

RockMod

RockMod is a rock properties plugin tool that allows you to compare magnetic, remanence and density properties in a range of standard rock property charts. ModelVision inversion produces compact rock properties that are much closer to the bulk rock properties of geological formations than can be obtained from unconstrained voxel inversions. This means that you can make geological inferences from your inversion data that will help you prioritise targets for further investigation.

Note: magnetic and gravity properties recovered by inversion will be close to the bulk rock properties, as long as the lateral dimensions are greater than or equal to the top depth below the sensor. If this criterion is not met, then the bulk properties for density and magnetic susceptibility will be underestimated. If you have estimates elsewhere for the properties, then you can use this information to re-invert the data to establish a probable thickness for a formation.

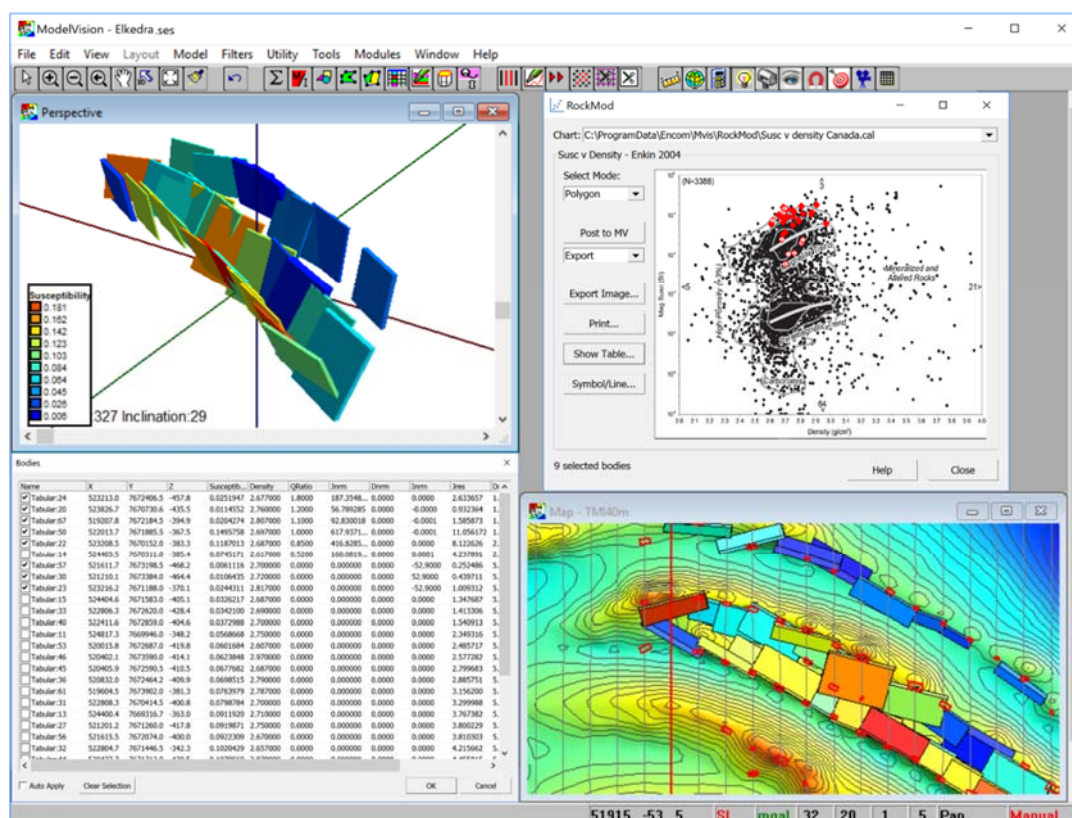
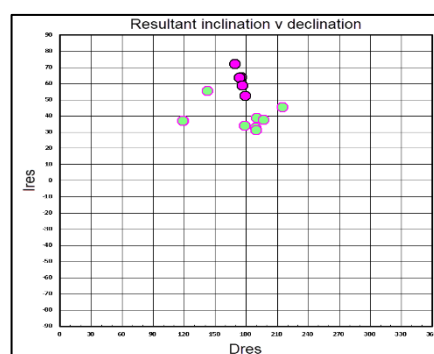


Figure 1: The RockMod dialog showing model representations as symbols in a susceptibility versus density plot (Enkin et al., 2020) and table format in a ModelVision session with other supporting display windows.

If you have spatially located lab data, import it to a Point Data Set using the General ASCII Import feature (csv). Then, convert the physical property point data to ModelVision bodies using the **Model>Import>Bodies from Points** menu option. This will convert the lab measurement to tabular pseudo-bodies that will behave in the same way as normal ModelVision bodies. The magnetic, remanence and density properties will then be available for use in RockMod.

RockMod is installed with a range of useful chart styles for magnetic, remanence and density properties. The chart images are associated with a companion calibration file that locates the graph section, determines the axis style (log/linear), property ranges, units and chart authorship. RockMod provides tools to select, query, list and control the display of the body properties. Selections can be sent back to ModelVision so that you can see your chart selection in a ModelVision map view.

RockMod Interface

Open RockMod from the **RockMod** option in the **Tools** menu. The dialog contains an interactive chart area where body property symbols are displayed along with a set of controls down the left-hand side. The last chart you used will automatically appear in the chart area, posted with the current model data from ModelVision. Use the pull-down **Chart** list to change the style and rock property combinations.

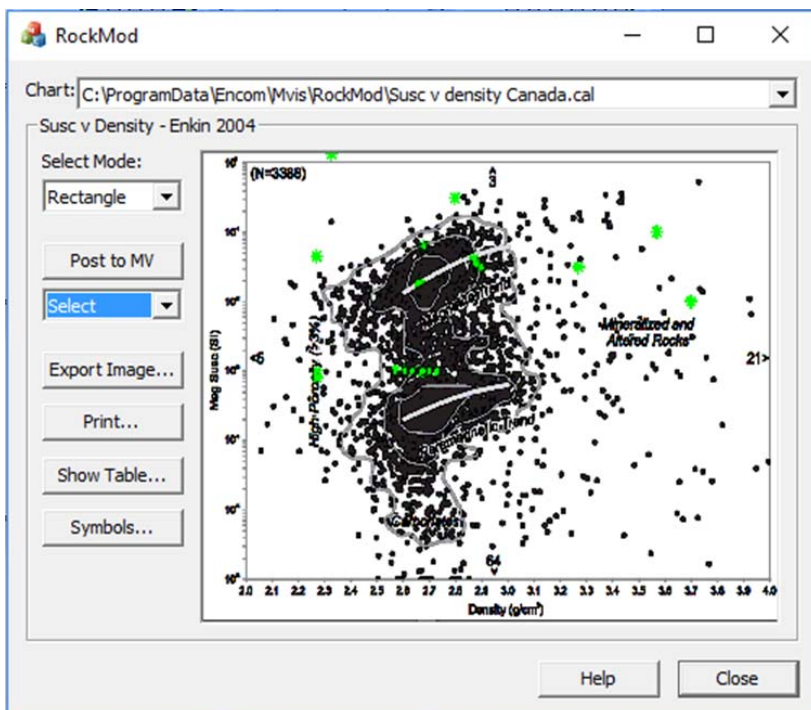


Figure 2: The RockMod dialog showing model representations as symbols in a susceptibility versus density plot (Enkin et al., 2020).

Symbols: This button opens a secondary dialog allowing the appearance of the plots representing the modelled bodies to be edited. Select a symbol type from the graphical area and then change the **Line colour** and thickness of the surrounding line and **Fill colour** of the symbol.

Use a different line and fill colour for the **Selected Symbol** to differentiate your current selection from the rest of the symbols.

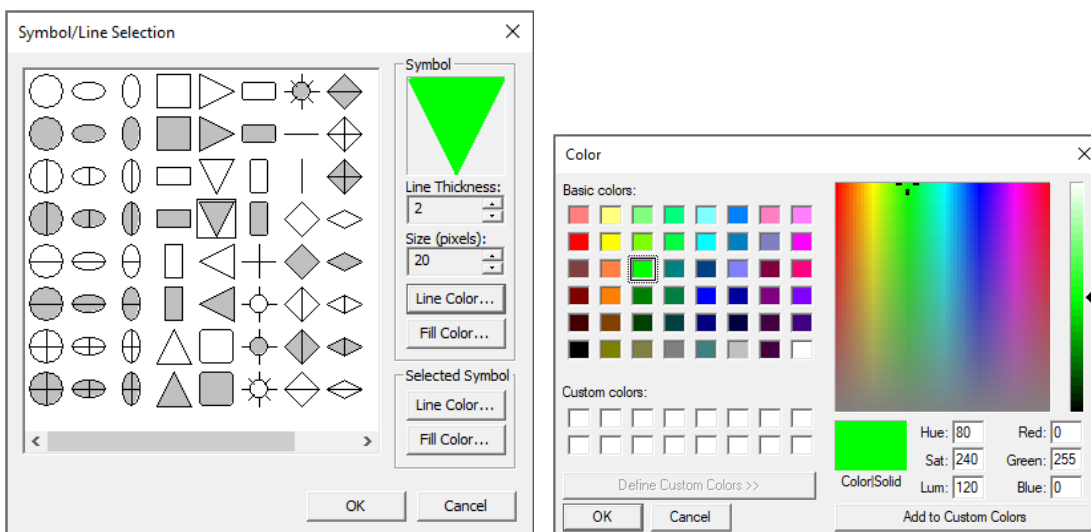


Figure 3: The symbol editing dialog, allowing the differentiation in appearance for selected and non-selected bodies in the RockMod chart.

Select Mode: provides different methods for selecting symbols in the chart.

In **Point** mode, select a symbol or line by double clicking on or near the symbol. In **Rectangle** mode, select the starting point and then drag the mouse to your final destination and then double-click the left mouse button. In **polygon** mode, select the starting point, then select a series of polygon points (don't drag the mouse) and finally double-click the left mouse button to close the polygon.

When **hover** mode is active, the mouse will show a vertical list of up to 10 body names that are near the current cursor location. The names can be found in the ModelVision **Body Properties** table for identification of all the magnetic and density values. If you don't want to see the pull down list use the check box to turn the list off.

Post to MV: This button sends the current selection of bodies in RockMod back to ModelVision so that the selected group can be displayed in map view. The action performed back in ModelVision is determined by the option in the drop-down list below the Post to MV button. The user can choose between:

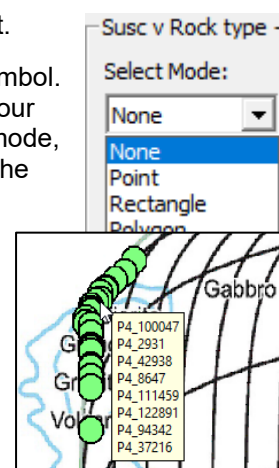
Select - Bodies selected in the chart view in RockMod are turned on in ModelVision, while the unselected bodies are made invisible. You can turn all bodies to visible again using the ModelVision **Body Properties** table and double clicking on the **Visible** header.

Export - Bodies selected in the chart view activate the **Model>Export>CSV** format dialog where you have a range of options available. Since all the bodies are still present, in memory, make sure that the **Visible bodies only** checkbox is on. If your bodies have remanence data, make sure the **Remanence** check box is also on.

Export Image – This button generates an image of the chart in an image format of either .BMP, .PNG, .JPG, .GIF or .TIF for use in technical reports. The PNG format is recommended because it preserves the integrity of line work in the charts.

Print - This button generates a hardcopy output (or PDF) of the graph component of the RockMod dialog window along with the chart title name. The output is scaled to the page width.

Show Table – use this feature to display a spreadsheet view of all the body properties along with the name, location and selection status. If you double click on any column header, it will sort the data based on the order of that field. Double click again and it will reverse the order. You can change the column widths by dragging the column separator left or right and the settings will be retained for later sessions.



Name	X	Y	Z	Susceptibility	Density	QRatio	Jnrm	Dnrm	Inrm	Jres	Dres	Ires
<input type="checkbox"/> Tabular	518414.4	7670872.5	-375.8	0.0308508	2.770000	0.0000	0.000000	0.0000	0.0000	1.274528	5.3000	-5
<input type="checkbox"/> Tabular:1	518415.1	7671164.0	-390.4	0.0107567	2.770000	0.0000	0.000000	0.0000	0.0000	0.444389	5.3000	-5
<input type="checkbox"/> Tabular:2	518805.9	7670826.5	-396.1	0.0091757	2.770000	0.0000	0.000000	0.0000	0.0000	0.379070	5.3000	-5
<input type="checkbox"/> Tabular:3	518807.5	7671115.0	-419.6	0.0058429	2.770000	0.0000	0.000000	0.0000	0.0000	0.241385	5.3000	-5
<input type="checkbox"/> Tabular:4	518806.8	7672109.5	-374.2	0.0501236	2.770000	0.0000	0.000000	0.0000	0.0000	2.070739	5.3000	-5
<input type="checkbox"/> Tabular:5	518807.9	7673681.0	-404.6	0.0310241	2.770000	0.0000	0.000000	0.0000	0.0000	1.281689	5.3000	-5
<input type="checkbox"/> Tabular:6	517211.6	7668955.0	-459.8	0.0039499	2.770000	0.0000	0.000000	0.0000	0.0000	0.163179	5.3000	-5
<input type="checkbox"/> Tabular:7	517211.4	7671068.5	-367.0	0.0200477	2.770000	0.0000	0.000000	0.0000	0.0000	0.828224	5.3000	-5
<input type="checkbox"/> Tabular:8	524804.9	7668938.0	-387.2	0.0571695	2.770000	0.0000	0.000000	0.0000	0.0000	2.361821	5.3000	-5
<input type="checkbox"/> Tabular:9	524811.8	7671101.0	-460.1	0.0656211	2.770000	0.0000	0.000000	0.0000	0.0000	2.710983	5.3000	-5
<input type="checkbox"/> Tabular:10	524400.4	7669289.0	-363.0	0.0911920	2.770000	0.0000	0.000000	0.0000	0.0000	3.767382	5.3000	-5
<input type="checkbox"/> Tabular:11	524404.6	7671583.0	-405.1	0.0326217	2.770000	0.0000	0.000000	0.0000	0.0000	1.347687	5.3000	-5
<input type="checkbox"/> Tabular:12	524014.9	7669566.0	-359.3	0.1670938	2.770000	0.0000	0.000000	0.0000	0.0000	6.903087	5.3000	-5
<input type="checkbox"/> Tabular:13	523614.9	7669882.0	-362.5	0.1338708	2.770000	0.0000	0.000000	0.0000	0.0000	5.530557	5.3000	-5
<input type="checkbox"/> Tabular:14	523605.2	7672170.5	-435.5	0.0114552	2.770000	0.0000	0.000000	0.0000	0.0000	0.473244	5.3000	-5
<input type="checkbox"/> Tabular:15	523221.1	7668864.0	-425.1	0.0222746	2.770000	0.0000	0.000000	0.0000	0.0000	0.920222	5.3000	-5
<input type="checkbox"/> Tabular:16	523208.5	7670152.0	-383.3	0.1187013	2.770000	0.0000	0.000000	0.0000	0.0000	4.903865	5.3000	-5
<input type="checkbox"/> Tabular:17	523216.2	7671188.0	-370.1	0.0244311	2.770000	0.0000	0.000000	0.0000	0.0000	1.009312	5.3000	-5
<input type="checkbox"/> Tabular:18	523213.0	7672406.5	-457.8	0.0251947	2.770000	0.0000	0.000000	0.0000	0.0000	1.040860	5.3000	-5
<input type="checkbox"/> Tabular:19	521210.4	7669826.0	-387.3	0.0170116	2.770000	0.0000	0.000000	0.0000	0.0000	0.702794	5.3000	-5
<input type="checkbox"/> Tabular:20	521208.5	7670089.5	-465.2	0.0181965	2.770000	0.0000	0.000000	0.0000	0.0000	0.751747	5.3000	-5
<input type="checkbox"/> Tabular:21	521201.2	7671260.0	-417.8	0.0919871	2.770000	0.0000	0.000000	0.0000	0.0000	3.800229	5.3000	-5
<input type="checkbox"/> Tabular:22	521210.1	7673384.0	-464.4	0.0106435	2.770000	0.0000	0.000000	0.0000	0.0000	0.439711	5.3000	-5

Figure 4: Body Table accessed from the Show Table button.

Below is a table listing the properties available in RockMod:

Column	Description
Name	Body name
Easting	Easting (m)
Northing	Northing (m)
Depth	Depth (m)
Susceptibility	Magnetic susceptibility
Density	Density
QRatio	Koenigsberger ratio
Jnrm	NRM Intensity
Dnrm	NRM declination (deg)
Inrm	NRM Inclination (deg)
Jres	Resultant magnetic Intensity
Dres	Resultant declination (deg)
Ires	Resultant inclination (deg)
ARRA	Apparent resultant rotation angle between J_{res} and J_{ind}

Figure 5: Table view in RockMod listing all bodies in the ModelVision session and the subset selected in the RockMod chart view.

RockMod Charts

A series of special charts have been compiled from recognised rock property experts' publications and internally developed charts. The charts consist of an image file in PNG format and a registration (.cal) file that contains the chart calibration information. You can create your own charts and connect them to one or two fields in the model data set.

Chart Name	Description
ARRA v Susceptibility	X-plot of the apparent resultant rotation angle versus magnetic susceptibility. Tensor Research (2020)
Density Range Igneous Rocks	Rock type versus density for a range of igneous rock type groups. Enkin (2014)
Density Range Major Rock Groups	Rock type versus density for a range of major rock type groups. Each rock type is represented by a histogram chart. Enkin (2014)
Henkel Susceptibility v Density	A Henkel style plot of magnetic susceptibility (log scale) versus density over-posted by rock type groups, %QFC

	(quartz + feldspar + calcite) and FM/M (Ferromagnesian silicate/ magnetite ratio). Enkin et.al. (2020)
Q v Rock Type bars	Rock type versus Q for a range of rock type groups. Clark (1997)
Resultant inclination v declination	X-plot of the resultant magnetisation vector inclination versus the resultant magnetisation vector declination. Tensor Research (2020).
Susc v density Canada	X-plot of magnetic susceptibility versus density for a large range of Canadian rock types. Contour densities of the 3388 samples are over-plotted on the chart to highlight the magnetite and paramagnetic trends. Enkin (2014)
Susc v rock type bars	Rock type versus magnetic susceptibility for a large range of Australian rock type and mineral groups. Clark (1997)

Rock Property Chart Format

The PNG format is preferred for chart images because this format reproduces line work with crisper edges than glossy format such as JPG. The essential elements for calibrating the chart are shown here.

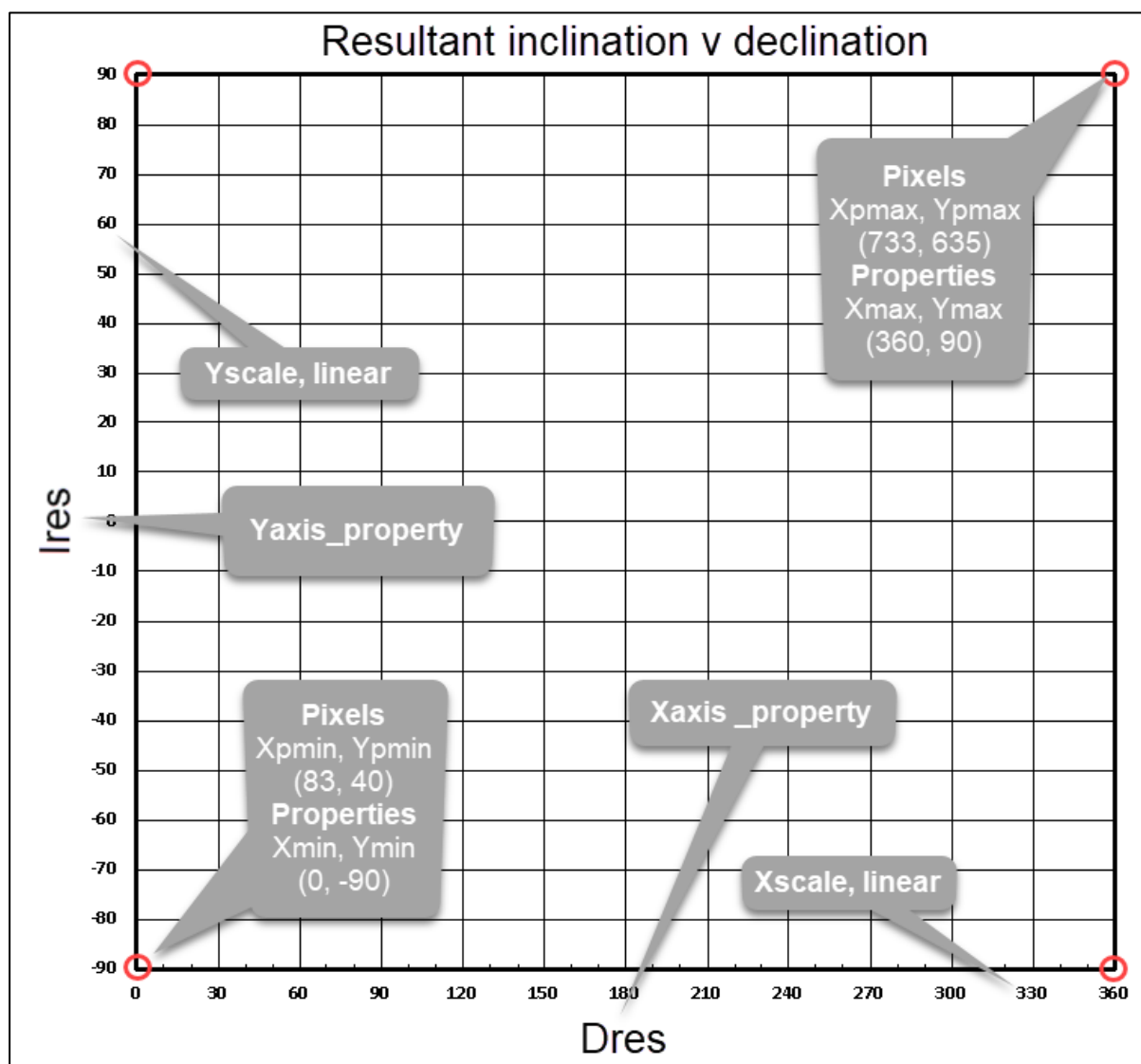


Figure 7: Image file *Resultant inclination v declination.png* showing the calibration information used to locate the lower left and upper right corners of the active chart area.

The associated calibration file called **Resultant inclination v declination.cal** is shown below.

```
File,Resultant inclination v declination.png
Xpmin_Xpmax,83,733
Ypmin_Ypmax,40,635
Xmin_Xmax,0,360
Ymin_Ymax,-90,90
Style,linear
Xscale,linear
Yscale,linear
Xaxis_property_units,Dres,deg
Yaxis_property_units,Ires,deg
Title,Resultant Inclination v Declination - Tensor Research
```

Style Options

The axis style defines the scale type which covers one or two dimensions, linear and log scaling.

Axis Style	Code
Linear X & Y	Linear
Log X & Y	Log
Linear X & Log Y	Linear_Log
Log X & Linear Y	Log_Linear
Log X & No numeric Y axis	LogX_NoY
No numeric X axis & Log Y	NoX_LogY
Linear X and No numeric Y axis	LinearX_NoY
No X axis & Linear Y	NoX_LinearY

Xscale, Yscale parameters

None – the axis is non-numeric and have text or other graphics information.

Linear – the axis is linearly scaled between the end points.

Log – the axis is logarithmically scaled between the end points.

Axis, Yaxis Properties and Units

Property name – ModelVision property name (see list for exact spelling)

Units – SI, CGS, none

Property Names	Sample values
Susceptibility	0.0409802
Density	2.770
QRatio	1.85
Jnrm	361.9
Dnrm	183.2
Inrm	61.7
Jres	1.6721
Dres	174.3
Ires	63.3
ARRA	171.9

Chart References

Clark, D.A. 1997. Magnetic petrophysics and magnetic petrology: aids to geological interpretation of magnetic surveys. *AGSO Journal of Australian Geology & Geophysics*, 17(2), 83-103.

Enkin, R.J. 2014. The Rock Physical Property Database of British Columbia, and the distinct petrophysical signature of the Chilcotin basalts. *Can. J. Earth Sci.* 51: 327–338 (2014) [dx.doi.org/10.1139/cjes-2013-0159](https://doi.org/10.1139/cjes-2013-0159).

Enkin, R.J., Hamilton, T.S. & Morris, W.A., 2020. The Henkel Petrophysical Plot: Mineralogy and Lithology from Physical Properties. *Geochemistry, Geophysics, Geosystems*, 20, e2019GC008818. <https://doi.org/10.1029/2019GC008818>.