Introduction to Geographical Information Systems (GIS)

Take a trip to Devon!

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GIS is a powerful software tool for compiling and interpreting many different kinds of geographical data. GIS is a tool you'll use throughout your degree and your future career.

In this taster exercise we are going to show you how to import a map into the software and then to associate a co-ordinate system with it so you know the location of any point on the map.

In order to do this, you first need to download a free piece of software: QGIS. You can download it for any operating system by following the link below:

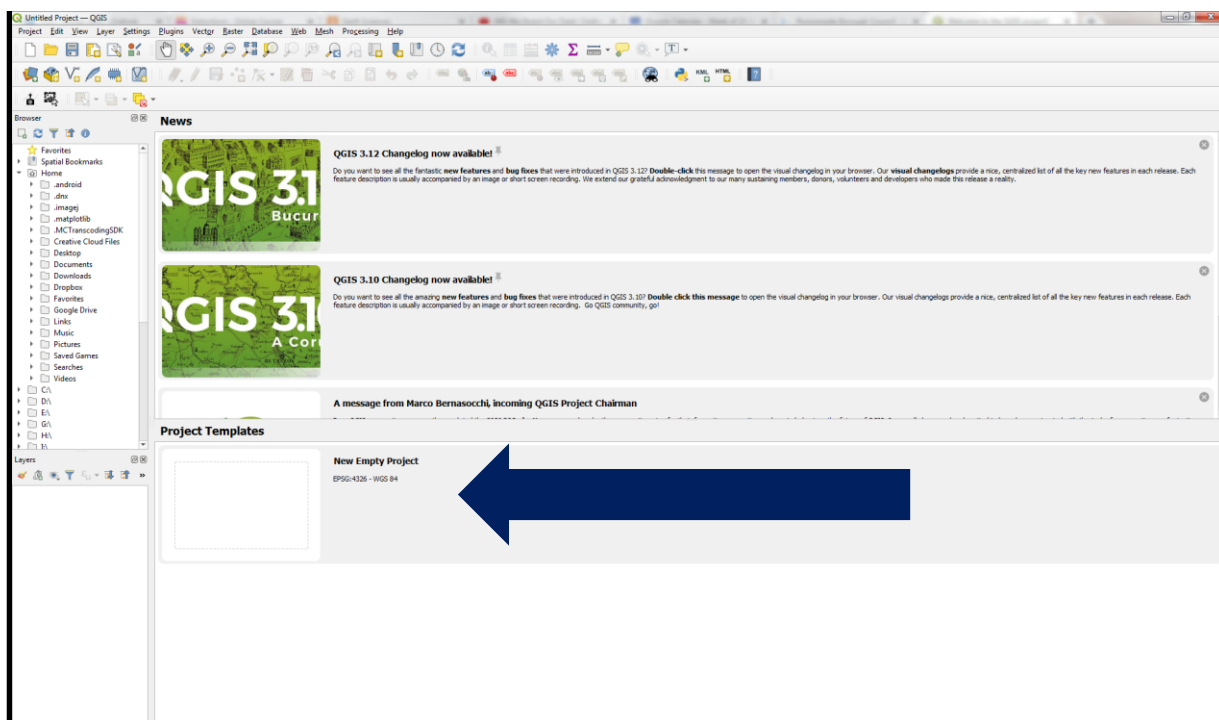https://qgis.org/en/site/forusers/download.html

We recommend downloading the latest version. At the time of compiling this guide this was QGIS 3.14.

Once the program is downloaded, click on it to open it. To make it easy to spot, the logo for QGIS is:

When the program opens, you should automatically get the option to create a 'New Empty Project'

Click on this and a blank project will appear (it should look like the below screenshot):
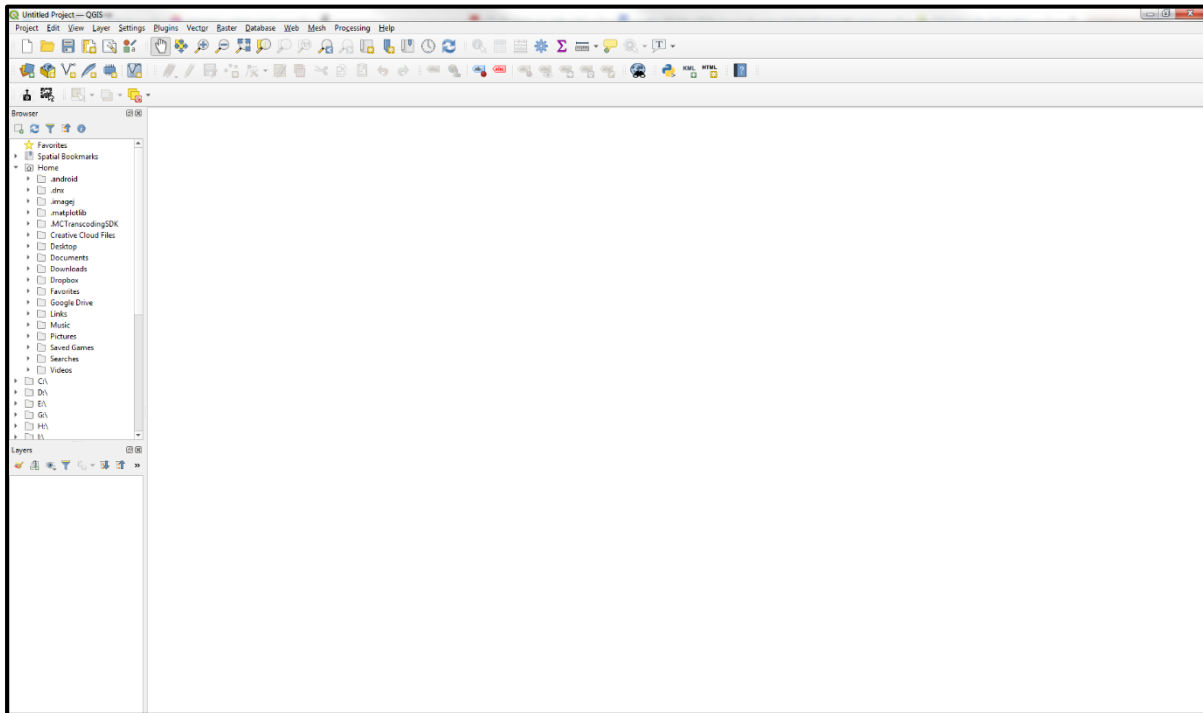

Before we move on, it is important that you generate a folder in your documents. You can call this 'Devon GIS Project'

Download the .JPEG 'eng_geol_stude_ref' that is available underneath these instructions, and make sure it is saved in your Devon GIS Project folder

This is an image of the 'eng_geol_stude_ref' .JPEG so you can check it is the right one:
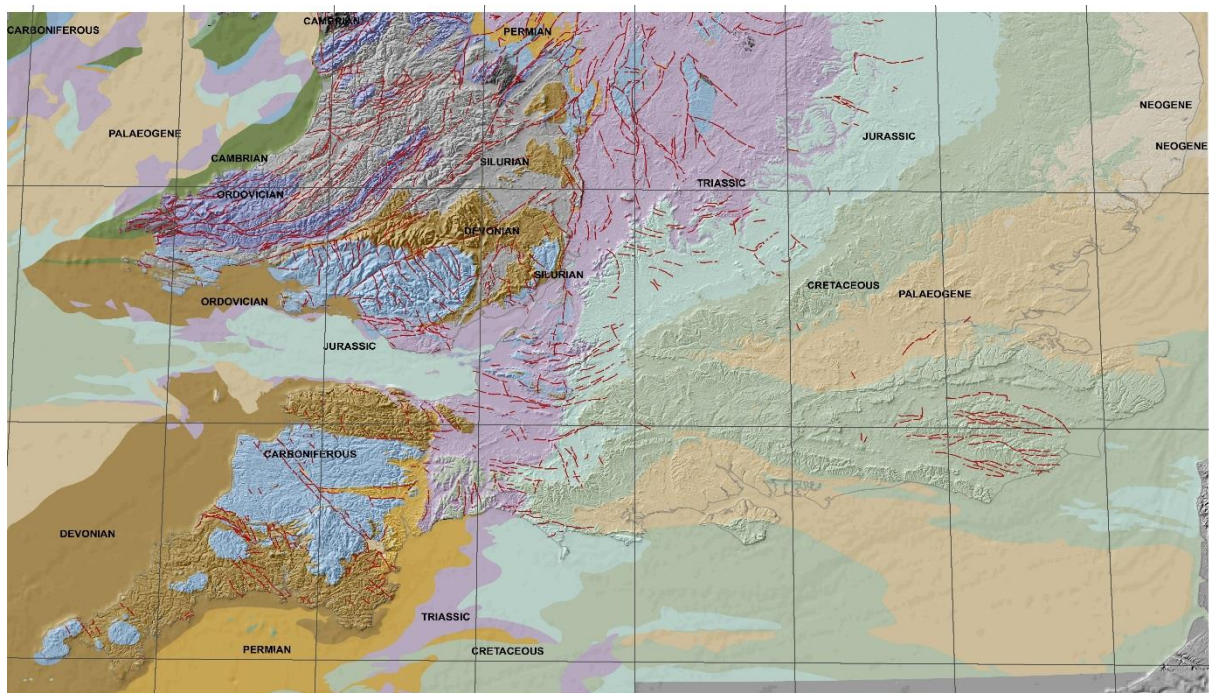
Now save your blank project to the same folder by clicking on 'Project' and 'Save As' in the QGIS software
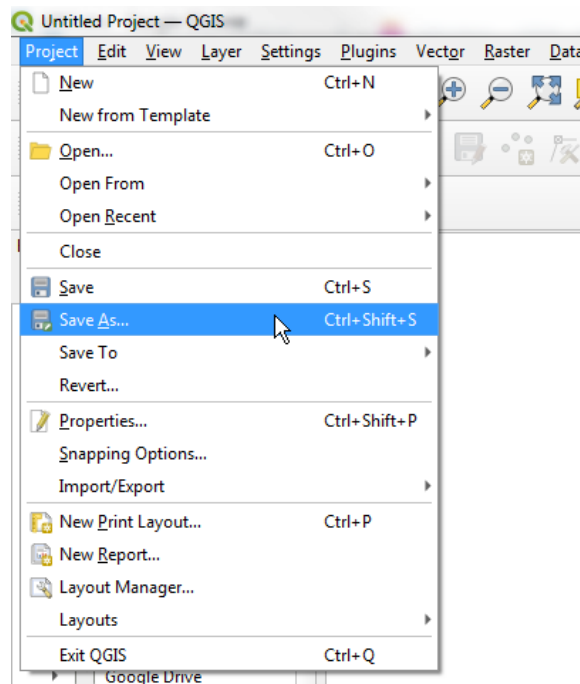
You can name the project UK_Geology with the extension .qgz (this is the standard extension for QGIS projects, so you don't need to change anything).

Now we want to add the 'eng_geol_stude_ref' geological map from your folder. There are two ways to do this:

1. There should be a 'Browser' Tree to the left of your project. You can navigate to your Devon GIS Project Folder in your Documents, and double click the 'eng_geol_stude_ref' file to add it.
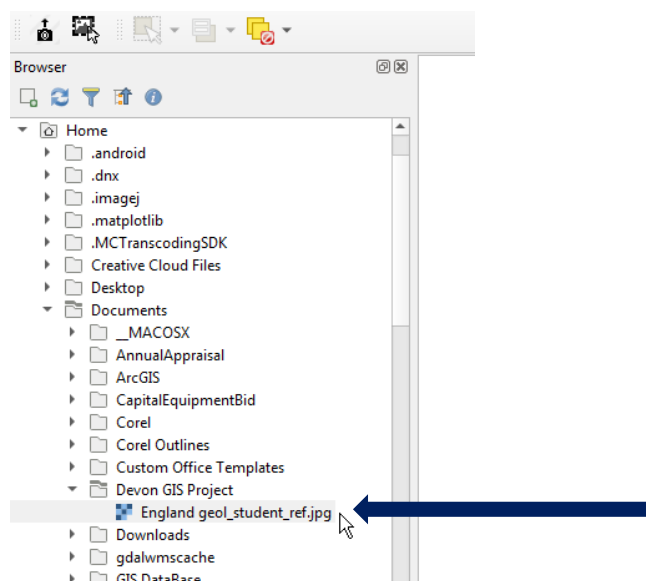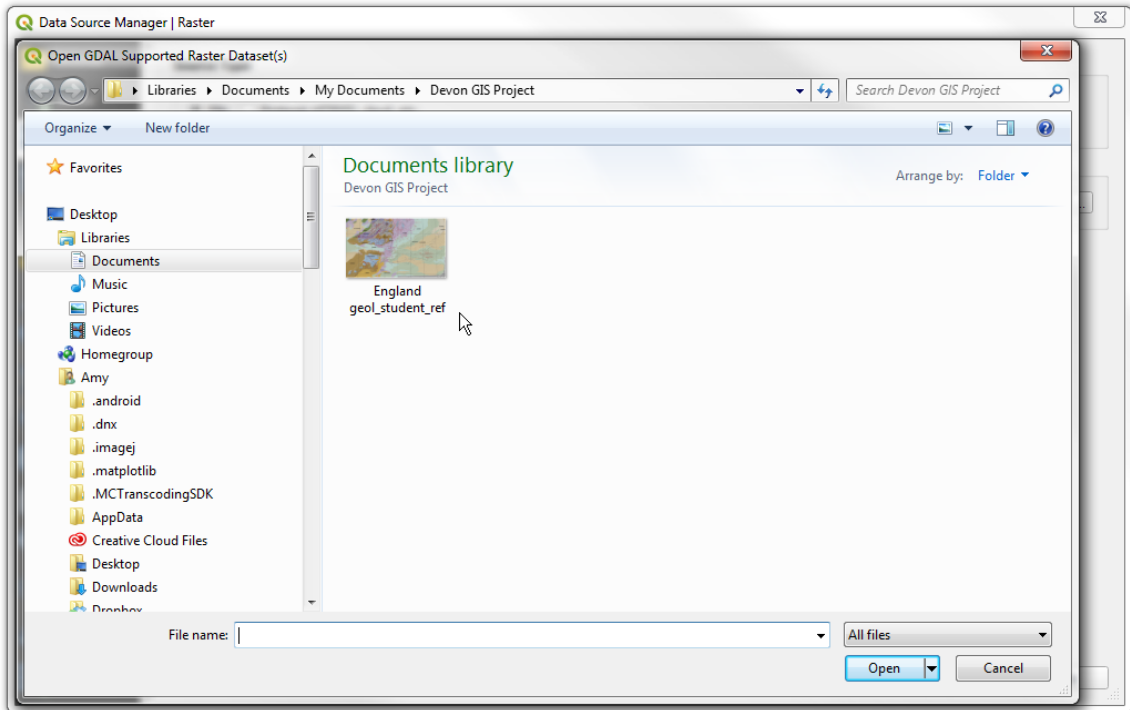
2. You can also go to 'Layer' on the Toolbar across the top and then scroll to 'Add Layer' followed by 'Add Raster Layer'
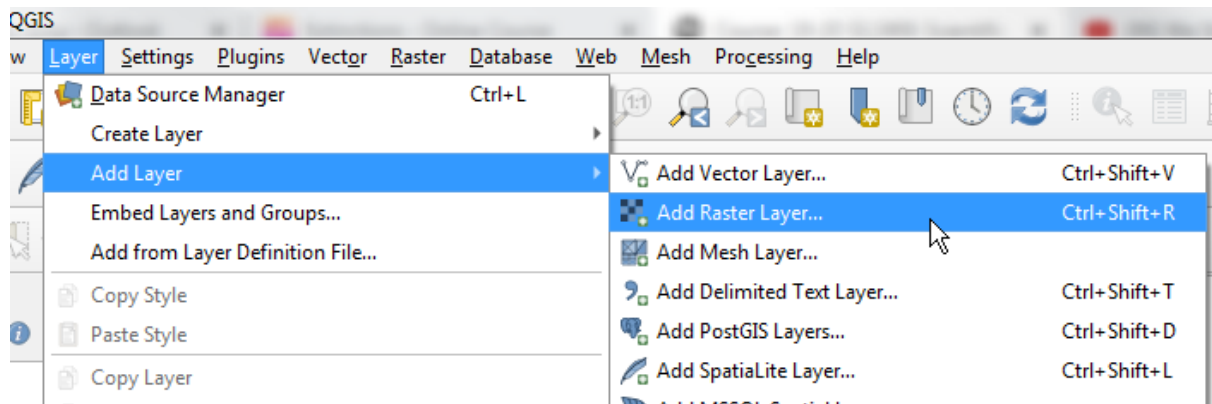

The Data Source Manager window will pop up, with the option to add a Raster Dataset Source. Click on the … next to the empty box (highlighted by the arrow on the following image).
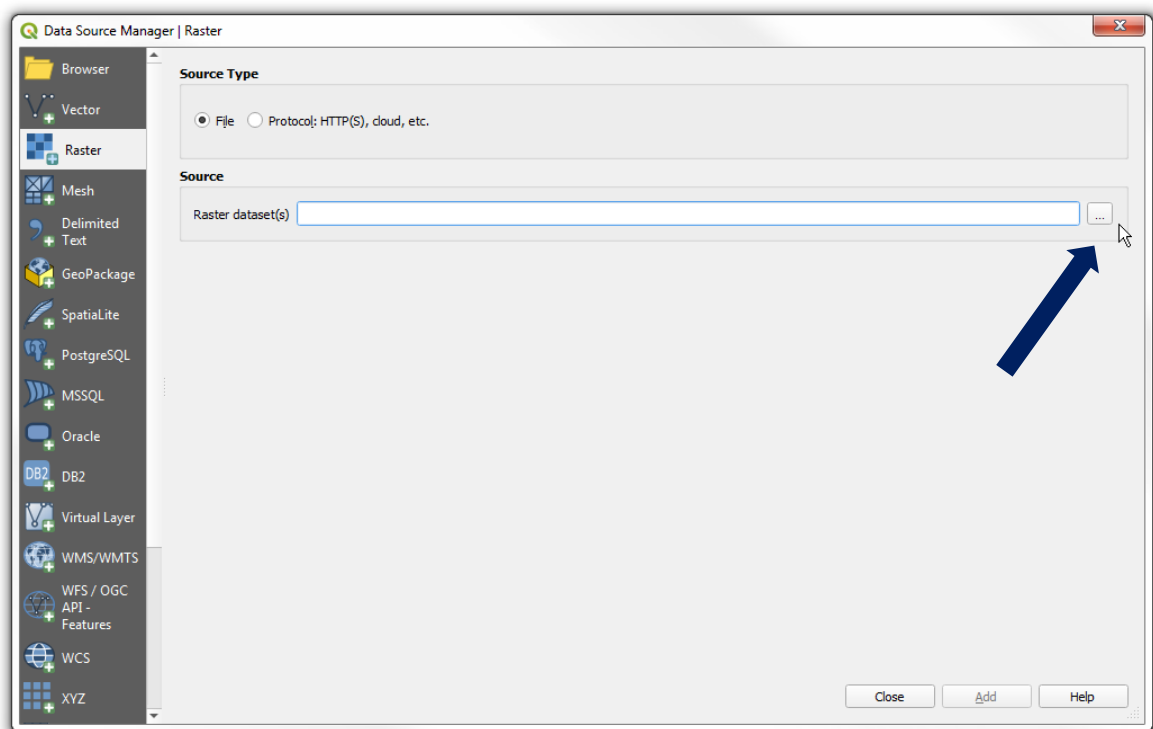
You can then navigate through the file directory to your 'eng_geol_stude_ref' image

Double click on the file and it will be added to the Data Source Manager. Click 'Add' and it will appear in your project. You can now close the Data Source Manager. You should be able to see the map in the QGIS project window, as well as the 'eng_geol_stude_ref' file in your Layers Tree. It will look a little like the image below:
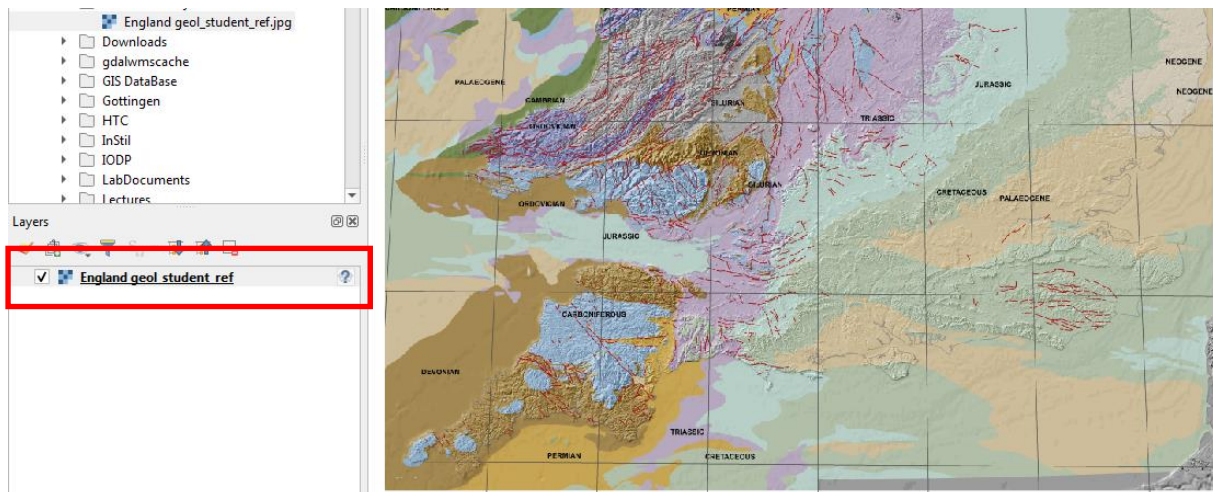

It is now important that we set the coordinate system for the geological map we have added, so we can use grid references to work out where we are!

If you right click the file in the Layers Tree, you should be able to select 'Properties'
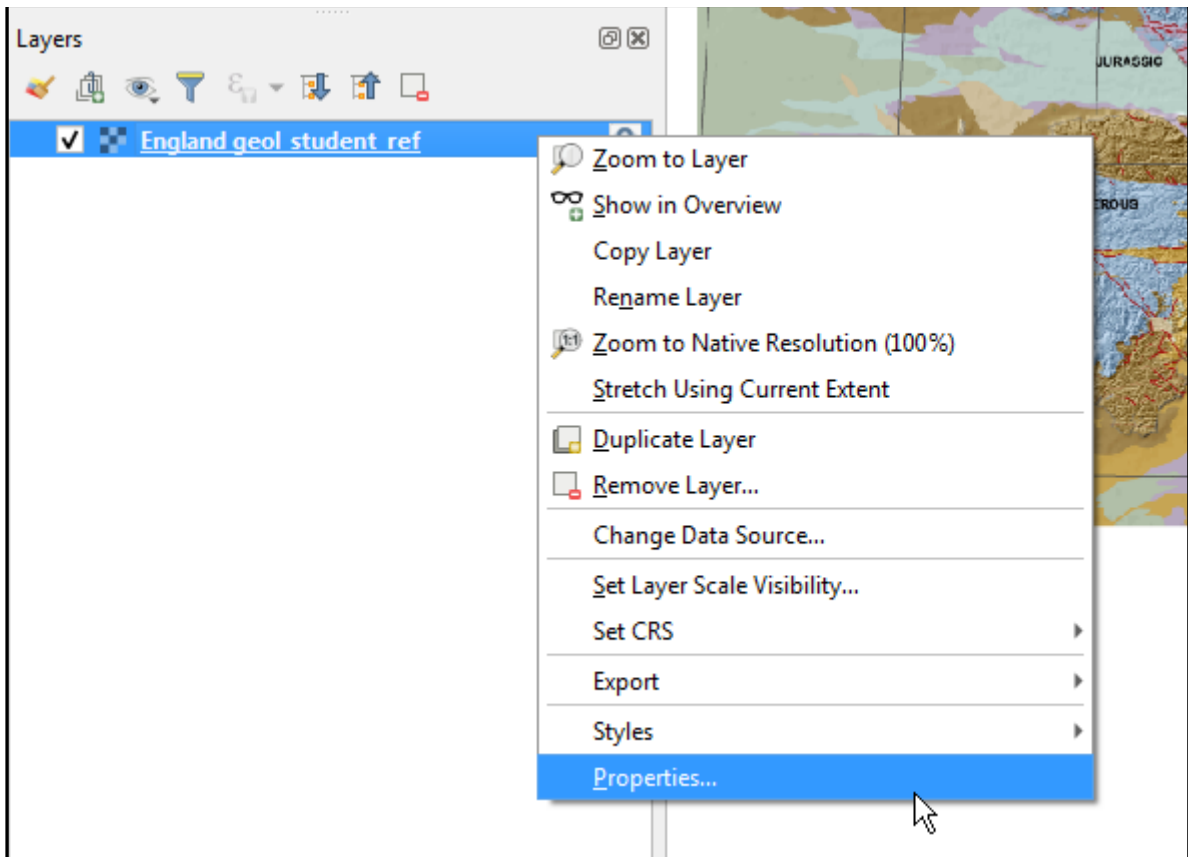
This will open the Layer Properties window for this file. There's a lot of information stored here (feel free to have a click around). The tab you need to click on is the 'Source' tab.
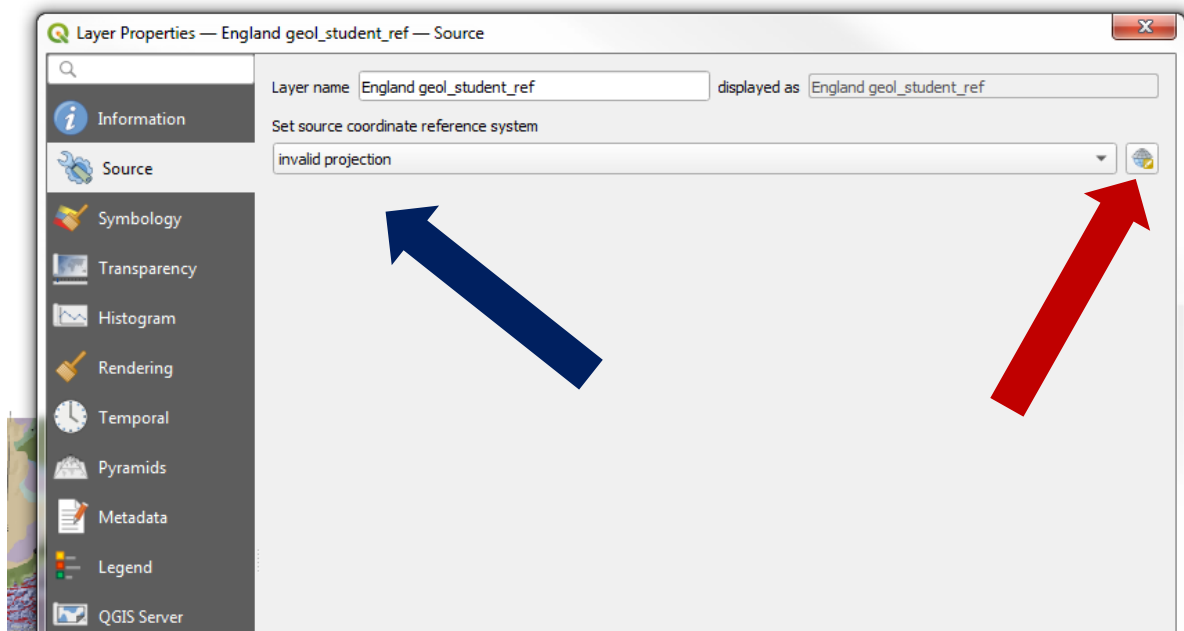

We want to set the source coordinate reference system, which you can see currently states 'invalid projection' (blue arrow) we can do this by clicking the button on the right (red arrow).

This opens the Coordinate Reference System Selector. In the 'Predefined Coordinate References Systems' section, click on the 'Geographic Coordinate Systems' to expand the list.
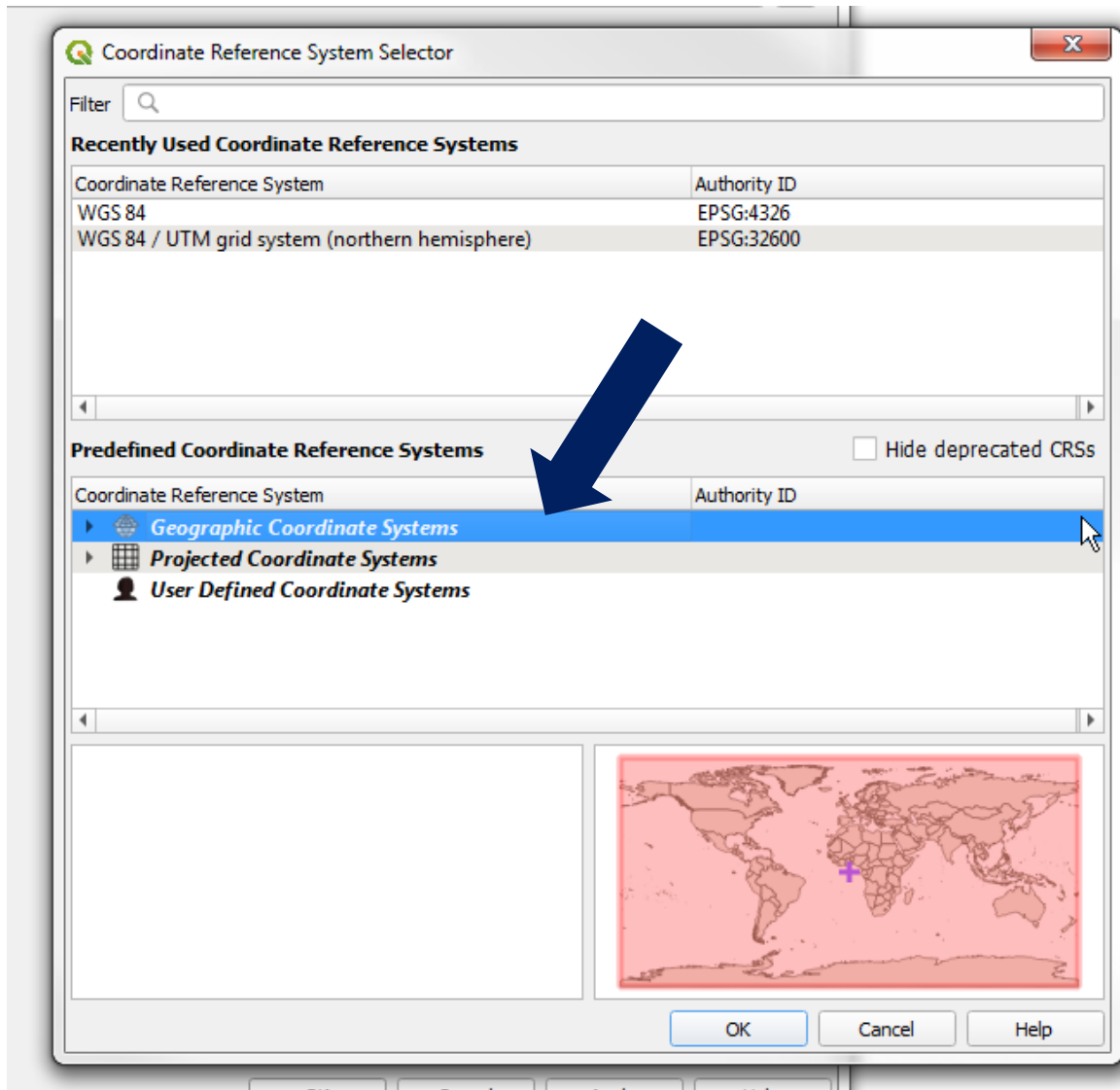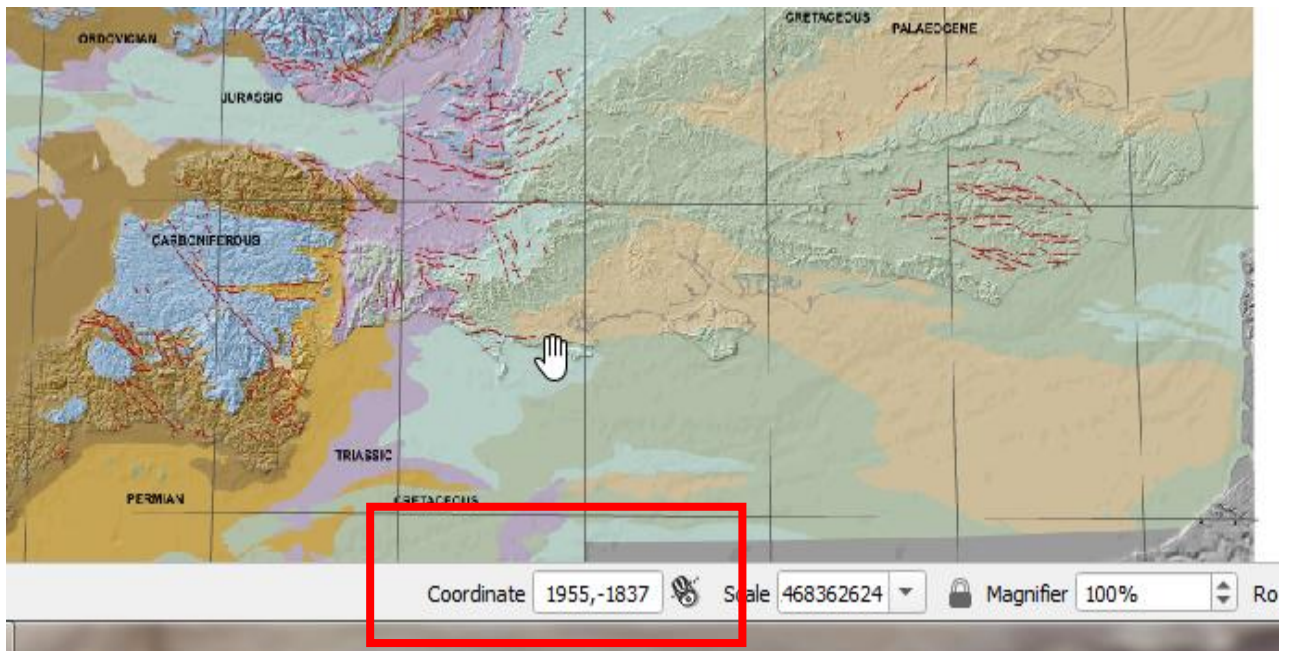

Scroll all the way down the list until you see 'WGS 84' there will be two in the list, so choose the first one:
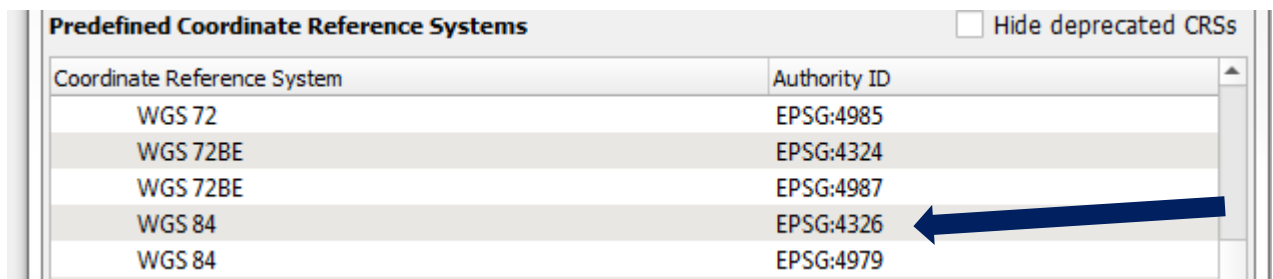

Double click on it, which will take you back to the Layer Properties screen, then press 'Apply' followed by 'OK'.

This has now set your coordinate system. You should be able to see changing coordinates at the base of the project as you move your mouse around the map:

QGIS is clever, however, it doesn't automatically know where the map is located so we need to tell it. We can do this by using something we call 'Georeferencing'
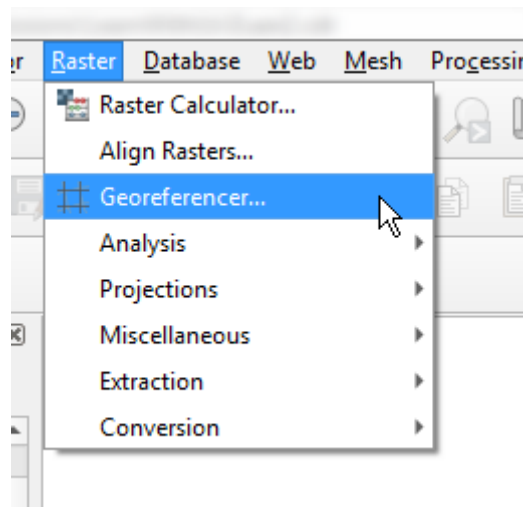

Go to 'Raster' on the Toolbar and select 'Georeferencer' from the drop down menu.
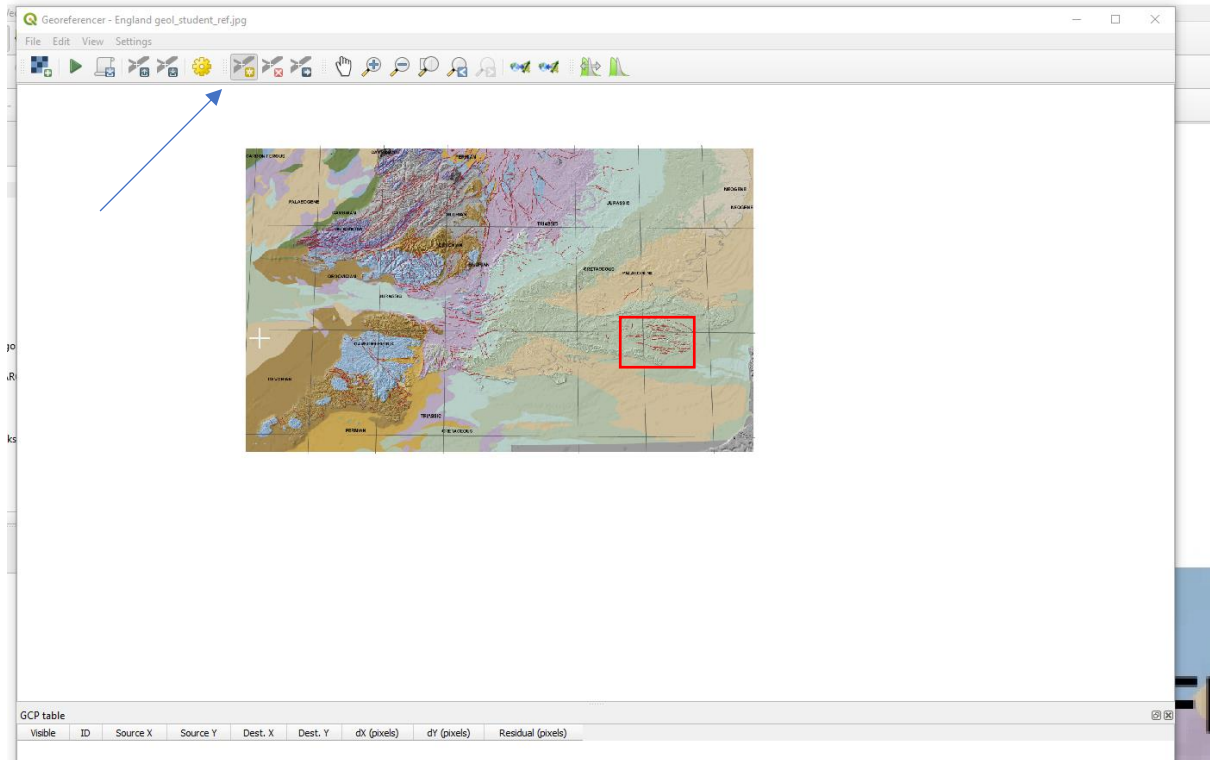
In the Georeferencer window zoom into the area just south of London with the series of red lines (these are faults shown here by the red box). We then need to add our points which we do by selecting the add point button (shown here with the arrow).
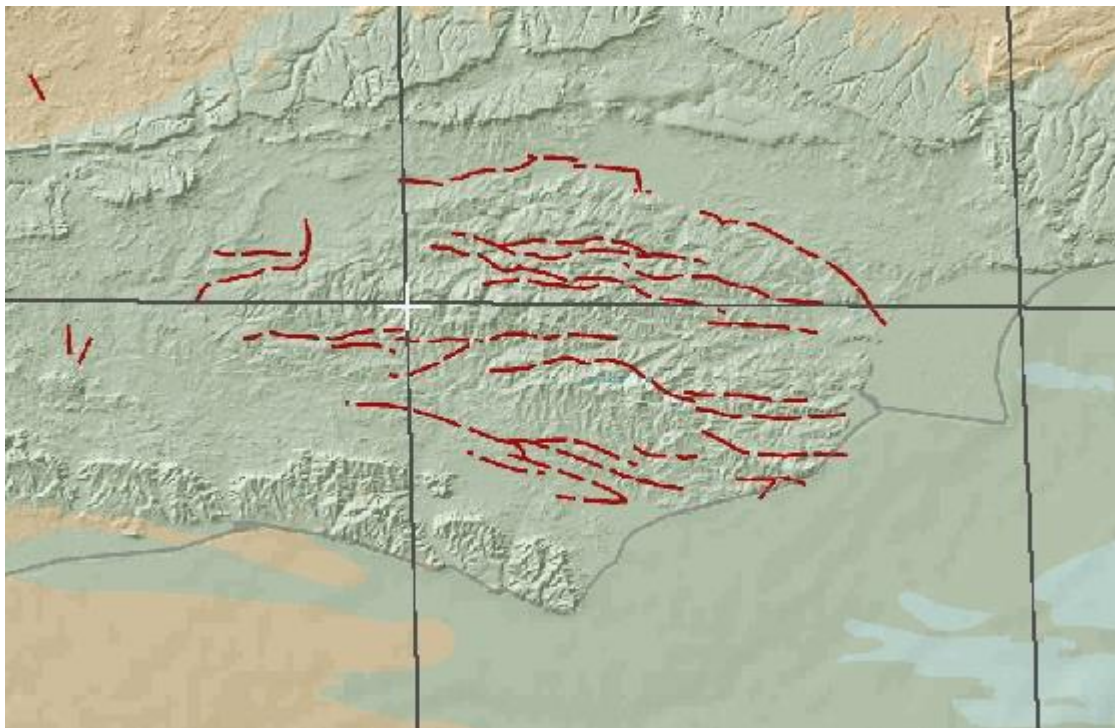

Use the select point icon to click a point on the cross hairs of the grid shown here, we will be adding four reference points in total.
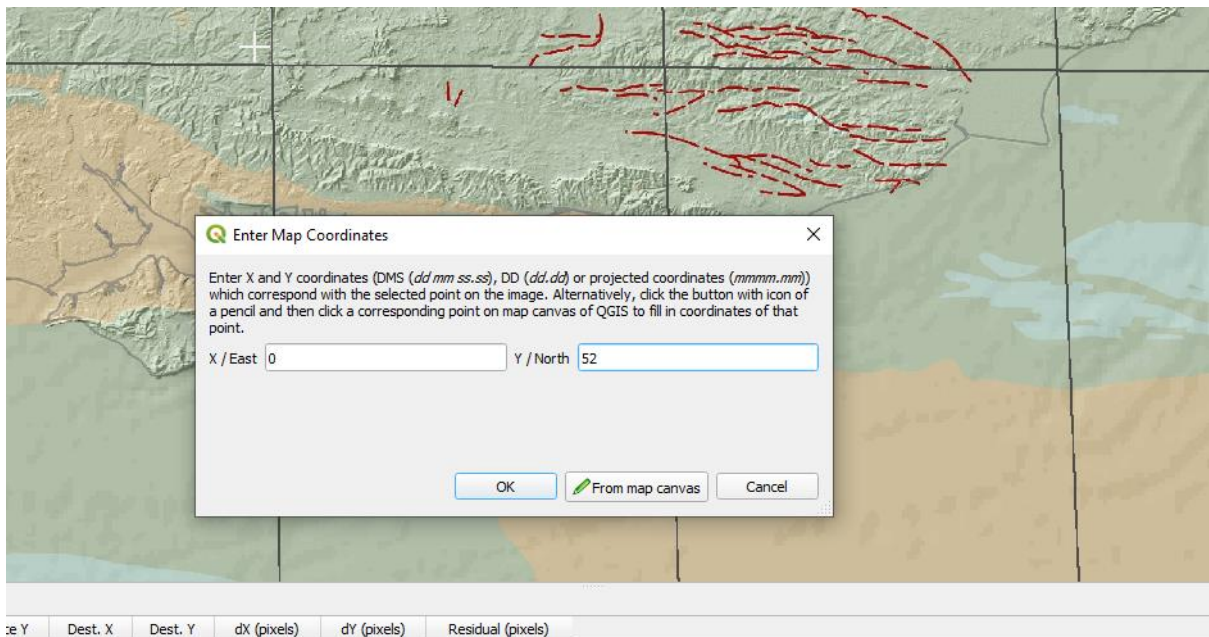
This will bring up the 'enter map coordinates' window, here we need to set out coordinates for this point – in this case we need to add X/East = 0 and Y/North = 52 and click 'OK'
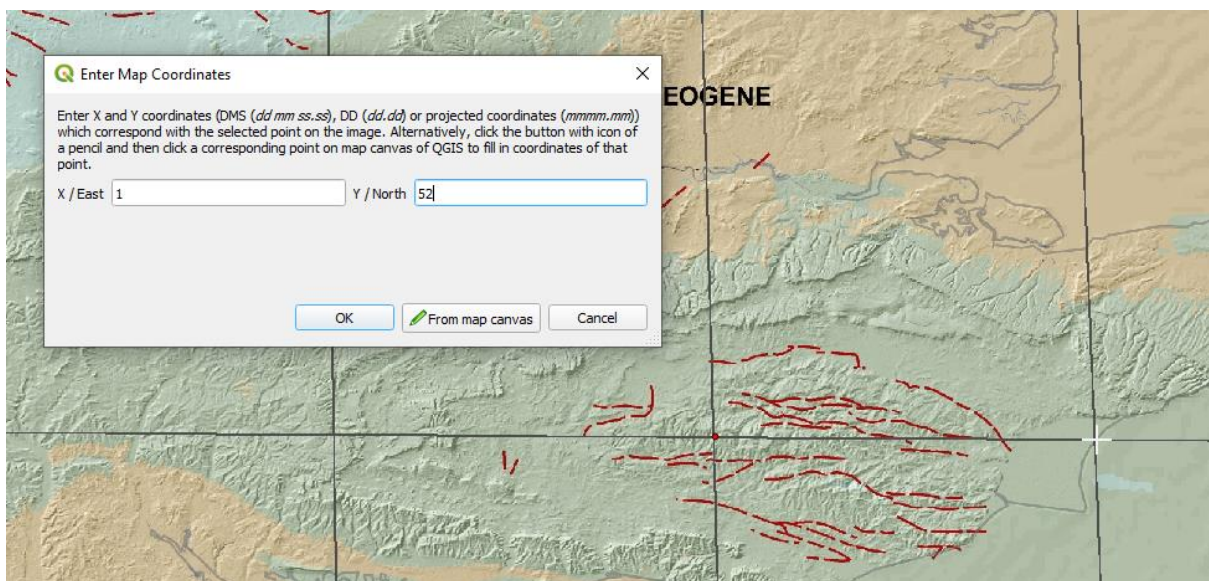

Next we move to the gridded cross hairs immediately east of the initial point and click to add another point. Our next coordinates are X/East = 1 and Y/North = 52.
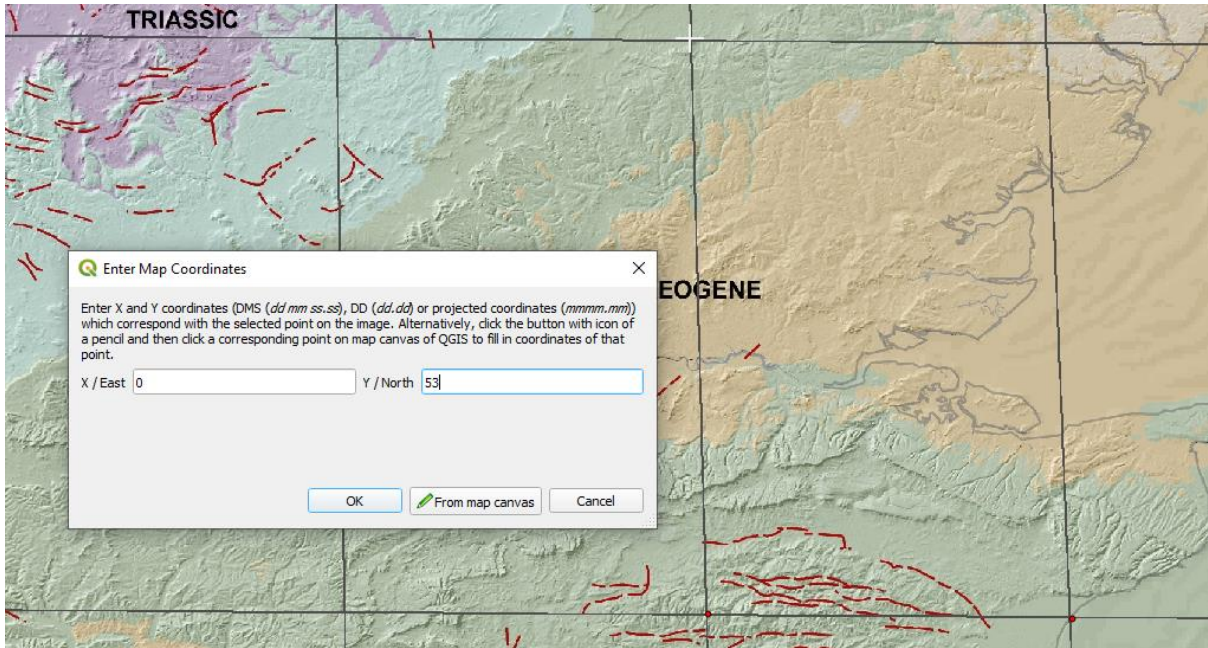
Next we move to the gridded cross hair immediately north of our initial point (shown above). Here the coordinates we need are X/East = 0 and Y/North = 53.
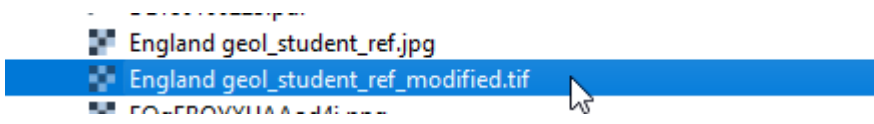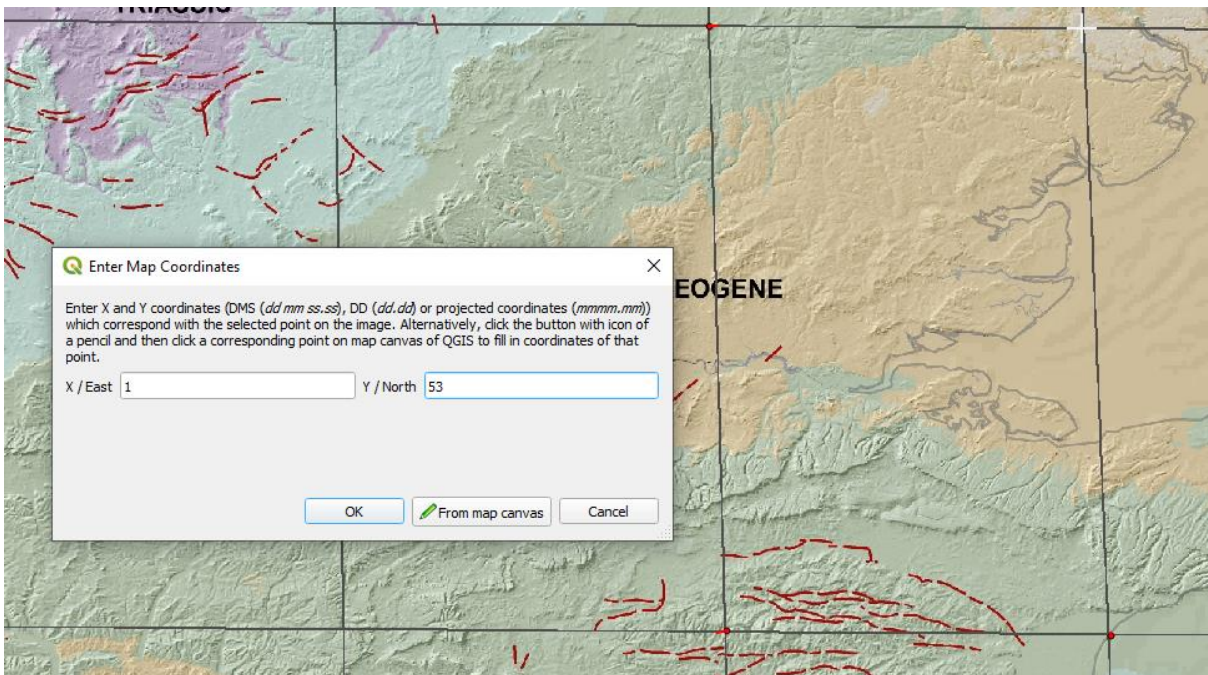

Finally, we add our last point in the gridded cross hair immediately to the east. Our final reference point coordinates are X/East = 1 and Y/North = 53.
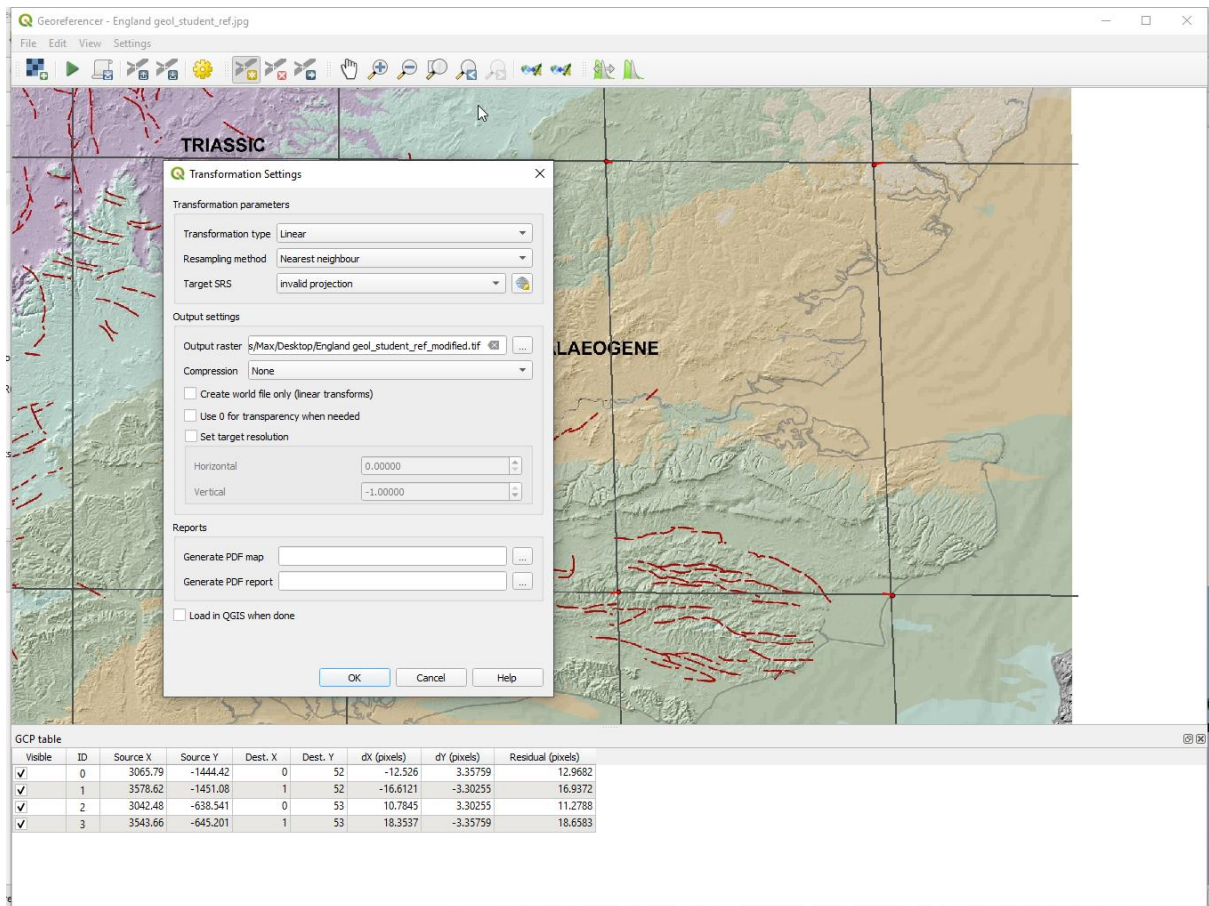
Next we need to make sure that our 'Transformation Settings' are appropriate to begin georeferencing. The path for this is Settings – Transformation Settings. In the 'Transformation Settings' window the important settings are 'transformation type' which should be set to 'Linear' and 'output raster' in which we chose the folder and file name for our resultant georeferenced image,
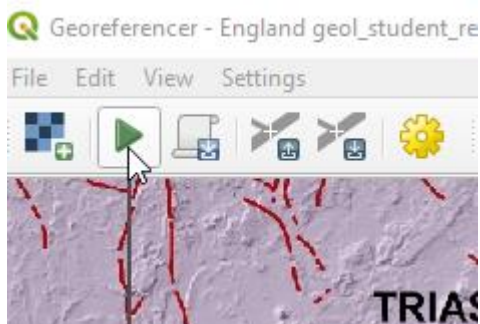

Finally, click the green arrow and the georeferencing window will run and output your final image.
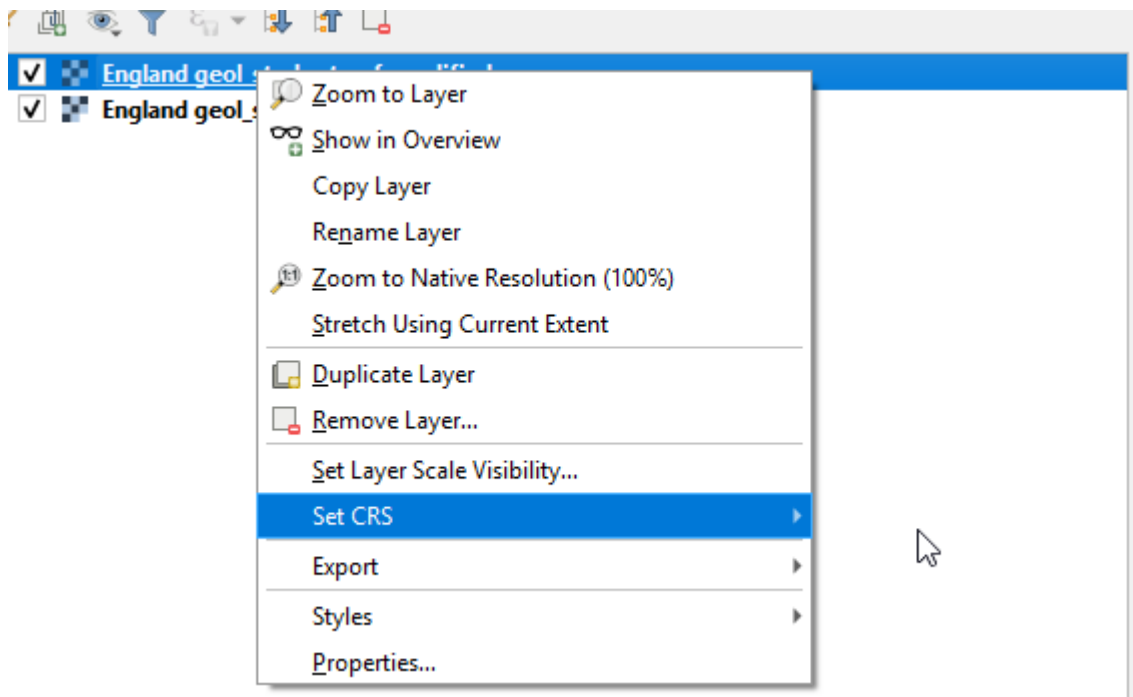
England geol_student_ref.jpg

England geol_student_ref_modified.tif

Your georeferenced image will then be output to the folder of your choice as a .tif or .Geotif (georeferenced .tif). As we saw before, you can now navigate to your 'Browser' tree and add the new georeferenced file by double clicking it or dragging it into the main window.

CRS was undefined: defaulting to CRS EPSG:4326 - WGS 84
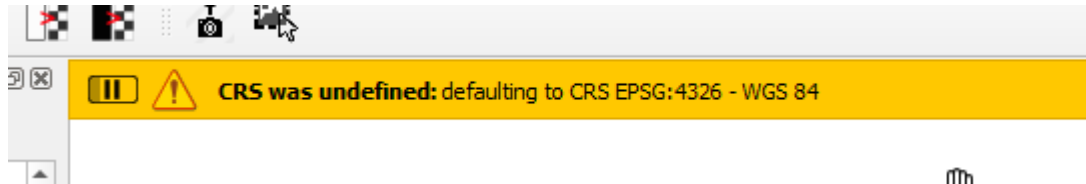
When the file is added the above error message may appear (CRS was undefined), which is easily solved.

England geol_...

England geol_s...

Zoom to Layer

Show in Overview

Copy Layer

Rename Layer

Zoom to Native Resolution (100%)

Stretch Using Current Extent

Duplicate Layer

Remove Layer...

Set Layer Scale Visibility...

Set CRS

Export

Styles

Properties...

To solve this error simply right click the georeferenced image navigate to 'Set CRS' and then 'Set Layer CRS'.
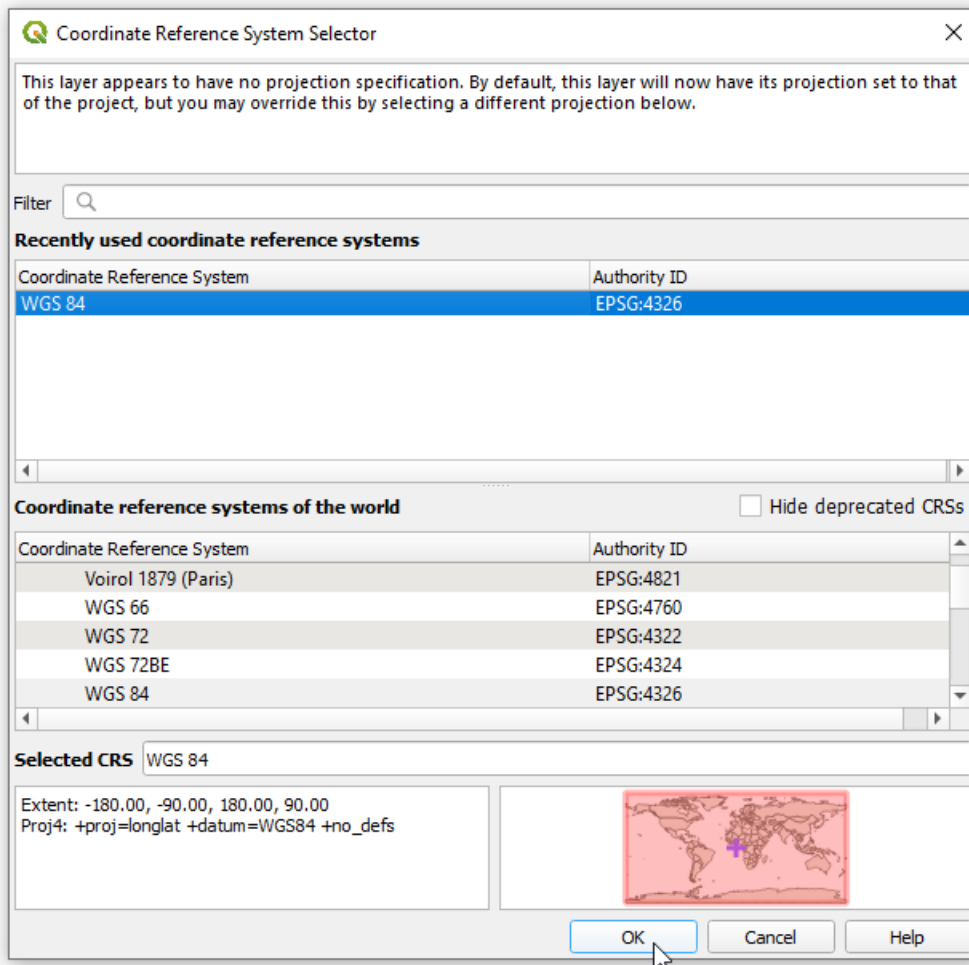
This will bring up the 'Coordinate Reference system Selector', here we simply select the correct coordinate system for the gridding system used in the georeferencing. In this case we use WGS 84, this can be found in the 'Coordinate Reference System' scroll menu. Finally click ok and we have our fully georeferenced usable map!

If you move your mouse around the map, you should see the correct coordinates appear at the bottom of the screen.

Congratulations! You can now upload and georeference geological maps!!!