



# Back to QGis: Georeferencing

## Summer School on Digital Humanities

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

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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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- 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
  - Accuracy improved by using a number of match points
  - The accuracy is measured by the Root Mean Square Error (RMSE)
- QGIS provides tools for this

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- A georeferencing tool then calculates the coordinates for all pixels
  - 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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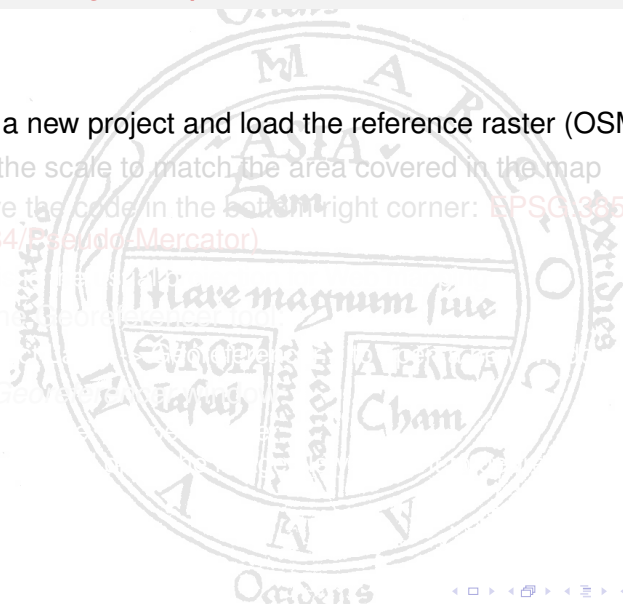


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# Georeferencing: Preparation

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



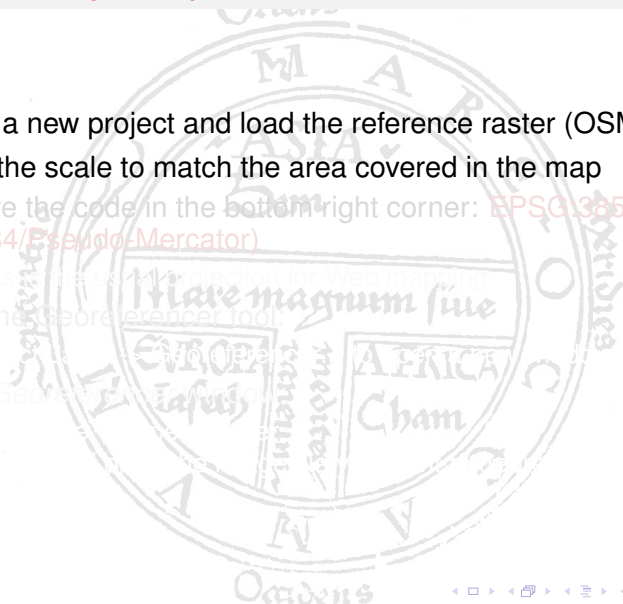
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● This will use the collection for Web mapping

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  - Select Tools > Open
- In the Georeferencer window:

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  - Select **Layer > Georeferencer...** to open a new window
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- Open the Georeferencer tool:
  - Select **Layer** -> **Georeferencer...** to open a new window
- In the Georeferencer window:
  - Select **File** > **Open...** File
  - Locate and open the image you want to georeference

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- In the *Georeferencer* window:
  - Select **File** -> **Open Raster**
  - Locate and open the image file you want to georeference



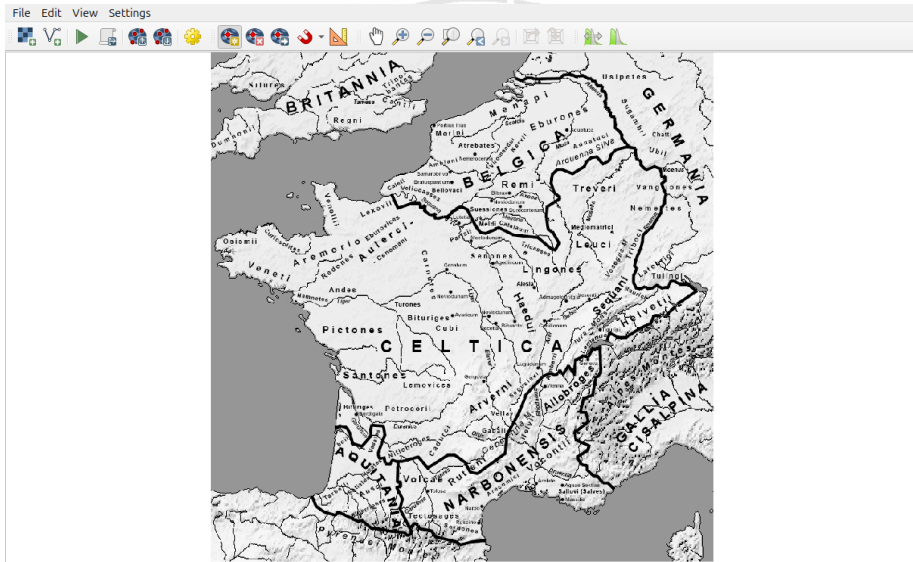
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  - Locate and open the image file you want to georeference

# 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 SRS is set to EPSG:3857 - WGS84 Pseudo-Mercator
- Specify a large file name (e.g. "World")
- Enable "Load on the fly" option
- Click OK to save the settings and enter the Referencer window

# Setup the transformation type

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

# Setup the transformation type

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

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

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



# Setup the transformation type

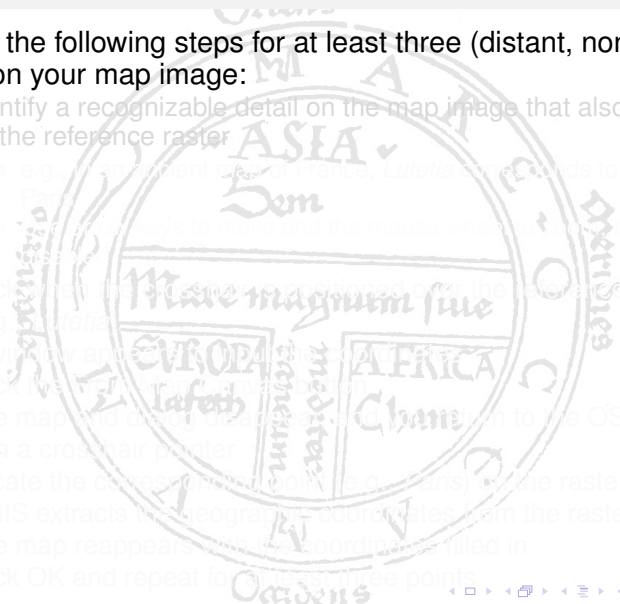
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# Matching Points

- 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 river, the *Sequana* corresponds to modern the Seine, but clicking to identify it is not possible
  - Click when the detail is positioned over the reference detail (e.g., *Lutetia*)
  - A window appears to input the coordinates
  - Click OK
  - 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 raster
  - The map reappears with the coordinates filled in
  - Click OK and repeat for at least three points



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    - Use arrow keys to move and the mouse wheel to zoom but clicking is disabled
  - Click when the crosshair is positioned over the reference detail (e.g., *Lutetia*)
  - A window appears to input the coordinates
  - Click the OK button
  - The map and raster disappear and you return to the QSM raster with a crosshair pointer
  - Locate the corresponding point (e.g., Paris) on the raster and click
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  - A window appears with the coordinates
  - Click OK
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  - 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
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  - A window appears to input the coordinates
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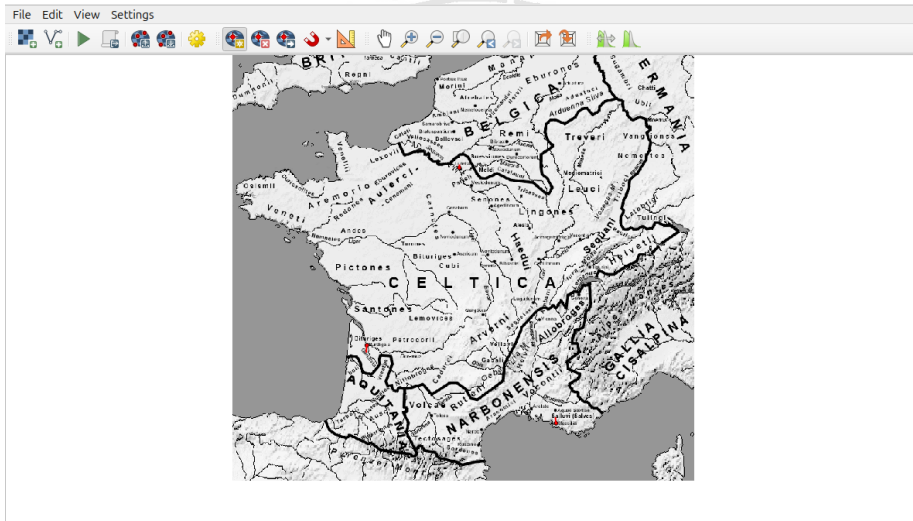
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# The map before georeferencing

File Edit View Settings

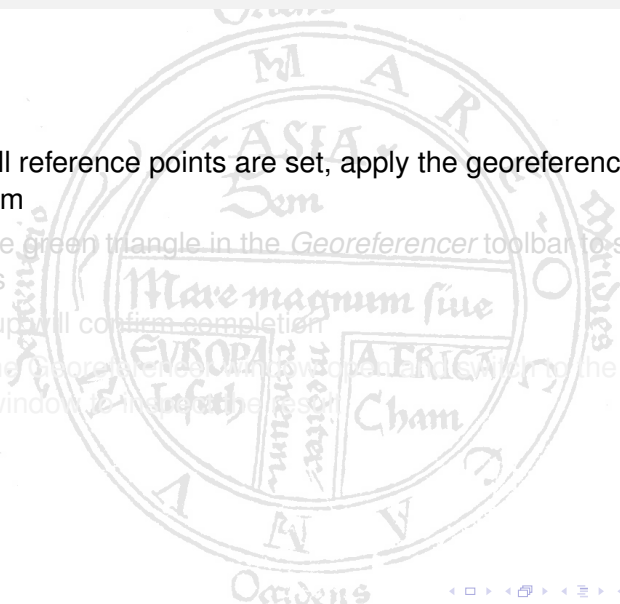


GCP table

Enabled	ID	Source X	Source Y	Dest. X	Dest. Y	dX (pixels)	dY (pixels)	Residual (pixels)
<input checked="" type="checkbox"/>	0	385.542577	-265.631889	260543.31	6265191.65	0.860690	-3.587920	3.689709

# 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





# Running the Georeferencer

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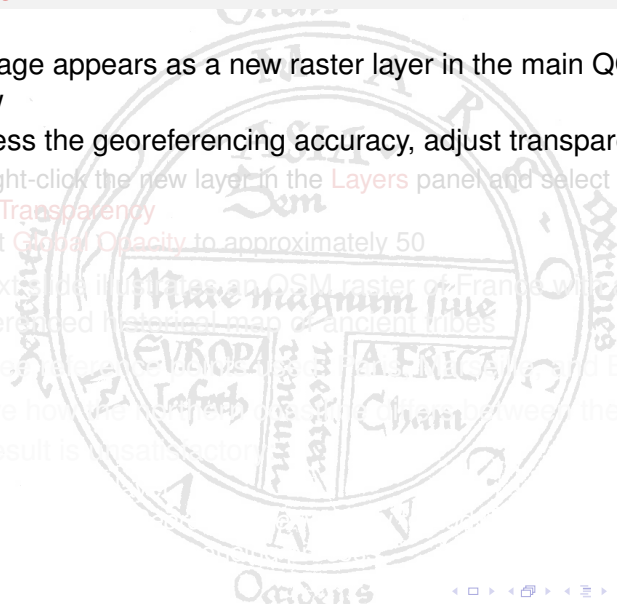
# Inspecting the Result

- The image appears as a new raster layer in the main QGIS window
- 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 slide illustrates an OSM raster of France which is georeferenced to the map of ancient Gaul
- The three reference points are Bordeaux, Lugdunum and Bordeaux
- Observe how the names of the cities are aligned between the maps
- If the result is unsatisfactory, repeat the process



# Inspecting the Result

- The image appears as a new raster layer in the main QGIS window
- 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 are Paris, Lyon and Bordeaux
- Observe how the northern coast is off by a few km between the maps
- If the result is unsatisfactory



# Inspecting the Result

- The image appears as a new raster layer in the main QGIS window
- 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 chosen opacity allows to compare the maps
- If the result is unsatisfactory

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- The next slide illustrates an OSM raster of France with a georeferenced historical map of ancient tribes
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- Observe how the northern coastline differs between the maps
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- The three reference points used: Paris, Marseille, and Bordeaux
- Observe how the northern coastline differs between the maps
- If the result is unsatisfactory:
  - Remove the layer
  - Return to the **Georeferencer** and add more points

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- Observe how the northern coastline differs between the maps
- If the result is unsatisfactory:
  - Remove the layer
  - Return to the *Georeferencer* window to add more points
  - Repeat the georeferencing process

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- Observe how the northern coastline differs between the maps
- If the result is unsatisfactory:
  - Remove the layer
  - Return to the *Georeferencer* window to add more points
  - Repeat the georeferencing process

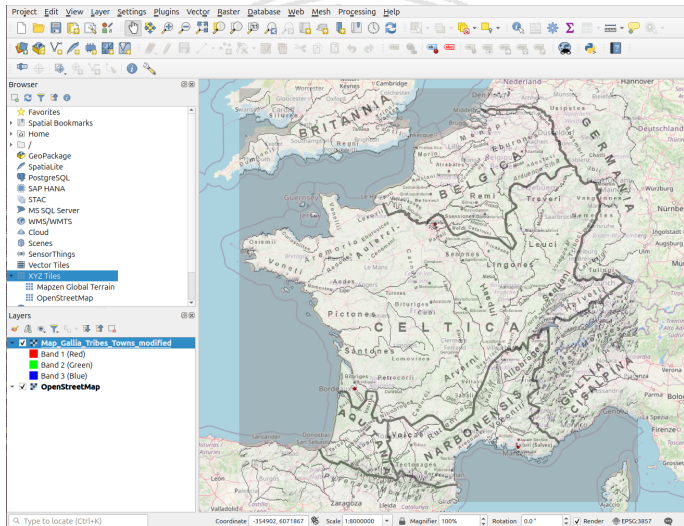
# Inspecting the Result

- The image appears as a new raster layer in the main QGIS window
- 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
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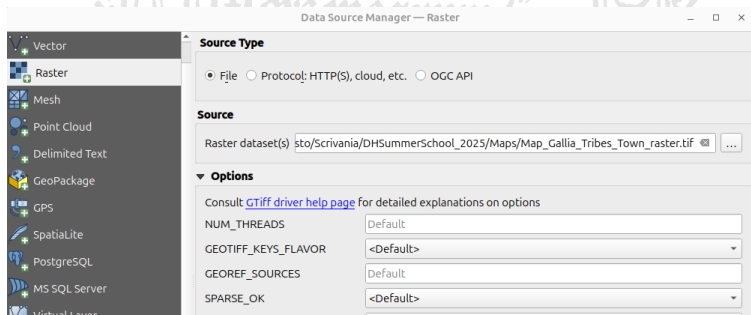
# Referenced image generated



# 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**

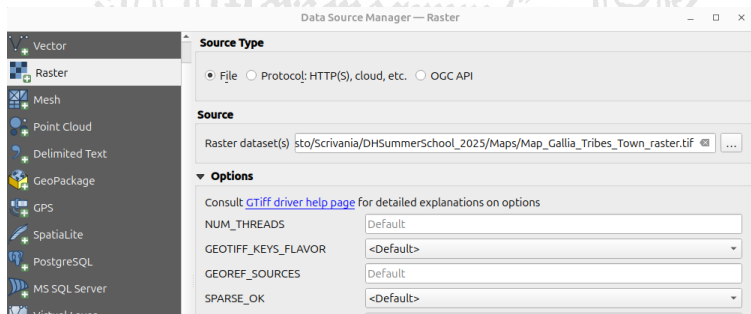
- Select **Raster** as the data source type
- Click **+** to choose the file format





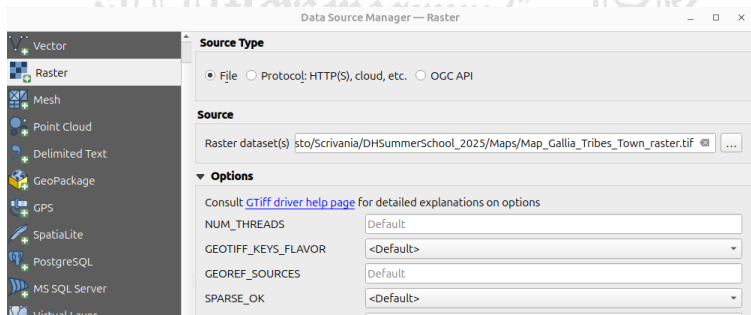
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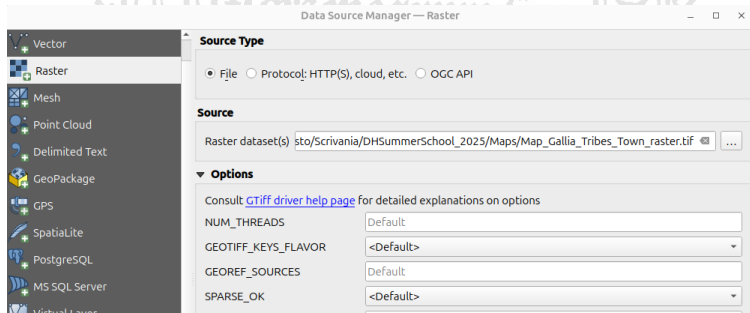
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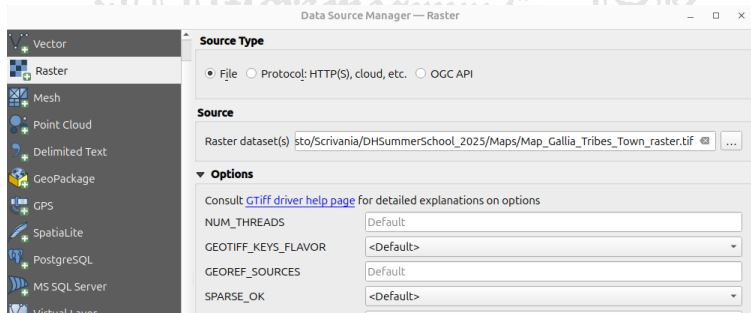
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