are we from achieving this?

“The inventions of philosophy are no less fantastic than those of art: Josiah Royce, in the first volume of his work *The World and the Individual* (1899), has formulated the following: 'Let us imagine that a portion of the soil of England has been levelled off perfectly and that on it a cartographer traces a map of England. The job is perfect; there is no detail of the soil of England, no matter how minute, that is not registered on the map; everything has there its correspondence. This map, in such a case, should contain a map of the map, which should contain a map of the map of the map, and so on to infinity.'

Why does it disturb us that the map be included in the map and the thousand and one nights in the book of the *Thousand and One Nights*? Why does it disturb us that Don Quixote be a reader of the *Quixote* and Hamlet a spectator of *Hamlet*? I believe I have found the reason: these inversions suggest that if the characters of a fictional work can be readers or spectators, we, its readers or spectators, can be fictions.”

— Jorge Luis Borges, *Partial Magic in the Quixote* (1964)

The Great Polish Map of Scotland;
images from Google Maps, May 2022

Additional References

“History of Cartography Project”, University of Wisconsin-Madison, great free 6-volume collection: https://geography.wisc.edu/histcart/

Visual Complexity, a database of historical data visualization: http://www.visualcomplexity.com/vc/

Flowing Data, collection of recent data visualizations: https://flowingdata.com/

Macrostat interactive geological map: https://macrostrat.org/map/#/z=1.5/x=16/y=23/bedrock/lines/