

## International workshop on GIS, Remote Sensing and Geoarchaeology

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## Practical 3 -> QGIS and historical maps

### Aims of the training

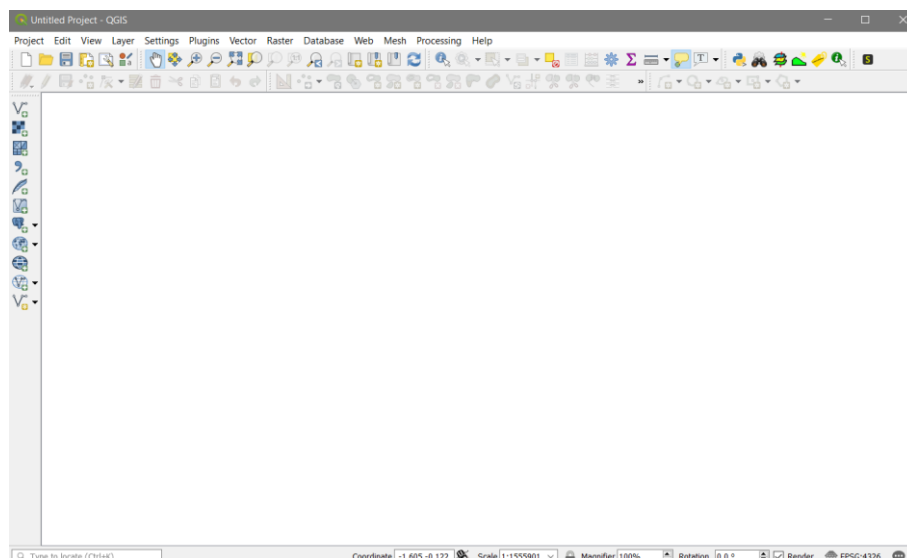
- Open QGIS and georeferenced an old map from the Survey of India historical collections.
- Explore the map and extract map features as new vector (*shapefiles*) data.
- Visualize different categories of features that can be related to Indus or ancient archaeological sites.

### Required software and data

- QGIS
- Shapefile “[ramdass\\_village](#)”
- Survey of India map n. [44 I/13](#)

### Instructions

1. Let's start by double-clicking on the QGIS folder icon on your desktop. This will open a window with several files. To start your QGIS session, double-click on the one named “QGIS Desktop” (followed by the version number). After few seconds a window might appear (prompting you about some tips), click on the OK button if that happens.
2. Now click on [Project](#) on the top left of your screen and then on [New](#). You should now see on your screen something very similar to the figure below (you might want to click on the square shaped icon on the top right of your window to have your program visualised in full screen):

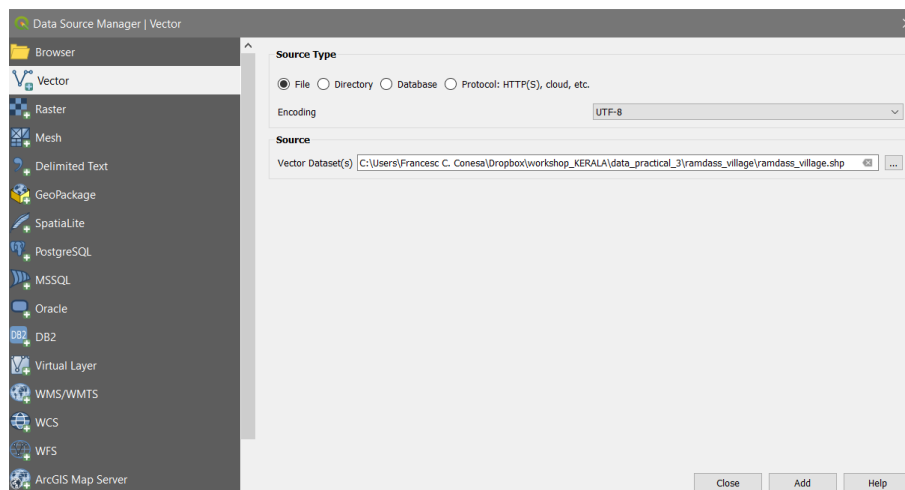


3. The large empty white window is your canvas and it is where we will be mapping our spatial data. Most GIS handle two kinds of data: **vector** and **raster**. The former is used to represent various kinds of shapes such as **points**, **lines**, and **polygons**. At a regional scale we often use point data to represent the location of sites while at the scale of an individual site this might be the spot where a specific find/object was recovered. Lines and polygons can represent a variety of things, from rivers to the shape of individual buildings. Rasters are instead grids which are used to represent things that are continuous over space, such as elevation or temperature.
4. Open the [ramdass\\_village.shp](#) file. This is a point (a vector), showing the location of Ramdass village in Amritsar district in the Indian state of Punjab. Note that **shapefiles** always come with other types of associated data, each one containing additional information such as the coordinates of the file.

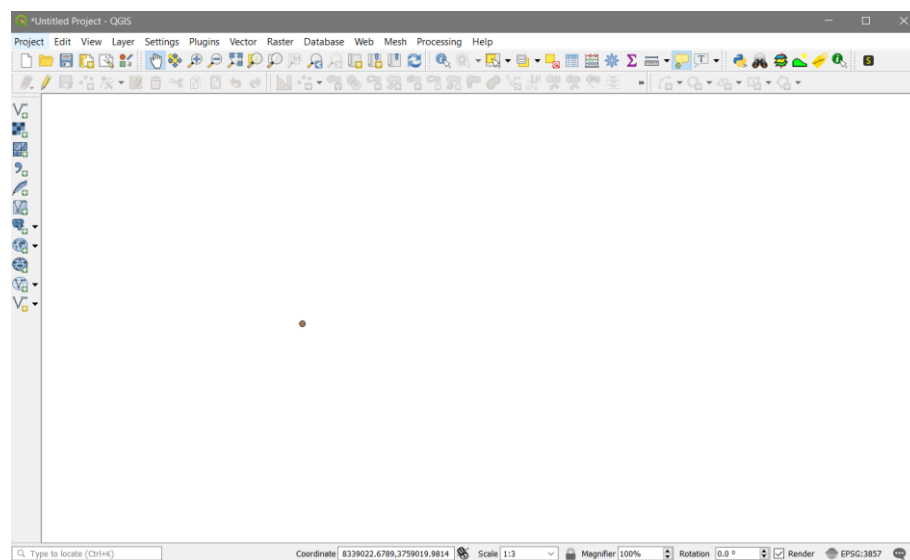
To open an existing shapefile in QGIS, go to [Layer/Add Layer/Add vector Layer](#) or go directly to the first icon in the left panel showing different **data types list**:



5. In the [Add Vector](#) dialogue box, select the shapefile file from your directory and add it to the main QGIS canvas.



6. The point for the village Ramdass should be displayed in your white canvas:



- Now since this single point is quite boring, we should add a basemap in the background so are able to display a Google Earth image in QGIS, and therefore we can be sure that the point is in a correct location.

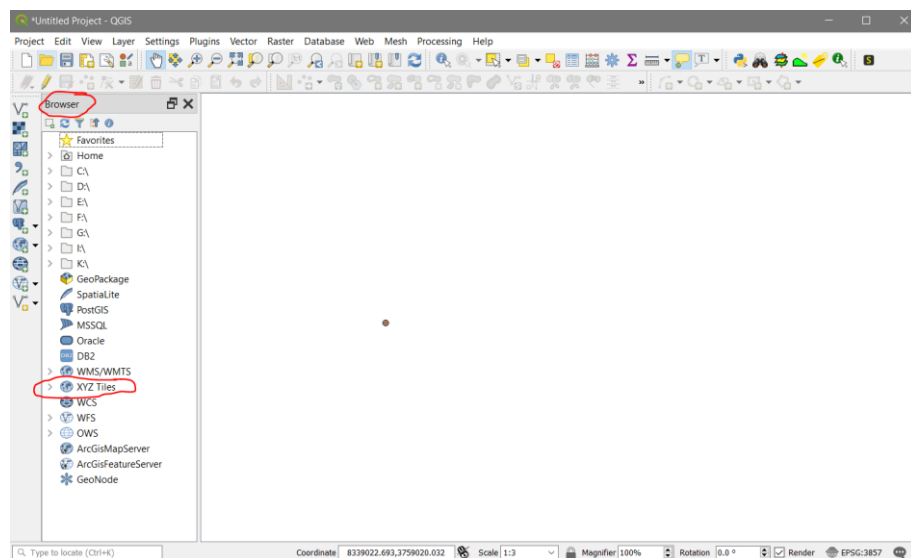
A basemap layer in QGIS is an online map service that is stored online (such as Google Earth). To add these layers in QGIS, first we need to know where to find them. For example, here:

<https://gis.stackexchange.com/questions/20191/adding-basemaps-from-google-or-bing-in-qgis>

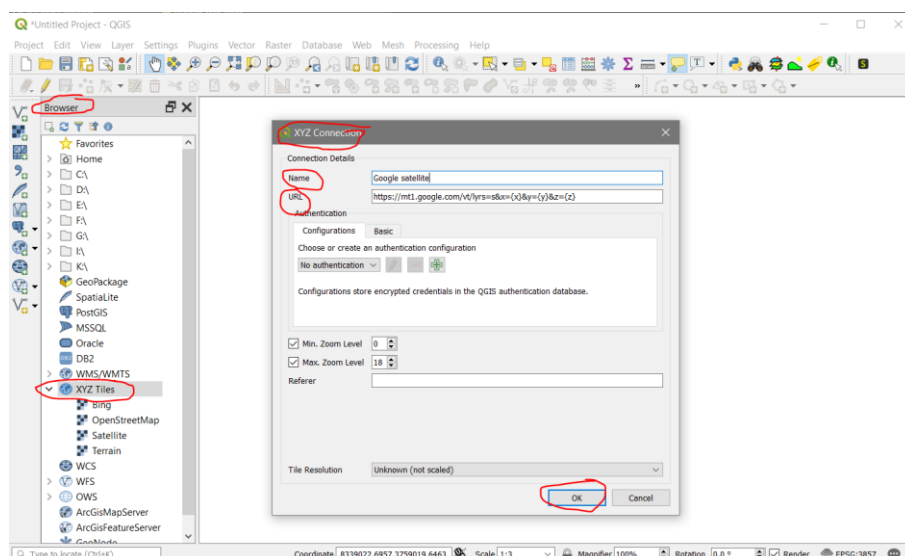
In the above website, copy the URL link of a Google Satellite Map, for example this one.

<https://mt1.google.com/vt/lyrs=s&x={x}&y={y}&z={z}>

- Back in QGIS, right-click in any white space in the superior menu and activate the *Browser panel* section. A menu should appear with several options. Right-click in the option *XYZ Tiles* and set up *New connection*.

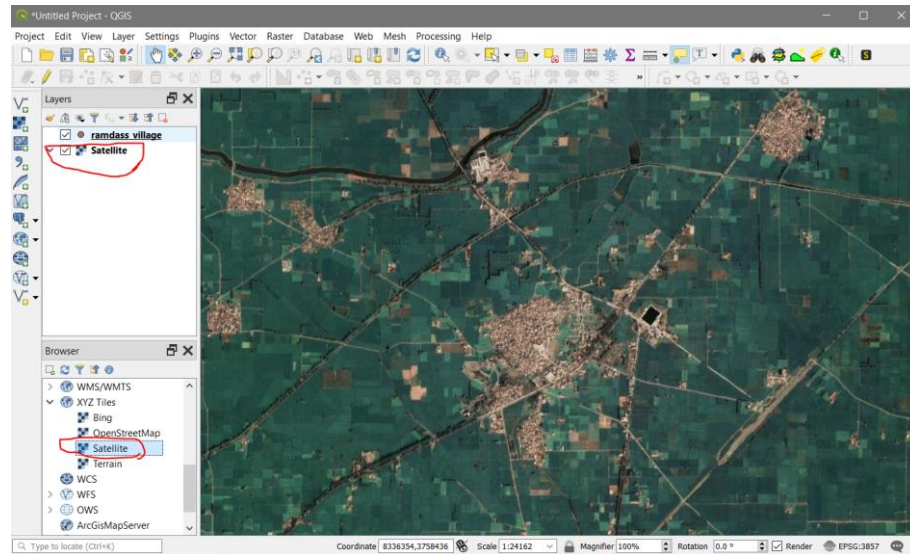


- In the *New connection* dialogue, add a **name** for the Google Map, and add the **URL** you copied before. Something like the following image, and then press ok.

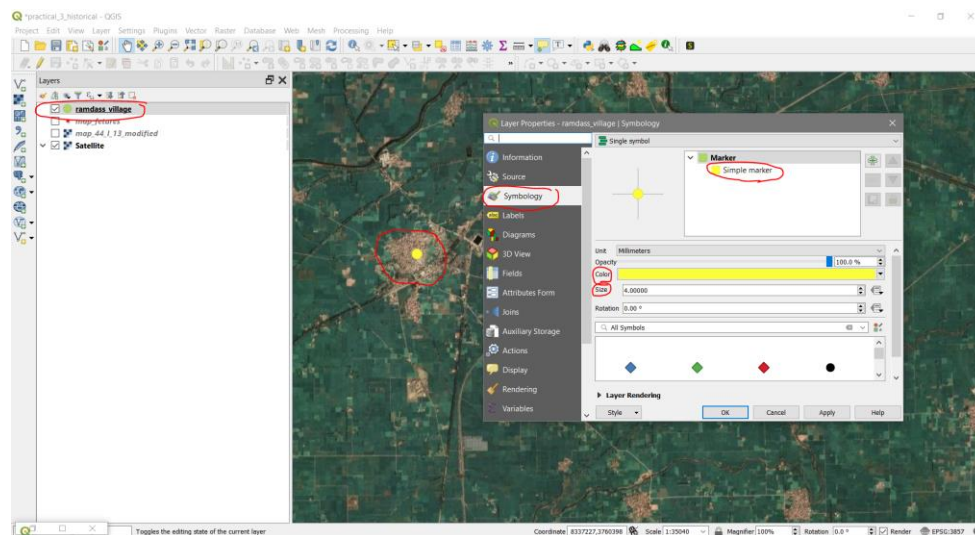


10. You are now ready to visualise Google Earth into QGIS. To do this, simple drag the map layer under *XYZ Tiles* into the main *Layer list*.

Note -> remember to locate the new layer at the **bottom** of the *Ramdass* point, or else you will not see the village point.



11. We will work later on this, but in this image the village point is almost invisible. Remember that you can change **vector visualisation** parameters such as **size**, **shape** and **color** by right-clicking the *Ramdass\_village* layer in the *Layer list*, and going to its *Properties*. In the *Layer properties* box, you can change the *Symbology* of the point feature.



12. Now that we have a location for the Indian Punjab and a Google basemap, it's time to integrate a 1912 Survey of India map for the same location!

You can access the map in the GitHub repository, and explore it in your computer photo gallery. This is a high-resolution scanned map from a hard-copy located at the **Cambridge University Library**.

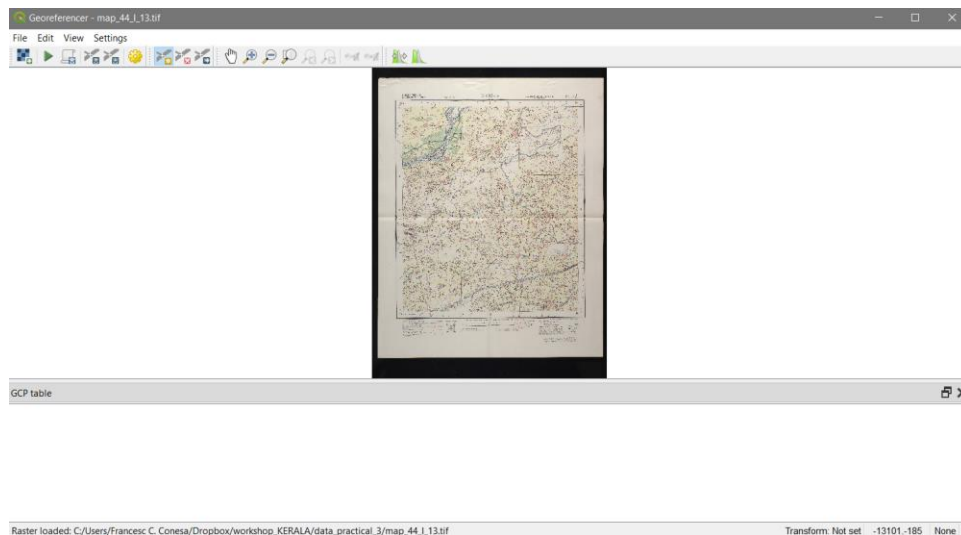
The *problem* with this map is that it's *just* an image. It doesn't have associated coordinates, so QGIS don't know where to display the map. To solve this, we will use the nice [Georeferencer](#) QGIS tool.

Any map in any image format like a **.jpg** or **.tif** is a type of **raster** data, and thus we need to open the main menu [Raster/Georeferencer](#).

13. When the [Georeferencer](#) window prompts, you can add and visualise the image map (which still doesn't have any associated coordinates!) by going to the main menu [File/Open Raster](#) or just by clicking on the **raster icon**:

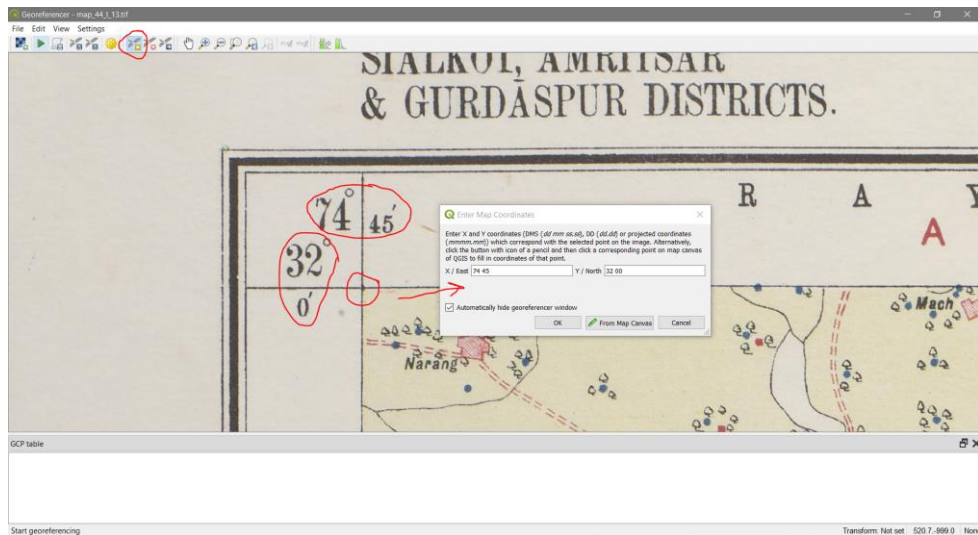


14. Search in your directory the [map\\_44\\_I\\_13](#) that you have download from GitHub. The map should appear as this one:

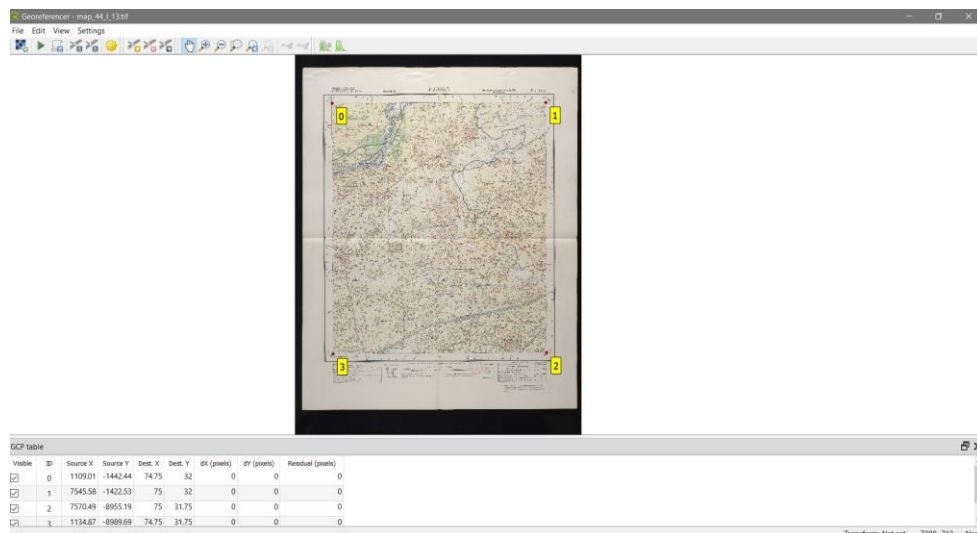


15. A georeferenced map needs at least a minimum of 3 **Ground Control Points** (GCPs). This are actual points/locations in the real world for which we know the coordinates. An ideal number of f points for each map should have, however, at least between 15-20 points. Usually, using more GCPs will increase the map accuracy.

The process can be simplified by adding the coordinates of each corner of the map as GCPs. This method is little accurate but it give an idea of the *real* position of the map. To add corner coordinates select the [Add point](#) icon in the [Georeferencer](#) menu . A window prompts, and you can add the **longitude** and **latitude** coordinates as displayed in the Survey of India map corners.

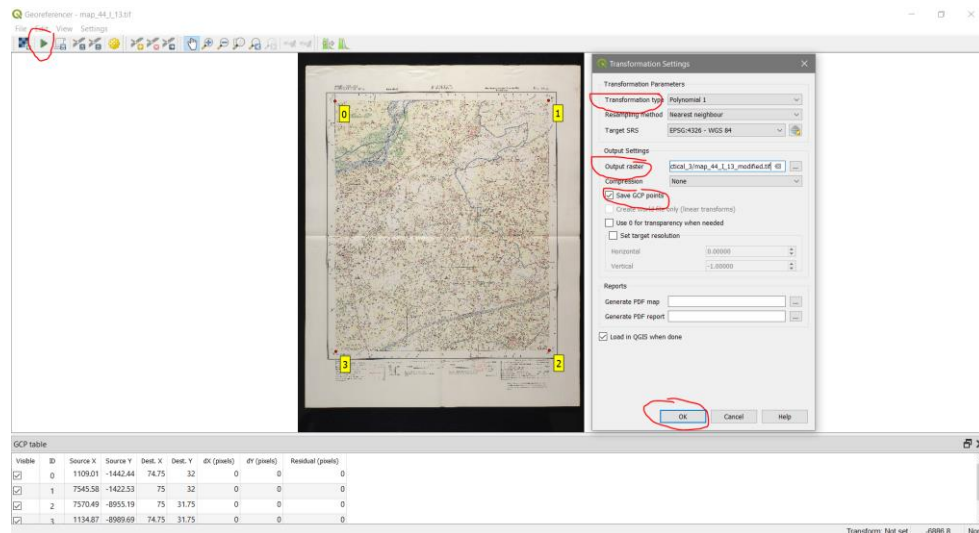


16. When you have completed to add the four corner points with its respective coordinate numbers from the maps, the *Georeferencer* should look like this:



17. The *Georeferencer* tool transforms the given *real* coordinates into a new spatial component for the old map. Once you are ready with the points, press the *Play* icon and in the new window *Transformation Settings*, leave the parameters as default. It is important to change the name of the **output raster** (the new map). You can also check *Save GCP points*, so we can use or evaluate them in the future. Press *OK* when ready, and then press again the *Play* icon. The tool should start processing the new coordinates.



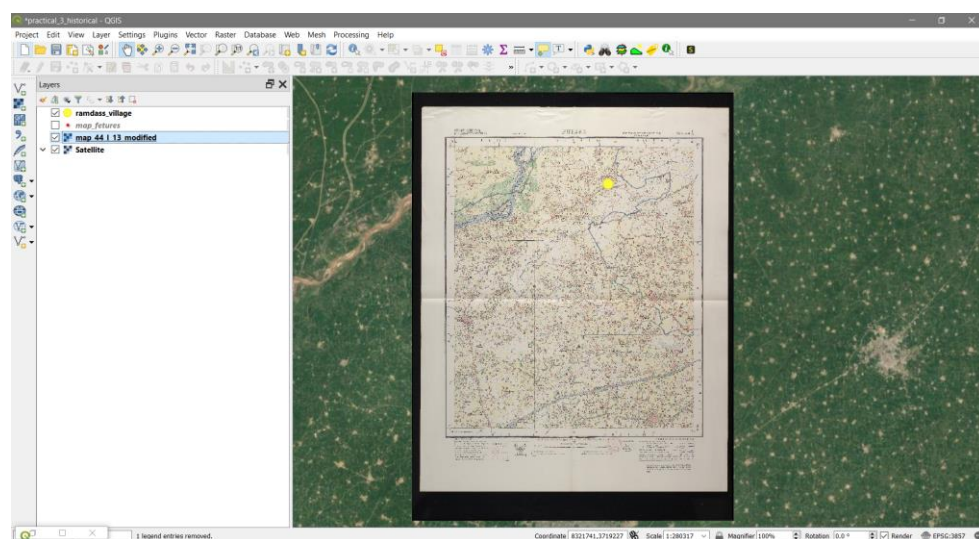


18. Eureka! Your new georeferenced old map should be correctly displayed in the QGIS canvas. You can zoom in and zoom out around Ramdass village to see how accurate is your georeferentiation.

How it looks like?

Are you sure this is a correct georeferenciation?

What if we add more **GCPs**?

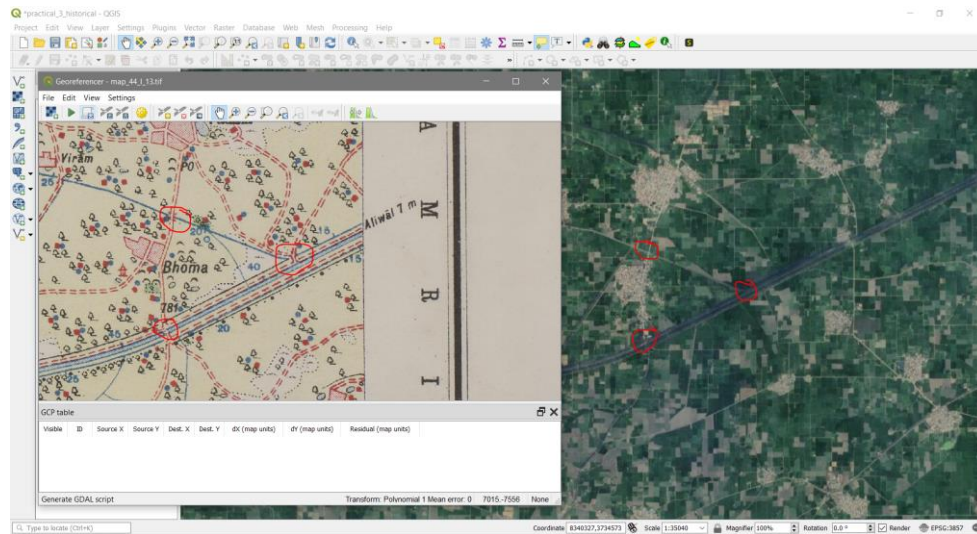


19. To be honest, the exercise we just made is actually a **bad exercise**. Adding the four corner coordinate is OK when you don't know which area is represented in the map, and it's OK for just preliminary results. However, in order to produce **highly accurate** georeferenced map that can be effectively used, for example, to address your next field survey, we need to add much more points! Note that the Survey of India maps have a **grid of 9 squares** within your map. Ideally, each sub-square should have at least 3 GCP!
20. Let's create a more accurate georeferenced map. To do this, we should repeat the first steps in the [Georeferencer](#) tool -> add the same original map. This time, however, in order to [Add Points](#) we will use the very same Google satellite imagery!

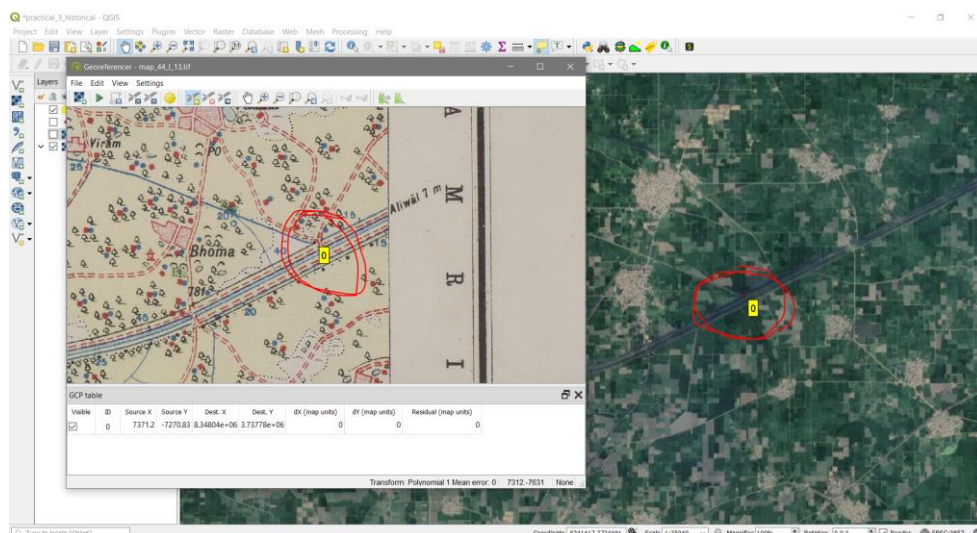
To start, you can have the two windows open at the same time (the [Georeferencer](#) and the [map canvas](#)). We will add coordinates from **present day visible features** to the same features that are

also visible in the old map. Despite landscape change, there are still some features that have been fossilised or haven't changed much, such as cross-roads, historical irrigation canals or train lines.

Can you identify some of such features in both **rasters**?



21. If so, please repeat **Add point tool**, and click on the **desired location** on the old map. When the **Enter Map Coordinates** dialogue box appears, please select **From Map Canvas** without manually entering any latitude or longitude. QGIS will activate the map canvas so you can directly **point and click** to the corresponding **present-day feature** on the Google image. By doing so, the exact coordinates of Google will be automatically displayed in the **latitude/longitude** dialogue box. Press **OK** and keep adding points!

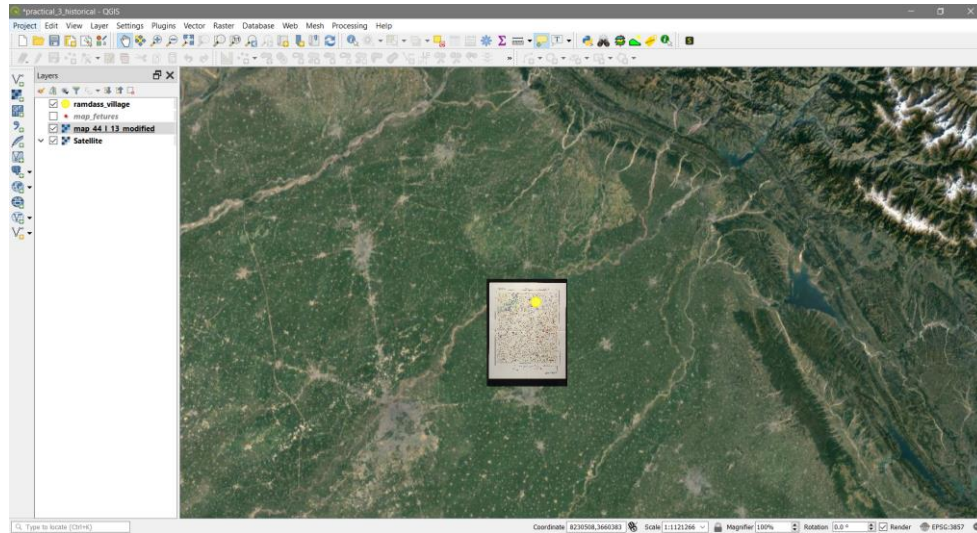


22. Repeat the **Play** and **Transformation Settings** step to transform your old map and successfully display it in your QGIS canvas.

Which **differences** can you see if compared with the first map?

How **accurate** are the old canals, roads and other features in the Google image?





We will stop this practical here and we'll resume it soon. If you have already finished and want to explore a little more of QGIS on your own, please let us know and we'll happy to guide you to more advanced features.