

# ENV101 EARTH SYSTEMS

## Practical Exercise 3 – Global Earthquakes and Volcanoes

### 1. OVERVIEW

This practical is designed to extend students abilities to display and analyse spatial data, and in particular to understand the spatial relationships between tectonic plates, earthquakes, and volcanoes. The concepts covered in this practical are assessable (see assessment items in unit outline), however students are not required to submit answers to questions contained herein.

#### 1.1. Learning Outcomes

After completing this practical, students will be able to:

1. Use basic qualitative and quantitative analysis tools within ArcMap;
2. Identify tectonic plates
3. Describe the global distribution of earthquakes and volcanoes;
4. Create a basic map to demonstrate spatial relationships;

#### 1.2. Preparation

External students:

- Ensure that you have installed and licensed the ArcGIS 10 software from the CD that you received in the mail Or for Mac users, that you can access ArcGIS 10 using the Virtual Desktop Interface (see the *Technical challenges* forum on the *learnline Discussion Board* for further info).
- Create a folder on your C drive on your home computer where you can store all the files and folders for this class. Regardless of the location, note that it is not good practice to use spaces in file or folder names. Instead, use an underscore to give the effect of a space between words.
- Copy all the data required for this tutorial from the CD you received in the mail, or download from week 3 of the ENV101 companion site <http://learnline.cdu.edu.au/units/ses101/materials.htm>, into the folder that you have just created. Hereafter this folder will be referred to as your *working directory*. **Note that if you download the compressed data.zip file from the companion site, you must then unzip it before ArcGIS can read/use the data.**

Internal students:

- Create a folder (e.g. Prac3) for today's practical on the desktop, your personal student folder (G:\ENV101\sXXXXXX), or a personal memory stick/hard drive. Hereafter this folder will be referred to as your *working directory*.
- Copy all the data required for this into the folder you created above (e.g. Prac3).
- If you are working in the GIS/RS lab, you can either work from the student server (slow, but will be backed up), your personal hard drive or your desktop (faster, but will NOT be backed up and all data will be removed on logout). If you are working from the desktop, you should copy your work onto a memory stick or the student server at the end of the session BEFORE logging out.

### 1.3. *Required data*

**ENV101-Prac3-EQs\_and\_volcanoes.mxd** - This project file has been created for the use of this practical and contains a number of global datasets as listed below:

**earthquakes\_gteq55** - Point based shapefile extracted from the USGS showing the epicentre location, magnitude, and depth of all earthquakes greater than or equal to M 5.5, between Jan 2005 and Feb 2010.

**global volcanoes** - Point shapefile containing location of all known volcanoes, extracted from the Smithsonian Institution.

**World populated places 110 million** - 1:10M mapping of population centers, extracted from koordinates.com (uploaded Dec 09).

**Faults** - Major continental faults, provided by ESRI 2001.

**Aust Geology** - Australian geological data of unknown origin.

**World** - Country boundaries, available from ESRI 1996.

**Continent** - Continental boundaries, available from ESRI 1996.

**Plates** - Tectonic plate locations, available from ESRI 1996.

**world.img** - Satellite image mosaic of the world, available from ESRI 1996.

## 2. DATA DISPLAY

**Open ENV101-Prac3-EQs\_and\_volcanoes.mxd** in ArcGIS

Some of the data sets available in this project you should already be familiar with from Practical 2, however there are some new layers available in this project. Spend some time viewing the different layers and their attributes in their attribute tables to understand the information that is being presented.

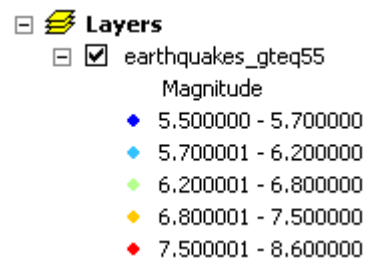
Q1. What is the name of the tectonic plate on which Australia sits?

Q2. What are the names of the plates bordering that identified in Q1?

Q3. Comment on the spatial relationship between plate boundaries, volcanoes, and earthquakes

### Tick 'on' the earthquakes layer

You will notice that each of the dots representing the earthquakes have a different colour. To check the meaning of the colour representation, click on the small + sign next to the layer name in the table of contents, and this will expand the legend. You can now easily see that red corresponds to the higher magnitude quakes.



Tick 'on' the world populated places layer, and zoom in to Chile.

Q4. Identify the towns closest to the two largest earthquakes. When did these earthquakes occur?

Q5. Along which plate boundary did these earthquakes occur?

**Zoom in to Australia and the southeast Asia region.**

**Right click on the world populated places layer in the table of contents. Go to Properties.**

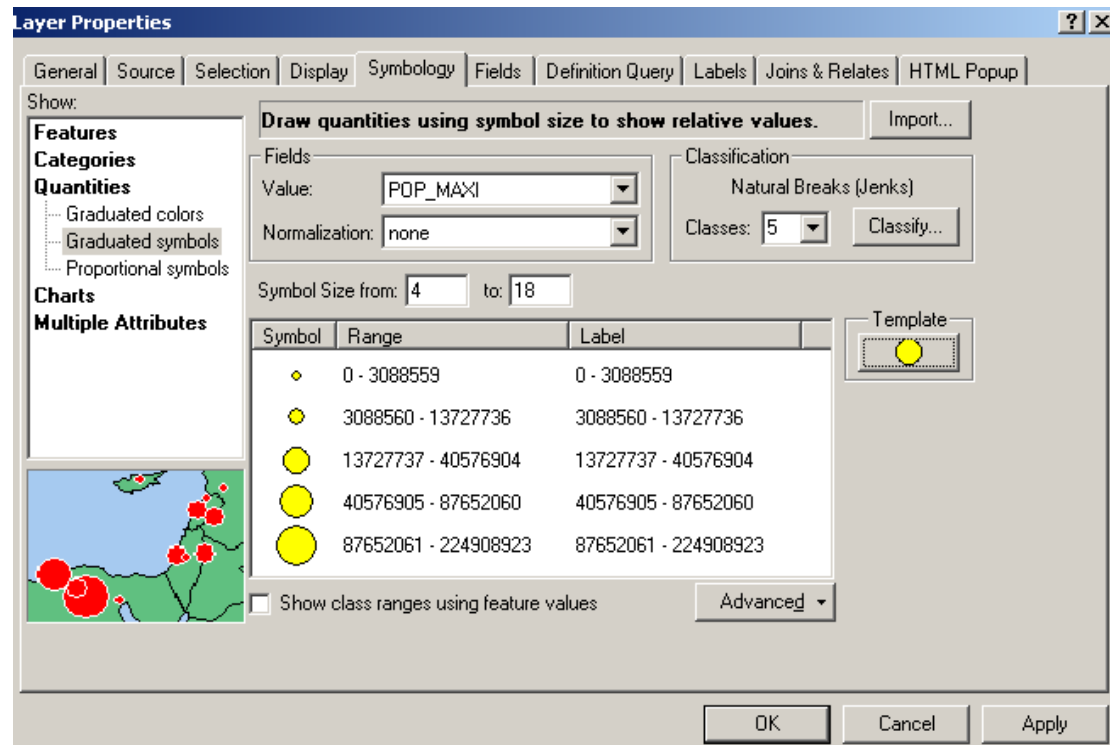
Ensure that the 'Symbology' tab is selected

Click on 'Quantities' on the left, and then select 'Graduated Symbols'

Select 'POP\_MAXI' as the value from the pull down box.

Leave all other defaults, but change the colour if you wish (under the 'template' button).

Click OK



This can be a useful way to visualise your data. This same technique was used to show the magnitude of earthquakes, except the 'graduated colour' option was selected, rather than 'graduated symbol'.

Experiment with different colours, symbol sizes, and ranges. There is no 'right' or 'wrong' way to do this – the aim is to make your map aesthetically pleasing and easy to interpret.

### 3. DATA EXPLORATION

Tick 'on' the Global volcanoes layer

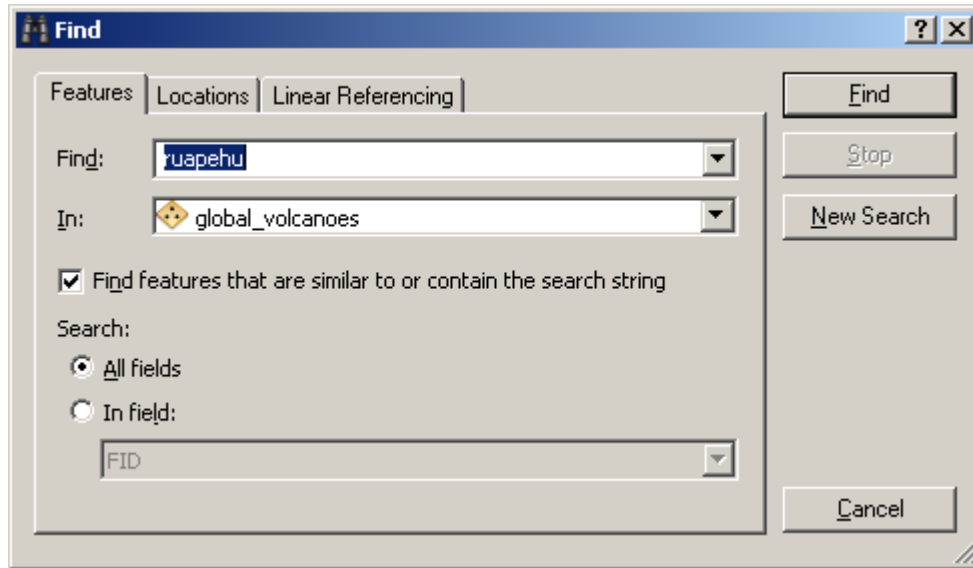


To find a certain feature of interest within your map, **click on the 'find' tool**.

Select the 'features' tab.

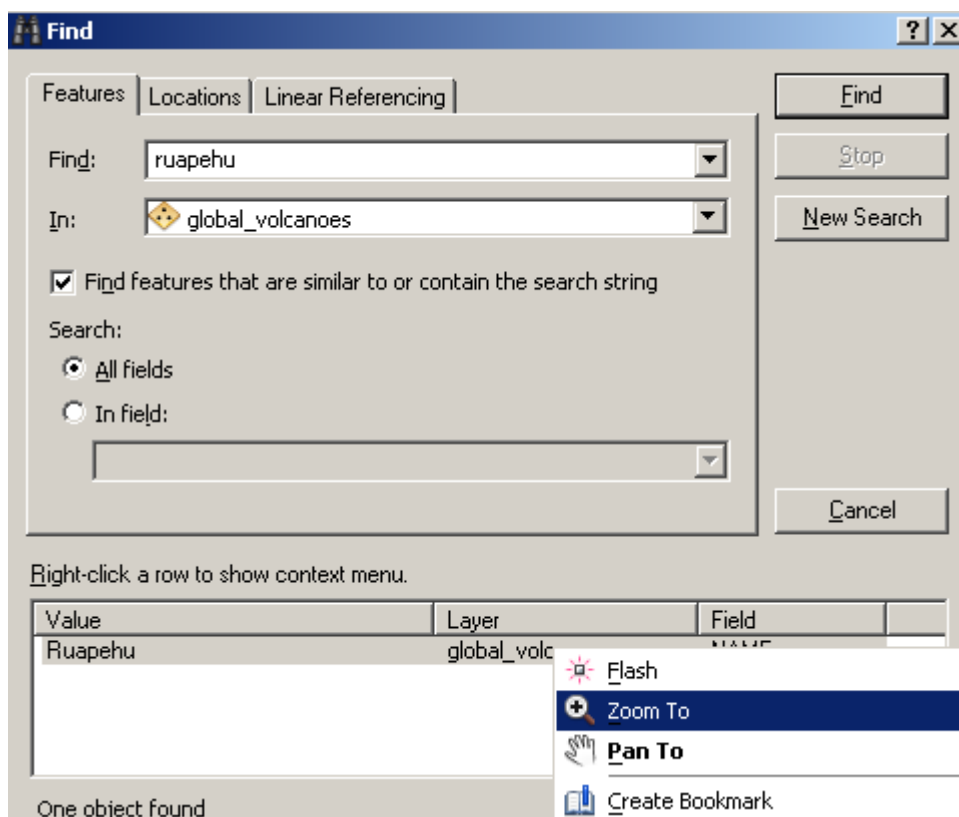
Type 'ruapehu' in the 'find' pull down box.

Select 'global volcanoes' as the layer in which to look for this feature.



**Click Find.**

Once it has found the feature, it will appear in the bottom of the 'find' dialog box. **Right click on the feature and select Zoom To.**



Use this tool to locate other cities and countries around the world from their respective data layers.

Q6. In which country is the volcano 'Takahe' located?

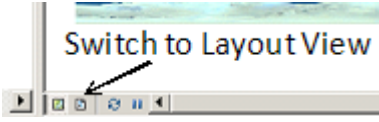
#### 4. MAKING A MAP

**Select a couple of layers that interest you** the most to place on a map. Don't try to depict too many things at once.

If you are not sure what to map, show the relationship between earthquake epicentres and plate boundaries, by ticking both of these layers on, perhaps with the satellite image as a background.

**Zoom in to an area of interest** – eg Australia, southeast Asia, or alternatively, make your map of the whole world. Remember to **consider the map projection** that you use for your display.

**Choose appropriate colours** for your map.

 In the bottom left hand corner of your viewer window, **click the tiny button** to switch to the layout view

Your view will change, and a new layout toolbar will become available.



Go to **File → Page and print set up** and change the orientation to **Landscape**. Make sure that in Map Page Size the Use Printer Paper Settings is selected. This will ensure the layout page is the same scale as your paper settings. **Then click OK.**

Move your map around the layout page until it is centered. You can also change its size by dragging out the handles of its bounding box.

Ensure that your **Draw toolbar** is turned on. If it is not, right click in the grey space at the top of ArcMap besides your other toolbars and turn on the Draw toolbar.

**Click on the 'A'** on the drawing toolbar, and then click on your map to add a title (eg. Tectonic plate boundaries and earthquake epicentres (2005-2010))



On the main menu, go to **Insert → Legend**

**Accept all defaults by clicking Next (4 times), and then Finish.**

Note that this produces a very basic legend, and it is beyond the scope of this practical to learn techniques to make this more 'map ready'. Once inserted, the legend is dynamically linked to your view, so if you tick on or off other layers, this will also be reflected in the legend.

Go to **Insert → North Arrow** and select a north arrow that you like, and then **click OK**

Go to **Insert → Scale Bar** and select a scale bar that you like, and then **click OK**. Note that if you change the extent of your map, the scale bar will also change, as it is dynamically linked.

At any stage you can delete anything on your map layout by selecting it and pressing delete on your keyboard.

You should also add other text on your map such as your name (as the map author) and date (to show its currency).

Here is a basic checklist of elements to include on your map:

- Title,
- Scale (bar and/or representative fraction),
- Projection,
- Datum,
- Coordinate system,
- North point,
- Map production date,
- Legend,
- Author,
- Data source/s and copyright.

Experiment with your map layout to make it visually pleasing.

To create a final map image, select **File > Export Map**. In the Export Map dialog box select the location where you would like to save your image and an appropriate name. Leave the image type as PNG (the default) and press Save.