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# Geo-Spatial Mining of Historical Maps and Texts: Comparing 16th c. Ottoman military logistics with 19th c. transport infrastructure in Southeast Europe

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Maps in Libraries 2019, IOS Regensburg

M. Erdem KABADAYI, Piet GERRITS,  
Grigor BOYKOV

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# Outline



- What is **Historical Geographical Information Systems/Science?**
- Why **HGIS?**
- Why and how are we conducting **digital research?**
- **Case Study:** Ottoman logistics & transport infrastructure, 16th-19th c.
- **Main Aim:** A **multi-modal** historical transport network with freight and passengers costs for the **Ottoman Empire, 1840s**
- **Potentials** and **risks** of digital humanities / (HGIS)?

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## Digital Humanities / HGIS?

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- **DH:** 'An academic field concerned with the application of **computational tools** and **methods** to **traditional humanities** disciplines such as literature, **history**, and philosophy.' *Oxford Dictionaries*. Web. 8<sup>th</sup> November 2017
- '**Historical GIS (HGIS)** is an **interdisciplinary field** that integrates the **tools** and **methods** of **geographic information Science** (GIS) into **historical research**. HGIS projects and studies emphasize the role of **spatial context** and **relationships** in understanding the **emergence**, **development**, and **consequences** of **historical events**.' *Oxford Bibliographies*. Web. 27<sup>th</sup> June 2017  
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## Why HGIS?



- **Revisiting** textual sources and historical maps
  - **Mapping** historical sources
    - **Geo-locating** places
    - A **geo-spatial turn** in history?
  - Revisiting **old** research questions
    - **RQ1:** Did Ottoman armies rely on wheeled vehicles?
  - Formulating **new** research questions
    - **RQ2:** How much did the transport infrastructure in Southeast Europe change between 16th-19th c.?
  - Devising **a multi-modal transport network** with **costs**
    - Distance, time-distance, slope, road conditions, seasonality
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This research is part of a larger ERC funded research conducted at Koç University, Istanbul.

The aim: bringing Ottoman/Turkish history into the newly emerging field of digital humanities revisiting archival documents and historical maps.

### Partners

The Cambridge Group for the History of Population and Social Structure.



+90-212-338-3736

urbanoccupationsoetr@ku.edu.tr

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### Industrialisation and Urban Growth from the mid-nineteenth century Ottoman Empire to Contemporary Turkey in a Comparative Perspective, 1850-2000

This project aims to overcome historiographical and disciplinary limitations in social and economic history, historical geography and urban studies for the Ottoman Empire and the Republic of Turkey. The chosen long-term Ottoman/Turkish perspective is intended to facilitate comparative approaches so as to overcome the limitations of national historiographies. By extending the analysis up to 2000 the project also challenges the disciplinary divide between economic history, economics and urban studies in research on Turkey. To pursue these multiple goals the project will adopt both an interdisciplinary approach and a comparative perspective. Throughout the project the focus will be on the dynamics of industrialisation, urbanisation and

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## Ottoman logistics & transport infrastructure, 16<sup>th</sup>-19<sup>th</sup>c.



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- **Research question 1:** Did Ottoman armies rely on **wheeled transport** for military logistics?
  - What is the **consequence** if they did?
  - A necessary **road infrastructure** was intact

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## Ottoman logistics & transport infrastructure, 16<sup>th</sup>-19<sup>th</sup>c.



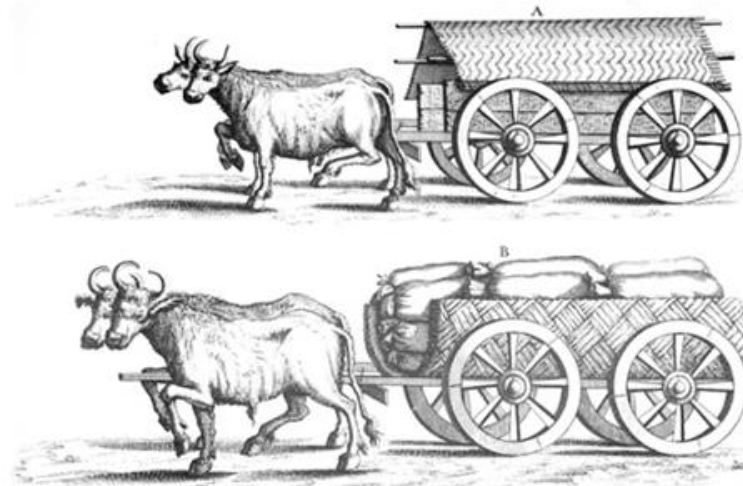
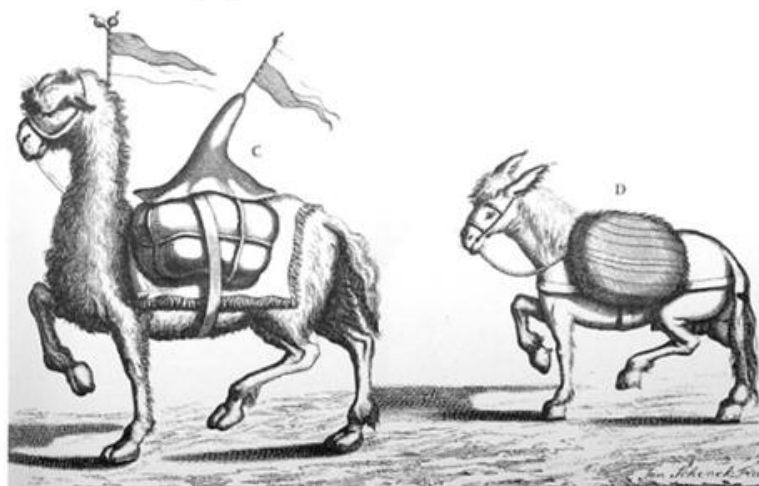
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- **Research question 2:** How much did the transport infrastructure in Southeast Europe **change** between 16th-19th c.?
  - **Continuity** and/or **rupture** in **historical transport capabilities**
  - **Long-term continuity?**
  - Conditions of **road infrastructure** in the long run?

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# RQ1: Pack animals versus wheeled vehicles, or both?



Source: L. Marsigli. *Stato militare dell' imperio Ottomano*, 1732

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# Köszeg Campaign Itinerary, 1532 in previous studies



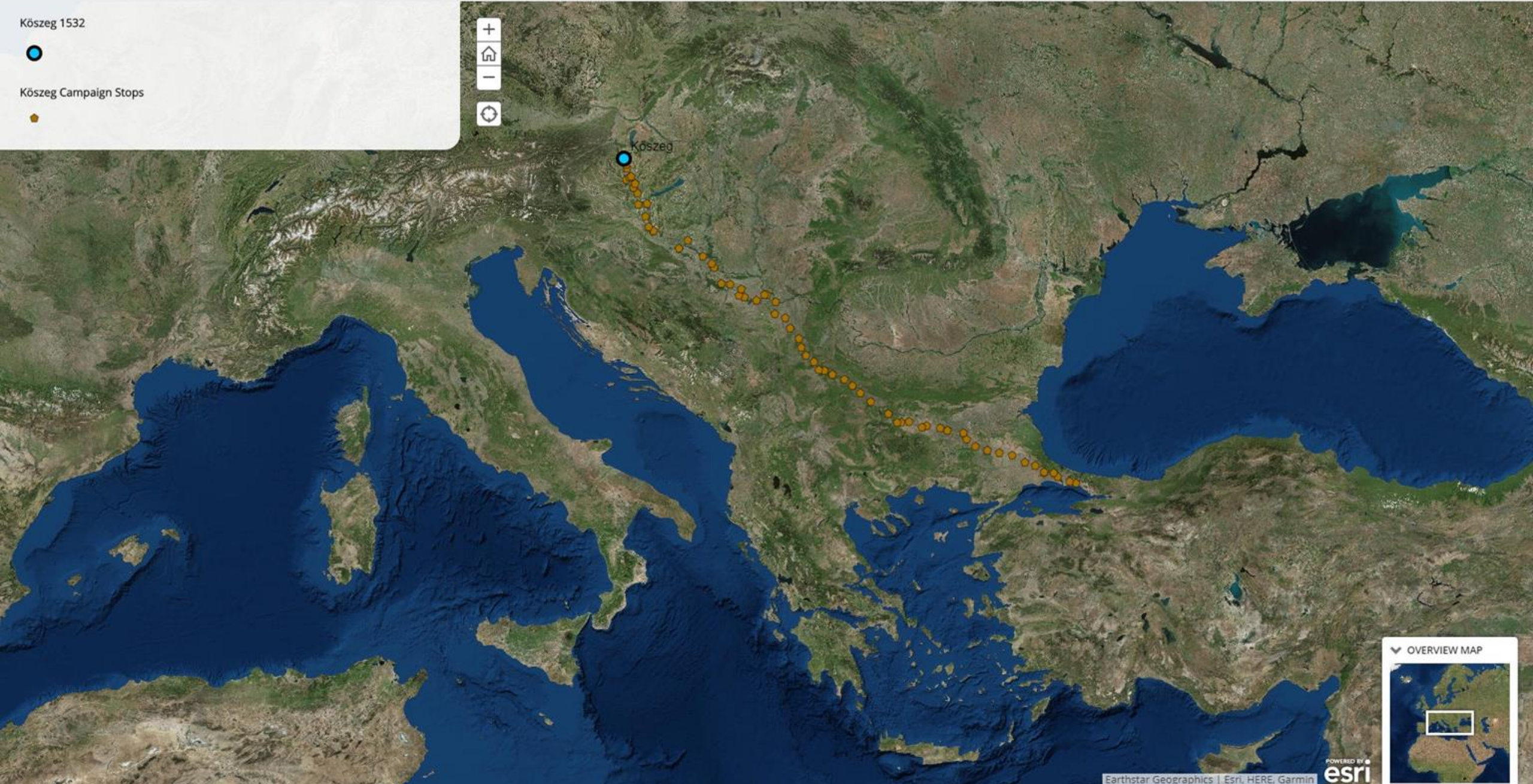
EK: SEFER HARİTASI  
IV. Murad'ın Revan ve Tebriz Seferi Yol Haritası



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Köszeg 1532  
  
Köszeg Campaign Stops

+  
Home  
-  
Refresh



OVERVIEW MAP  
  
POWERED BY  
Earthstar Geographics | Esri, HERE, Garmin

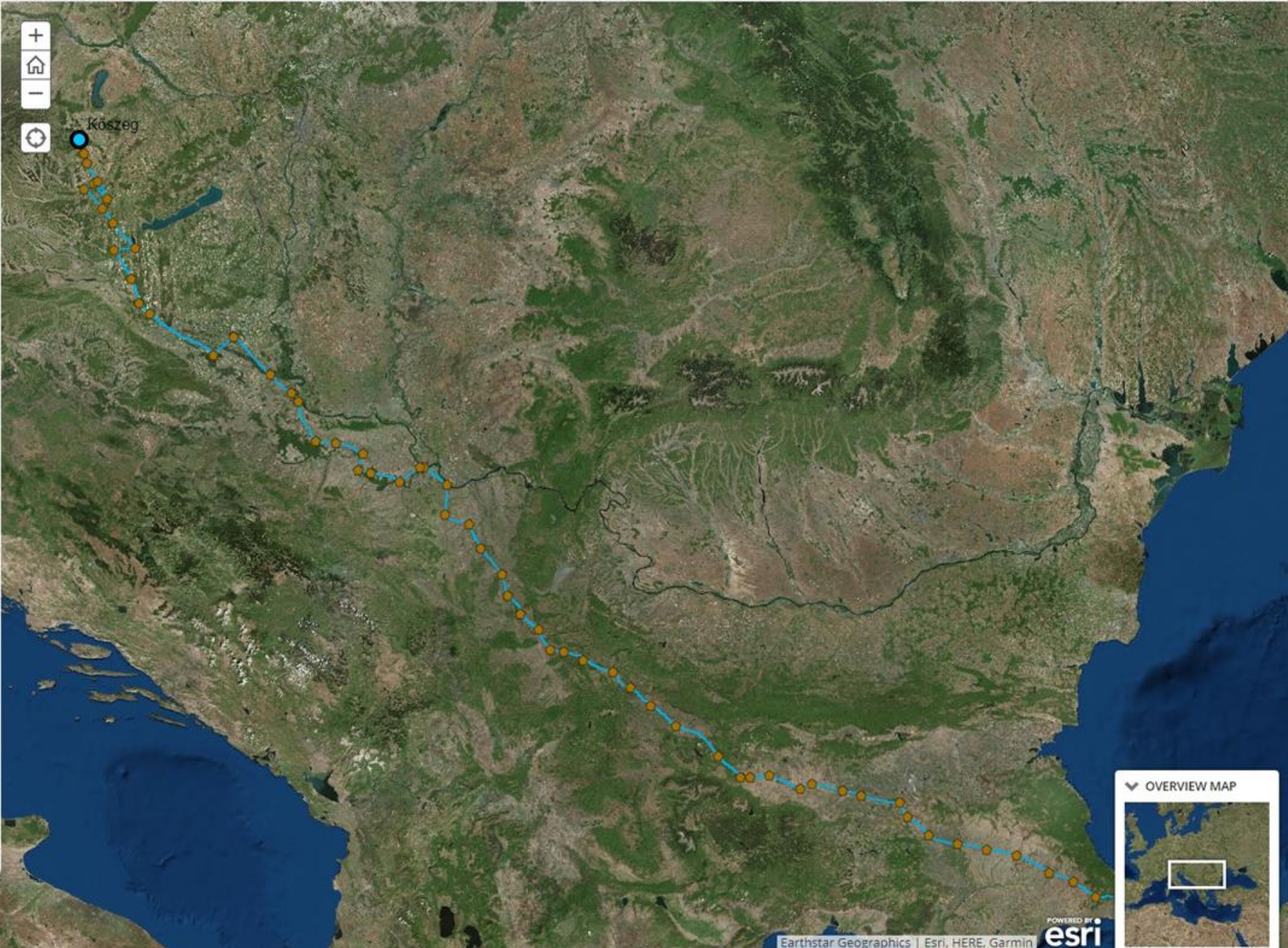
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. Use of the Tobler Hiking function to determine Least Cost Path analyses between Ottoman Army stops.

Icon\_large.png

Tobler Information.png

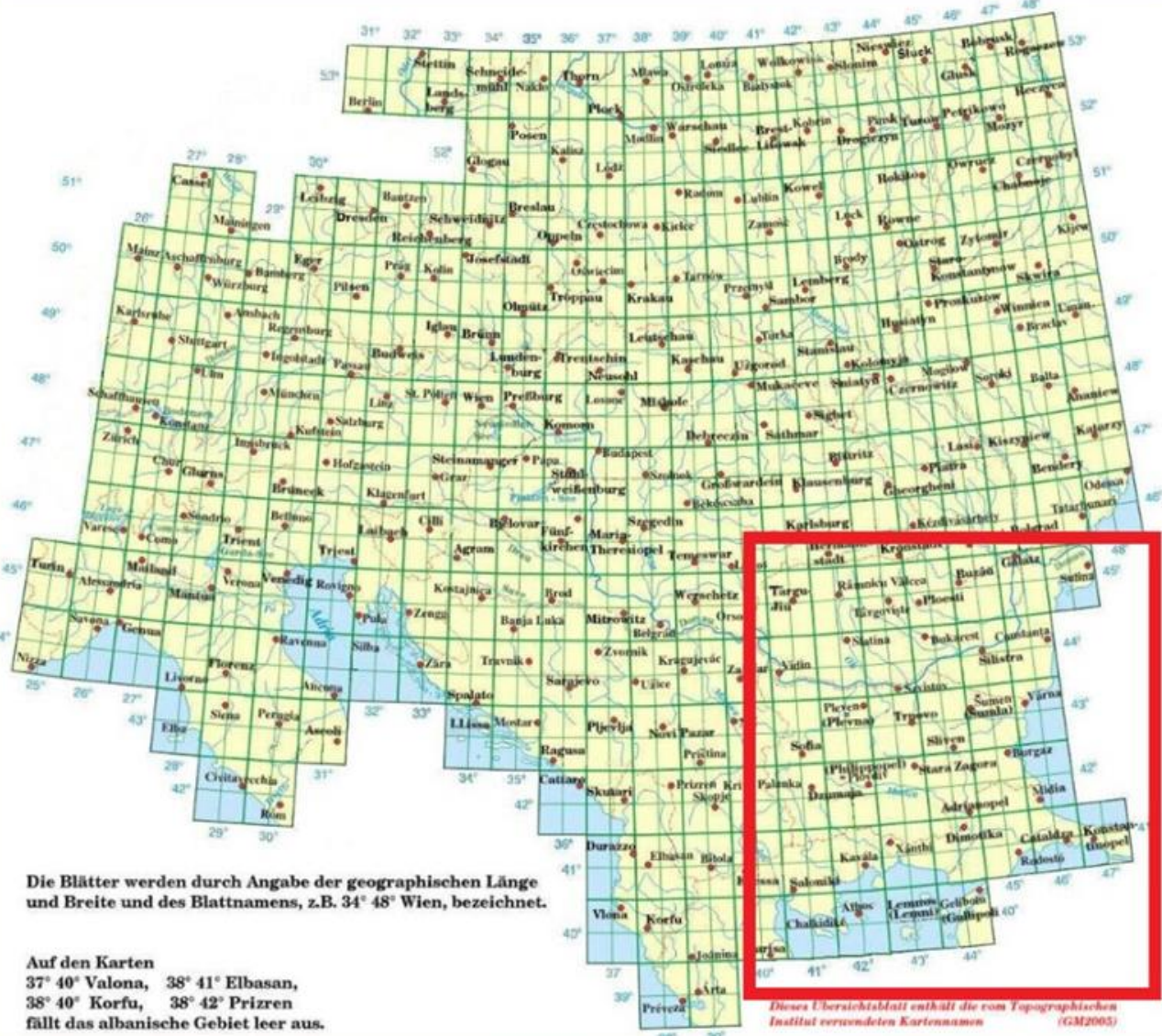
- Köszeg 1532
- Köszeg Campaign Stops
- Köszeg Campaign (Tobler Hiking Function)



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### 3. Generalkarte von Österreich - Ungarn 3rd Military Mapping Survey of Austria-Hungary

Übersicht zur Generalkarte ZENTRALEUROPA (1:2000 000) Index sheet of the general map of Central Europe (1:200 000)  
 Durch klicken auf ein Gradfeld rufen Sie die jeweilige Karte auf Clicking on an index map you can look at the sheets (3-2.5 MB each)  
 Aufgelegt wurden diese Karten etwa 1910 The original sheets were published about 1910  
 Verfügbar sind 264 Kartenblätter Currently 264 sheets are available (930 MB)



Die Blätter werden durch Angabe der geographischen Länge und Breite und des Blattnamens, z.B. 34° 48' Wien, bezeichnet.

Auf den Karten  
 37° 40' Valona, 38° 41' Elbasan,  
 38° 40' Korfu, 38° 42' Prizen  
 fällt das albanische Gebiet leer aus.

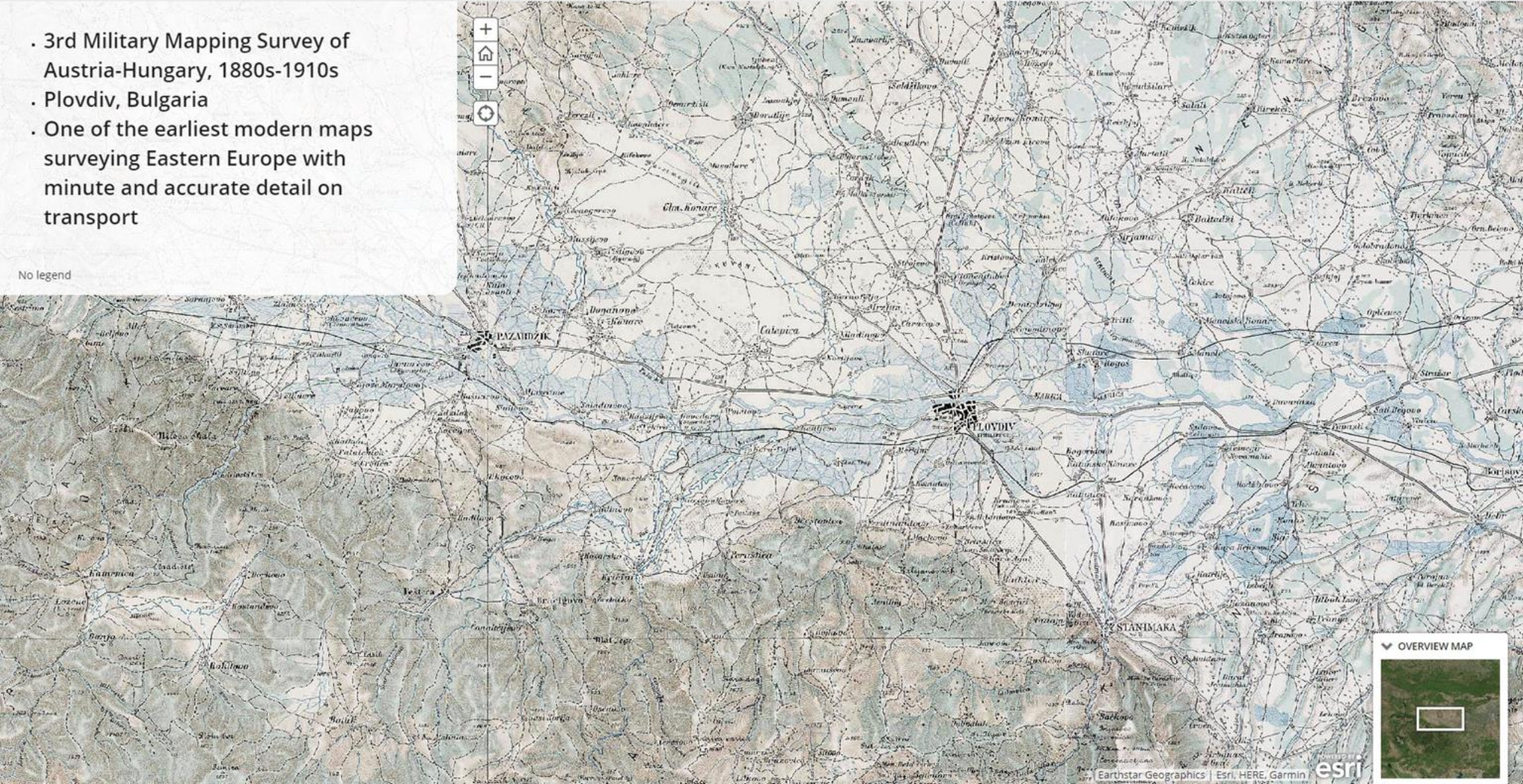


Dieses Übersichtsblatt enthält die vom Topographischen Institut verwendeten Kartennamen (GM2005)

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- 3rd Military Mapping Survey of Austria-Hungary, 1880s-1910s
- Plovdiv, Bulgaria
- One of the earliest modern maps surveying Eastern Europe with minute and accurate detail on transport

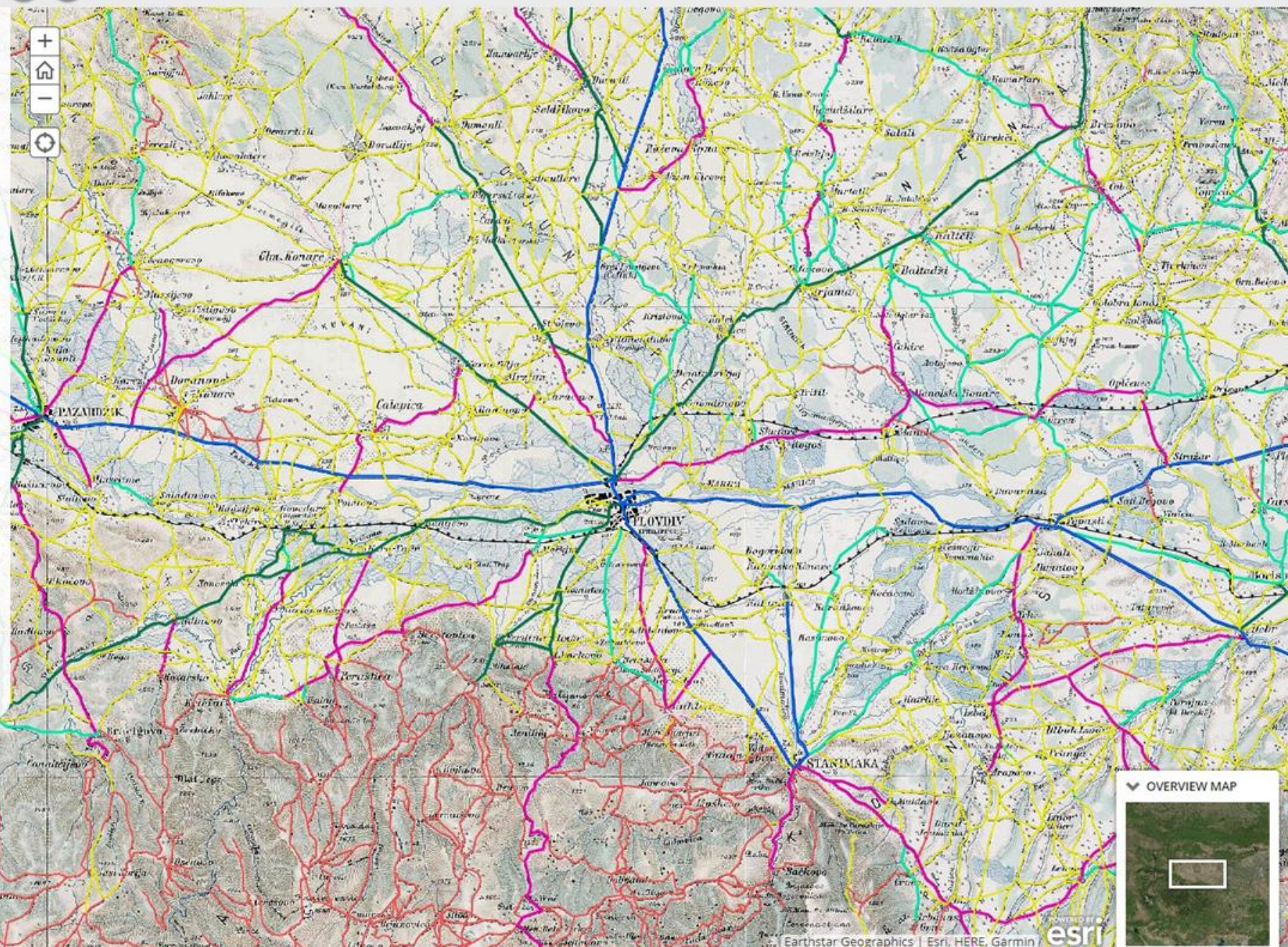
No legend



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3rd Military Mapping Survey of Austria-Hungary (1880s-1910s)

- <Null>
- Eisenbahn\_im\_Bau
  - Erhaltener\_Fahrweg
  - Fahrbare\_Wegspuren
  - Fußweg
  - Hauptstraße
  - Karrenweg
  - Kommunikationen\_Eingeschnittene
  - Landstraße
  - Nicht\_Erhaltener\_Fahrweg
  - - - Normalspurige\_Eisenbahn\_eingleisig
  - - - Normalspurige\_Eisenbahn\_zwei-oder-mehr-gleisig
  - Saumweg
  - Schmalspurbahn
  - Straße\_in\_Bau
  - Straßenbahn\_auf\_der\_Kommunikation
  - Streckenweise\_Saumweg
  - Verfallene\_Straße



- 1 2 3 4 5 6 7 8 9 10 11 12 13 14

**Path Type** 

— Bridle Path


**Road Type**


— Cart Road


General Karte 1904 - Road Types


Road / Path Type	Segment Count	Sum of Length	Average of MEAN	StdDev of MEAN	Median
Cart Road	10972	41802	6,0	4,60	4,8
Bridle Path	9255	37453	12,6	6,40	12,7





Cart Roads - General Karte 



Cart Roads And Bridle Paths - ... 



Bridle paths - General Karte 



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Following the route paths over a weighted 6% (Cart road) and 12% (Bridle Path) slope gradient, we can see the preference of the army's route.

Kőszeg 1532

 Kőszeg Campaign (Pack Animals)

 Kőszeg Campaign (Carts)

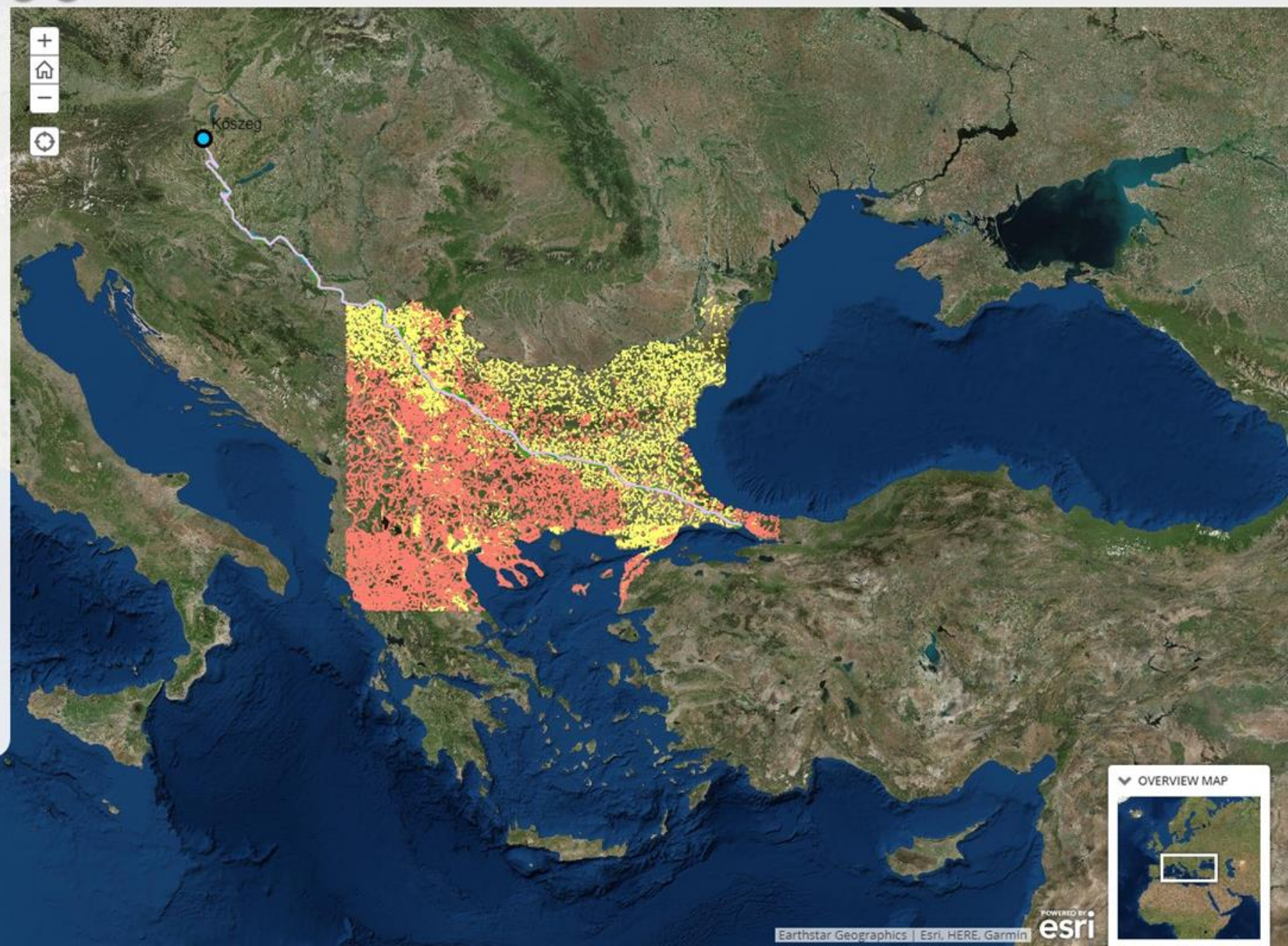
 Kőszeg Campaign (Tobler Hiking Function)

 Path Type

 Bridle Path

 Road Type

 Cart Road



OVERVIEW MAP

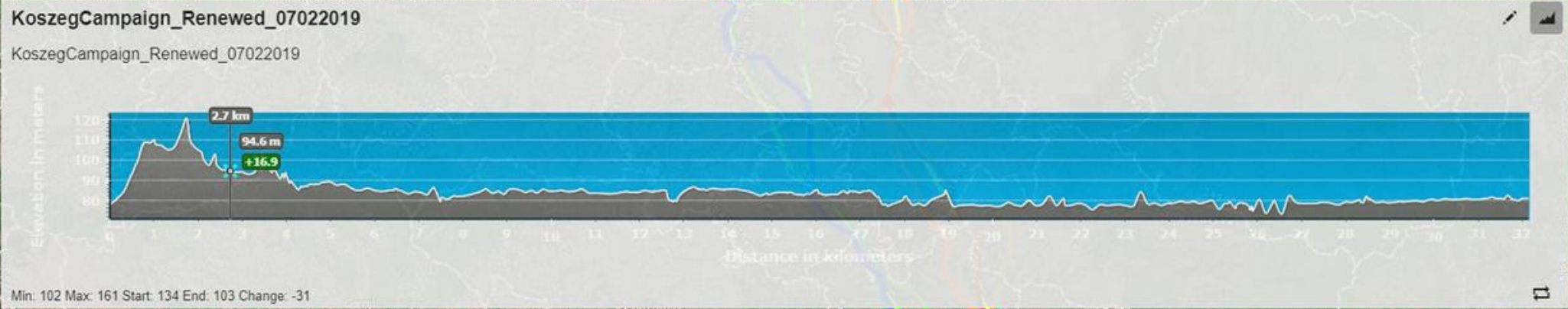
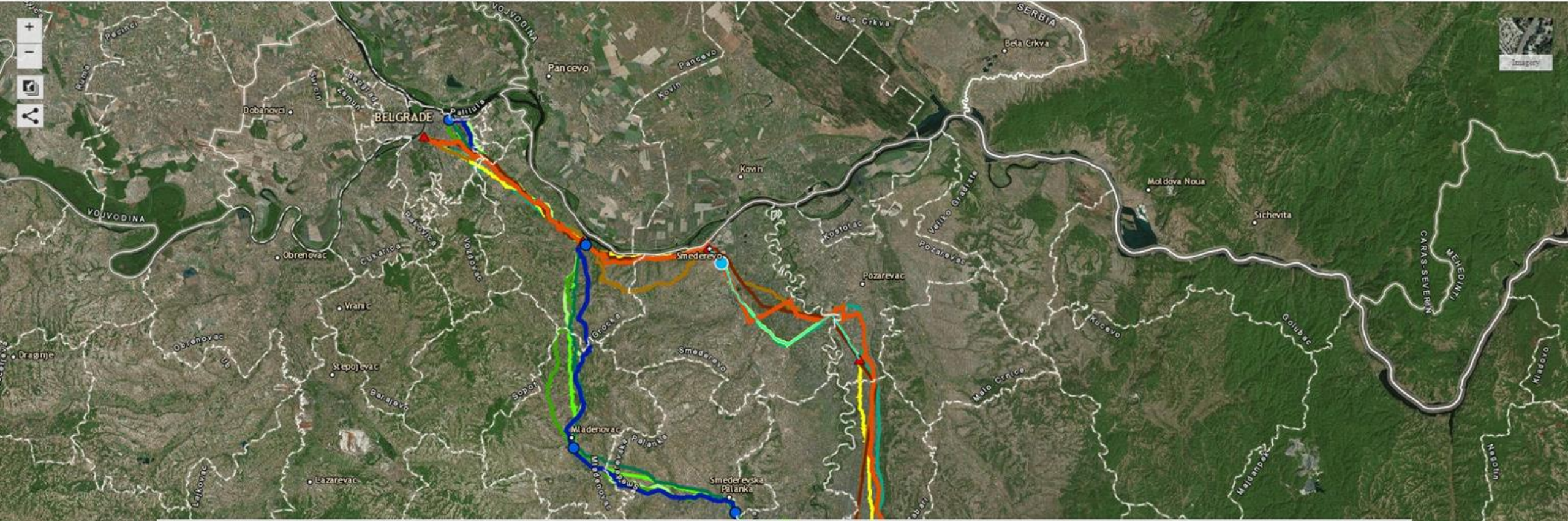


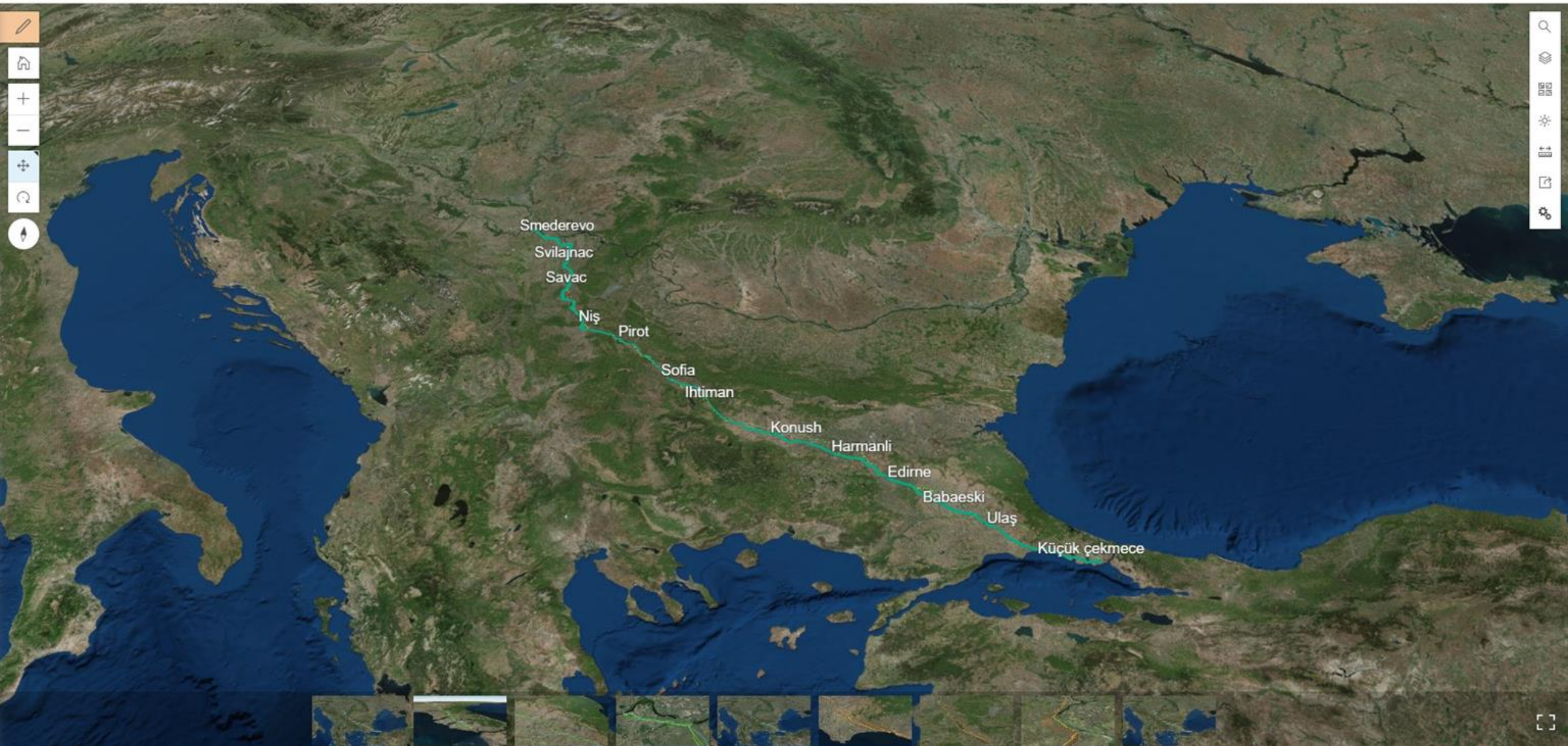
POWERED BY  esri

Earthstar Geographics | Esri, HERE, Garmin



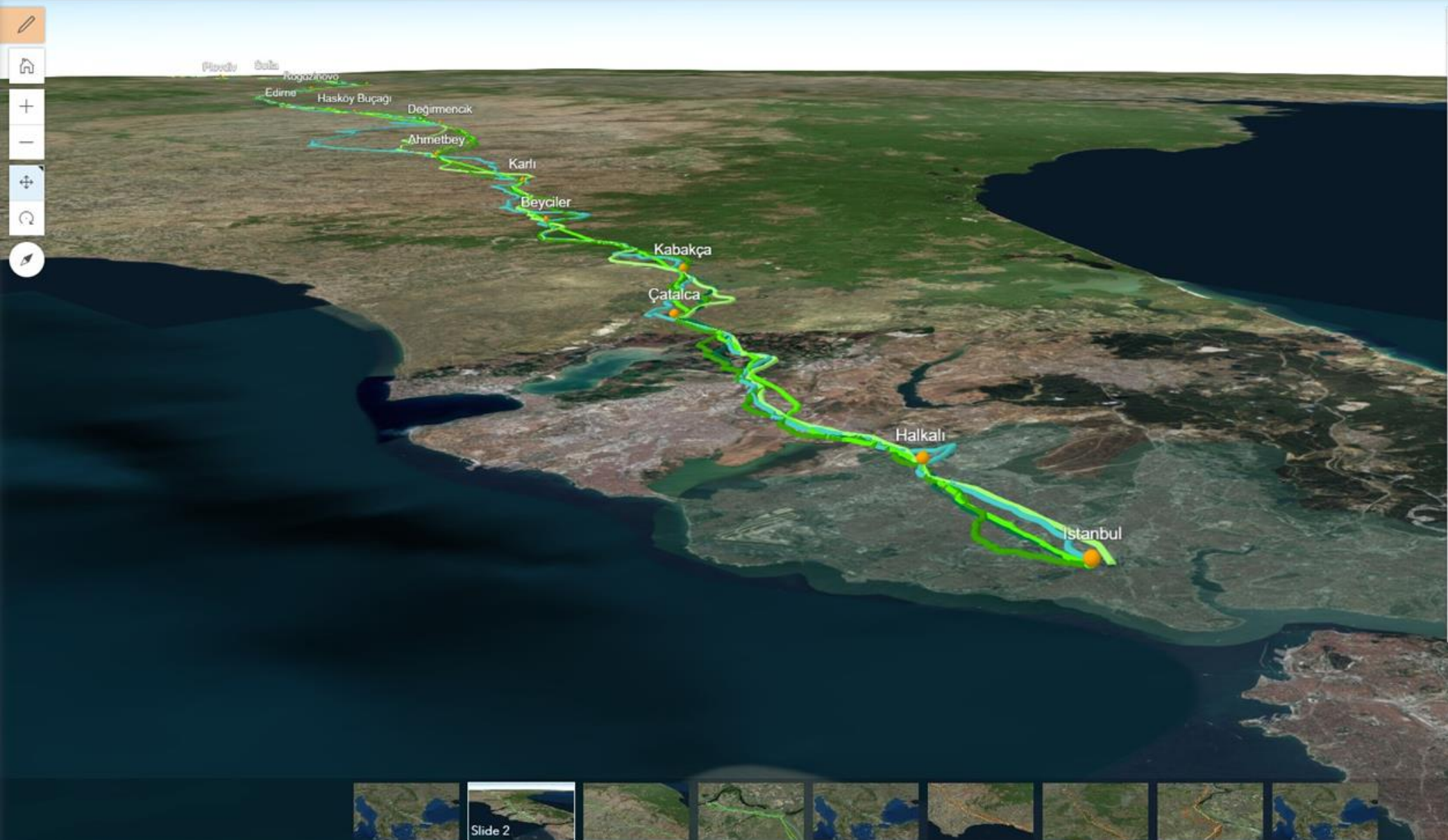
- 1 2 3 4 5 6 7 8 9 10 11 12 13 14














A vertical toolbar on the left side of the map interface. It contains several icons: a pencil (edit), a hand (pan), a plus sign (zoom in), a minus sign (zoom out), a crosshair (pan), a circular arrow (refresh), and a compass (orientation).



Layers Legend 

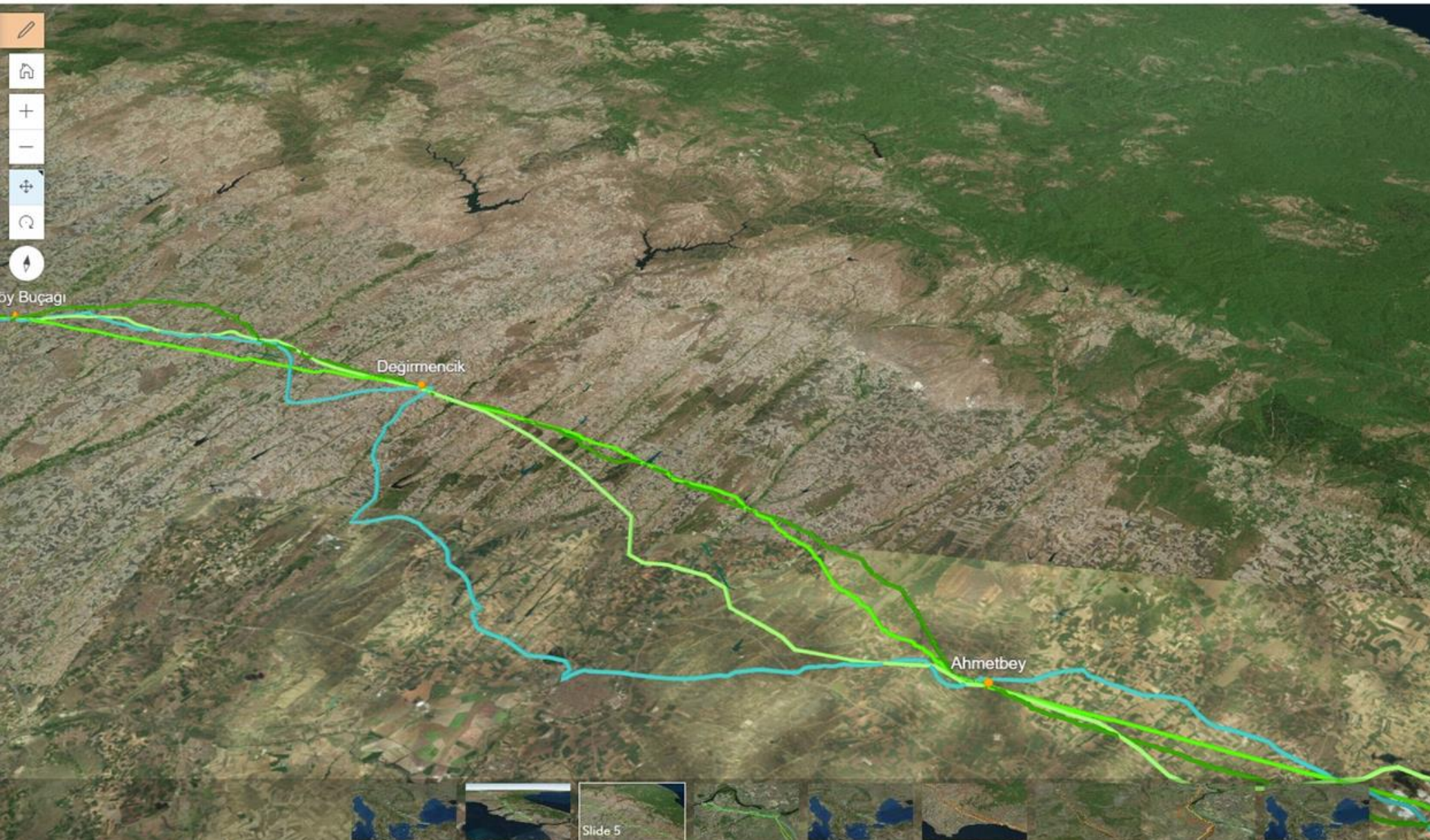
- Departure stops - 1532 Köszeg campaign 
- Departure - Pack Animals 
- Departure - Tobler Walking Function 
- Departure - Carts 
- Departure - Manual 
- Departure - 3rd Military Mapping Survey of Austria-Hungary (1880s-1910s) 









A horizontal navigation bar at the bottom of the map, showing a series of small thumbnail images representing different slides or views. The second thumbnail from the left is highlighted and labeled "Slide 2".

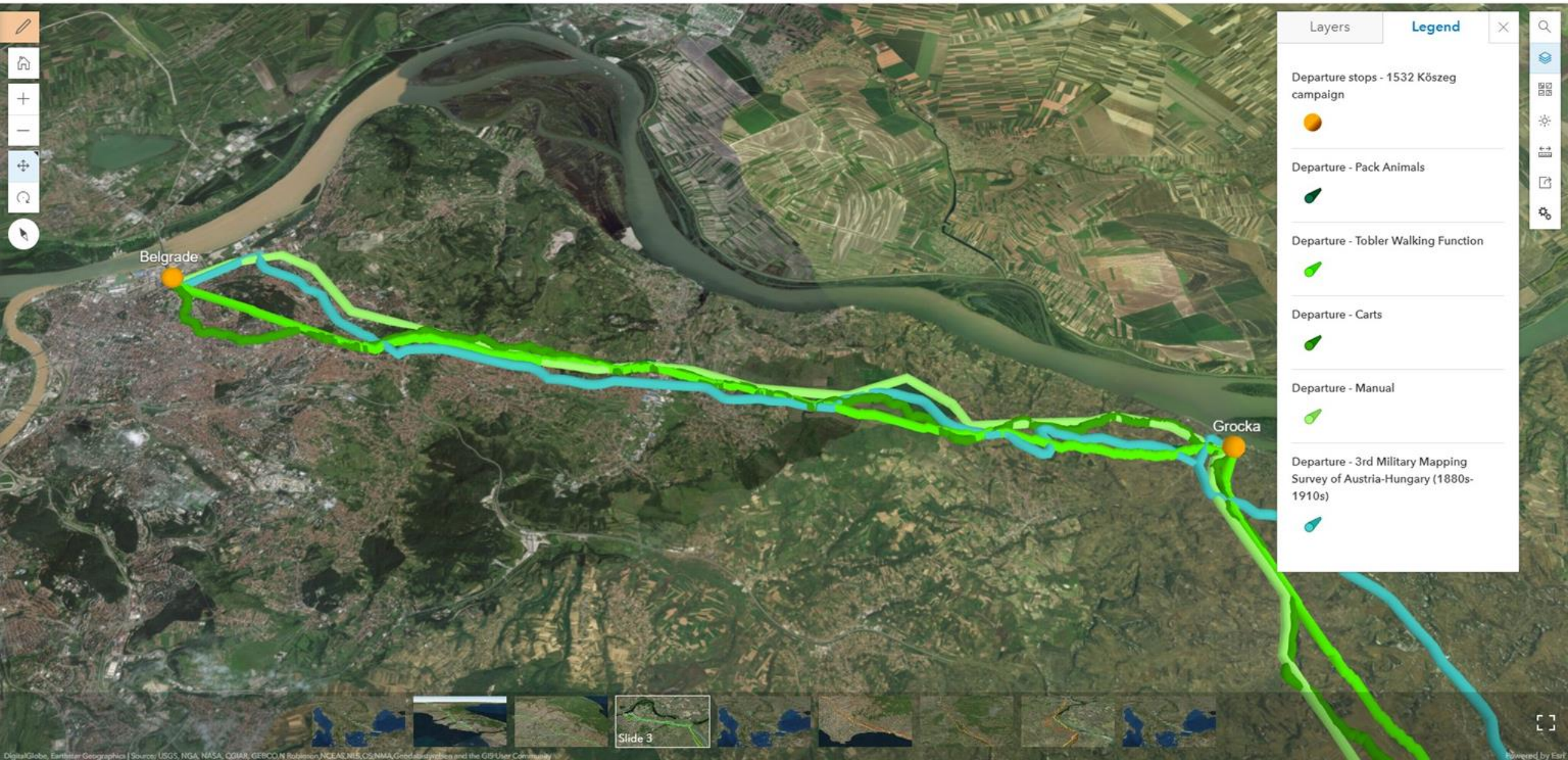


Map navigation toolbar with icons for edit, home, zoom in (+), zoom out (-), pan (crosshair), rotate, and compass.









Layers Legend

- Departure stops - 1532 Közveg campaign 
- Departure - Pack Animals 
- Departure - Tobler Walking Function 
- Departure - Carts 
- Departure - Manual 
- Departure - 3rd Military Mapping Survey of Austria-Hungary (1880s-1910s) 









Layers Legend X Q

- Departure stops - 1532 Közseg campaign 
- Departure - Pack Animals 
- Departure - Tobler Walking Function 
- Departure - Carts 
- Departure - Manual 
- Departure - 3rd Military Mapping Survey of Austria-Hungary (1880s-1910s) 




Layers Legend X






- Return stops - 1532 Kőszeg campaign 
- Return - Pack Animals 
- Return - Tobler Walking Function 
- Return - Carts 
- Return - Manual 
- Return - 3rd Military Mapping Survey of Austria-Hungary (1880s-1910s) 




A vertical toolbar on the left side of the map interface. It includes icons for editing (pencil), home (house), zoom in (+), zoom out (-), pan (crosshair), refresh (circular arrow), and a compass (north arrow).




Layers Legend 

- Return stops - 1532 Kőszeg campaign 
- Return - Pack Animals 
- Return - Tobler Walking Function 
- Return - Carts 
- Return - 3rd Military Mapping Survey of Austria-Hungary (1880s-1910s) 




A vertical sidebar on the right side of the map interface. It contains icons for search (magnifying glass), home (house), layers (stack of papers), settings (gear), and other map controls.

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Layers Legend 


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Departure stops - 1532 Kőszeg campaign




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Return stops - 1532 Kőszeg campaign




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Return - Pack Animals




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Return - Tobler Walking Function




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Return - Carts



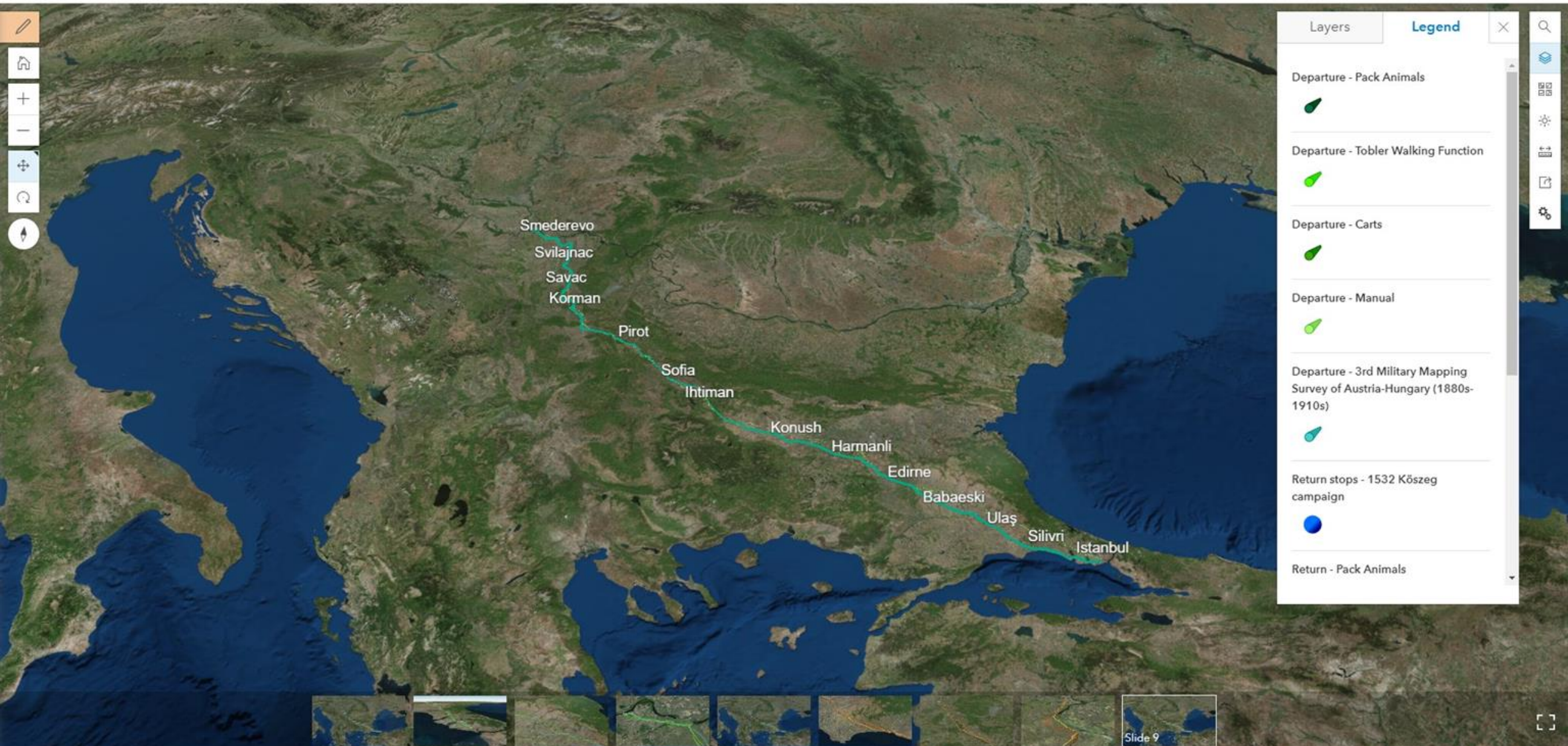
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Return - 3rd Military Mapping Survey of Austria-Hungary (1880s-1910s)











## RQs: Conclusions

### Ottoman logistics, 16<sup>th</sup>-19<sup>th</sup> c.



- Ottoman armies relied on **wheeled transport** for military logistics
- Necessary **road infrastructure** should have been intact, 16th-19th c.
- There should have been a long-term **continuity** of **logistic infrastructure**, Generalkarte\_1900 **suitability** for the 1840s
- HGIS can allow us to build a **historical multi-modal transport** network incorporating costs
  - distance in kilometres / time-distance
  - slope
  - road conditions
  - seasonality

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## Risks & Potentials



- Using HGIS and other techniques with **unsuitable** or not **curated** historical data
  - **Over**-analysing
  - **Mis**-mapping
  - **Misleading** conclusions
- Integrating **multiple** and **connected** research questions within a **generative** digital research infrastructure

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***Thank you for your attention***

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