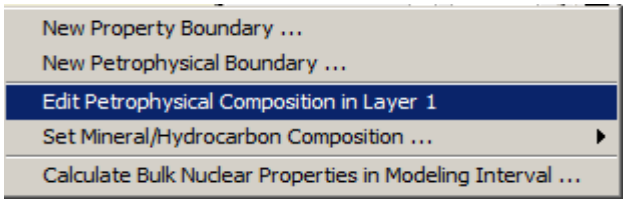
Guideline for the Compositional Palette in Version 4 of 3D UTAPWeLS.

The Earth Model Builder consists of 6 modules; this guideline will present the Compositional Palette.

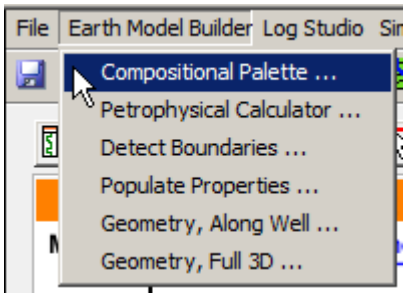
Opening the Compositional Palette:

-A right click within a track and clicking on Edit Petrophysical Composition in Layer (x) will open the Palette and it will represent that specific layer:

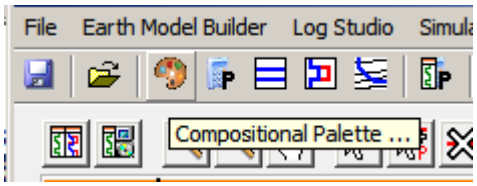


In this case since it was within Layer 1, it is in that layer it is opened as seen below.

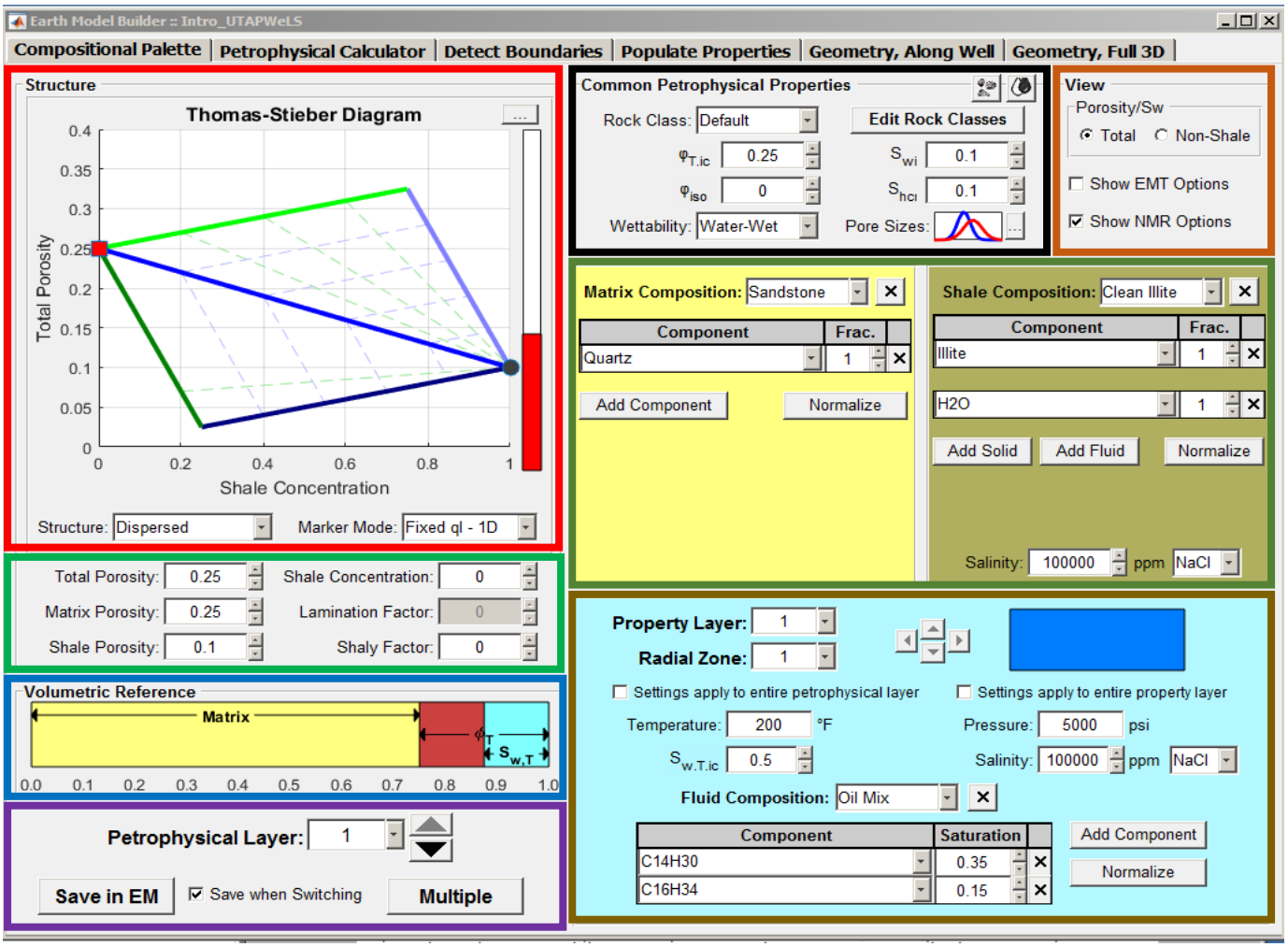
Using the pull-down menu:



or the Compositional Palette icon:

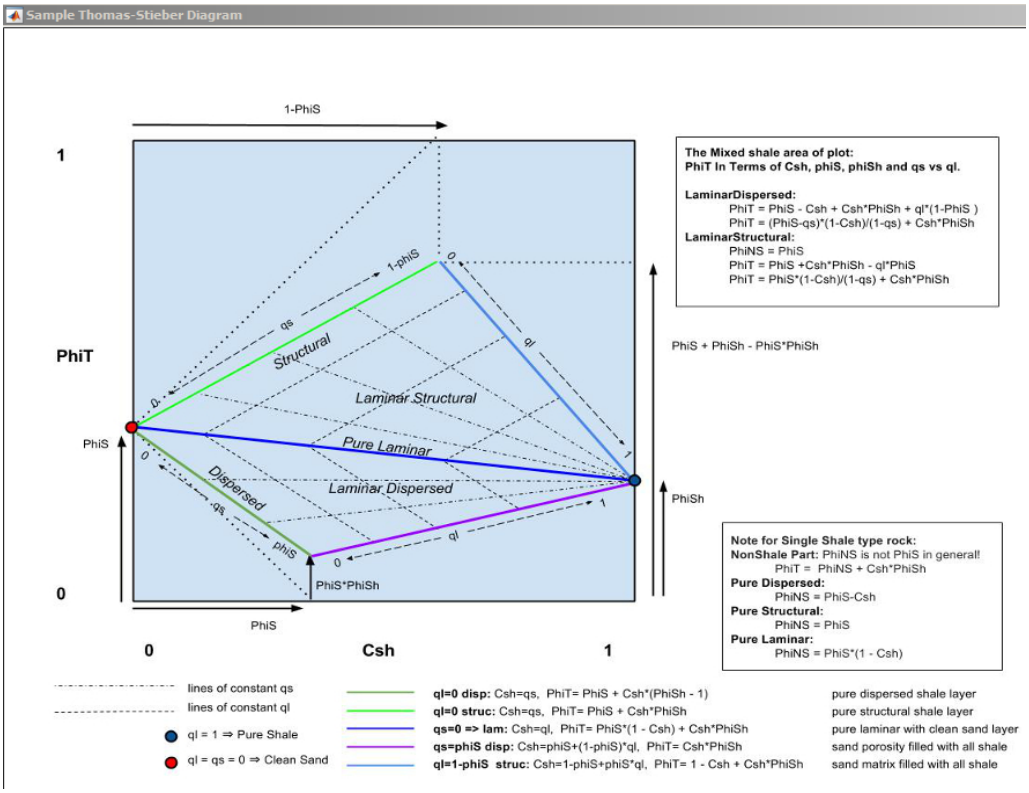


The Palette offers a number of panels concerning the make-up of each specific layer with interconnections with one another:



Clicking on the button, 

will open a Thomas-Stieber diagram:



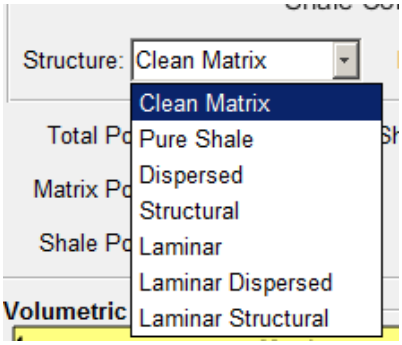
The vectors and areas within the diagram represents the potential conditions within the rock formation.

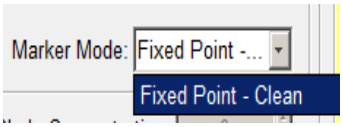
The points on the plot indicate the volumetric concentration of shale and the total porosity.

Depending upon which Structure is chosen will present a number of Marker Modes.

For example, when the Compositional Palette is first opened the Structure default is Dispersed and the Marker Mode is Fixed ql - 1D. Therefore, the square marker will only move along the Dispersed vector line. Some additional examples:

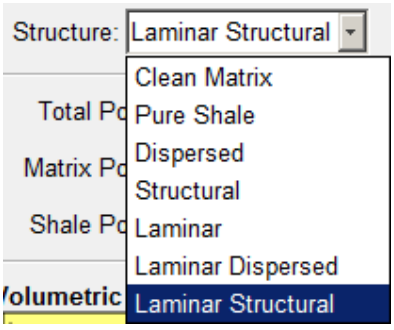
If a Clean Sand matrix is chosen:

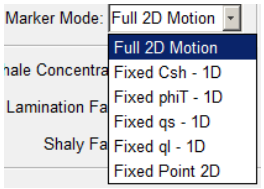




The Marker will only move on the zero shale vector with only the Total Porosity changing.

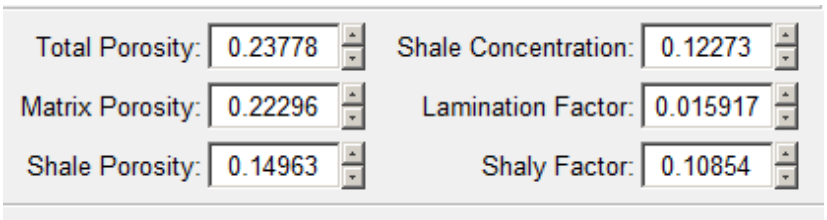
If the Laminar Structural is chosen:





Multiple marker modes are available as seen to the right. Depending upon which mode is chosen will determine the location and movement of the Marker.

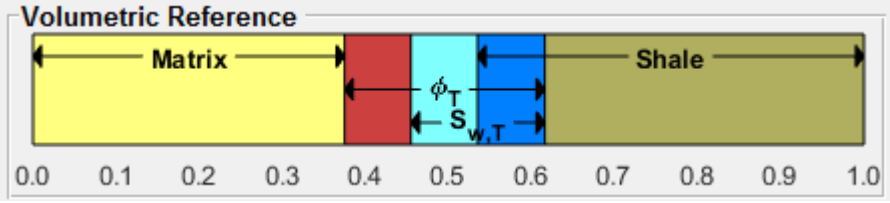
In the panel below changes can occur in the Total, Matrix and Shale Porosities. Plus, the Shale Concentration and both Lamination and Shaly Factors may vary.



These changes are also reflected in the movement of the Marker within the Thomas-Stieber Diagram.

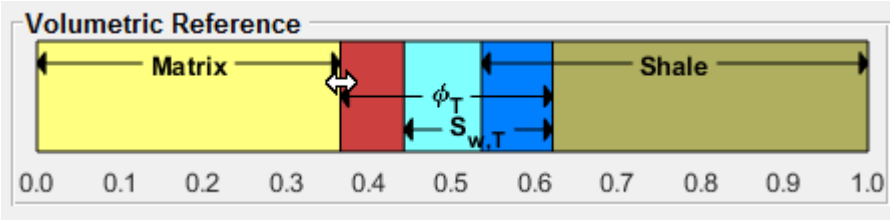
Volumetric Reference:

The changes that are seen in the Porosity panel can also be seen in the Volumetric Reference Panel.



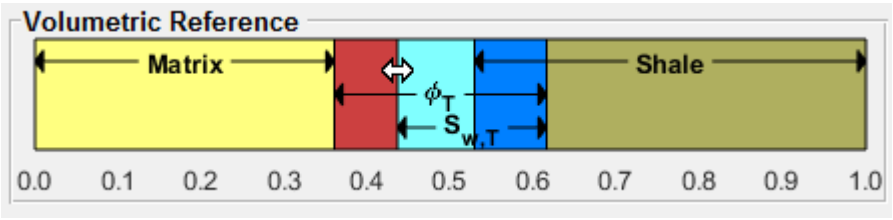
The panel not only shows the change it can also be used to create the change since it is interactive. The two panels below show that when the mouse pointer is placed over the two conditions, a double arrow appears. Moving the arrow left or right will cause a change in the conditions of the adjacent panels.

For example, between the Matrix and hydrocarbon panel:

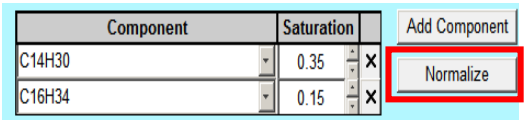


When a change is produced here or any change in S_w the Normalize button in the Property Layer panel needs to be clicked

Between hydrocarbon and water saturation:



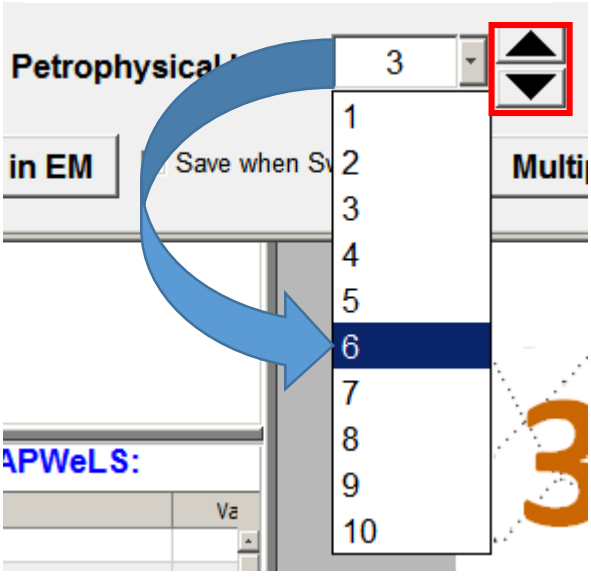
Normalize hydrocarbon saturation:

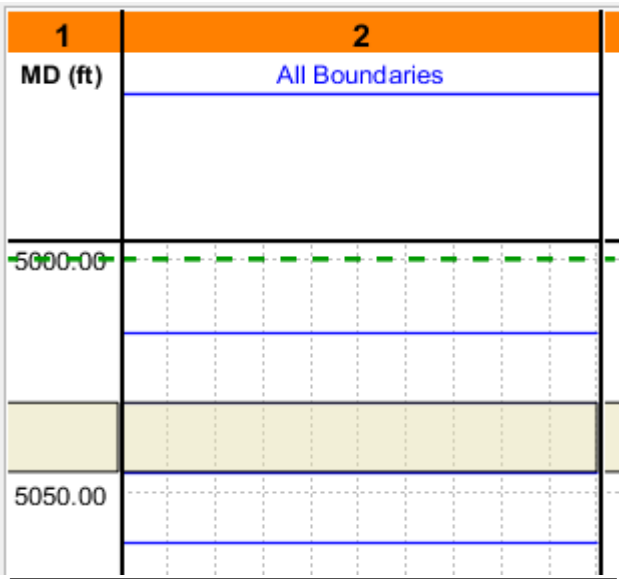


Petrophysical Layer:

This panel will enable the movement from one layer to another:
Click on the layer and jump to a specific layer.

To move one layer at a time using these up / down arrows.



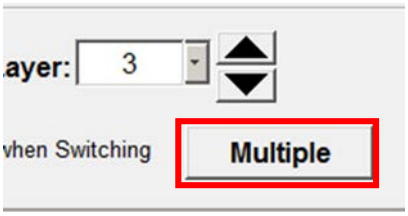


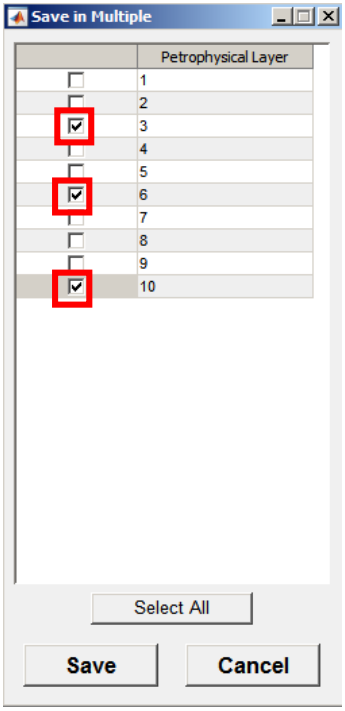
The layer in which the Palette is opened is highlighted as seen above.

Replicate Palette conditions in multiple layers:

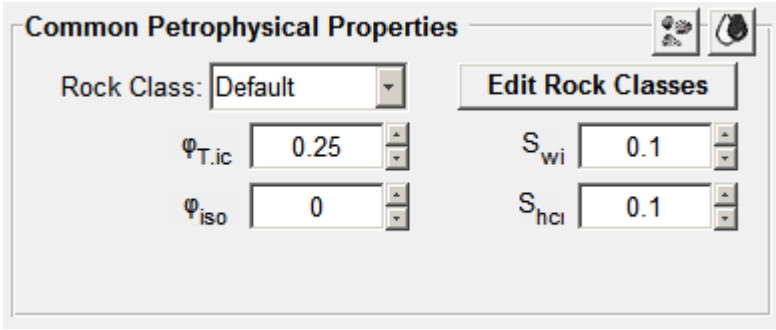
The conditions set in a layer may be repeated to multiple layers without the need to set up each layer individually.

-Setup one layer and save it.
-Click on the Multiple button.
-Place a check in layers to populate.
-Click on Save.





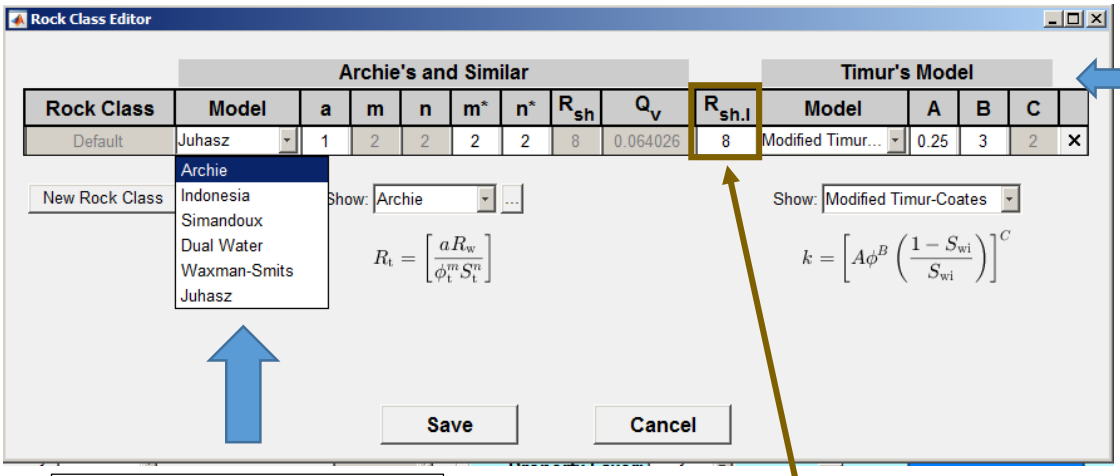
Common Petrophysical Properties:



This panel refers to the equations used for specific rock models.

Specifically, if it is a clean sand layer or one that is a shaly sand layer.

Edit Rock Classes:

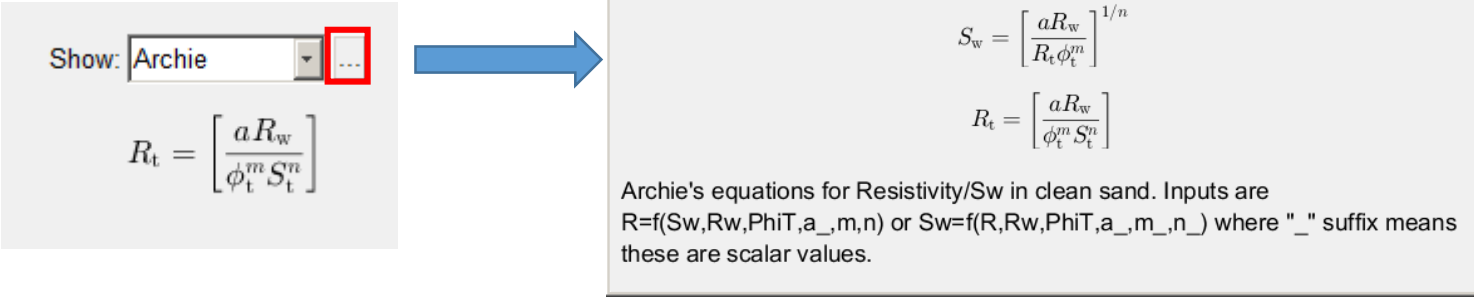


Two Timur's Model equations associated with permeability.

The Model drop-down menu offers six possible Archie Family equations available.

The shale resistivity value may also be set here.

In the area below choosing the Model of Rock Class there is additional information available.
-An equation about a specific Rock Class is displayed.
-Clicking on the button next to the name of the Rock Class, [...], will open the panel below with additional equations and information.

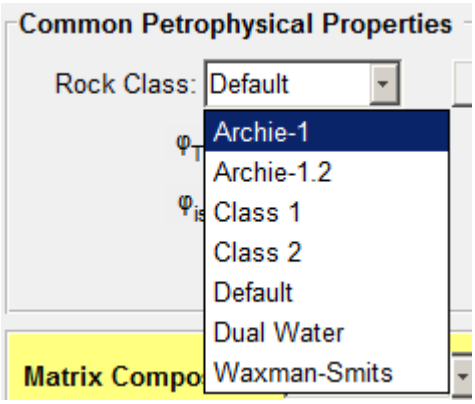


Additional Rock Class values for different Petrophysical Layers can be created.
-In Rock Class Editor, click on the New Rock Class button, [New Rock Class].
-Additional Models may be added and renamed.
-Click Save and the additional Rock Class models will be available in the Palette.

Rock Class Editor

	Archie's and Similar									Timur's Model				
Rock Class	Model	a	m	n	m*	n*	R_{sh}	Q_v	$R_{sh.I}$	Model	A	B	C	
Archie-1	Archie	1	2	2	2	2	8	0.064026	3	Timur-Tixier	0.25	3	2	×
Archie-1.2	Archie	1.2	2	2	2	2	8	0.064026	3	Timur-Tixier	0.25	3	2	×
Default	Juhasz	1	2	2	2	2	8	0.064026	3	Modified Timur...	0.25	3	2	×
Dual Water	Dual Water	1	2	2	2	2	8	0.064026	3	Timur-Tixier	0.25	3	2	×
Class 1	Simandoux	1	2	2	2	2	8	0.064026	3	Timur-Tixier	0.25	3	2	×
Class 2	Waxman-S...	1	2	2	2	2	8	0.064026	3	Timur-Tixier	0.25	3	2	×

The added Rock Classes will be available in the Common Petrophysical Properties panel for inclusion for model building:

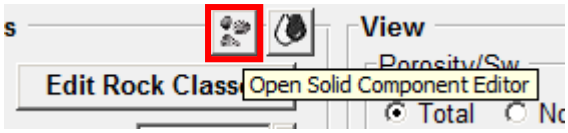


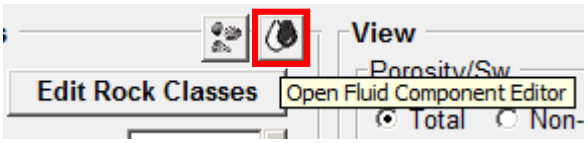
The default Rock Class is Juhasz.
This can be changed within the Rock Class Editor.

When adding additional New Rock Classes, they acquire the default name of Class 1, Class 2, etc.

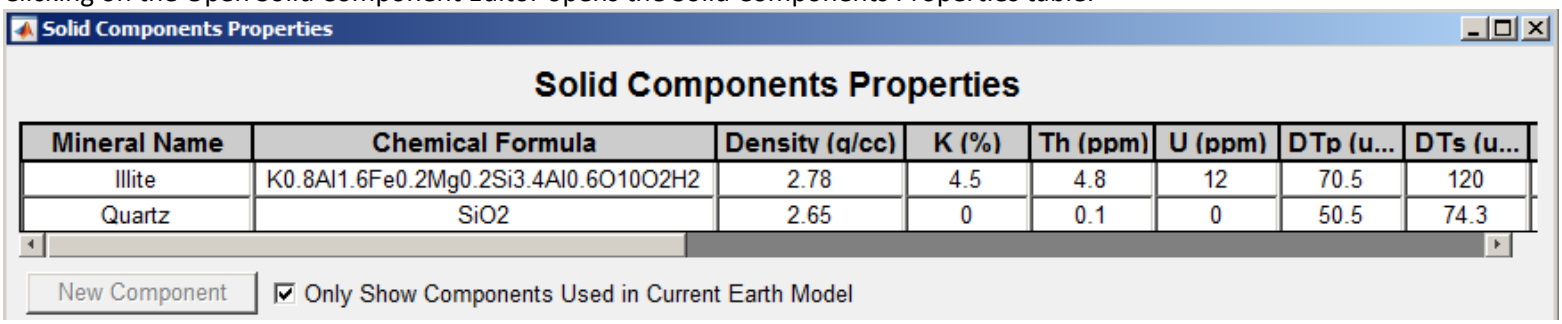
These can be renamed to allow them to differentiated as seen: Archie-1, Archie-1.2, etc.

The two additional buttons are within the Common Petrophysical Properties panel are the Solid and Fluid Component Editors.



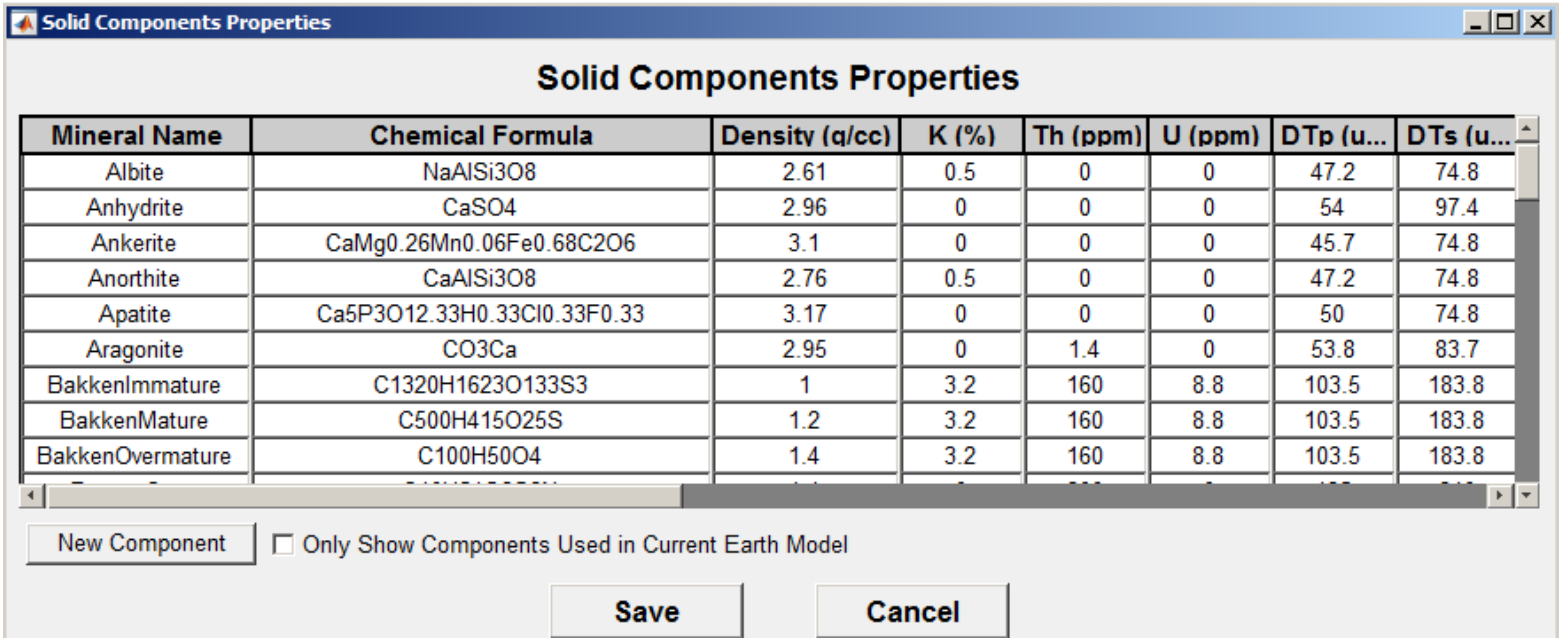


Clicking on the Open Solid Component Editor opens the Solid Components Properties table:

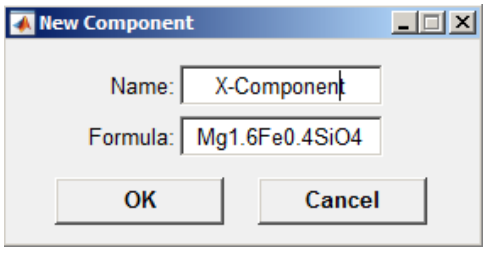


The only components listed are those that are used in the Current Earth Model. The default components are Quartz for the Matrix and Illite for Shale Compositions.

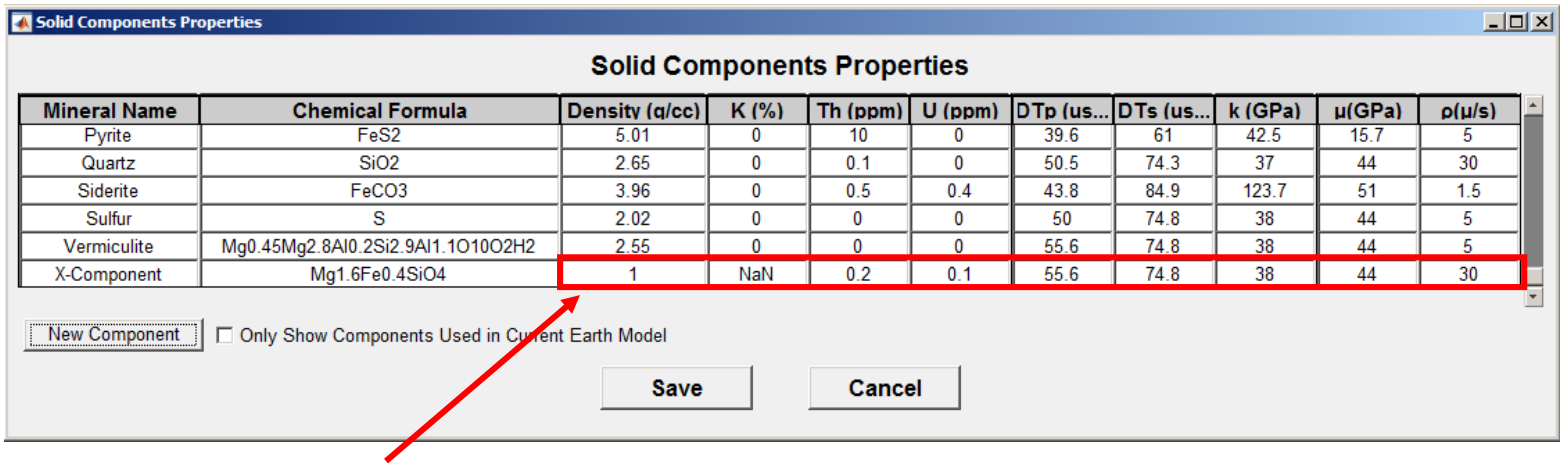
Unchecking the Only Show Components Used in Current Earth Model opens a database with additional components:



It is also possible to add components to the list by clicking on the New Component button and adding the information:

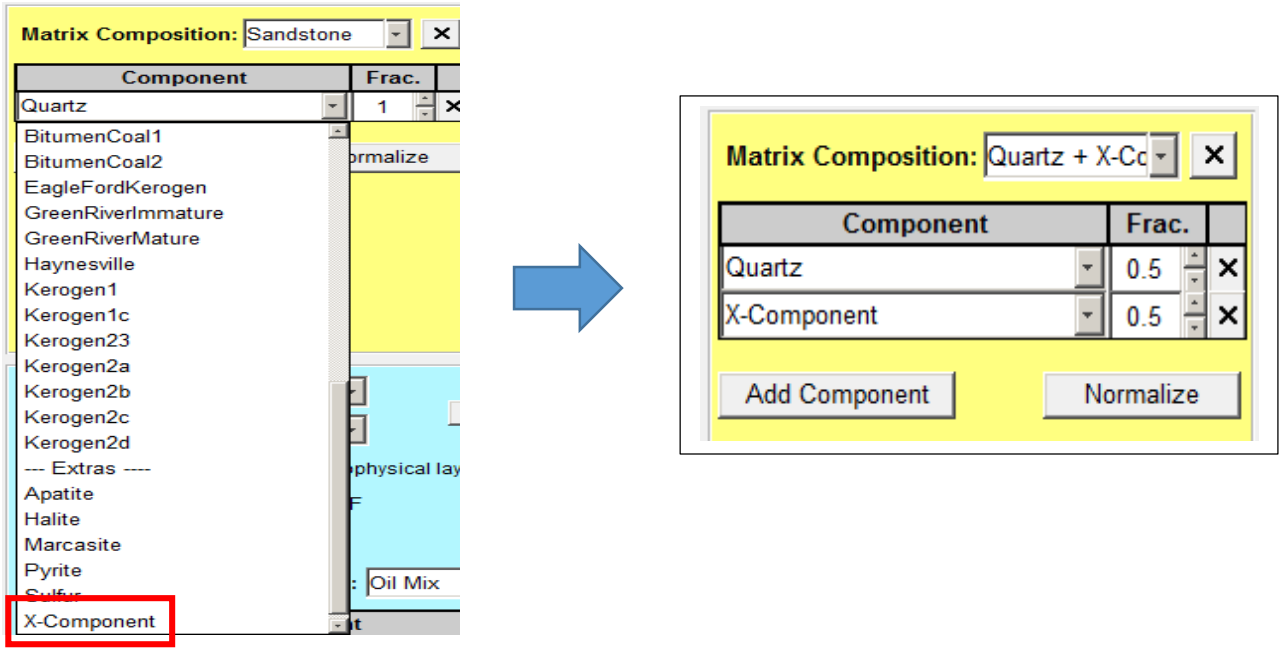


The X-Component is added to the Solid Component Properties table and the components properties are populated with generic values.

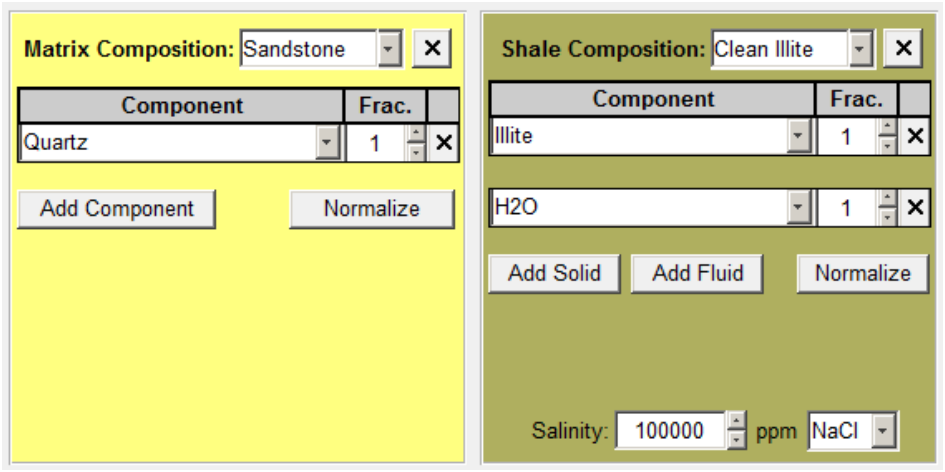


The correct values for Density, K, Th, U, etc. will need to be entered for correct calculations.

When the Save button is clicked the new compound is available for use in the Matrix or Shale Composition menus:

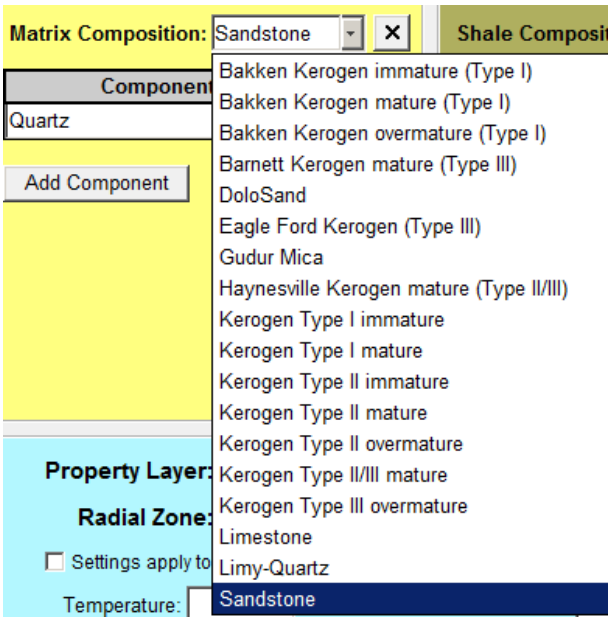


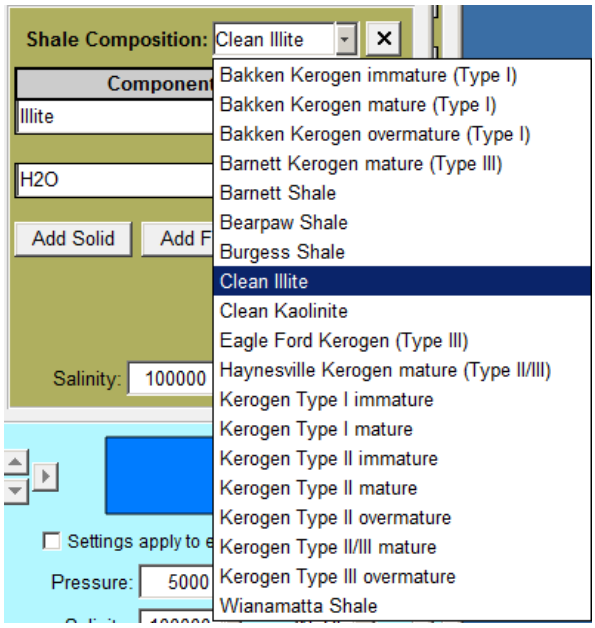
Matrix and Shale Composition:



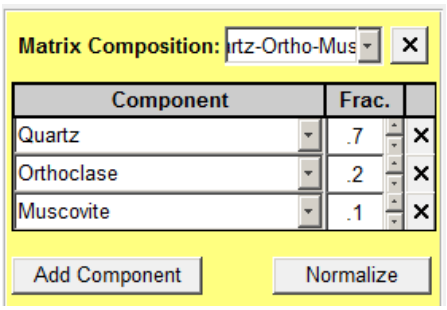
The mineral composition of the layers is chosen through the above panels.

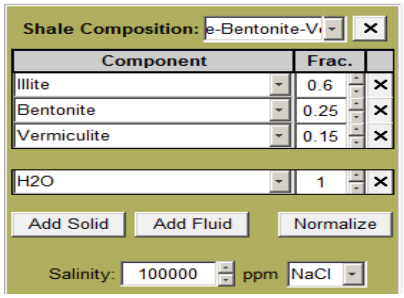
Both the Matrix and Shale Compositions have a number of compositions available via their pull down menu:

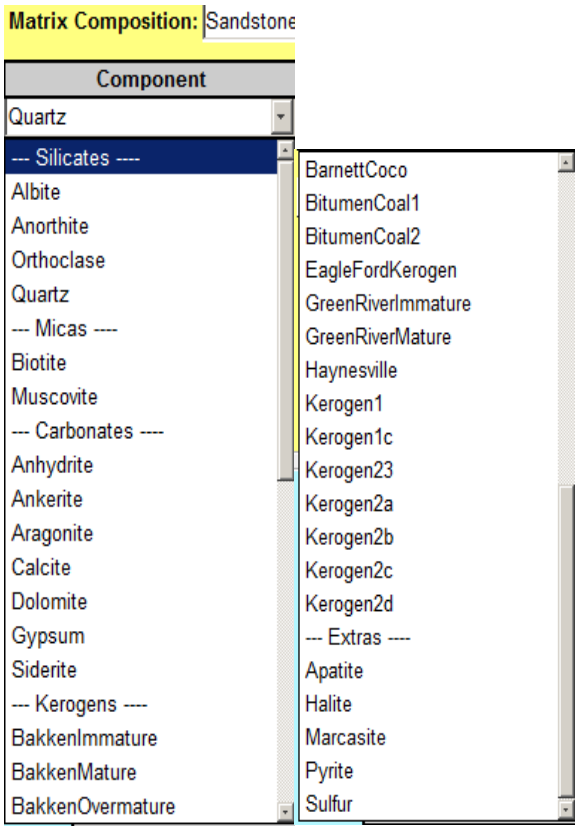


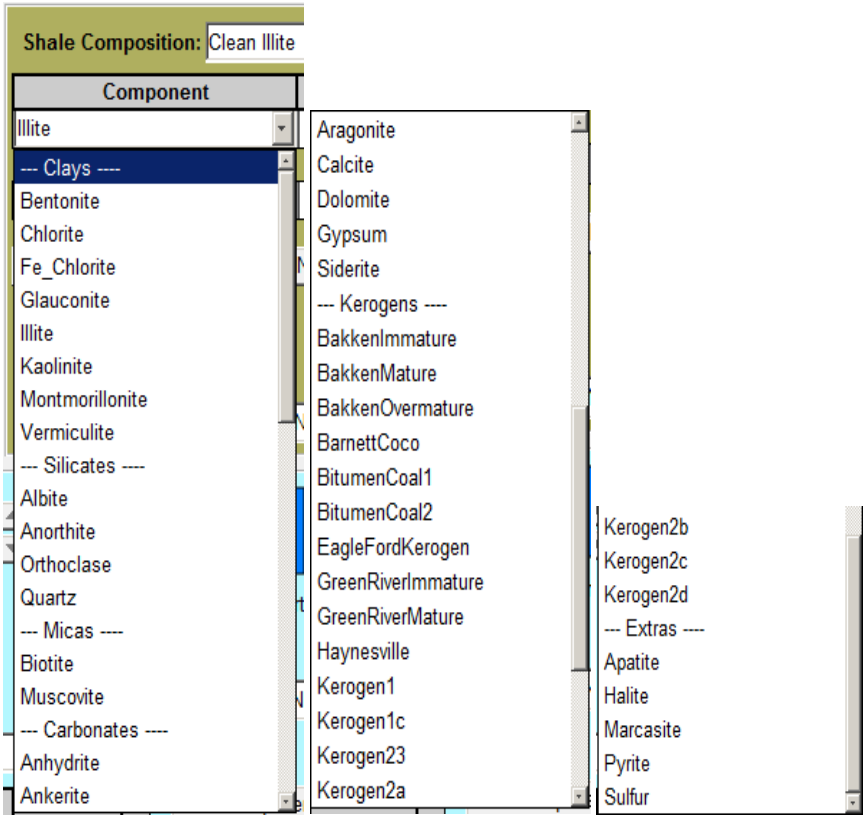


Custom compositions for both Matrix and Shale can be created:
-Using the Add Component button additional components from the dropdown menu may be added.
-They can be Normalized or Fractions can be determined for each component.

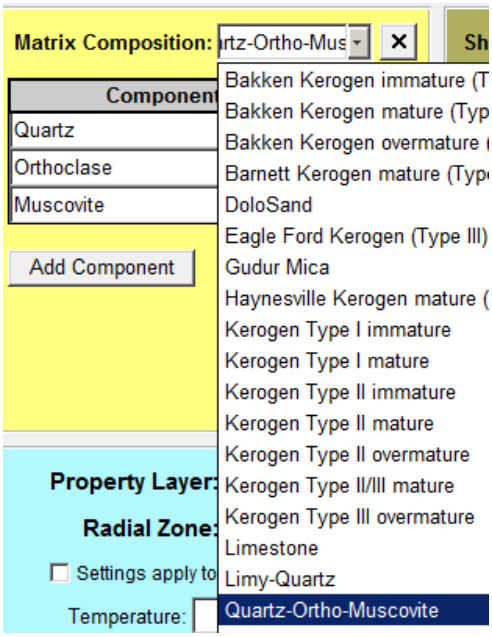


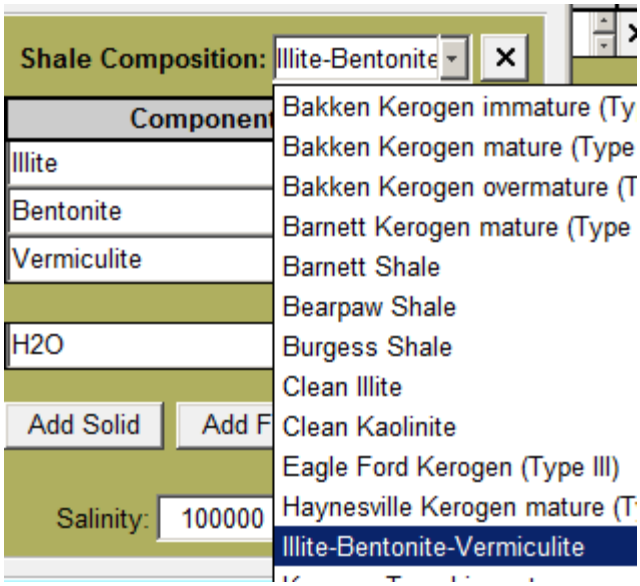






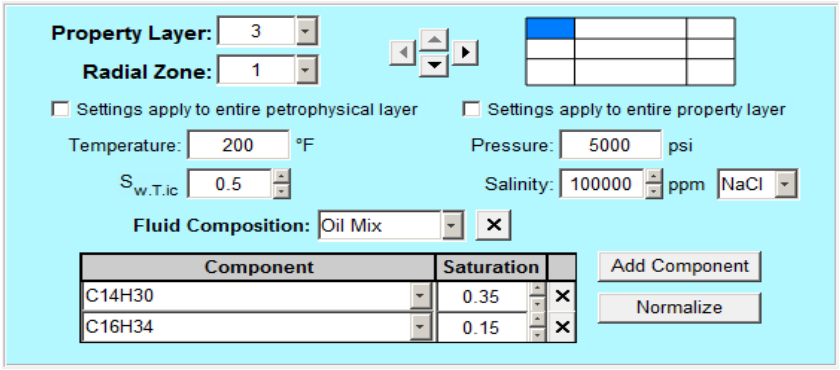
The custom component compositions are saved for use with other layer(s):

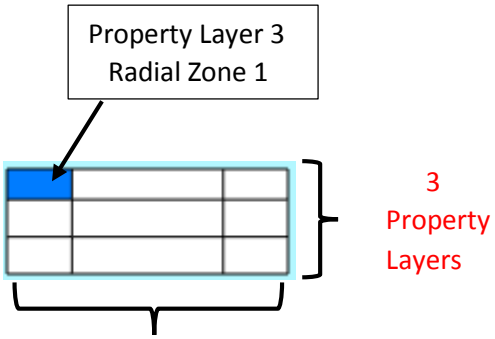




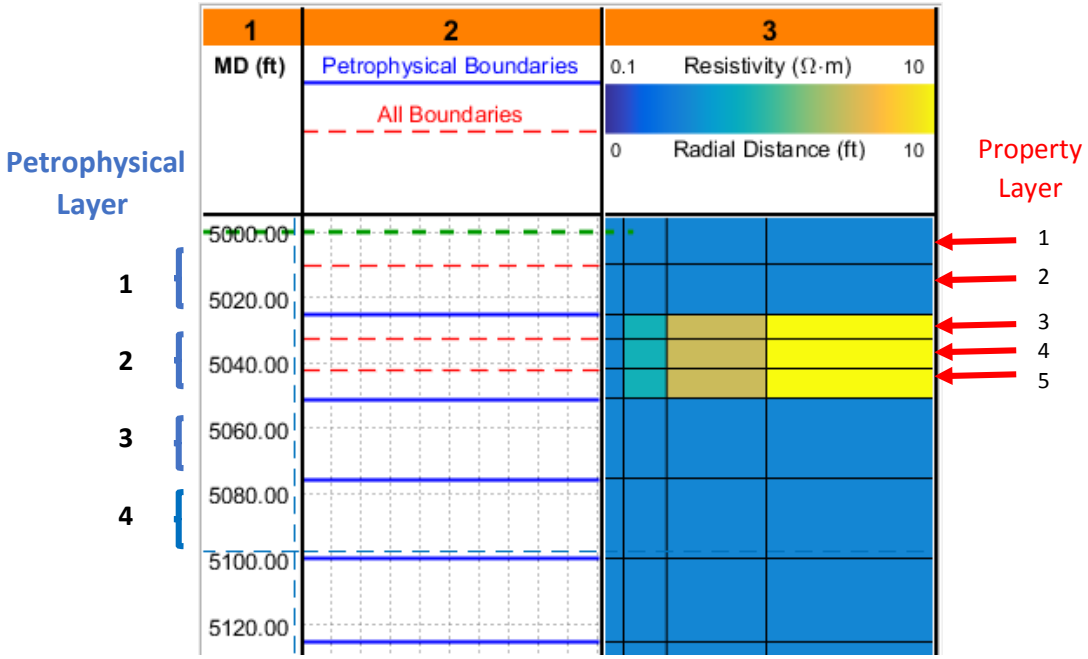
Fluids and the salinity of the shale layer may also be modified in the Shale Composition panel.

Property Panel:

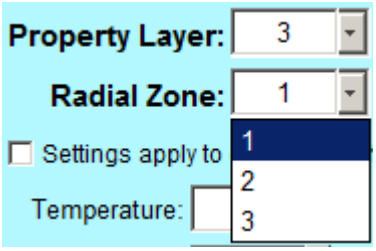




This is a multi-layer model:

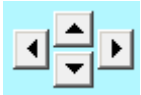


Using the down arrow to move from one Radial Zone to another:



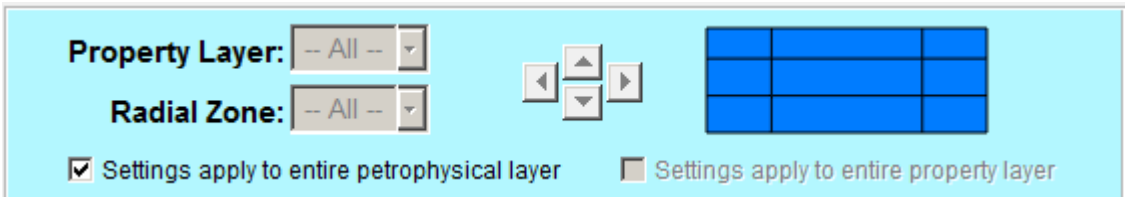
The same can be done for each Property Layer.

The four arrows also allow moving to a Zone or Layer within a Petrophysical Layer:

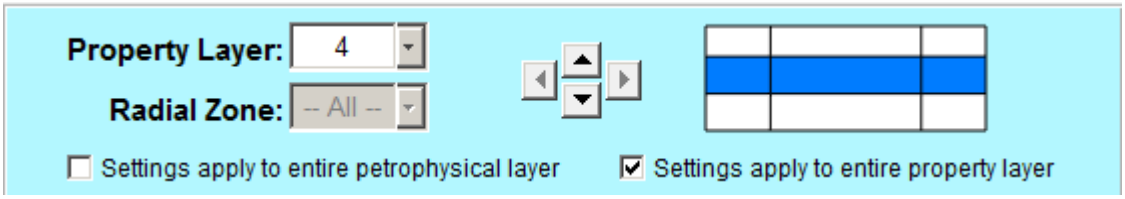


Apply setting for entire petrophysical layer or property layer.

Depending upon which box is checked will determine if the petrophysical layer is affected or the property layer:



or



Petrophysical Layers:

Constant 'Rock' Properties

k, k_r, Pc, ϕ, C_{sh}, $S_{w,irr}$, Mineralogy

Additional information about Petrophyiscal and Property/Fluid Layers.

Property/Fluid Layer:

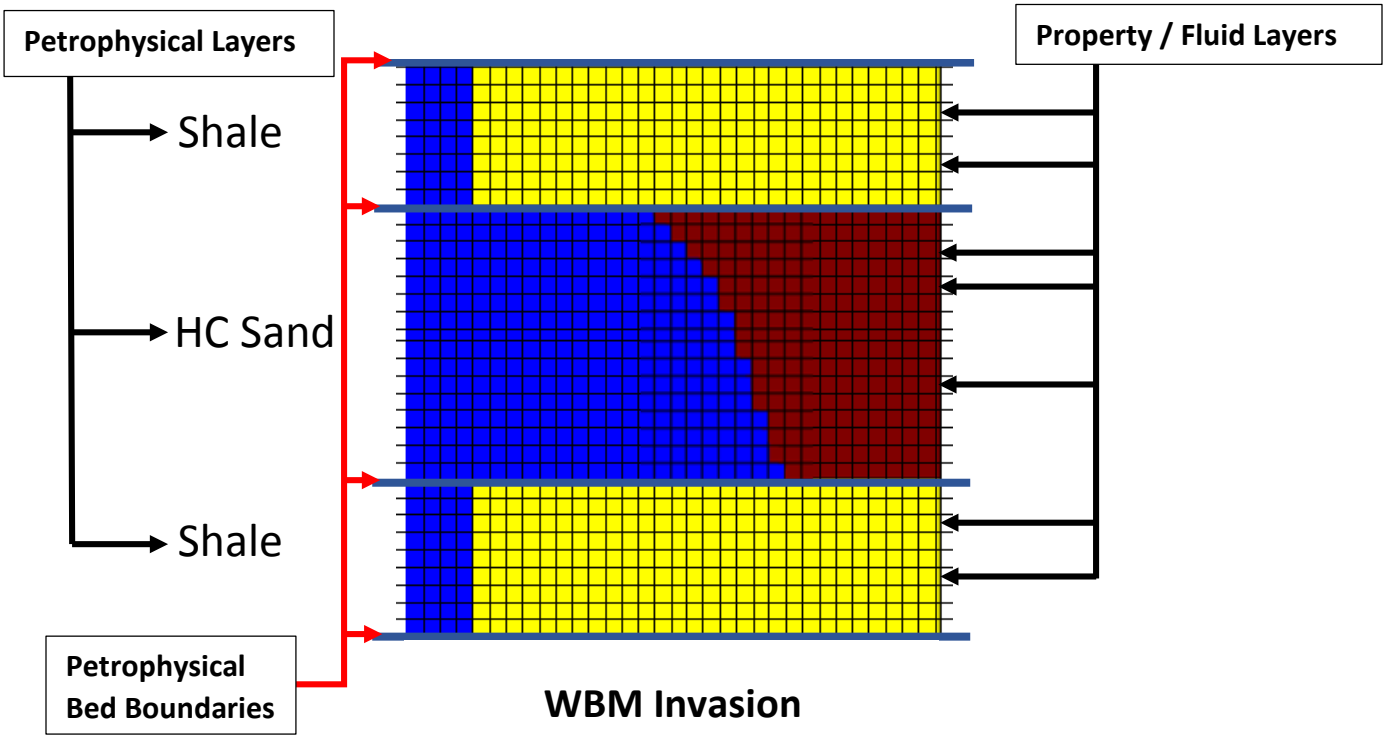
Constant 'Rock' Properties

Constant in Vertical Direction

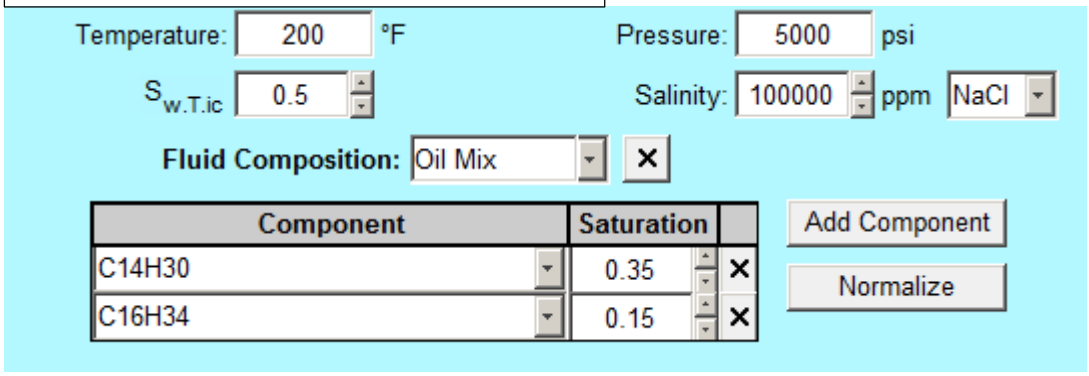
S_w; Pore Pressure; Salinity; Hydrocarbon Components

'Fluid' Properties can vary in Radial Direction

Petrophysical vs. Property/Fluid Layers

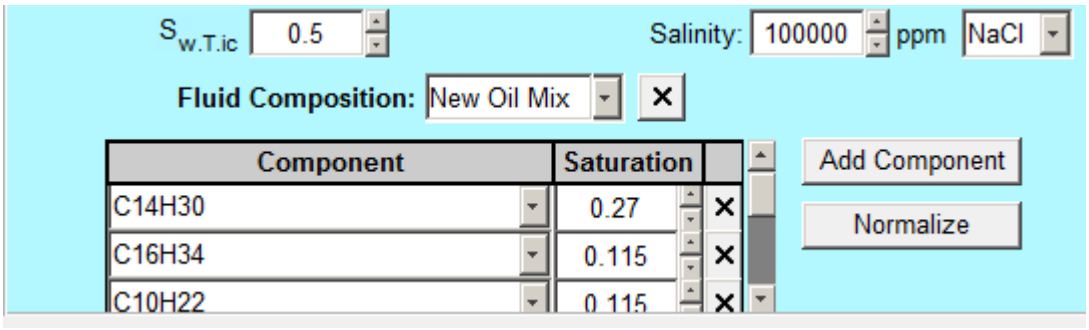


Additional settings in Property Layer panel:



As seen above, Temperature, Pressure, S_w, Salinity, and Fluid Composition may be modified in the panel.

Additional Oil Mixes may be created using the Add Component button and choosing the fluid.



Clicked on Normalize to adjust the Saturation values. They also may be changed manually to specific values.

Clicked on the **Save in EM** button and 'New Oil Mix' is now a part of the drop-down list: