

The DMG Manuals

XDigiMac

Screen Digitizer

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XDigiMac

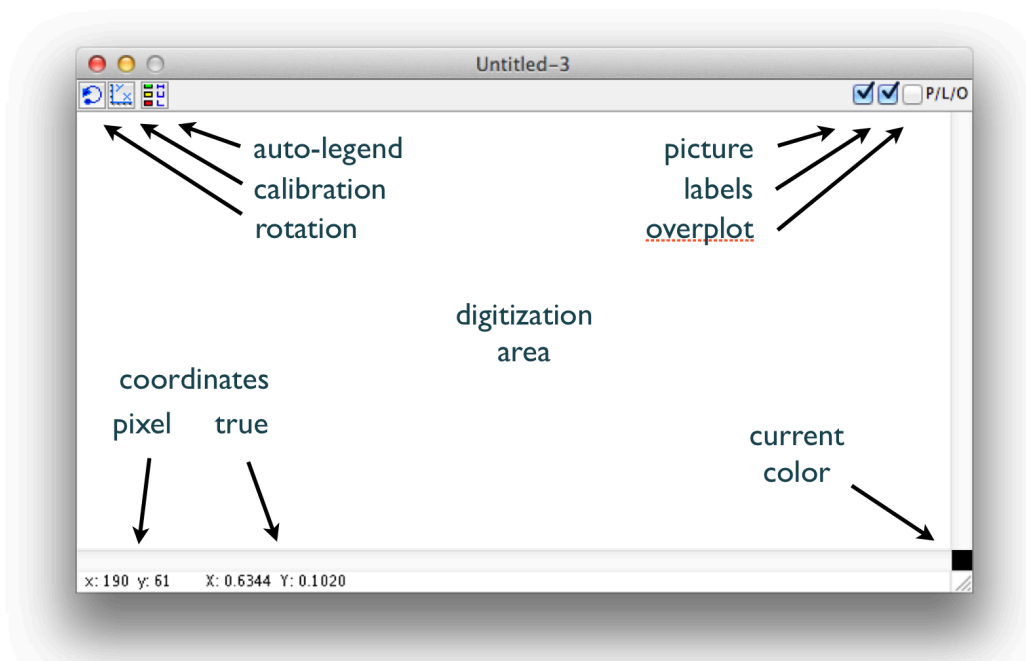
Introduction

XdigiMac is a tool expressly developed for the preparation of *.pof files, that is digital files representing 2D cross-sections to be used for the generation of ground shaking scenarios along laterally heterogeneous structures.

Nevertheless, it can be used to digitize any information that can be represented on the screen.

Main window (the digitizer)

The main window is actually the screen digitizer:



The user can either import a TIFF file, to be used as a guide for the actual drawing, or start drawing from scratch using the true coordinates as a guide. In both cases, the digitizer needs to be calibrated first, so that true, real-world coordinates are associated with the pixel coordinates read on the screen.

Digitizer calibration

The digitizer must be calibrated to associate a real world coordinate to the pixel coordinate system read with the mouse pointer on the screen. This is done by clicking on the calibration button of the digitizer window:



a) Cursor changes to cross + one vertical line: click on the top corner of the profile drawn, closest to the source (top-left or top-right according to source location) and set its coordinates in km (typically 0,0).

b) Now the cursor has changed to a cross with two vertical lines: click on the opposite corner of the drawn profile (bottom-right or bottom-left) and give its coordinates in km.

If calibration is successful, moving the cursor over the model shows both the pixel coordinates, and the position in km.

Drawing a profile over an image

An image can be used as a guide for drawing the profile. It can be either read from the File -> Import -> Picture

menu or the image can be placed in the clipboard, from whatever application you prefer, and then pasted into the main XDigiMac window.

An alternative is to take a screenshot of the image open in any other application: press

```
command-ctrl-shift-4
```

and then drag a rectangular selection with the mouse around the image to put the selection into the clipboard. Then open a new XDigiMac window and paste the image into it.

If a digitizer window is already open, the paste operation will resize the image to fit into the window. If a new digitizer window is created while the image is in the clipboard, the window dimensions will fit the pixel size of the picture.

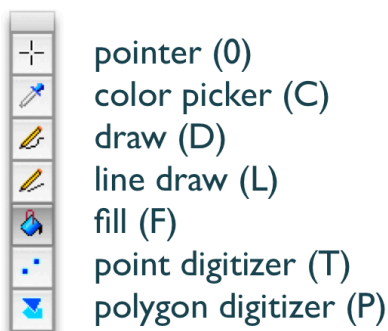
Converting a scanned image into a proper drawing that can be digitized properly on screen might be a tricky operation. See Appendix A for some useful tips.

Drawing a profile from scratch

When drawing a profile from scratch, the user has to create a new digitizer window, use the calibration tool to associate real world coordinates to pixel coordinates, and then use the real world coordinates to draw the profile.

Tools palette

This palette provide the following tools:

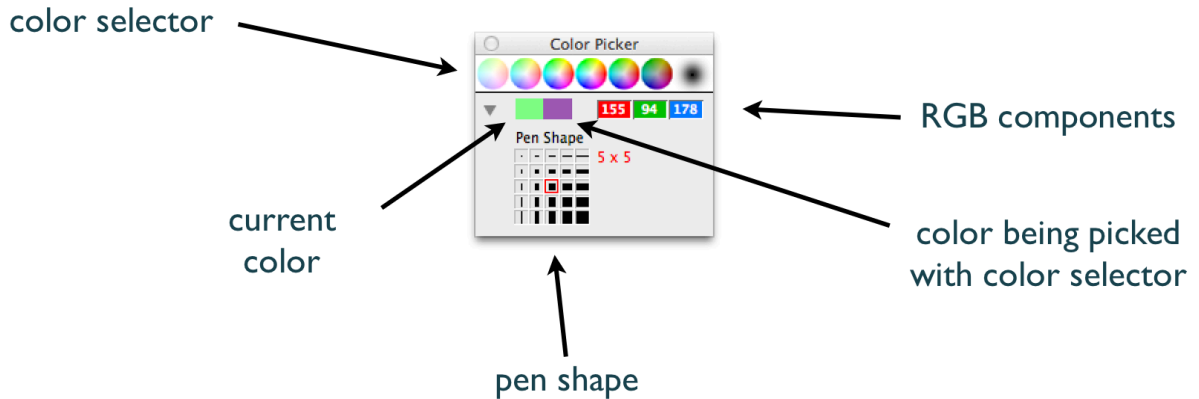


From top to bottom:

- Standard pointer (0)
- Color picker (C)
- Drawing tool (D)
- Line tool (L)
- Filler (F)
- Point digitizer (T)
- Polygon digitizer (P)

In parenthesis the keyboard equivalents are indicated. (0) is zero, not a capital letter "o".

Color palette



When drawing a cross-section, a set of layer properties (density, V_p , V_s , Q_p , Q_s) is uniquely associated with the chosen layer color.

The user chooses the color by clicking with the mouse on the color selector, and draws the layer boundaries in the main window. It is suggested that a pen size of 3x3 pixel is used at first. The 1x1 pen should be used at the end of the drawing to refine the small details of the profile.

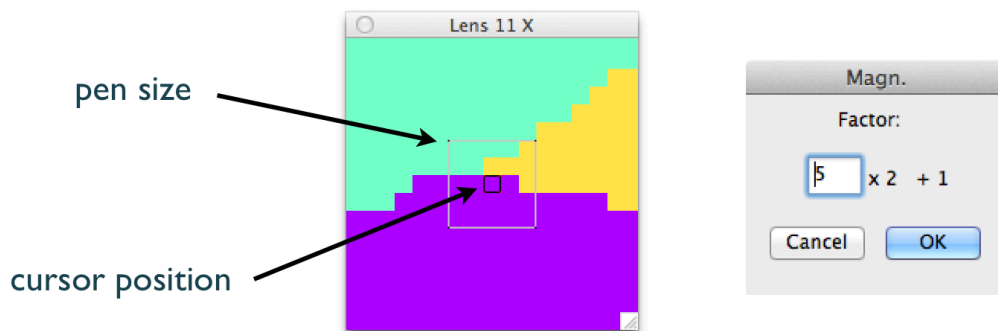
Dragging and dropping colors

Once a color is chosen by clicking on the color selector, it is also automatically placed into the current color indicator of the active digitizer window. The current color can also be dragged and dropped to a legend palette, or a library palette, or onto a layer already drawn in the digitizer to change its color.

If a single item is already selected in a legend or library palette, dropping the color on that palette will substitute the color property of that item. In doing this, if the target is a legend palette, the color substitution will be also applied to the pixels of the associated digitizer that were characterized by the original color.

A color can also be dragged from the current color indicator of a digitizer window, possible targets being a legend, library or the color palette.

Lens palette

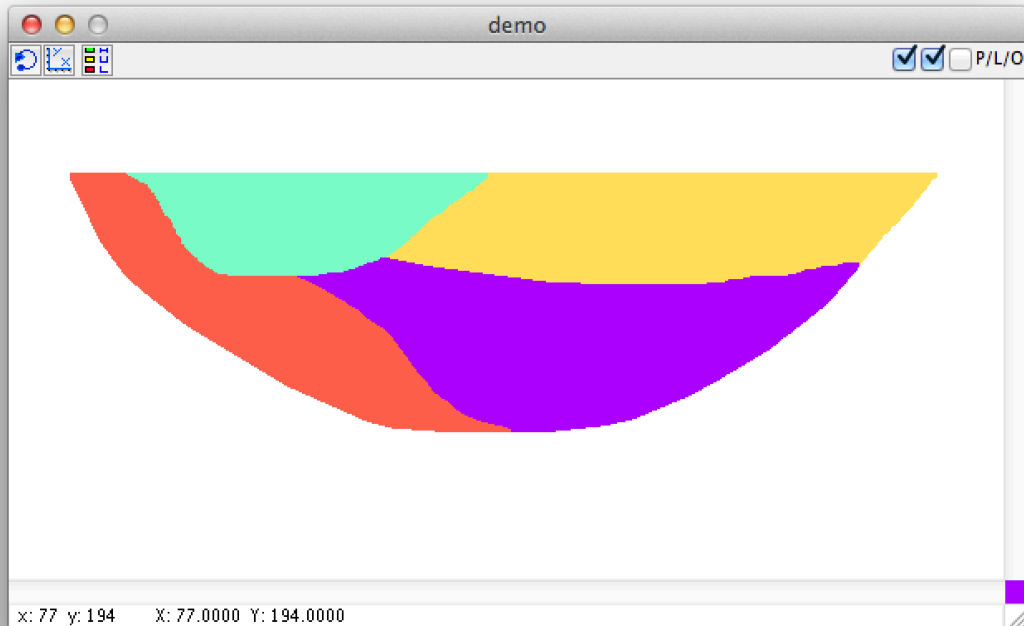


A lens palette is associated with each digitizer window open. It can be resized, and its magnifying factor can be modified by clicking over it and filling in the value in the dialog that appears.

Legend palette

After a profile has been drawn, the properties of the layers must be defined. This is done associating properties to colors in the legend palette.

Let's have a profile drawn like in the figure below:



Auto-legend

Clicking the auto-legend button of the digitizer window will automatically generate the color items found in the main window.

unique colors

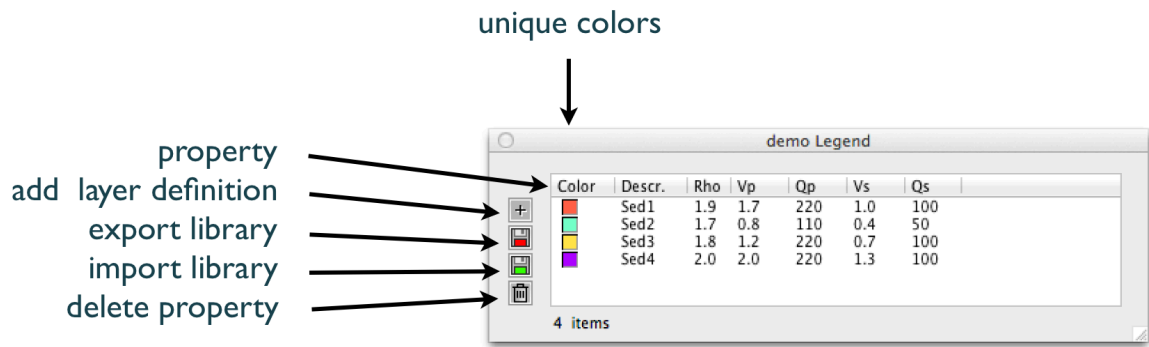
property
add layer definition
export library
import library
delete property

Color	Descr.	Rho	Vp	Qp	Vs	Qs
White	1	1	1	1	1	1
Red	2	2	2	2	2	2
Cyan	3	3	3	3	3	3
Yellow	4	4	4	4	4	4
Purple	5	5	5	5	5	5

5 items

The 'demo Legend' window is shown with a toolbar on the left containing icons for adding, exporting, importing, and deleting. Arrows point from these icons to the corresponding actions in the text. A table with 7 columns (Color, Descr., Rho, Vp, Qp, Vs, Qs) and 6 rows (including a header) is displayed. The table contains five entries corresponding to the colors in the main window. The status bar at the bottom indicates '5 items'.

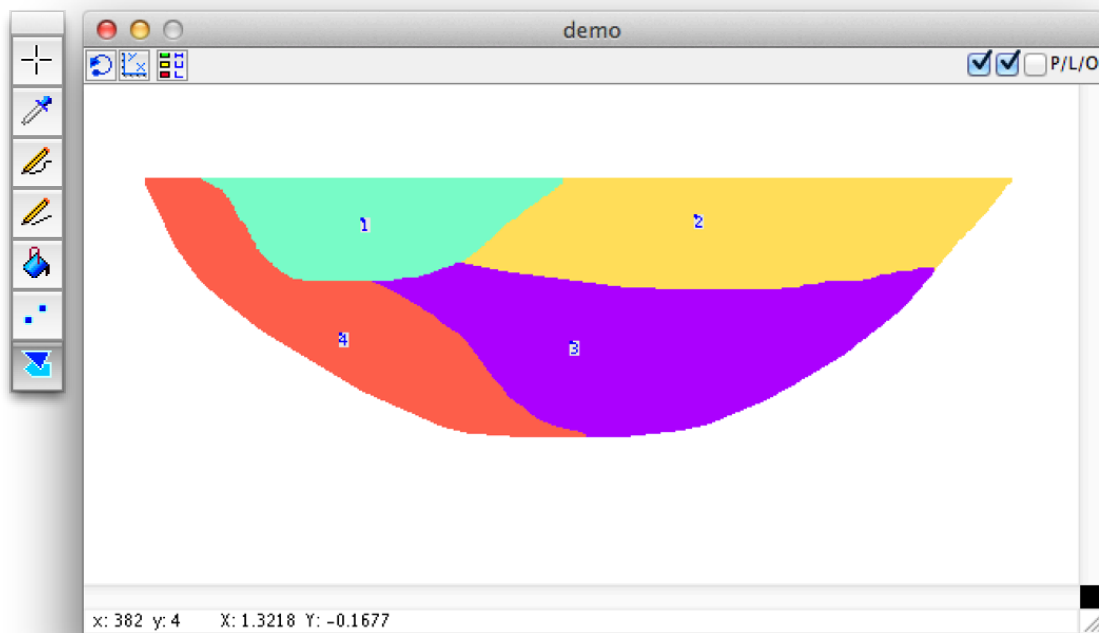
The user will then have to fill in the property values: rho in gm/cm³, Vp and Vs in km/s, Q dimensionless. The white color associated with the digitizer background can be removed.



Profile digitization

Once the profile has been drawn, the digitizer is calibrated, and the properties of the layers have been assigned in the legend the digitization of the profile is just a couple of clicks away.

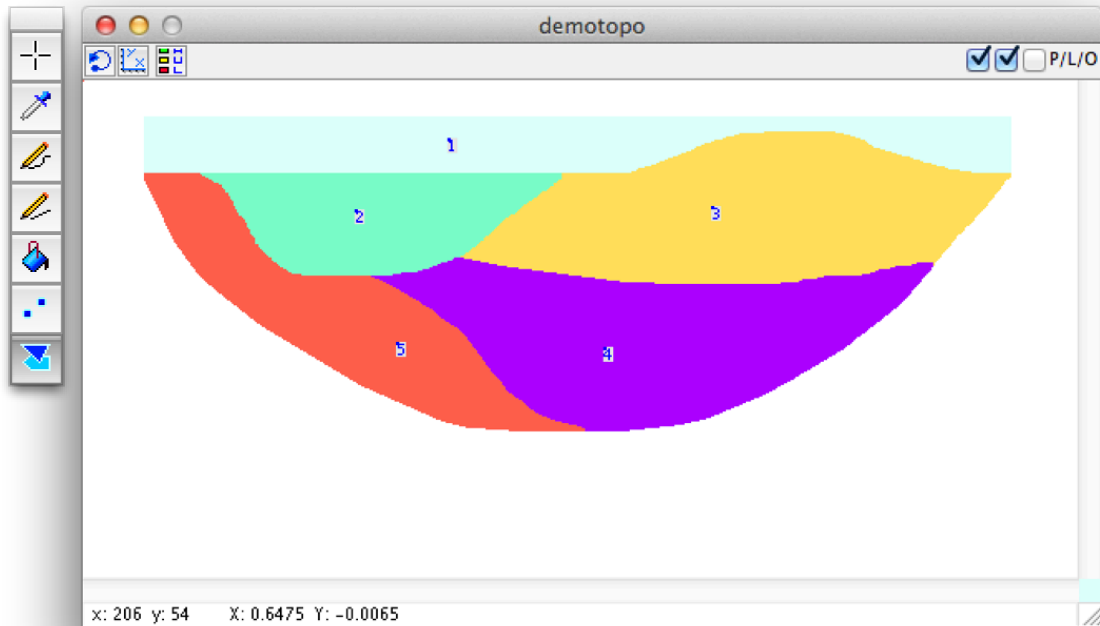
The user has to select the Polygon Digitizer tool from the Tools palette, and click inside each layer drawn in the main window. A label will appear after each click to confirm that the layer has been digitized.



In a simple model like with flat topography and no inclusions, the layers can be digitized in any order.

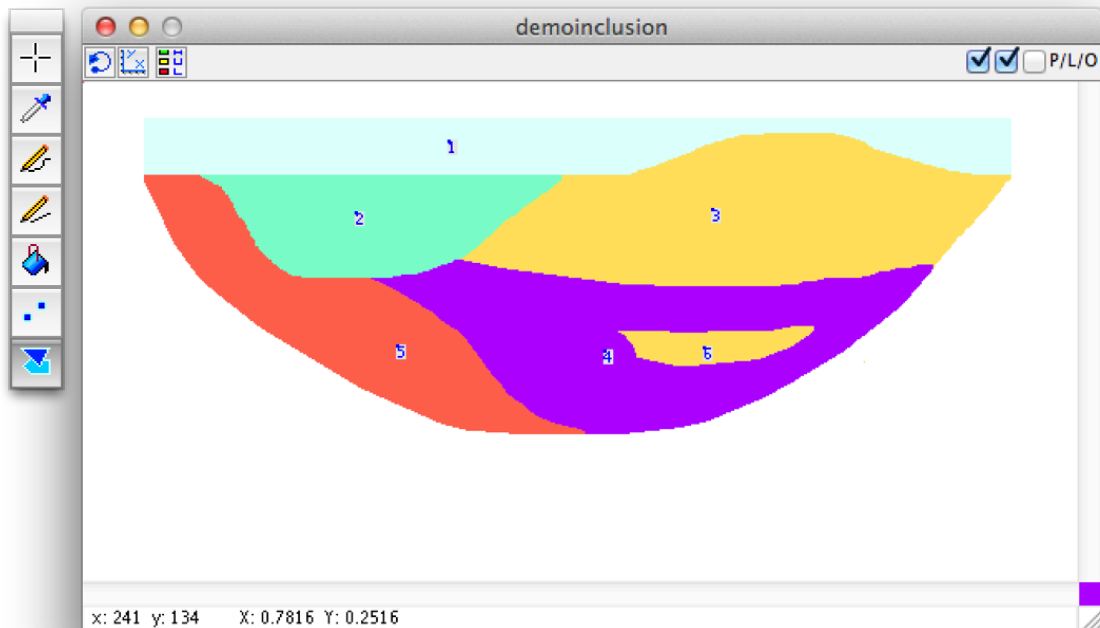
Topography

If topography is present in the model, it must be shaped using the so called “air layer”. The air layer is usually drawn in a light blue color, like in the figure below. In this case, the air layer(s) must be digitized first, then the others in any order.

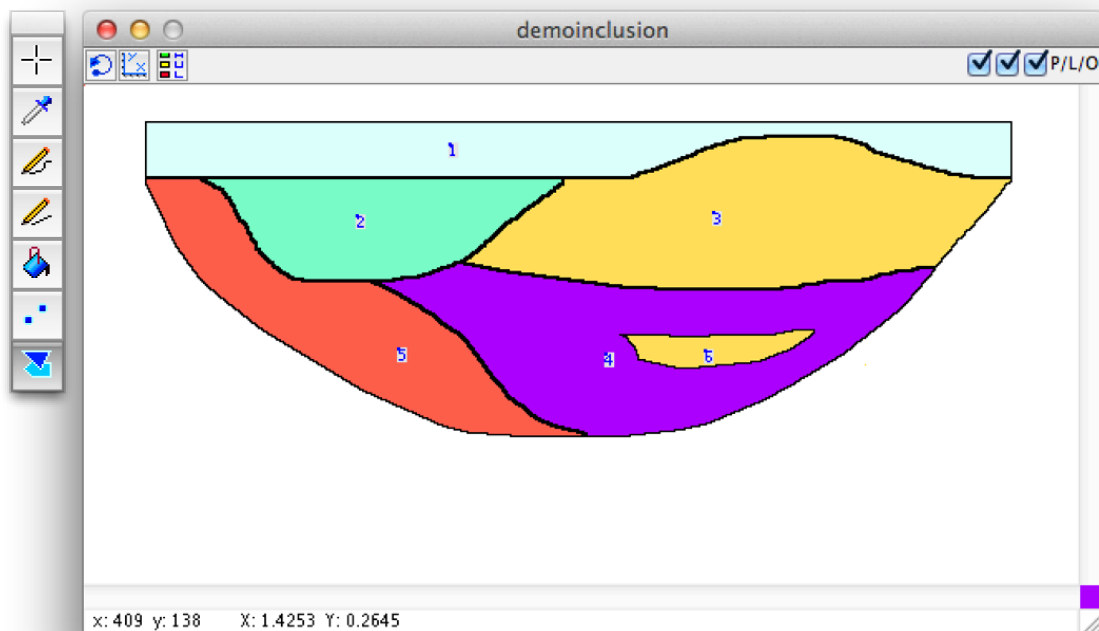


Inclusions

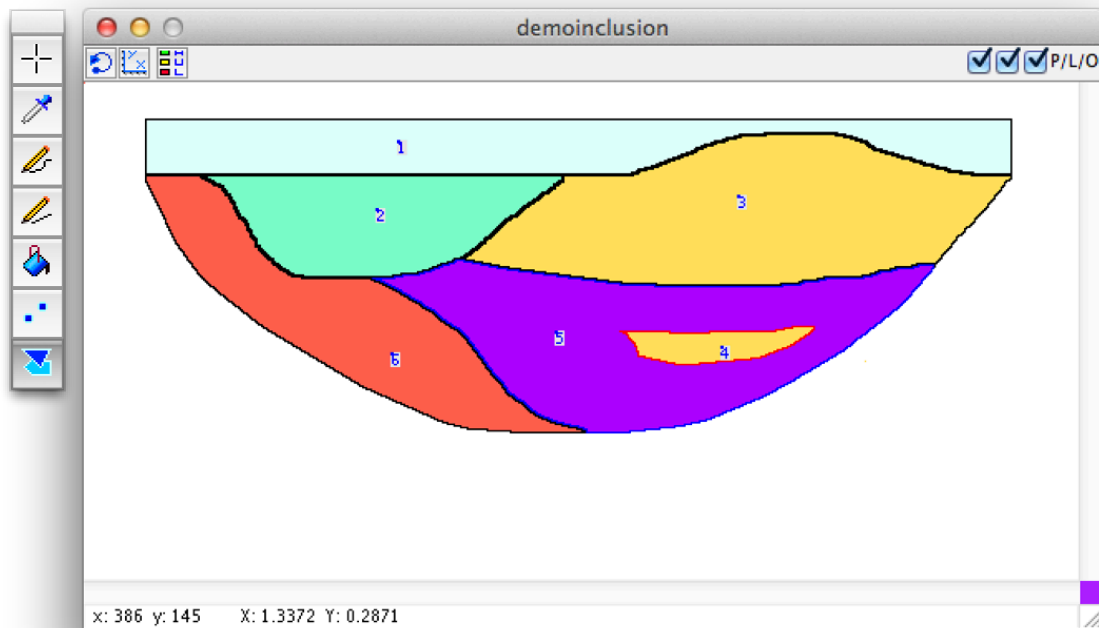
If a layer inclusion is present in the model, i.e. a layer completely surrounded by another one, it must be digitized after the surrounding layer, or it will not appear in the FD model generated by program pfdg13.out.



To be sure that a model with inclusions has been digitized properly, the overlay checkbox can be checked, so that the digitized polygons are plotted over the model. If the digitization order is correct, all the polygons will be plotted with black lines.

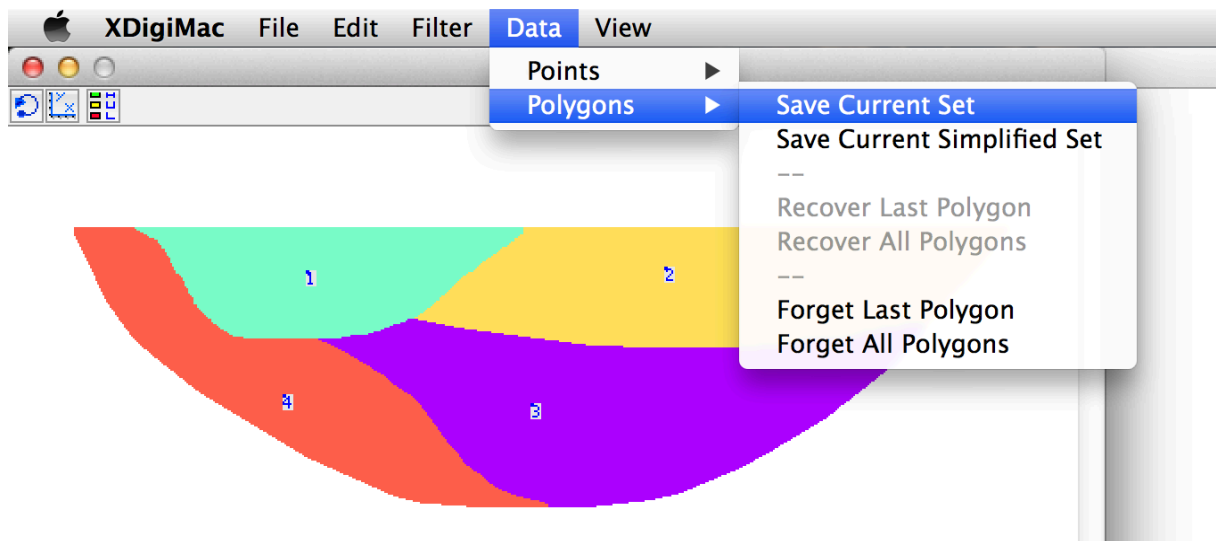


If the digitization order is wrong, the polygons that will be lost in the true FD model will be marked in red.



Saving the .pof file

After all the layers have been clicked, the file can be saved from the dedicated menu



and it is strongly suggested that the user explicitly assigns the extension .pof to the exported file. This is the file that will be passed to program pfdg13.out used in the configuration of the FD modelling experiment.

Never use the “Save Current Simplified Set” menu! It will produced a set of polygons that do not reproduce closely the drawn model!

From Google Earth to .pof

Here you will learn how Google Earth can help you in the preparation of an image representing a cross-section of the Earth along a selected profile. The image will be then imported into XDigiMac and digitized, so that wave propagation can be modelled with the hybrid technique based on modal summation and finite differences.

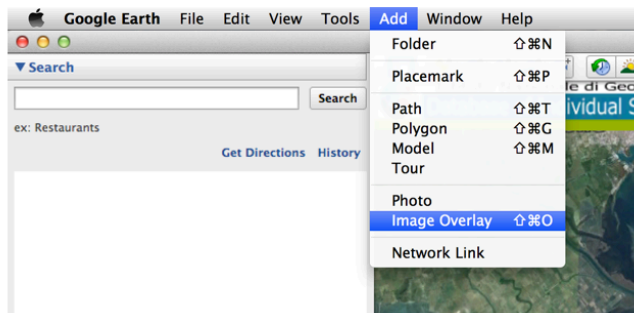
Changing the view in Google Earth

The most important keyboard shortcuts used in Google Earth to adjust the view are:

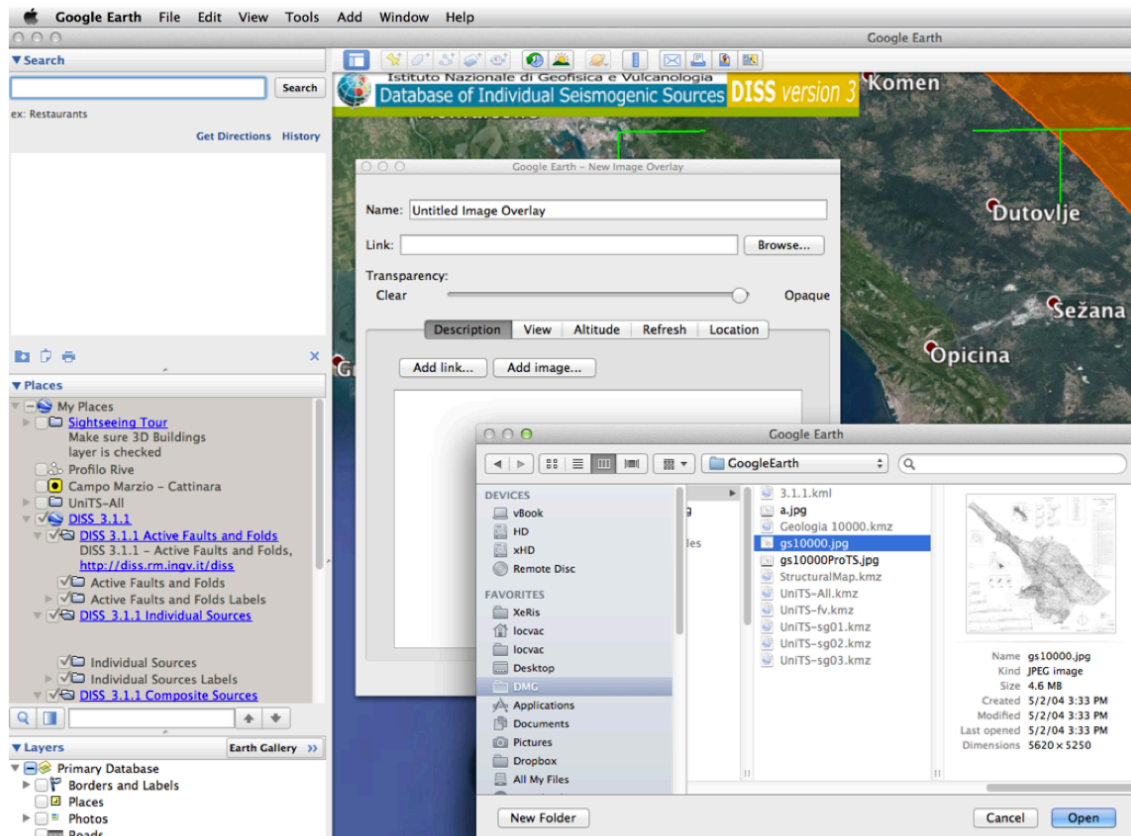
arrows	pan the view
shift-arrows	rotate/tilt the view
N (North)	orient the view to the North
U (Up)	view the area from above
+	zoom in
-	zoom out

Importing a geological map

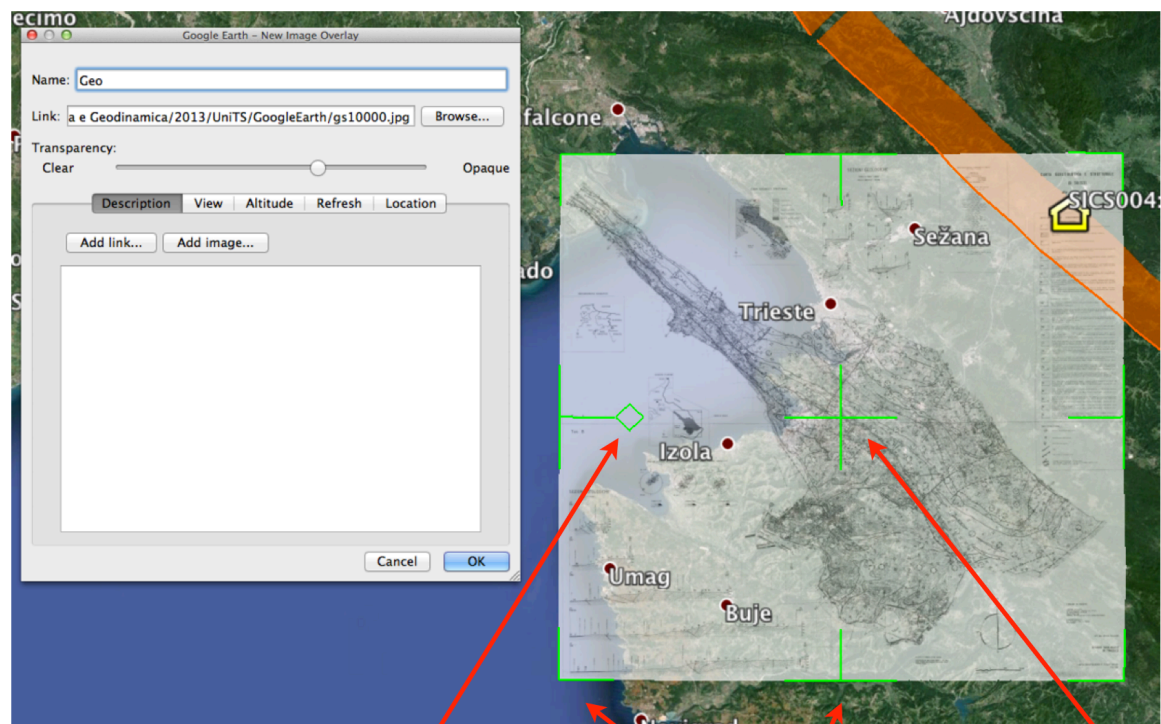
An image of a geological map can be imported into Google Earth in order to facilitate the drawing of the geological units along the profile that is being prepared. Select the Image Overlay tool from the Add Menu:



Click on the Browse button, and select the image file:



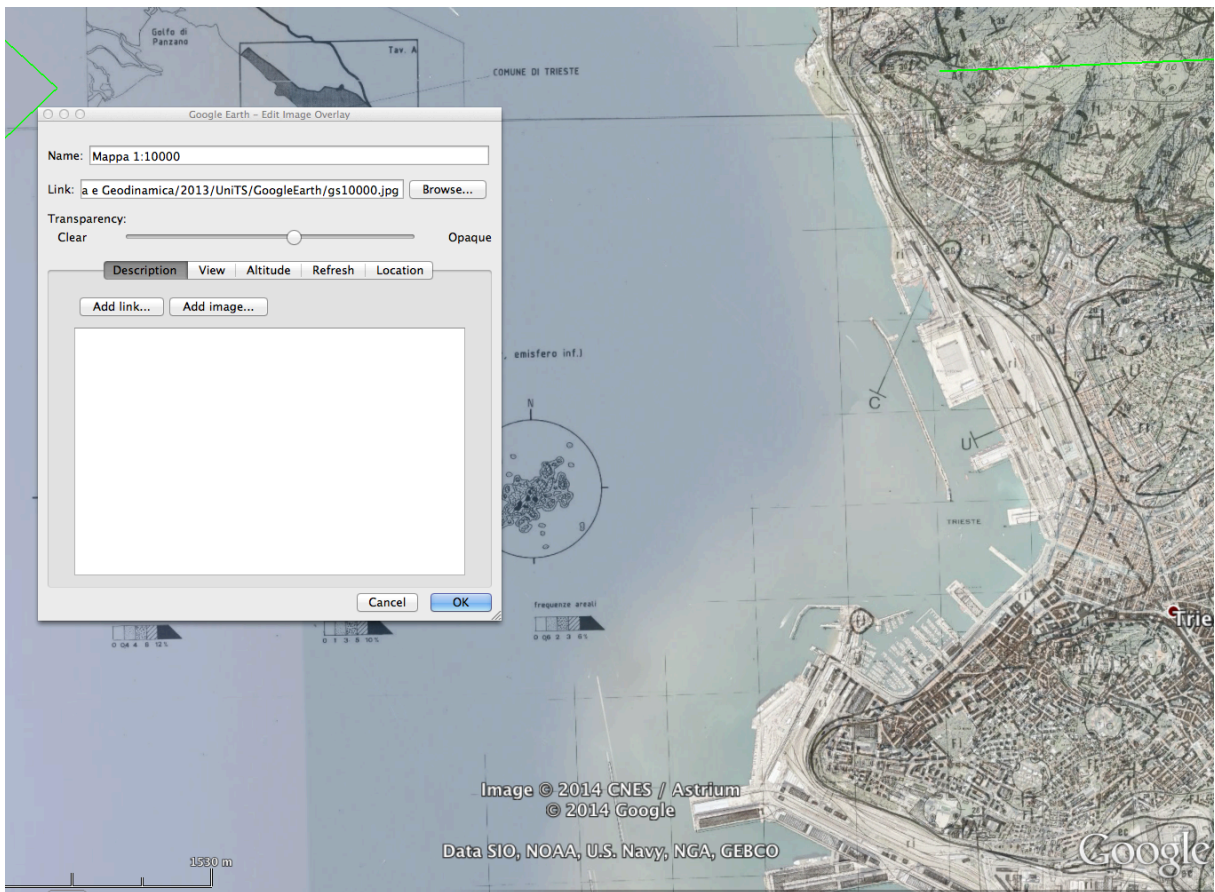
Adjust the image opacity and make it fit with the terrain, checking the correspondence of evident features in all the map areas:



Rotate

Resize

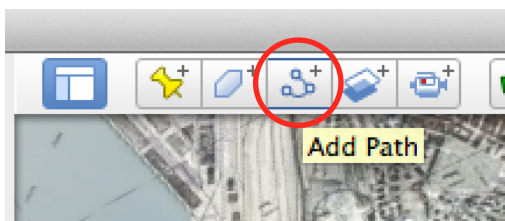
Drag



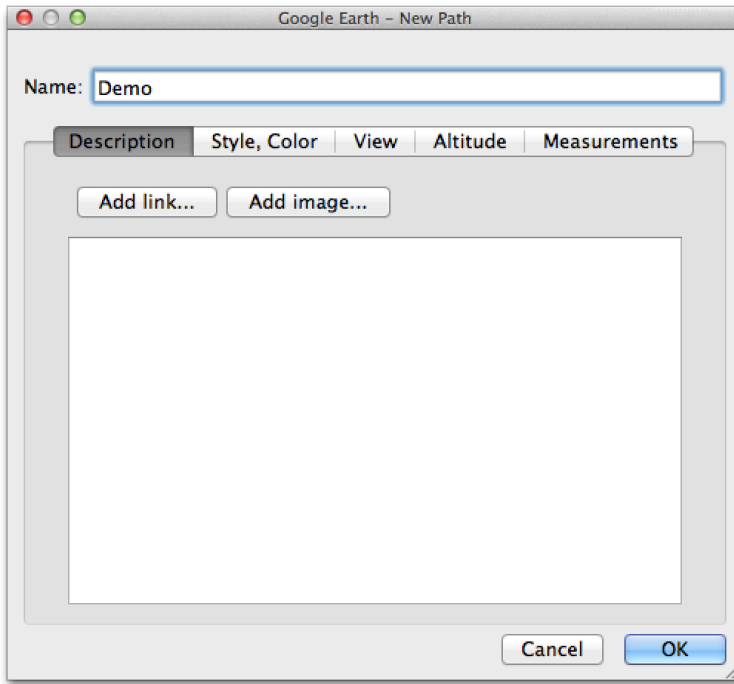
Save the image overlay! Move it outside of the Temporary Places or it will be lost when you quit Google Earth.

Tracing a profile

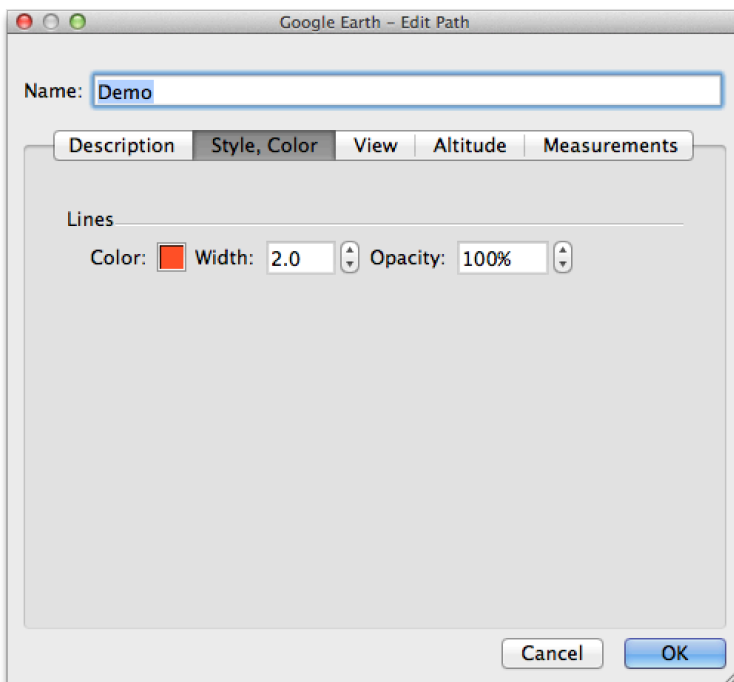
The path tool available in Google Earth (GE) can be used to trace a profile and get its altimetric profile. Select the Add Path tool from the toolbar



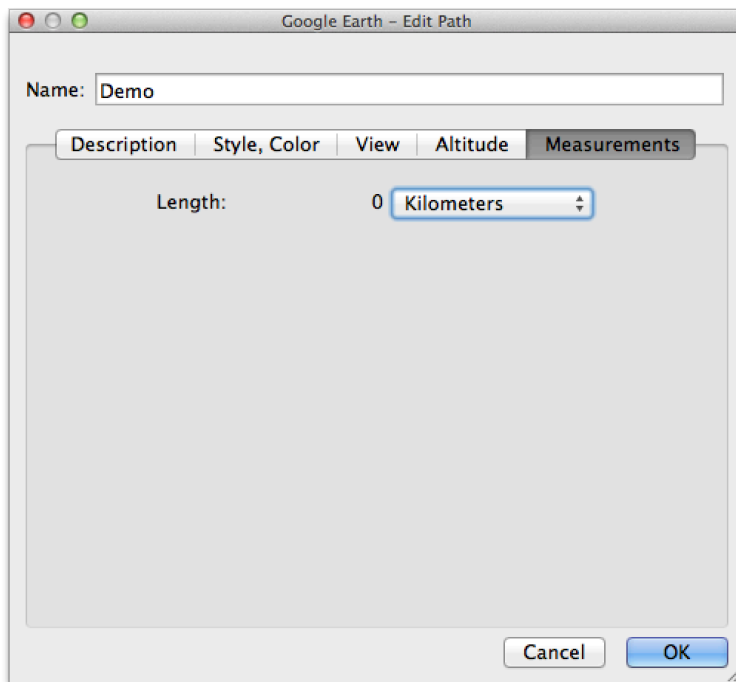
A Window will appear:



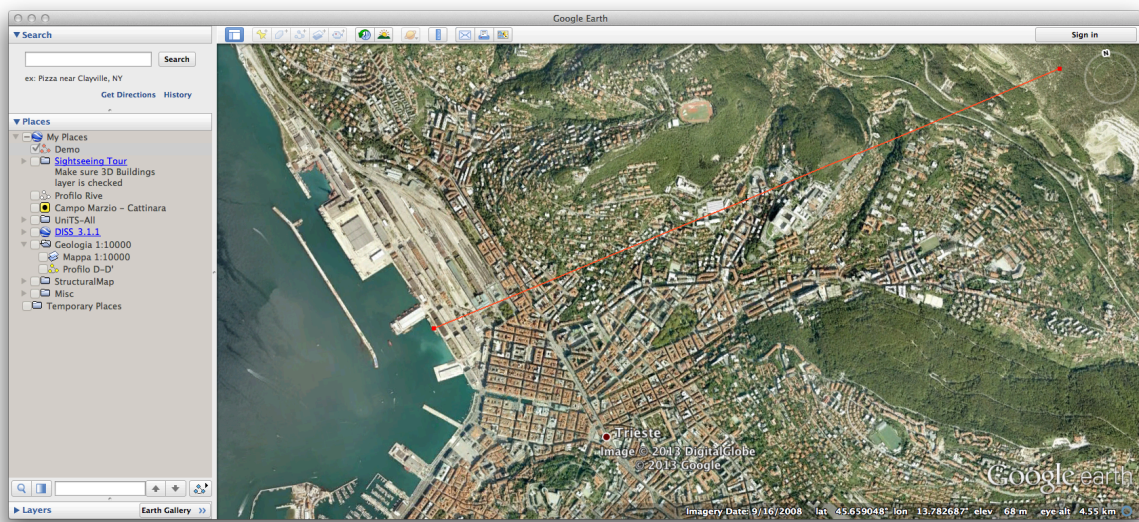
Type in the name to the profile (Demo in the example), modify the style to your wish



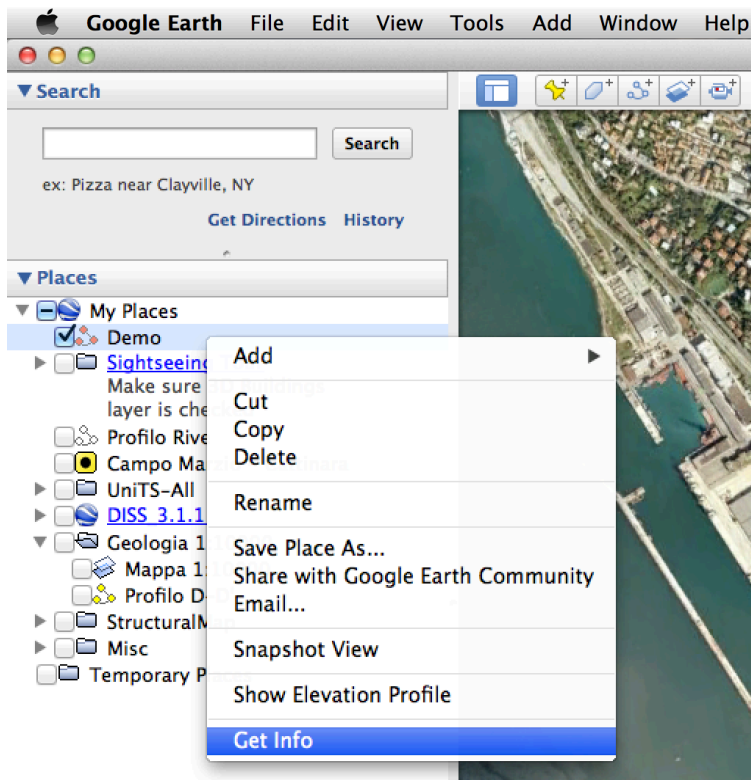
and adjust the measuring units to your wish.



and click onto the two extremes of the path you are interested in. In doing this, be careful not to drag the cursor around the map, or you will add in real time many points to the path. You need to have just two of them, marking the two extremes of the profile! If you happen to add unwanted points to the path, you can delete them by ctrl-clicking the unneeded points.

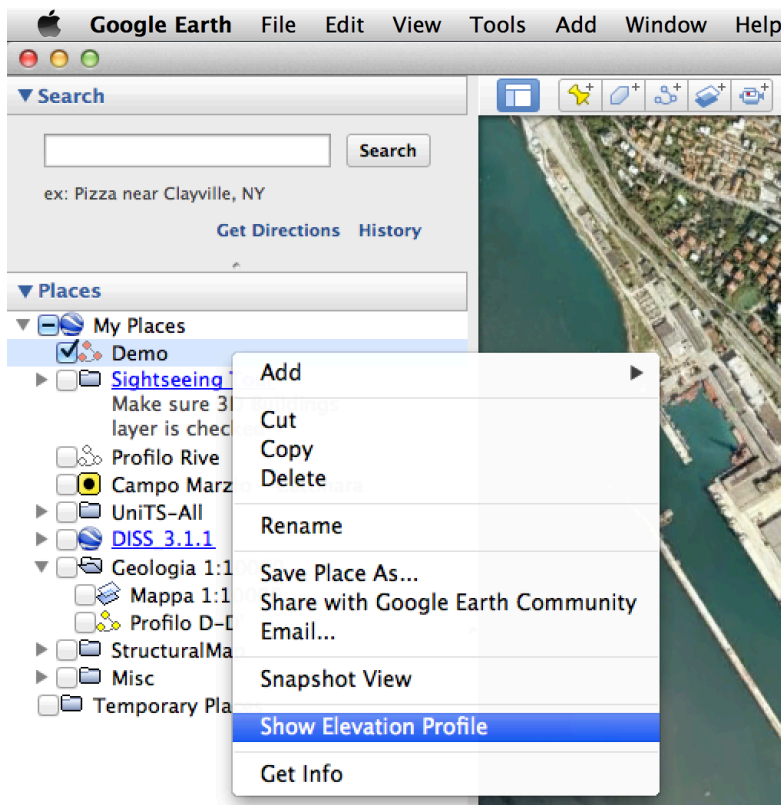


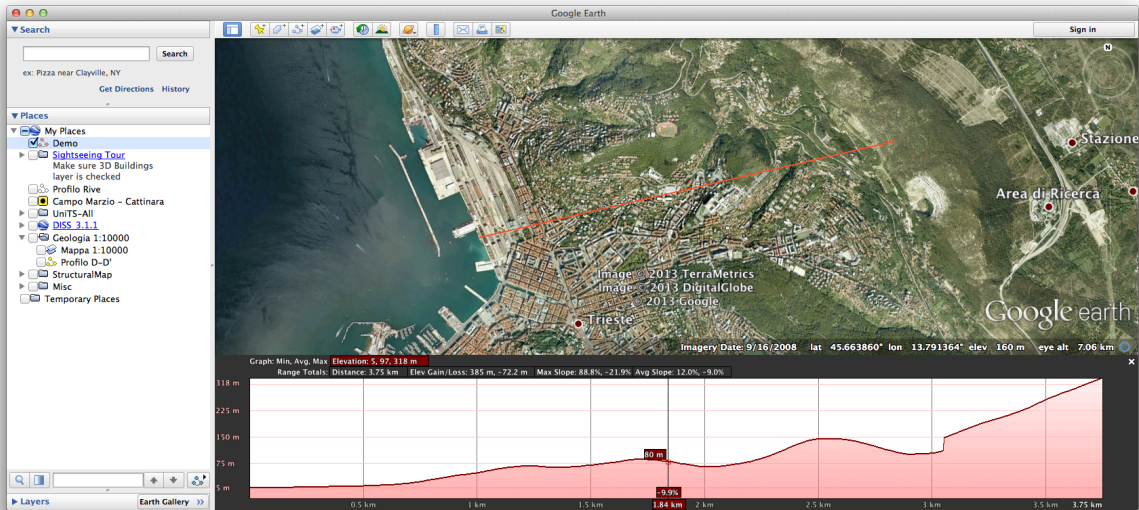
After the profile has been defined, close the "Edit Path" dialog. You can open it again by ctrl-clicking the item in the GE sidebar, and selecting the "Get Info" menu item:



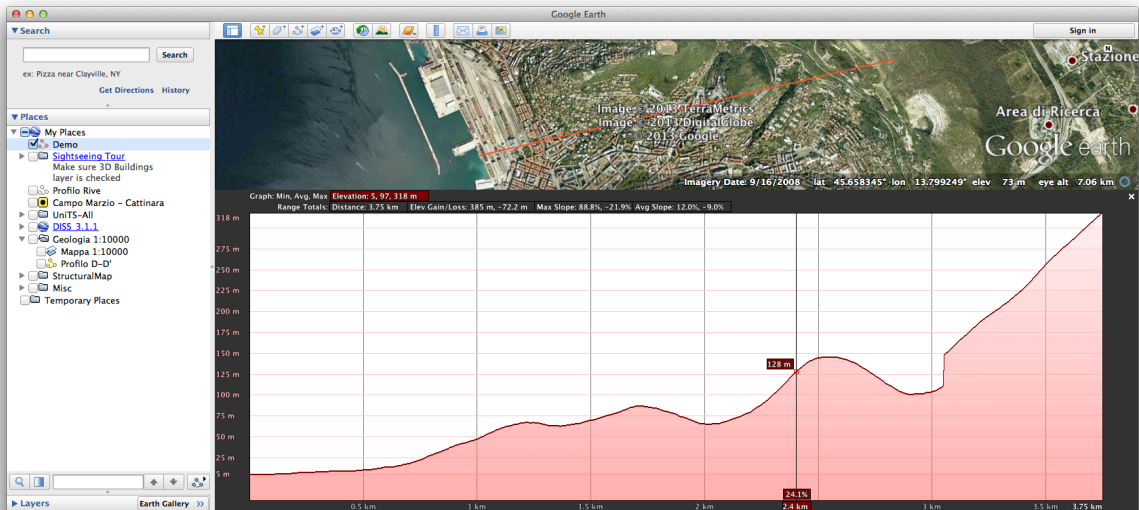
Getting the elevation profile

To visualize the elevation profile along the traced path, ctrl-click on the path in the GE sidebar, and select the “Show Elevation Profile” menu item:

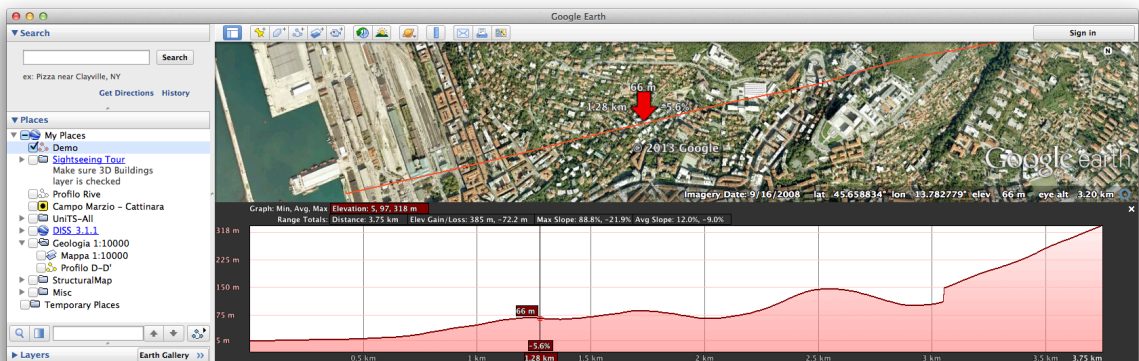




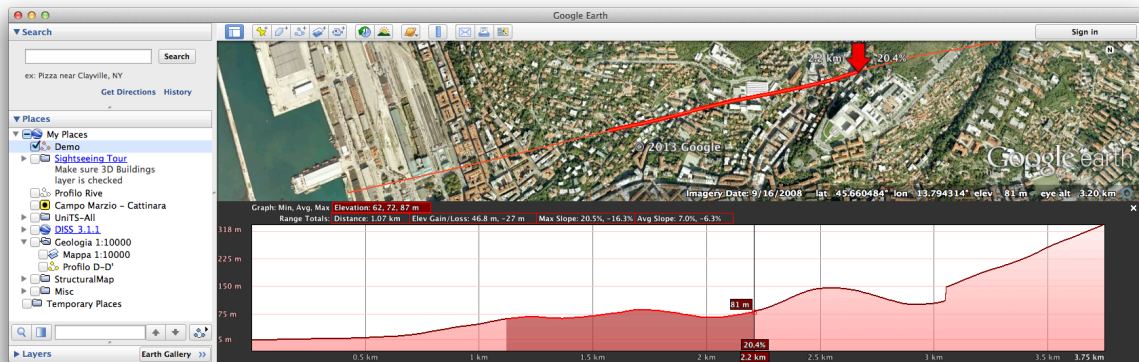
The profile will appear in the lower part of the screen. The size of its frame can be adjusted by dragging up or down the frame's upper bound



Moving the cursor along the elevation profile, an arrow appears on the map, indicating the corresponding position, the elevation and the distances from the profile extremes:

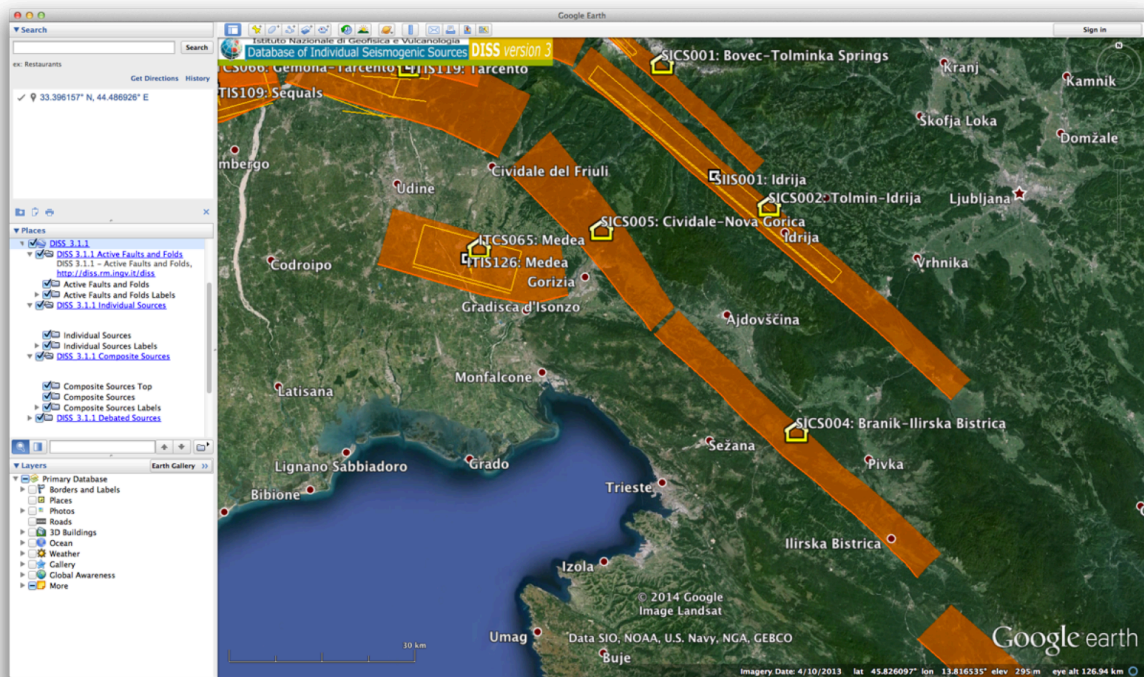


By dragging a selection along the elevation profile, the corresponding part will be evidenced in the map, and some info shown about the selected range will be shown

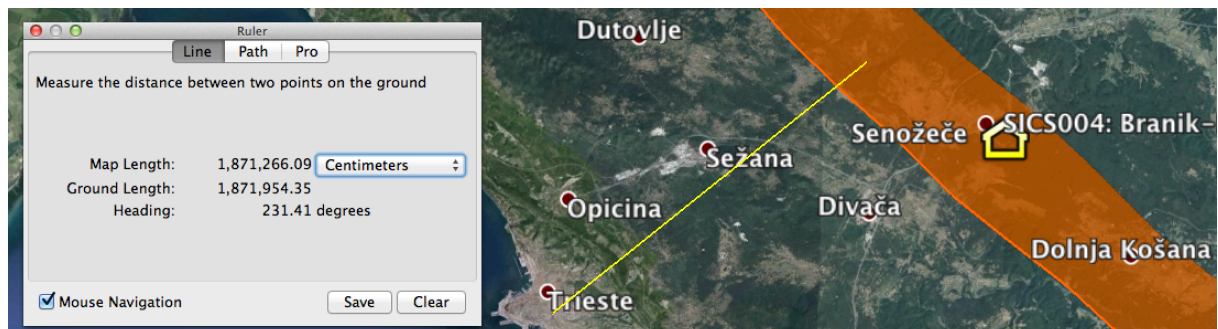


Checking for active sources

For Italy, the Database of Individual Seismogenic Sources (DISS) can be loaded into Google Earth starting from the link <http://diss.rm.ingv.it/diss>.

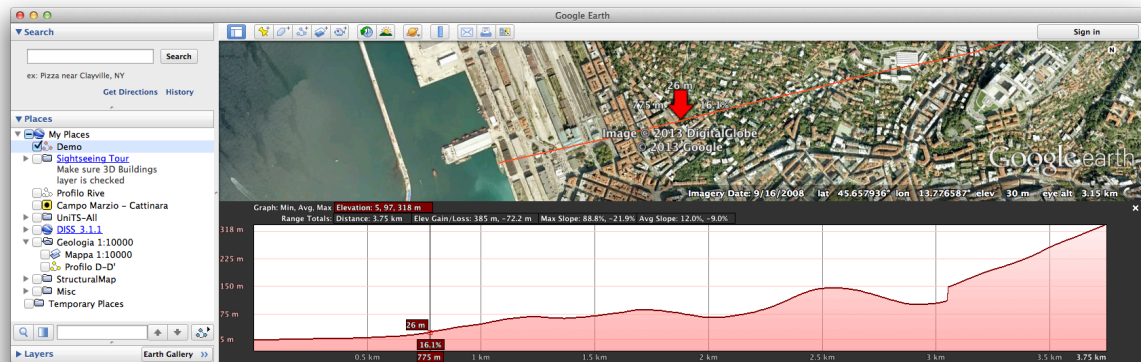


Then the azimuth of the profile, and the strike-receiver angle, can be measured in Google Earth using the ruler tool:



Bringing the elevation profile into XDigiMac

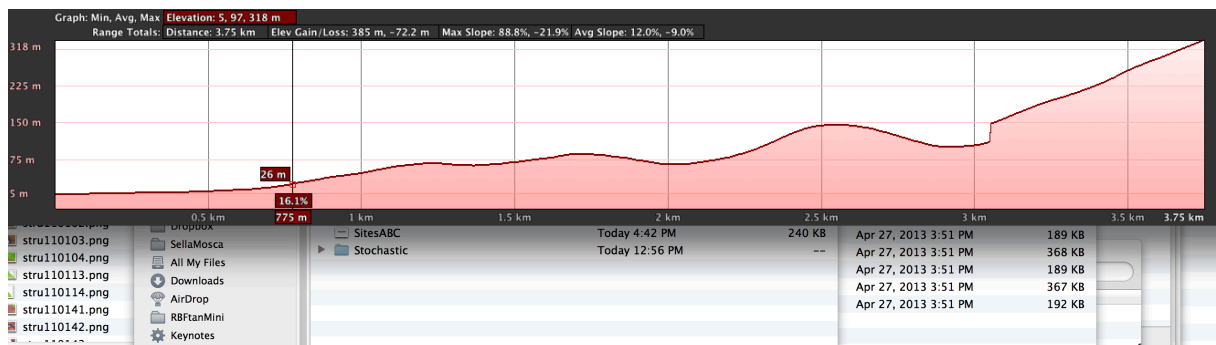
Once the elevation profile is shown in GE, a screenshot of that part of the screen can be taken. Before taking the screenshot, be sure to have the altitude marker along the elevation profile in such a position that its label do not cover any portion of the free surface. For instance



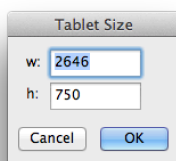
Then you can:

- press cmd-ctrl-shift-4 (the cursor will change to a cross)
- drag a selection around the area with the cross-section, including labels along x and z directions

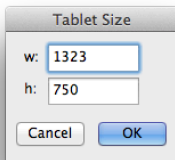
The above operation will put into the clipboard the selected area of the screen. Note that since we are interested in defining the properties of the profile at depth, it is usually recommended to take the screenshot of an area extended below the profile, even if it generally includes other elements unrelated with the profile.



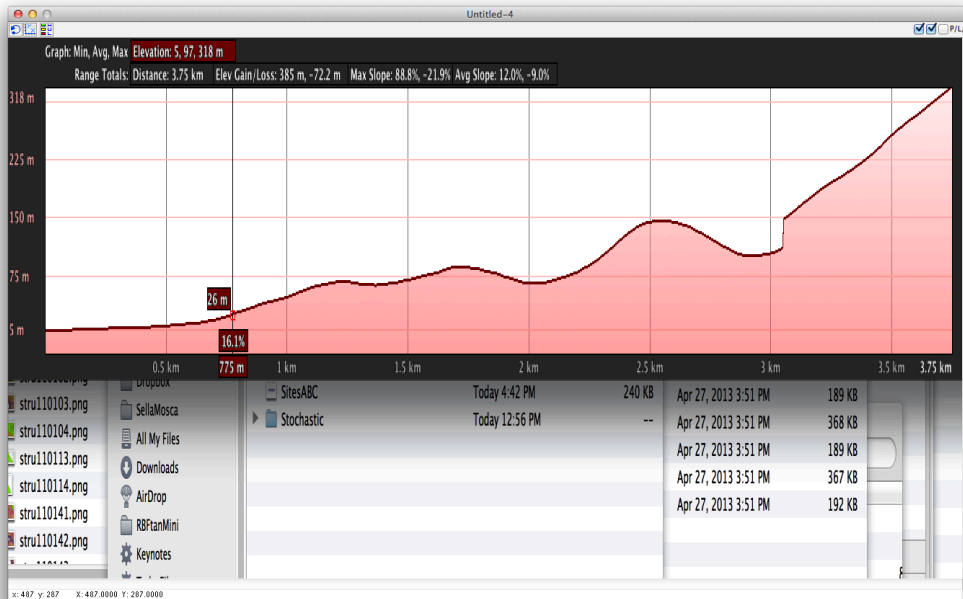
You can then launch XDigiMac and ask for a new Tablet (cmd-N). The proposed size will correspond to the size of the screenshot taken.



You can reduce the tablet size if you wish, this is usually done for the x direction:



After the new, empty Tablet opens, you can paste the clipboard content into it. If you have modified the Tablet size, the picture will be resized to fit the Tablet size



Temporary Tablet calibration

It is convenient at this point to calibrate the Tablet using the same reference system provided by GE. Therefore, using the calibration tool

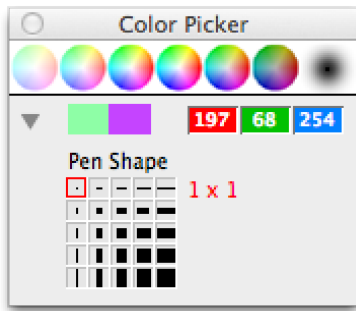


the user should click on the leftmost point of the profile and provide coordinates (0., 0.005) in km, and then on the right edge of the profile, at the max elevation, i.e. coordinates (3.75, 0.318) km.

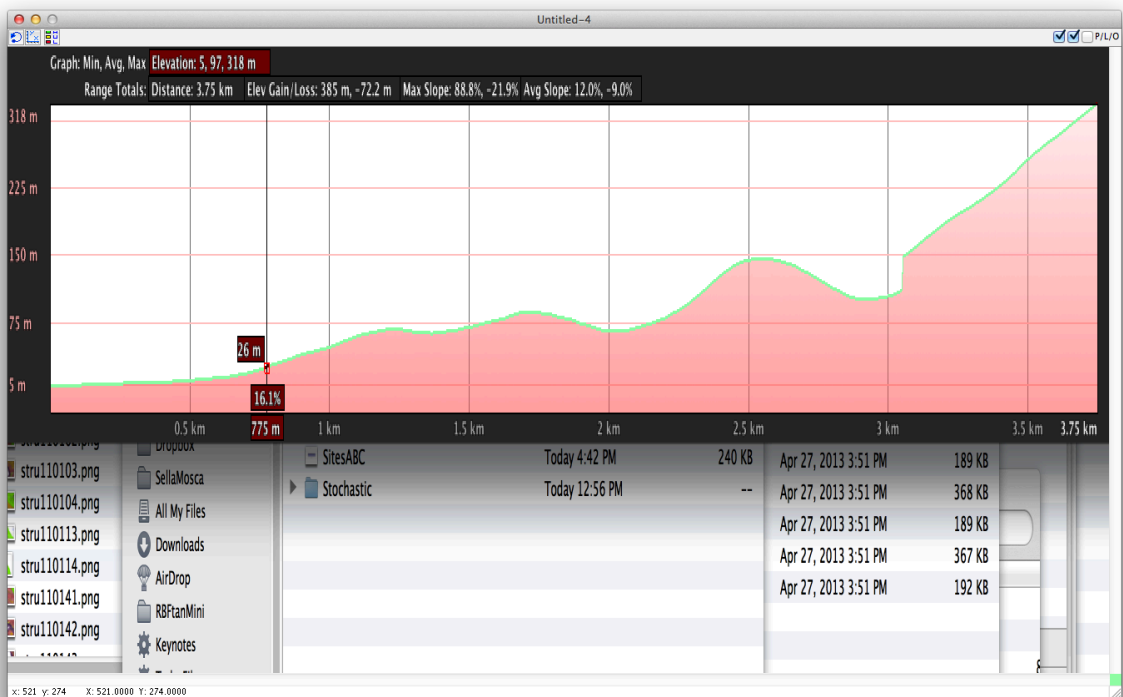
Delineation of the profile

Now the perimeter of the profile must be traced, in a proper contrasting color. A bright green might be a good choice.

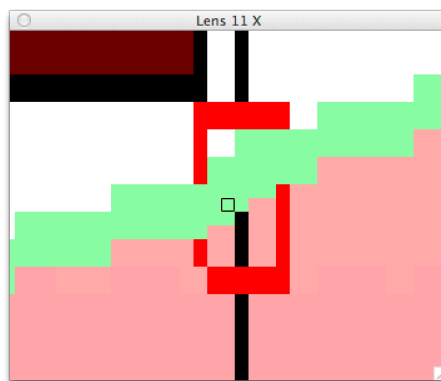
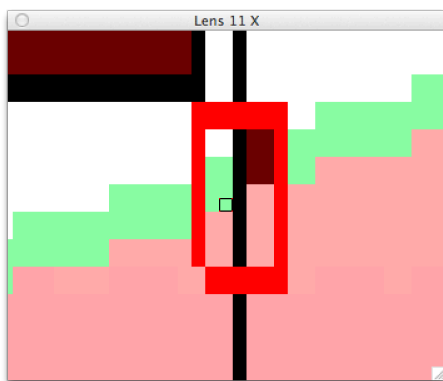
To begin with, the color must be selected in the color picker



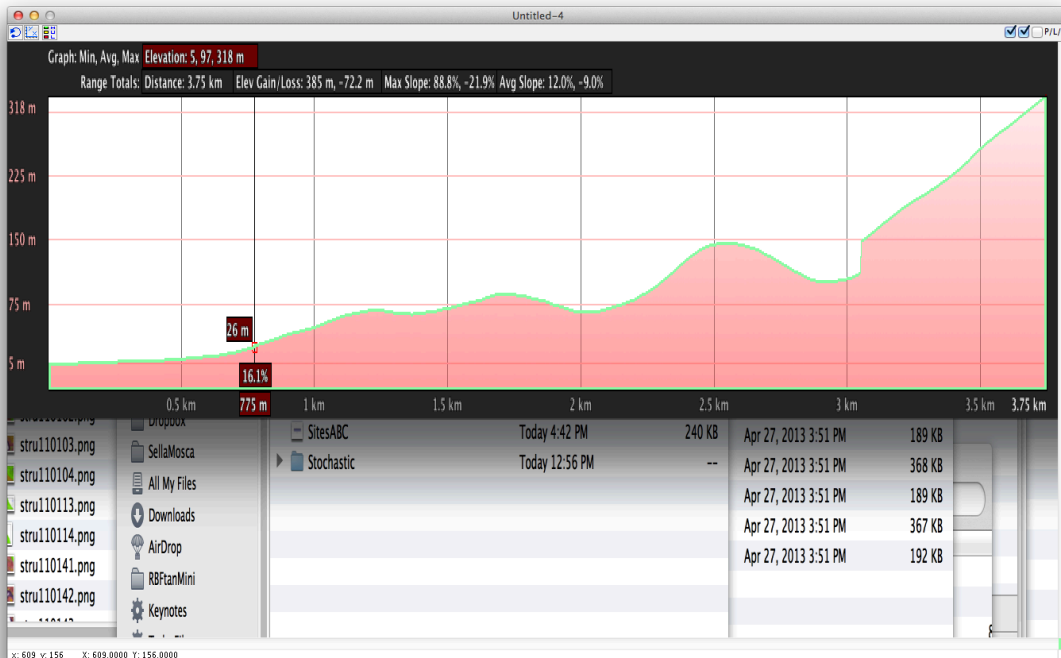
Then the fill tool should be selected, and used to click on the thick brown line delineating the elevation profile. More than one click might be necessary if the brown area is not continuous. Typically this happens where the position marker is present along the profile, but other interruptions might be present. By doing this, we should get the brown replaced by the green along the free surface of the profile.



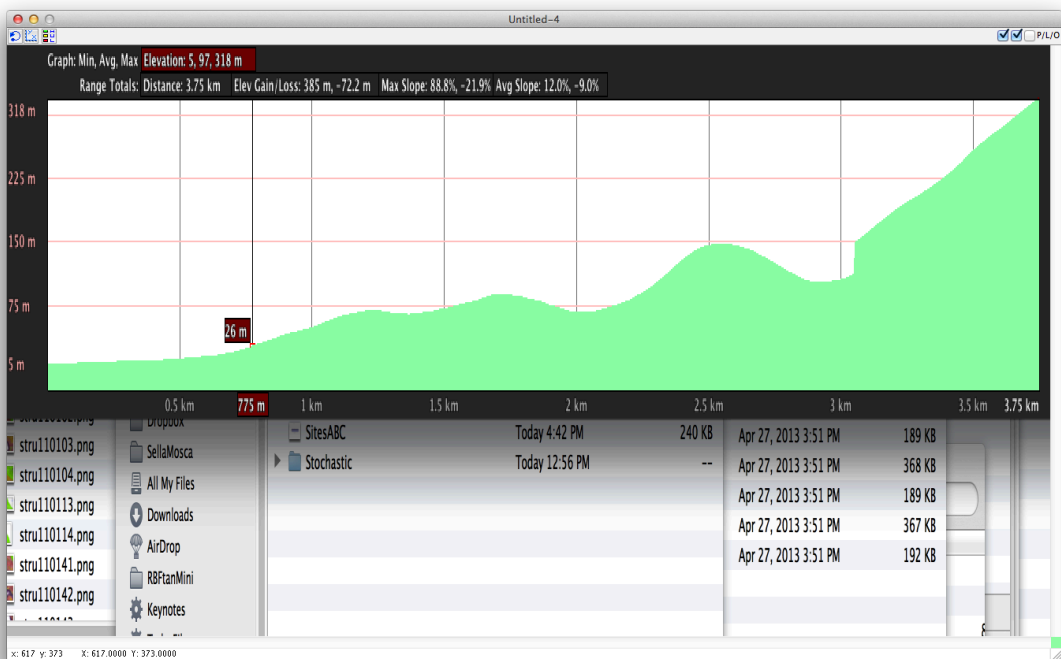
The line should be edited wherever it is not continuous, using the line and/or the fill tool:



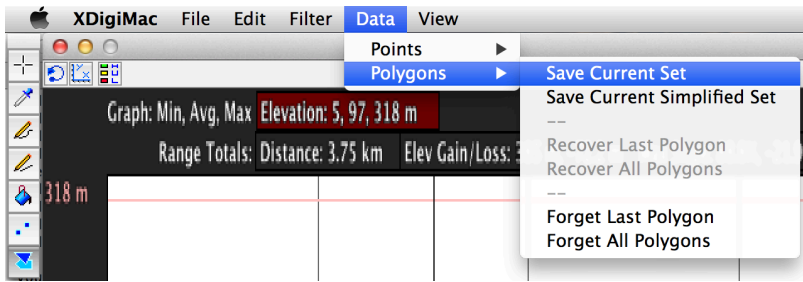
Then with the same green color the other three sides of the profile should be traced, using the straight “line draw” tool (L). Lines should be drawn while keeping the “shift” key pressed, to ensure that they are drawn perfectly vertical and horizontal. A line thickness of “3” is suggested. It can be selected in the Color Picker, or by simply typing the “3” character on the keyboard. Pixel precision is required for all the drawing operations, so the use of the Lens is compulsory.



Once the perimeter of the profile has been fully traced with the green color, the Fill tool can be used to paint in green all the elements inside the profile itself. This can be done by shift-clicking anywhere inside the polygon. The operation can be performed only if the perimeter is continuous, and only if the color used for the fill matches the color of the perimeter (RGB matching, that is the red, green and blue components).

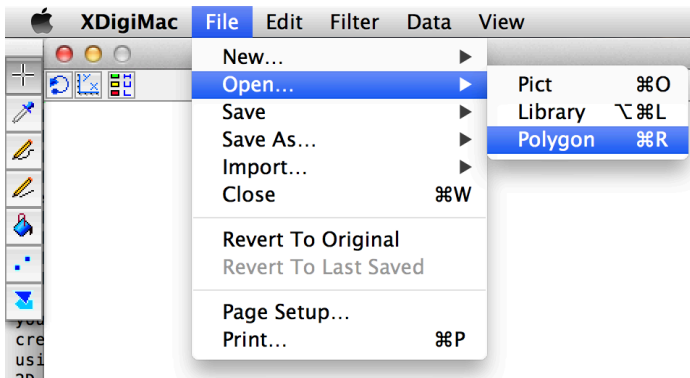


At this point, the Polygon Digitization tool can be used to digitize the profile: just click inside the green area. The digitized polygon must then be saved by selecting "Save Current Set" from the "Polygons" sub-menu of the "Data" menu:

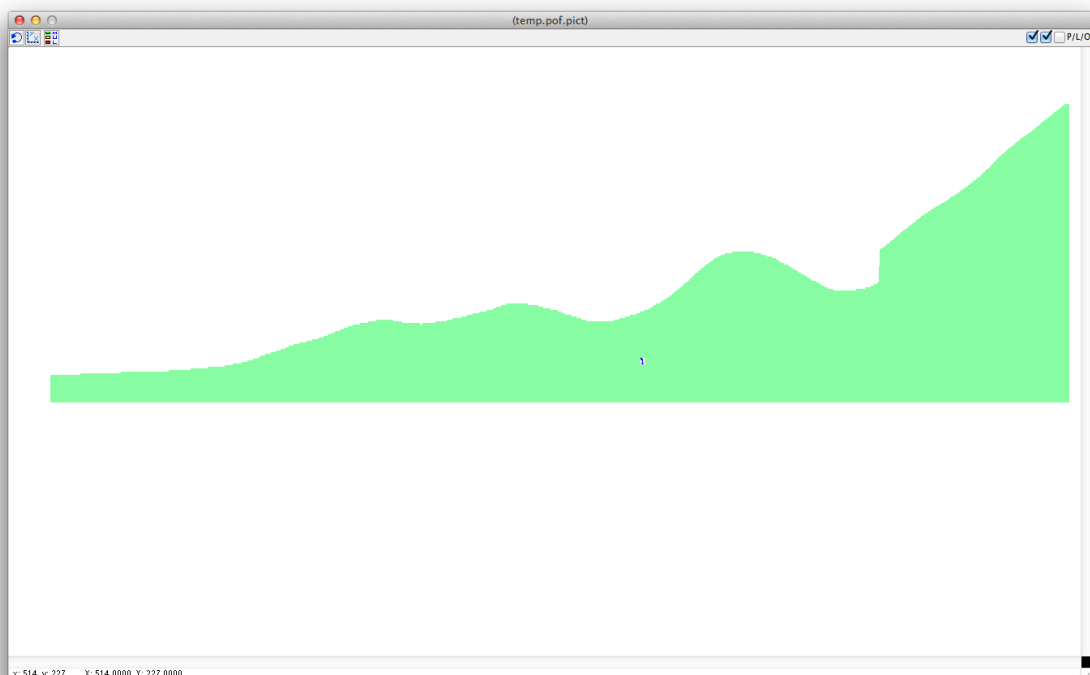


The file should be named temp.pof as it is just a temporary file. It should then be read in a new Tablet. Doing this will end up in a perfectly clean colored profile, on which the different layers can be drawn with properly contrasting colors.

To read the temp.pof file into a new Tablet, use the dedicated sub-menu

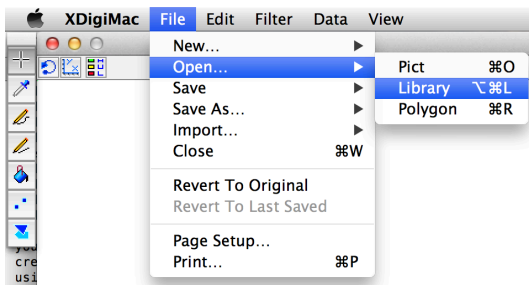


or use the keyboard equivalent cmd-R. This will open a New tablet as seen below.

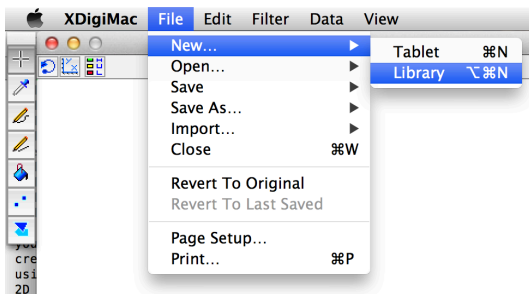


Drawing of the geological units

The process of drawing the geological units starts with the definition of a library, where the rock properties should be defined. You can use an existing library



or you can define a new one and then define the properties

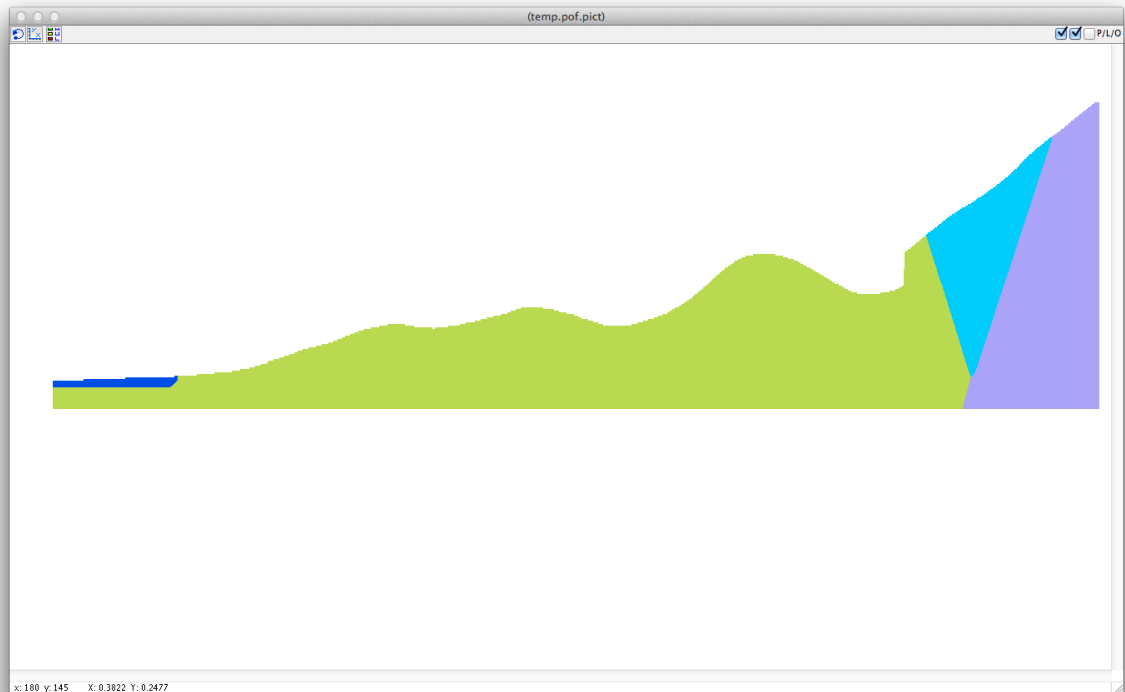
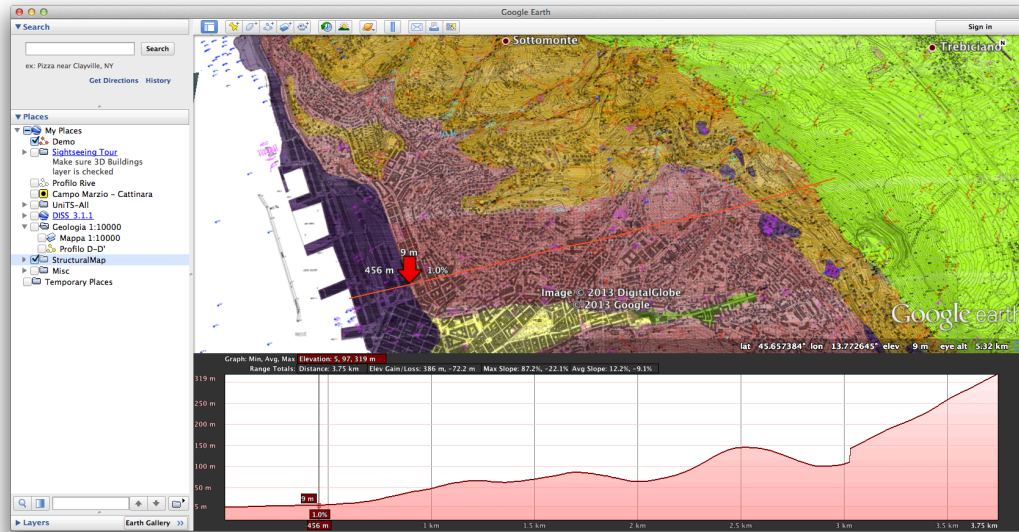


Either way, you should end up with something like this

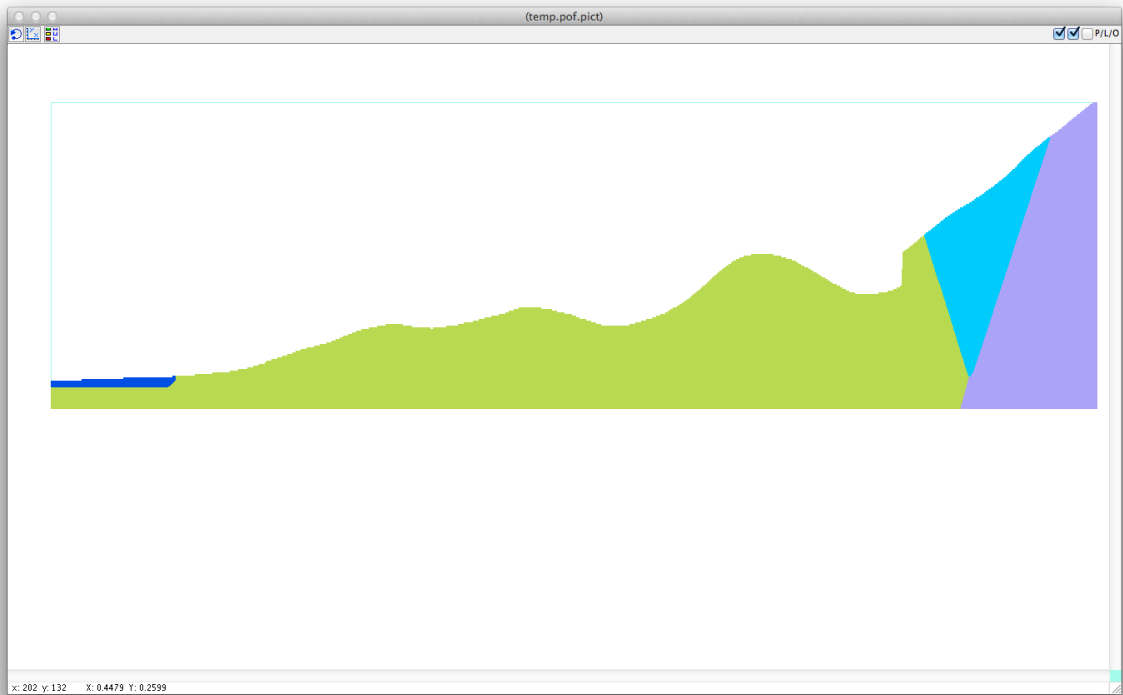


Color	Descr.	Rho	Vp	Qp	Vs	Qs
[Blue]	Aria	0.000	0.000	0.000	0.000	0.000
[Orange]	Riporti	1.800	0.420	30.000	0.200	15.000
[Yellow]	Sed. marini	1.900	0.740	40.000	0.370	20.000
[Green]	Alluvioni	1.950	1.000	40.000	0.500	20.000
[Light Green]	Flysch	2.000	1.800	100.000	1.000	50.000
[Dark Green]	Marne	2.000	1.900	200.000	1.100	100.000
[Light Blue]	Arenarie	2.100	2.000	200.000	1.200	100.000
[Purple]	Calcarì	2.300	2.500	200.000	1.400	100.000
[Teal]	Flyschprof	2.400	3.600	200.000	2.000	100.000

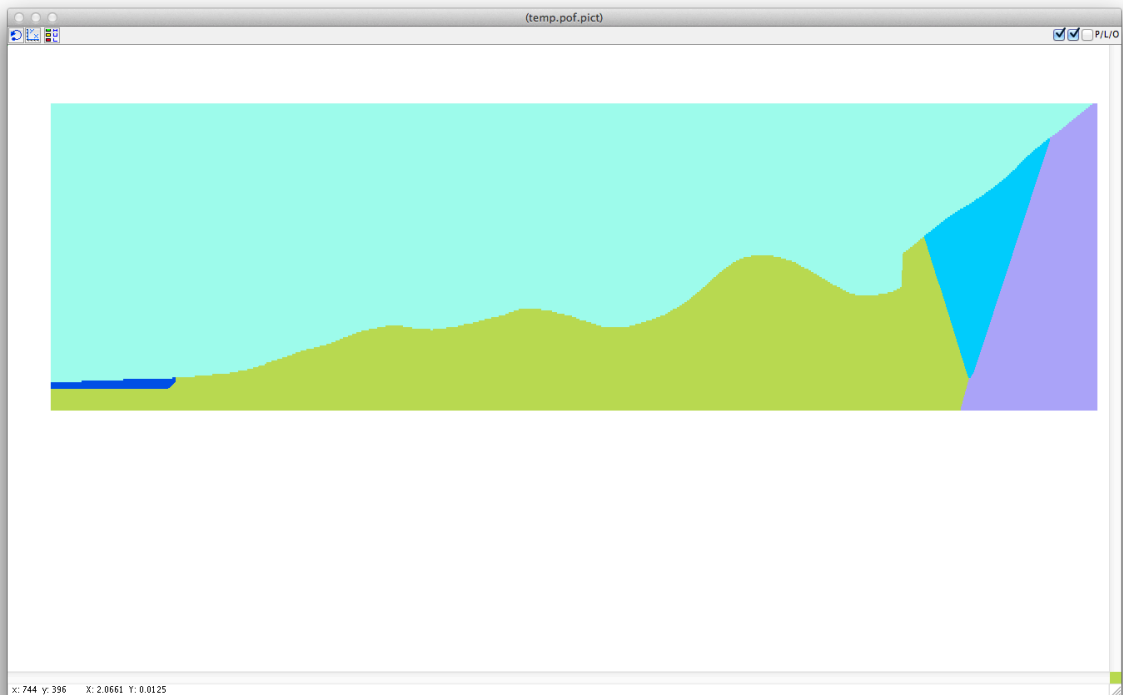
where different contrasting colors are associated to the rocks and sediments. If a geological map is conveniently overlaid in GE, it's easy to read in GE the distance from the beginning of the profile where there is a geologic transition, and draw that transition in XDigMac taking advantage of the calibrated Tablet.



At this point, the Air “layer” can be drawn, that will take care of the topography definition in the FD part. At first its perimeter has to be drawn using the Line tool, with line thickness of “1”, to complete the rectangular box model, again keeping the shift key press while drawing the lines.



Then the Fill tool can be used to complete the drawing:



Recalibrating the tablet

Now the Tablet should be re-calibrated, as the programs for the computations of the synthetic seismograms require the z-axis to be positive downward, and the x-axis positive in the direction of increasing distance from the source.

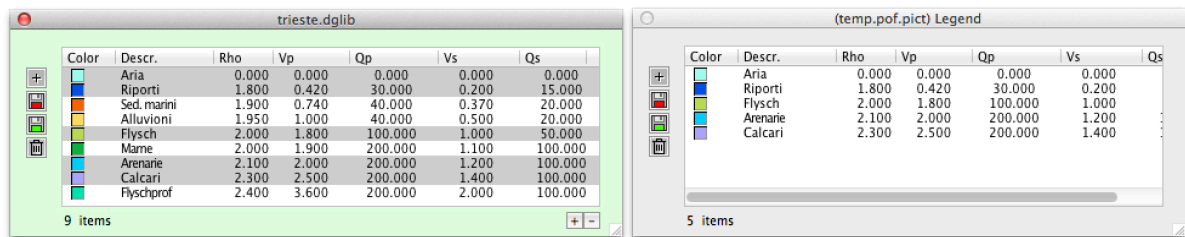
Supposing that the source is placed to the right of the model drawn, using the calibration tool



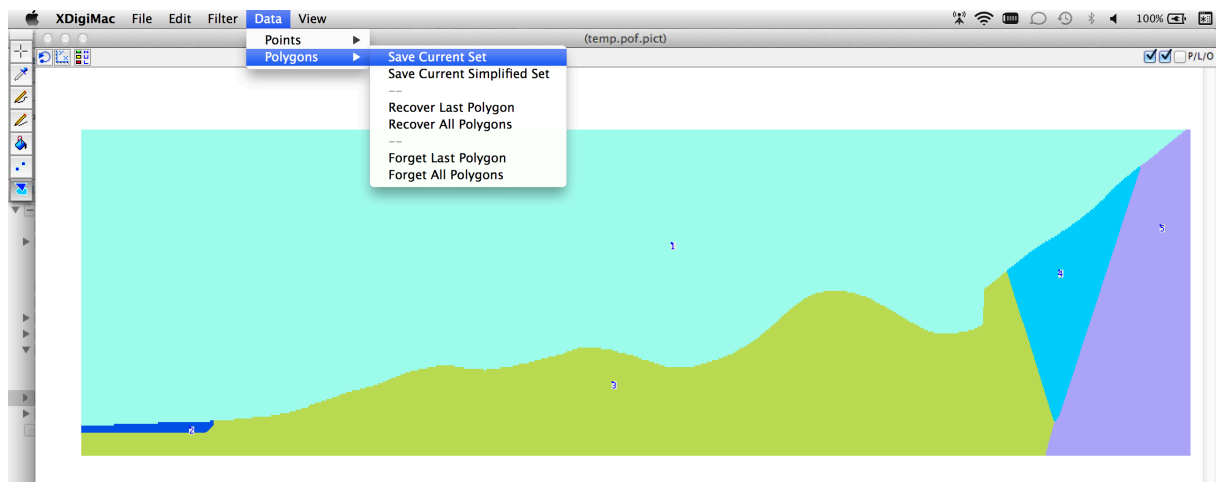
we should change the coordinates associated with the two calibration points selected before. Therefore, the user should click on the leftmost point of the profile and provide coordinates (3.75, 0.313), and then on the right edge of the profile, at the max elevation, assigning coordinates (0, 0) km. The z-value 0.313 is obtained subtracting 0.005 from 0.318, i.e. the two heights used in the temporary calibration. This calibration will force XDigiMac to forget the polygon read from file temp.pof.

Digitization of the model

With the tablet properly calibrated, and all the geological units drawn, the user can digitize the model. The first step is to drag the required units from the Library to the Tablet Legend:

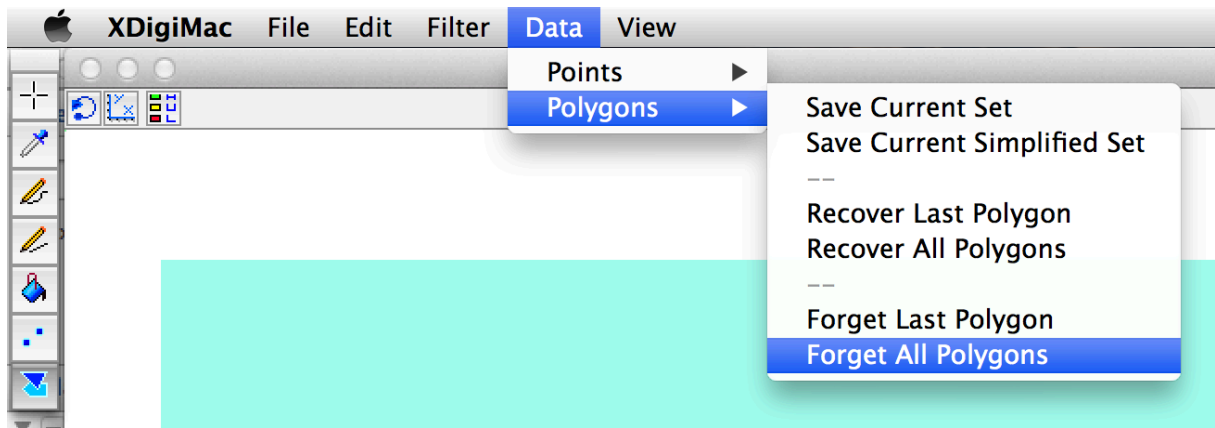


Then the user should click with the Polygon Digitizer tool inside each colored polygon in the Tablet. The "Air" layer should be digitized first, then all the other layers. The polygons can be saved with a proper name, using extension .pof to better qualify its content.

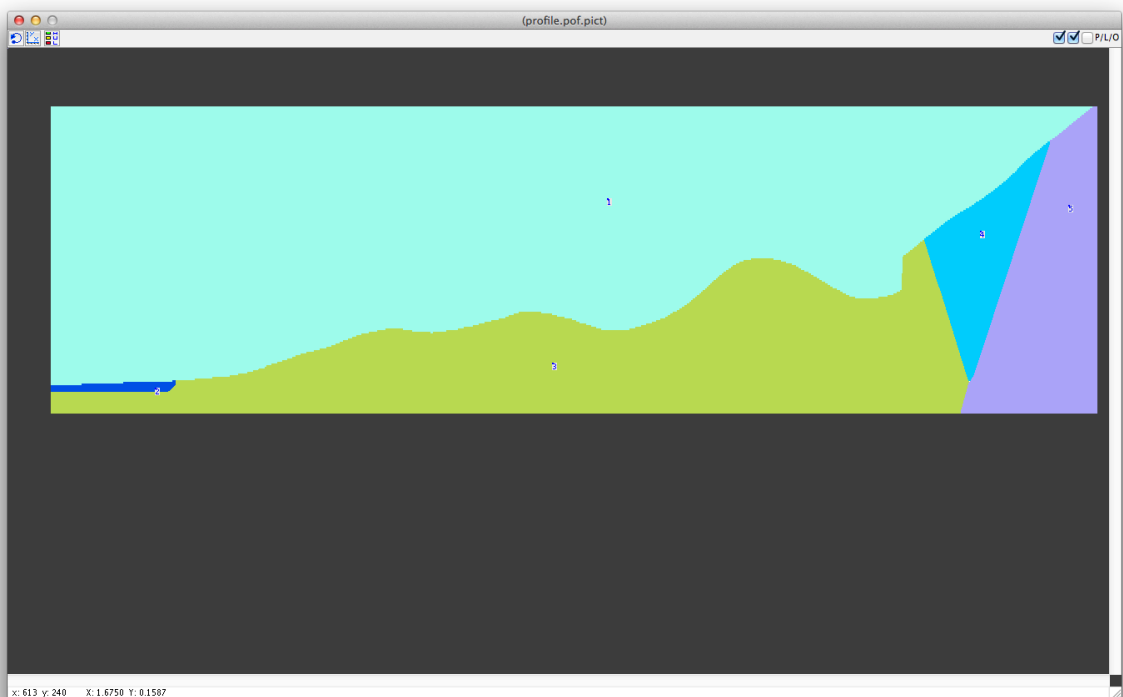


Checking for spurious pixels inside the model

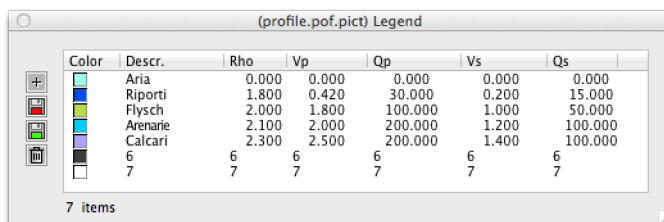
To check for a proper digitization of the model, the user should open again the .pof file just saved, and should check for the existence of spurious white pixels mistakenly left at the transitions between different geological units. This should be done manually, by moving the cursor along the discontinuities while checking the Lens palette. Eventual mistakes should be corrected with the usual drawing tools, removing the white pixels and digitizing the model again. Before the re-digitization of the polygons, the old ones should be forgotten:



A final check is suggested: use the Fill tool to add a dark color around the model



Then the “Auto-legend” button should be pressed. If a white element appears in the Legend, besides the new dark color element, then still at least one white pixel is present inside the model, and should be found and eliminated. It is most probably located along the transitions between the units, but not necessarily so.



Only when all the white pixels have been eliminated, the .pof file saved can be considered correct, and can be used for the FD computations.