



# Back to QGis: Georeferencing

## Summer School on Digital Humanities

Web site: <https://bit.ly/dt4h-gis>

Augusto Ciuffoletti

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# Back to QGIS: Georeferencing

- Georeferencing involves transforming an image into a map
  - assigning geographic coordinates to each pixel in the image
- To achieve this, match points on the image with corresponding locations on an accurate reference raster (e.g., OSM)
- A georeferencing tool then calculates the coordinates for all pixels
- QGIS provides tools for this

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- A georeferencing tool then calculates the coordinates for all pixels
  - Accuracy improved by using a higher number of match points
  - The accuracy is measured by the Root Mean Square Error (RMSE)
- QGIS provides tools for this

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  - Accuracy improves with the number of reference points
  - The image may need warping (non-linear transformation)
  - Optimal reference points are constant and non-aligned
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# Georeferencing: Preparation

- We want to georeference the map available at
  - Download the *png* file

[https://it.m.wikipedia.org/wiki/File:Map\\_Gallia\\_Tribes\\_Towns.png](https://it.m.wikipedia.org/wiki/File:Map_Gallia_Tribes_Towns.png)

- Create a new project and load the reference raster (QTM)
- Adjust the scale to match the area covered in the map
- Observe the code in the bottom right corner: EPSG:31466 (WGS84 / UTM zone 31N)
- Open the Georeferencer window
- In the Georeferencer window

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- Create a new project and load the reference raster (OSM)
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- Observe the code in the bottom right corner: EPSG:31457 (WGS84 / Pseudo-Mercator)
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- Adjust the scale to match the area covered in the map
- Observe the code in the bottom right corner: **EPSG:3857**  
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- Open the Georeferencer tool
  - Select **Layer > New > New window**
- In the *Georeferencer* window

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- Open the Georeferencer tool:
  - Select **Layer** -> **Georeferencer...** to open a new window
- In the *Georeferencer* window:

- Select File ->

- Locate and open



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- Observe the code in the bottom right corner: **EPSG:3857** (WGS84 - Pseudo Mercator)
- Open the Georeferencer tool:
  - Select **Layer** -> **Georeferencer...** to open a new window
- In the *Georeferencer* window:
  - Select **File** -> **Open Raster**
  - Locate and open the image file you downloaded

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  - Select **File** -> **Open Raster**
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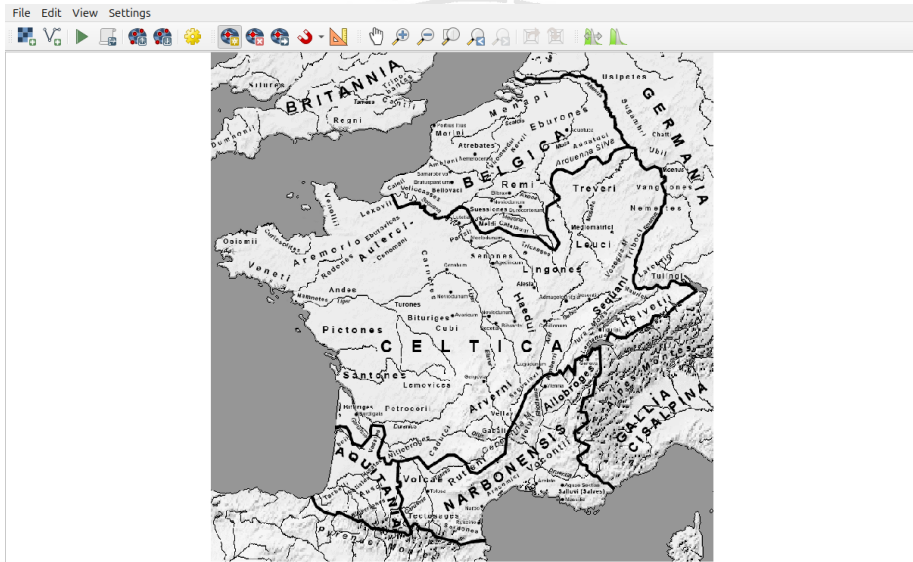
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# Unreferenced image loaded



GCP table

# Setup the transformation type

- Configure transformation settings:

- Select **Settings** -> **Transformation Settings**
- Choose a transformation type (TPS is generally suitable)
- Ensure the SR is set to EPSG:3857 - WGS84/Pseudo Mercator
- Specify a large file name (e.g. "World")
- Enable "Load" and "Save" buttons
- Click OK to go to the settings and then to the Referencer window

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  - Select **Settings** -> **Transformation Settings**
  - Choose a transformation type (TPS is generally suitable)
  - Ensure the SR is set to EPSG:3857 - WGS84/Pseudo-Mercator
  - Specify a target file for the map
  - Enable Load settings on the map
  - Click OK to save the settings and return to the Referencer window

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- Configure transformation settings:
  - Select **Settings** -> **Transformation Settings**
  - Choose a transformation type (TPS is generally suitable)
  - Ensure the SR is set to EPSG:3857 - WGS84/Pseudo-Mercator
  - Specify a target file format
  - Enable "Load project when done"
  - Click OK to go to the settings and the referencer window

# Setup the transformation type

- Configure transformation settings:
  - Select **Settings** -> **Transformation Settings**
  - Choose a transformation type (TPS is generally suitable)
  - Ensure the SR is set to EPSG:3857 - WGS84/Pseudo-Mercator
  - Specify a target file for the result
  - Enable "Load in project when done"
  - Click OK to apply the settings and return to the Georeferencer window



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- Configure transformation settings:
  - Select **Settings** -> **Transformation Settings**
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  - Specify a target file for the result
  - Enable "Load in project when done"
  - Click OK to apply the settings and return to the Georeferencer window

# Setup the transformation type

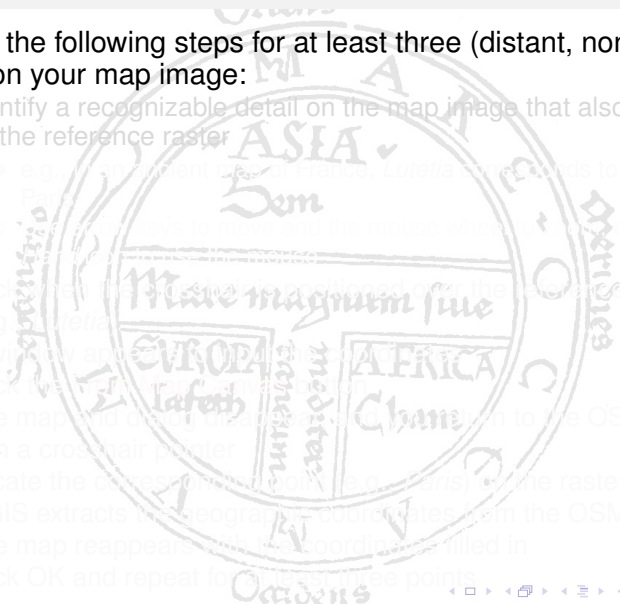
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# Matching Points

- Repeat the following steps for at least three (distant, non-aligned) points on your map image:
  - Identify a recognizable detail on the map image that also appears on the reference raster
    - e.g., an ancient name of France, *Lutetia* corresponds to modern Paris
    - or a city name, *Mediter* corresponds to modern and the mouse wheel to zoom or select the layer
  - Click when the detail is positioned over the reference detail (e.g., *Lutetia*)
  - A window appears to input the coordinates
  - Click the OK button
  - The map and detail disappear and you return to the OSM raster with a crosshair pointer
  - Locate the corresponding point (e.g., Paris) on the raster and click
  - QGIS extracts the geographic coordinates from the OSM raster
  - The map reappears with the coordinates filled in
  - Click OK and repeat for at least three points



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    - e.g., in an ancient map of France, *Lutetia* corresponds to modern Paris
    - Use arrow keys to move and the mouse wheel to zoom or select the Hand icon to use the mouse
  - Click when the crosshair is positioned over the reference detail (e.g., *Lutetia*)
  - A window appears to input the coordinates
  - Click the OK button to save the point
  - The map and detail disappear and you return to the OSM raster with a crosshair pointer
  - Locate the corresponding point (e.g., Paris) on the raster and click
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  - Click when the crosshair is positioned over the reference detail (e.g., *Lutetia*)
  - A window appears with the coordinates
  - Click the *Match Map Canvas* button
  - The map and detail disappear and you return to the OSM raster with a crosshair pointer
  - Locate the corresponding point (e.g., Paris) on the raster and click
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  - Click when the crosshair is positioned over the reference detail (e.g., *Lutetia*)
  - A window appears to input the coordinates
  - Click the *From Map Canvas* button
  - The map and display disappear and you return to the OSM raster with a crosshair pointer
  - Locate the *Carte* on the raster (e.g., Paris) and click
  - QGIS extracts the geographic coordinates from the OSM raster
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  - Click the **From Map Canvas** button
  - The map and dialog disappear and you return to the OSM raster with a crosshair pointer
  - Locate the corresponding point (e.g., Paris) on the raster and click
  - QGIS extracts the geographic coordinates from the OSM raster
  - The map reappears with coordinates filled in
  - Click OK and repeat for the next three points

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  - Click the **From Map Canvas** button
  - The map and dialog disappear, and you return to the OSM raster with a crosshair pointer
  - Locate the corresponding point (e.g., *Paris*) on the raster and click
  - QGIS extracts the geographic coordinates from the OSM raster
  - The map reappears, with the coordinates filled in
  - Click OK and repeat for the next three points

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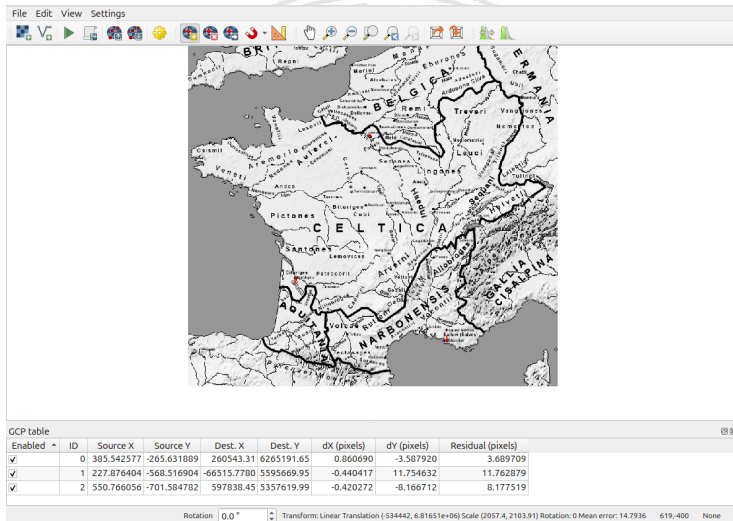
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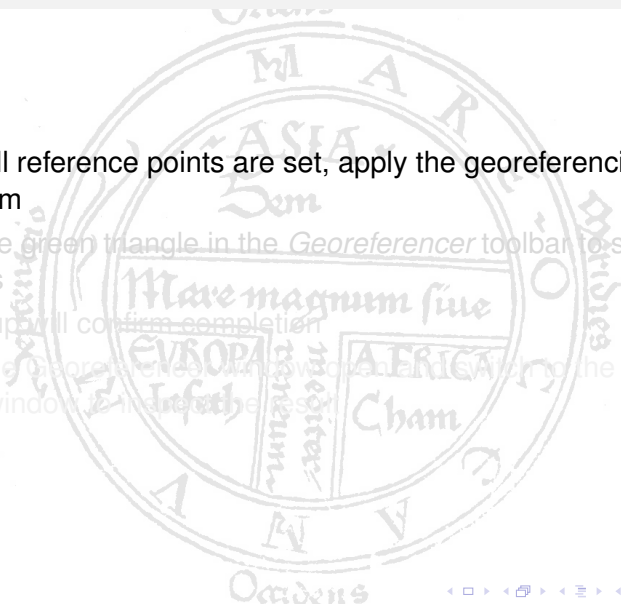
# The map before georeferencing





# Running the Georeferencer

- Once all reference points are set, apply the georeferencing algorithm
- Click the green triangle in the *Georeferencer* toolbar to start the process
- A pop-up will confirm completion
- Keep the *Georeferencer* window open and switch to the main QGIS window to inspect the result



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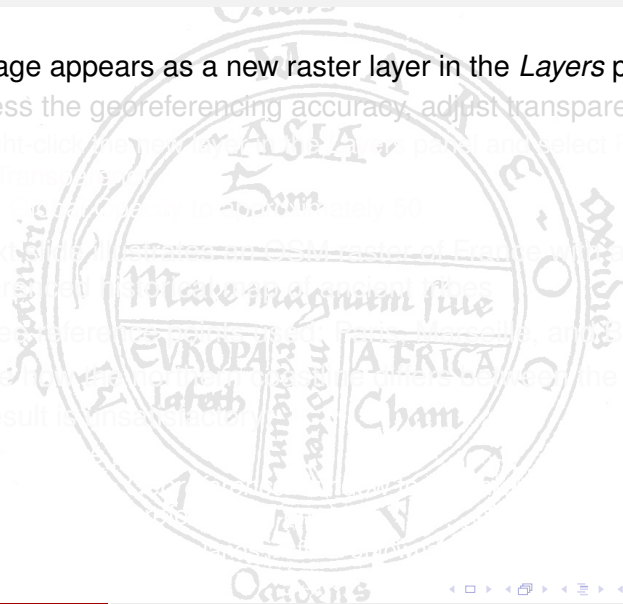
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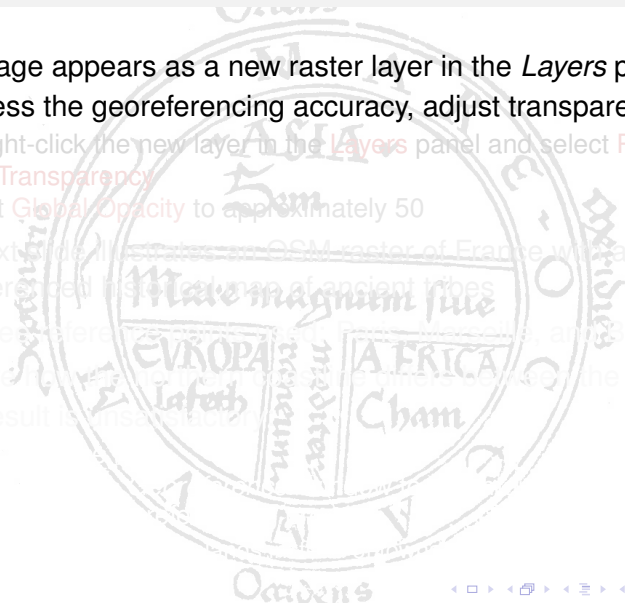
# Inspecting the Result

- The image appears as a new raster layer in the *Layers* panel
- To assess the georeferencing accuracy, adjust transparency:
  - Right-click the new layer in the *Layers* panel and select *Properties*
  - → *Transparency*
  - Set *Opacity* to approximately 50
- The next step is to compare the 1569 *Carta Marina* of Willem Blaeuw with the 1594 *Carta Marina* of Gerard Mercator
- The next step is to compare the 1569 *Carta Marina* of Willem Blaeuw with the 1594 *Carta Marina* of Gerard Mercator
- The three reference points are: Paris, Rome, and Bordeaux
- Observe how the shape of the continents differs between the maps
- If the result is unsatisfactory, repeat the process



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-> *Transparency*
  - Set *Global Opacity* to approximately 50
- The next slide illustrates an OSM raster of France with a georeferenced historical map of ancient tribes
- The three reference points: Paris, Marseille, and Bordeaux
- Observe how well the historical map aligns with the modern map
- If the result is unsatisfactory



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- Observe how the northern coastline differs between the maps
- If the result is unsatisfactory



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- To assess the georeferencing accuracy, adjust transparency:
  - Right-click the new layer in the **Layers** panel and select **Properties**  
-> **Transparency**
  - Set **Global Opacity** to approximately 50
- The next slide illustrates an OSM raster of France with a georeferenced historical map of ancient tribes
- The three reference points used: Paris, Marseille, and Bordeaux
- Observe how the northern coastline differs between the maps
- If the result is unsatisfactory

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• Hint: use small icons

# Inspecting the Result

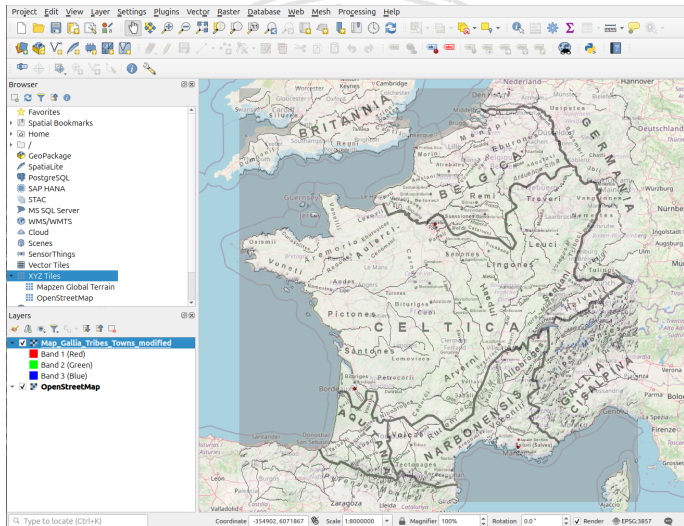
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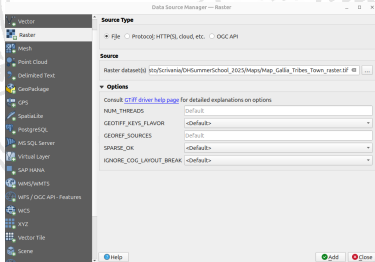


# Referenced image generated



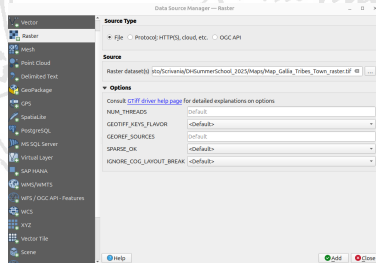
# Use Your New Raster in QGIS

- During the georeferencing process, you specified a location to save the new raster
- To load it in QGIS, open a new project and access the **Data Source Manager**
  - Select **Raster** as the data source type
  - Click **+** to choose the raster format



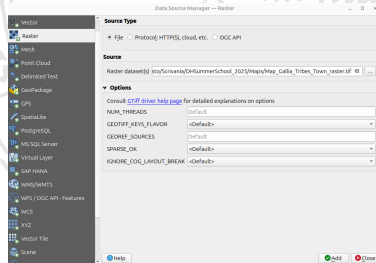
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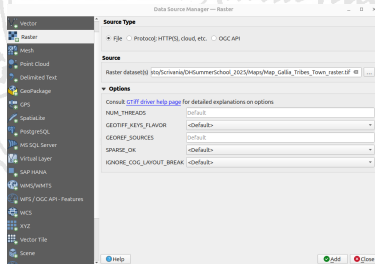
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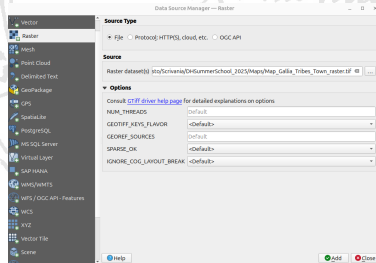
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# More Resources

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- <http://www.openstreetmap.org/> (OpenStreetMap)

- <http://www.geonames.org/> (Geonames)

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<https://www.esri.com/arcgis/arcgis-workspace/working-with-terrain.html>



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