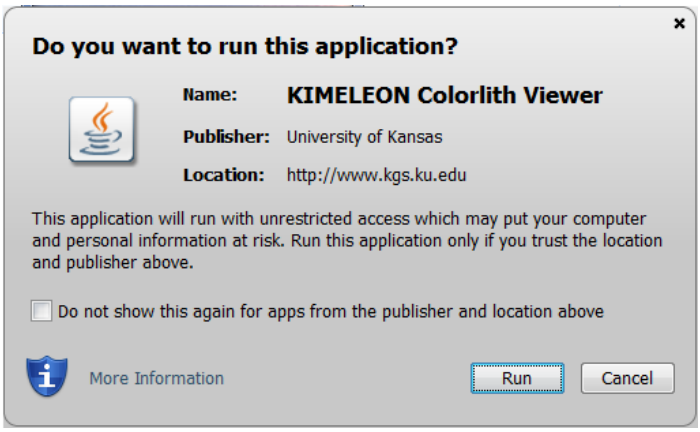
KIMELEON Java Applet

by John R. Victorine

Introduction

The KIMELEON web app has 2 sources for importing well data, 1) the user's PC or 2) the Kansas Geological Survey (KGS) Server & ORACLE Database. This program allows the user to import Log and Tops Data.

There will be occasions when the user would like to inspect the contents of a LAS file. So, for example, the user may wish to find the identity of the well, the types of logs, depth range, well or log parameters. Alternatively, the user can suspect that the file is not coded correctly in LAS format if the Import LAS function fails, and wishes to examine the file to troubleshoot the problem. The LAS file is an ASCII file and can be read by any text editor, i.e. Notepad, WordPad, TextPad, etc. The CSV (Comma Separated Values) files are also ASCII and can be edited in the same way or with Microsoft Excel.



To access Synthetic Seismic web app go to http://www.kgs.ku.edu/stratigraphic/KIMELEON/. At the top of the web page there is a menu "Main Page|Description|Applet|Help|Copyright & Disclaimer|". Select the "Applet" menu option a "Warning - Security" Dialog will appear. The program has to be able to read and write to the user's PC and access the Kansas Geological Survey (KGS) Database and File Server, ORACLE requires this dialog. The program does not save your files to KGS, but allows you to access the KGS for well information that may be missing in your Kansas logs. The program does not use Cookies or any hidden software it only reads the LAS and CSV files for the KIMELEON Session and writes Portable Network Graphics (PNG) and/or Portable Document Files (PDF) Files to your. The blue shield on the warning dialog is a symbol that the Java web app is created by a trusted source, which is the University of Kansas.

Contents

Importing KGS (Database & Server) Data 3
Importing Well Data 3
* LAS File Data 7
- Map Curves & Change Curve Selections 9
* Tops Picks 14
- MKD Source Example 15

Importing PC Data – Download Well Data from PC 20
Log ASCII Standard (LAS) version 2.0 File 21
- Map Curves & Change Curve Selections 23
Tops CSV (Comma Separated Values) File 33
- Tops CSV (Comma Separated Values) File Structure 35
Core CSV (Comma Separated Values) File 38
- Core Data CSV (Comma Separated Values) File Structure 40

KIMELEON History 43

Data Entry Dialogs 47
Edit Header Information Dialog 47
Adding & Modifying Tops 55
* Enter Horizon Data - Stratigraphic Units Panel 55
- Add Shawnee Group to the Stratigraphic Units List 57
- Add Unknown Bed (SG-A Bed) to the Stratigraphic Units List 60
- Modify data for the Severy Shale Formation in the Stratigraphic Units List 62

KIMELEON Colorlith & Color Image Tracks 64
Colorlith Plot Tracks 65
Color Image Plot Tracks 66

Changing the Colorlith Plot Track Limits & Log Curve Limits 68
Changing LAS Plot Limits 73
Changing Colorlith Limits 74

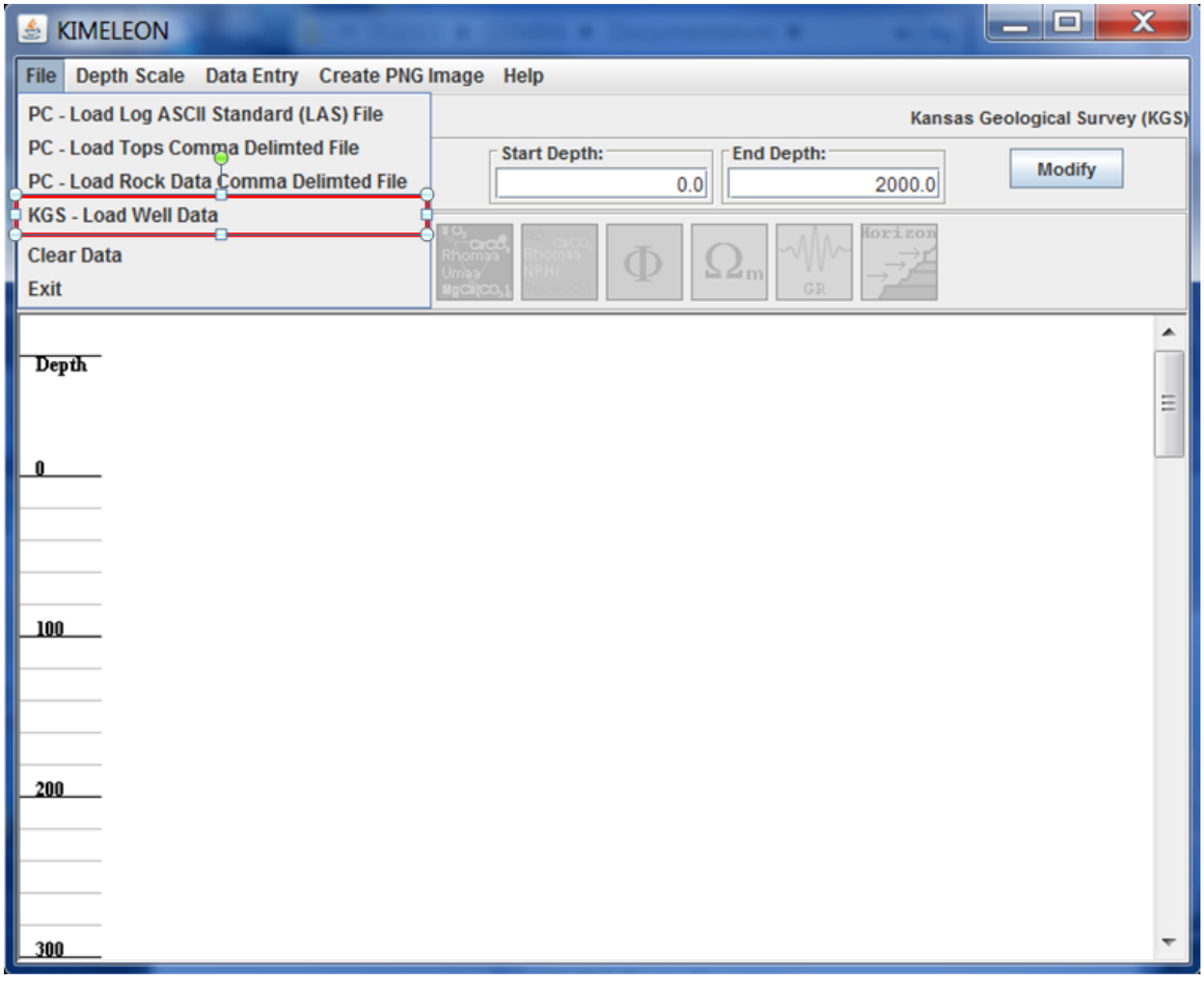
Change Depth Range & Scale 78

Creating a Portable Document Format (PDF) Document of Plot 80

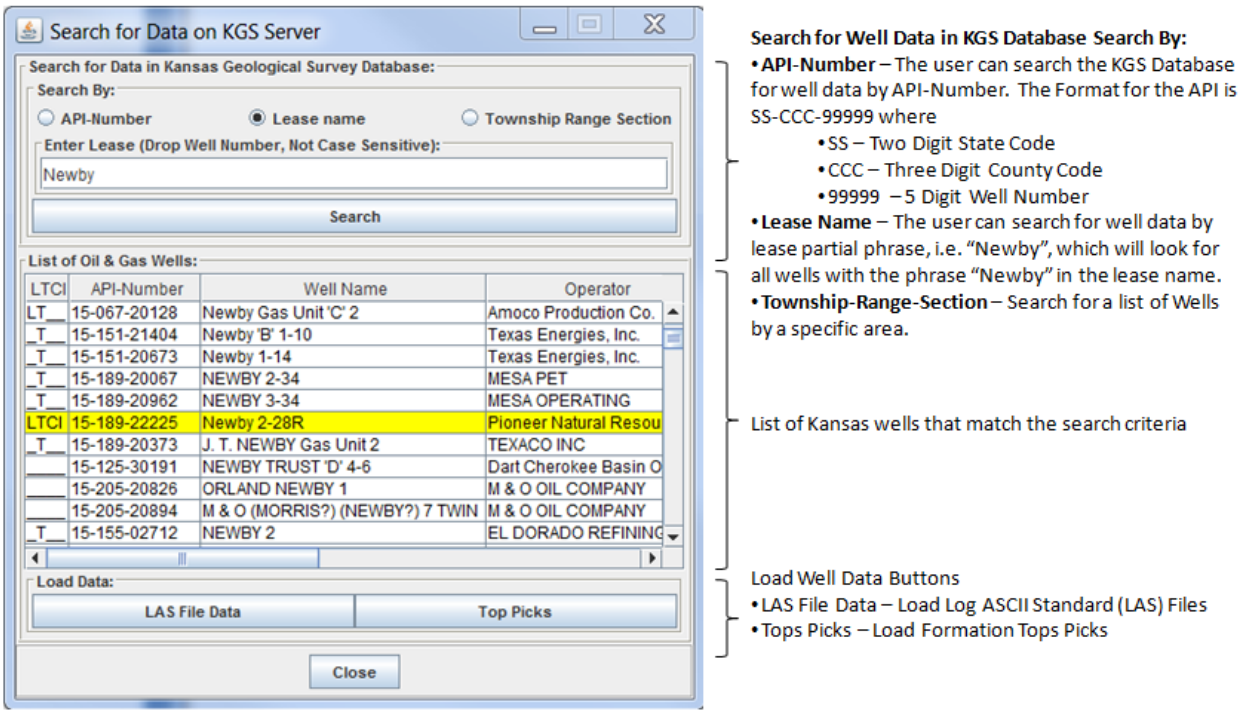
Importing KGS (Database & Server) Data

KGS (Database & Server) - Importing Well Data

The Kansas Geological Survey (KGS) has a good collection of well data stored in the ORACLE Database and File Server as Files Log ASCII Standard (LAS) version 3.0 Files. In this example the user will download the well data available from the KGS, Log data (LAS version 2.0 File), Tops Data, Measured Core Data, and Perforation Data. The ORACLE Database is accessed by making Stored Procedure PL/SQL calls to the ORACLE Database from which an Extensible Markup Language (XML) data stream is created containing the well data that is passed back to the web app making the request.



Click on the "File" Menu in the menu bar at the top of the "KIMELEON" Dialog, which will display a list of menu options to import well data into the web app. Select the "KGS - Load Well Data" menu option.

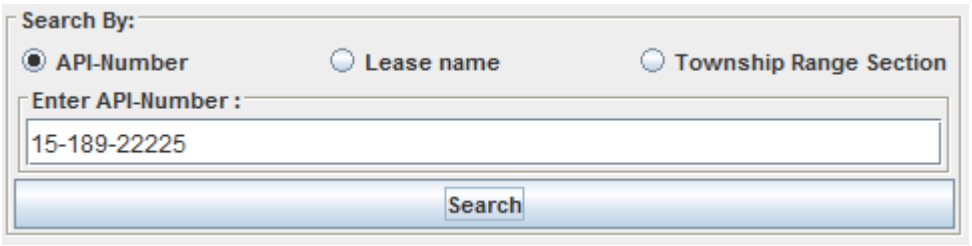


NOTE: LTCI Column in Table: L-LAS Files; T-Formation Tops; C-Measured Core Data; I-Core Images

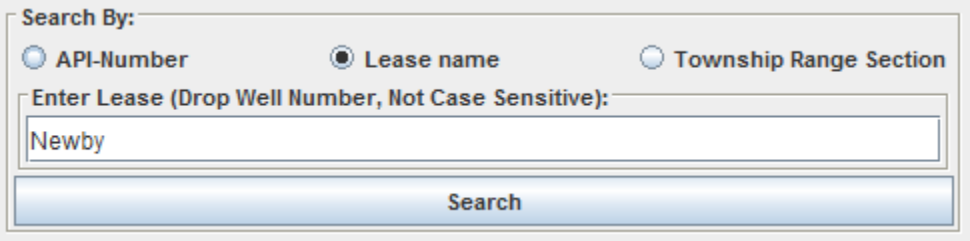
This will display the "Search for Data on KGS Server" Dialog, see above image. This dialog allows the user to search the KGS database for well data. In this example, the well of interest will be the Newby 2-28R, this well contains all the well data that can be retrieved from the KGS Database, i.e. Log Data (LAS version 3.0 File), Tops Data, Core Data, and Perforations.

As the Summary image suggests there are 3 methods for searching for the well data within this dialog,

- By API-Number – KGS has a specific format for the API-Number, i.e.SS-CCC-99999 where SS is the state code for Kansas 15, CCC is the county code for Newby 2-28R it is 189 for Stevens County and the 5-Digit Well Number for Newby 2-28R it is 22225.

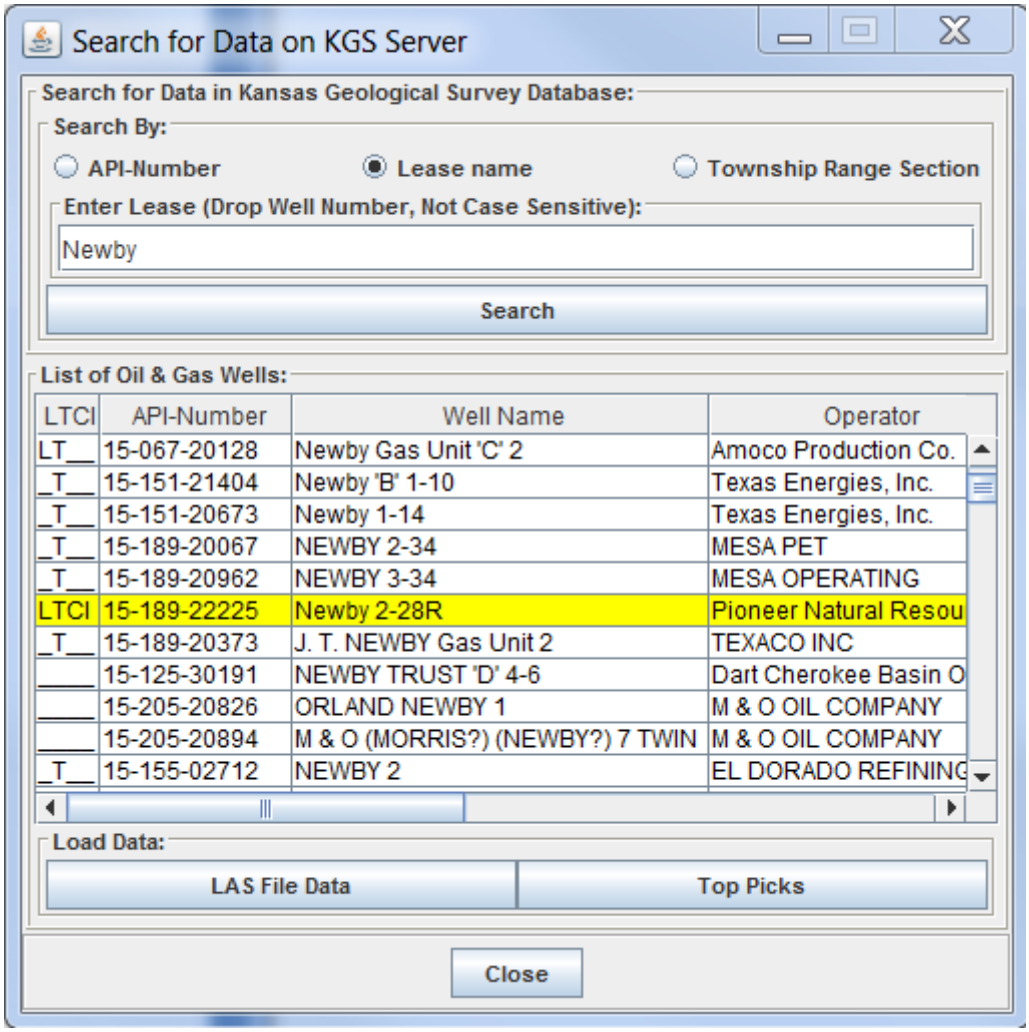


- By Partial Lease Name – The stored procedure used to retrieve the well header information allows the user to enter a partial phrase, in this example Newby. The program places a '%' in front and back of the phrase and sends the request to the Database, i.e. "%Newby%".



- By Township Range Section – This search is by location in Kansas, this search also allows the user to enter just the Township and Range to search for wells, e.g. to look for the Newby 2-28R, enter Township as 31 set the S (South) Radio button and Range as 37 set the W (West) Radio button.

The user only needs to enter the above data and select the "Search" Button to display the list of Wells in the Kansas Database that match the search criteria. In the image below the Lease Name "Newby" was entered to search for all wells in Kansas with the Phrase Newby in it. The user searches through the list until they find the well of interest. In this example it is the Newby 2-28R, which is highlighted.



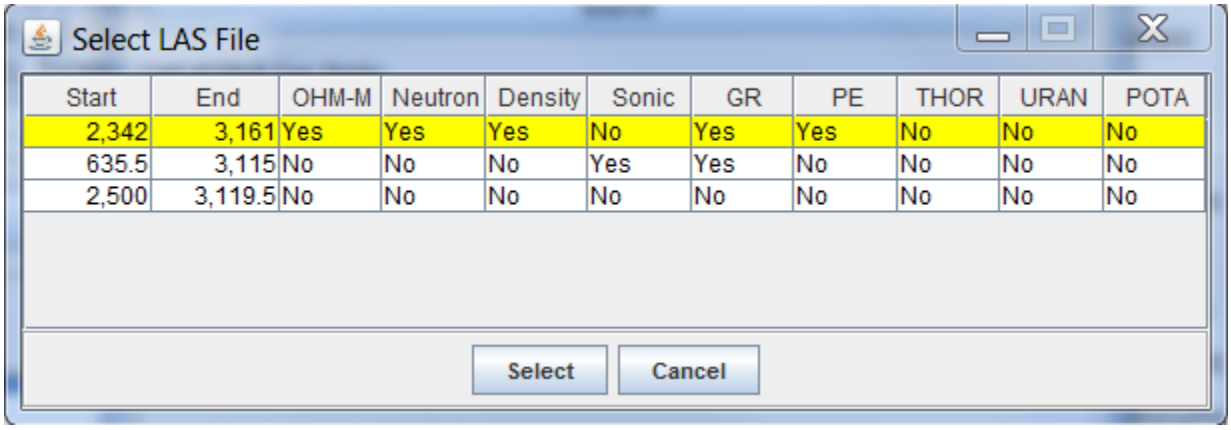
Notice that the LTCI represents the type of data that the well contains. It is a visual aid that lets the user see what is available before trying to download the data. If you require a LAS file you would want to see an L in that column. The LTCI labels stand for the following,

- L – Log ASCII Standard (LAS) version 2.0 Files
- T – Tops Data (Stratigraphic Unit Horizons)
- C – Measured Core Data
- I – Core Joint Photographic Experts Group (JPEG) Image Files

This dialog allows the user to now download each of the data types that are available.

Load KGS Well Data – LAS File Data

The "Search for Data on KGS Server" Dialog allows the user to download data from the KGS Database & Server to the web app. The "LAS File Data" Button will display the "Select LAS File" Dialog with a list of LAS version 2.0 Files that are available.

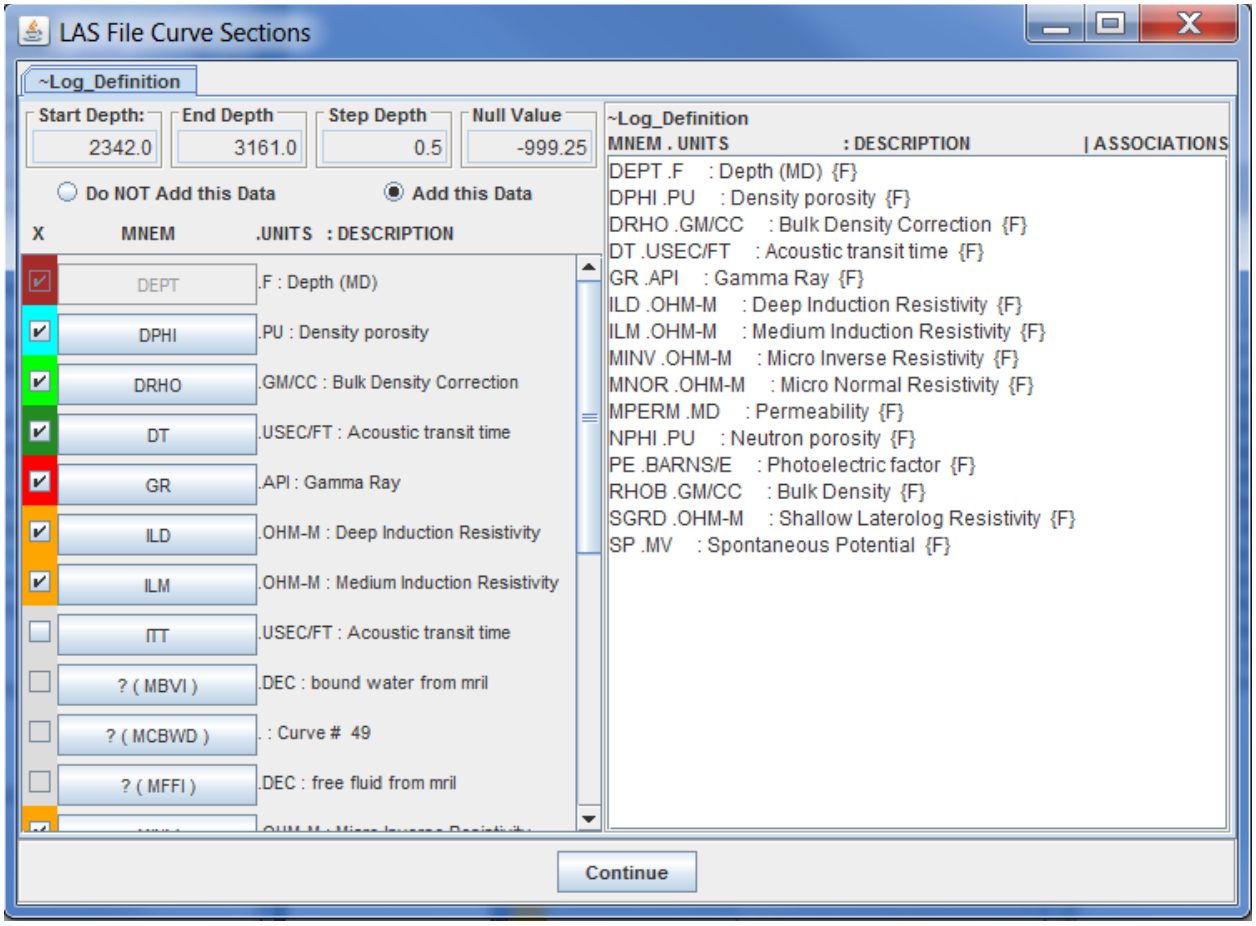


In this example there are three LAS files available, with a table suggesting the log data type in the file. In the beginning of the GEMINI Project (2000-2003) a precursor to the GEMINI Tools the KGS populated the Tool Types from every log that was in the KGS Server at that time. Unfortunately KGS has not maintain that table for wells uploaded after 2003 so the LAS File may have "No" for all the log types, which is not accurate. The user will need to open or download the file or search for the Well on the KGS Master List of Oil and Gas Wells in Kansas Web Page (http://www.kgs.ku.edu/Magellan/Qualified/index.html) to see what is in the File Header before deciding to download data from this program. For this example the first log has most of the data necessary except the Spectral Gamma Ray Logs. The Table above identifies the following log types,

- OHM-M – Resistivity Logs
- Neutron – Neutron Porosity Log
- Density – Bulk Density and/or Density Porosity Log
- Sonic – Acoustic Transit Time and/or Sonic Porosity Log
- GR – Gamma Ray (API units) Log
- PE – Photoelectric Factor Log
- THOR – Thorium Concentration
- URAN – Uranium Concentration
- POTA – Potassium Concentration)

In this example the first log contains the data needed, highlight the first log and click on the "Select" Button to display the "LAS File Curve Sections" Dialog. The "LAS File Curve Sections" Dialog allows the user to map unknown LAS Curve Mnemonics to the KGS "Standard" Curve Mnemonics so they will be plotted in the Synthetic Seismic Web App Plot. This program reads the "LAS Tool Curve Mnemonics map to KGS Standard Mnemonics" XML File (http://www.kgs.ku.edu/software/gemini/data/las_standard_tools.xml), which will

automatically maps the Curve Mnemonics from the LAS file to one of 31 KGS “Standard“ Curve Mnemonics.



As you can see this log has all the log types of interest, Gamma Ray API, Resistivity, Neutron/Density, Photoelectric Factor, Sonic and Permeability. If a curve Mnemonic is not recognized the program will place a “?” in front of the Mnemonic, e.g. “?(MPERM16)” for the “. : Curve # 51” Log Curve. If the user is satisfied with the automatic curve selections, which are checked and color coded, they only need to select the “Continue” Button at the bottom of the Dialog to import the file. The next section will take the user through a series of examples in changing the curve selections and mapping unknown curve mnemonics.

Notice that some of the check boxes are colored with different colors, which shows that the curves were automatically selected, but also to represent the curve type by color.The Curves are colored by type (data units) as follows,

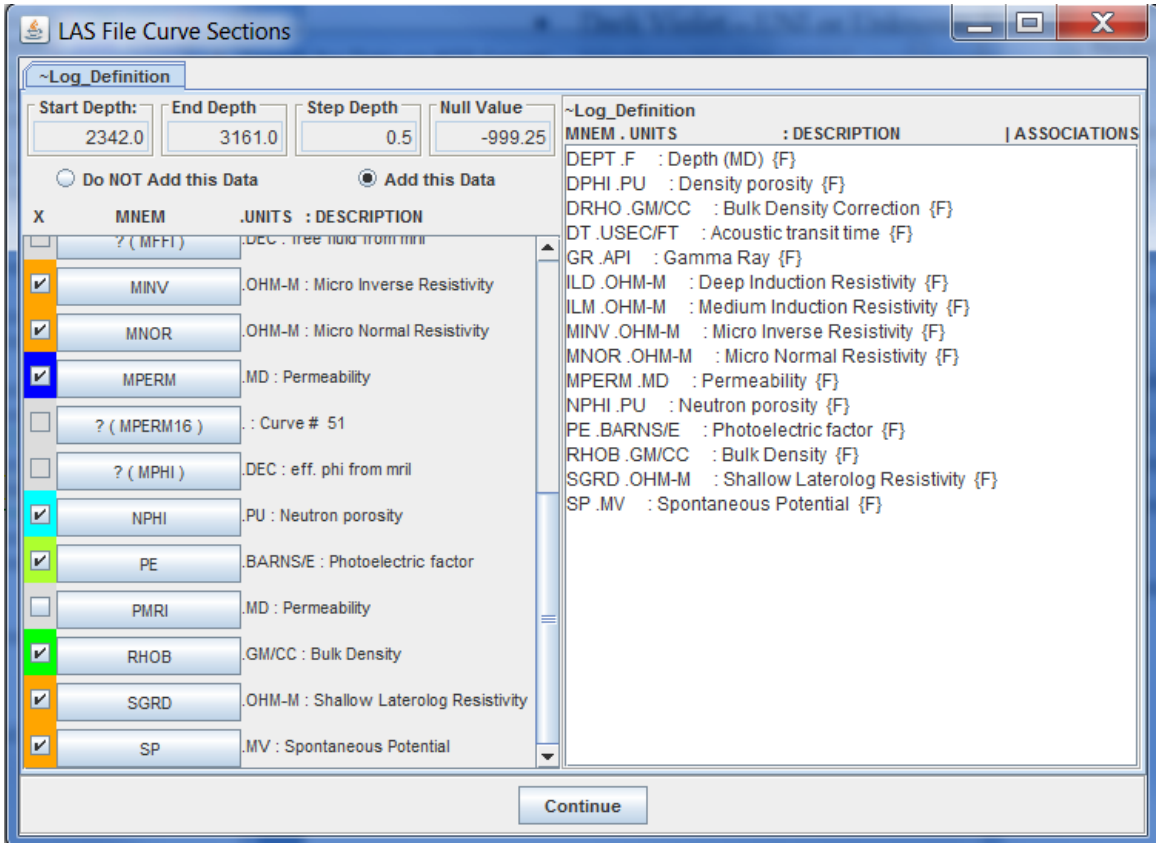
- Orange - OHM-M or Resistivity Logs
- Cyan – PU or porosity Logs, Neutron Porosity, Density Porosity, etc.
- Greenish yellow – BARNS/E or Photoelectric Factor Logs
- Green – GM/CC or Bulk Density Log
- Forest Green – USEC/FT or the Acoustic Transit Time Log

- Red – API, PPM or "%" as Radioactive logs, Gamma Ray, Spectral Gamma Ray, etc.
- Blue – MD or Permeability Logs
- Brown – F, FT or IN or Depth
- Middle yellow – FRAC, or other log curve types.
- Dark Violet – UNI or Unknown Linear Curves
- Medium Violet – UNL or Unknown Logrithum Curves

The color coding of the selected curves were added to also help the user visually recognize that a curve was selected or not.

Map Curves & Change Curve Selections

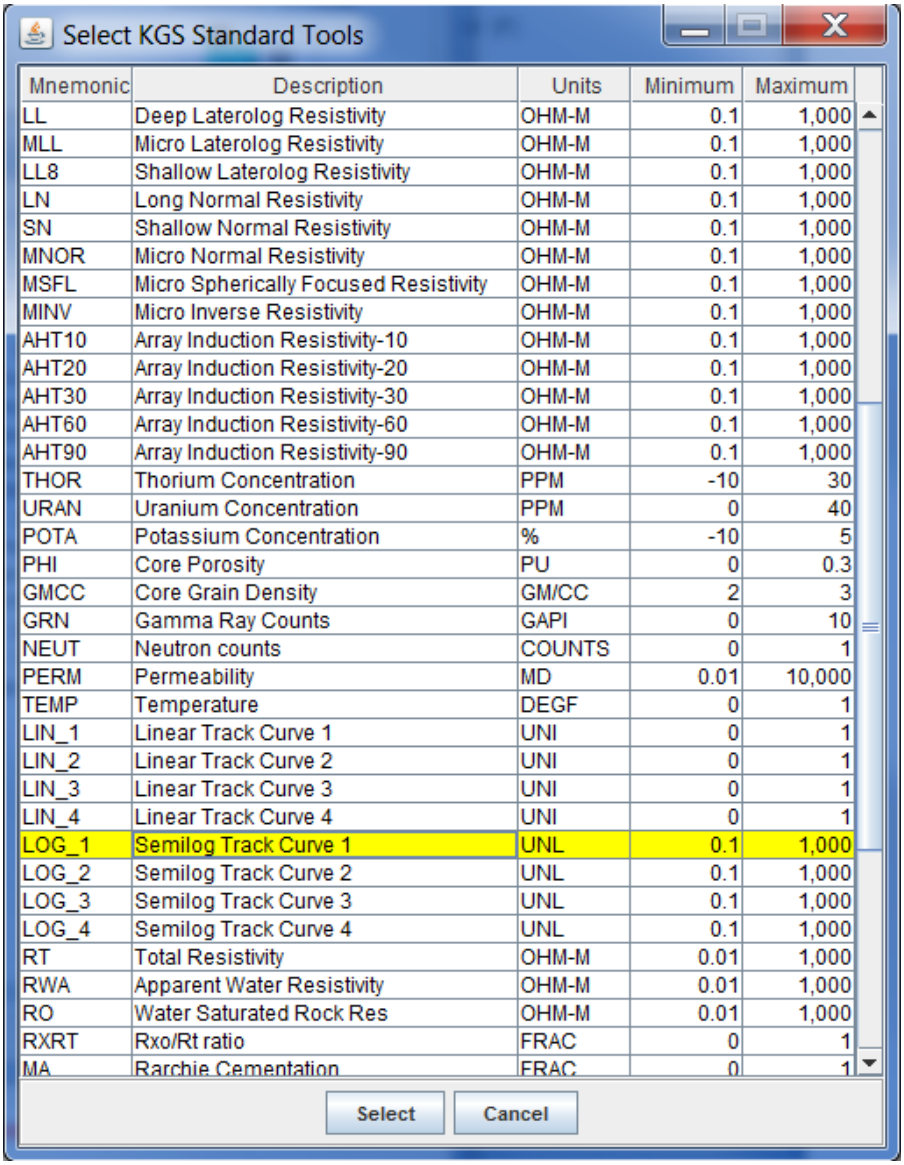
Some logs will have curve mnemonics that are not recognized as one of the KGS "Standard" Curve Mnemonics. The user will need to map the log curve to one of the KGS standard curves if they want to display the curve. Slide the scroll bar down to the Permeability Curves MPERM and ?(MPERM16).



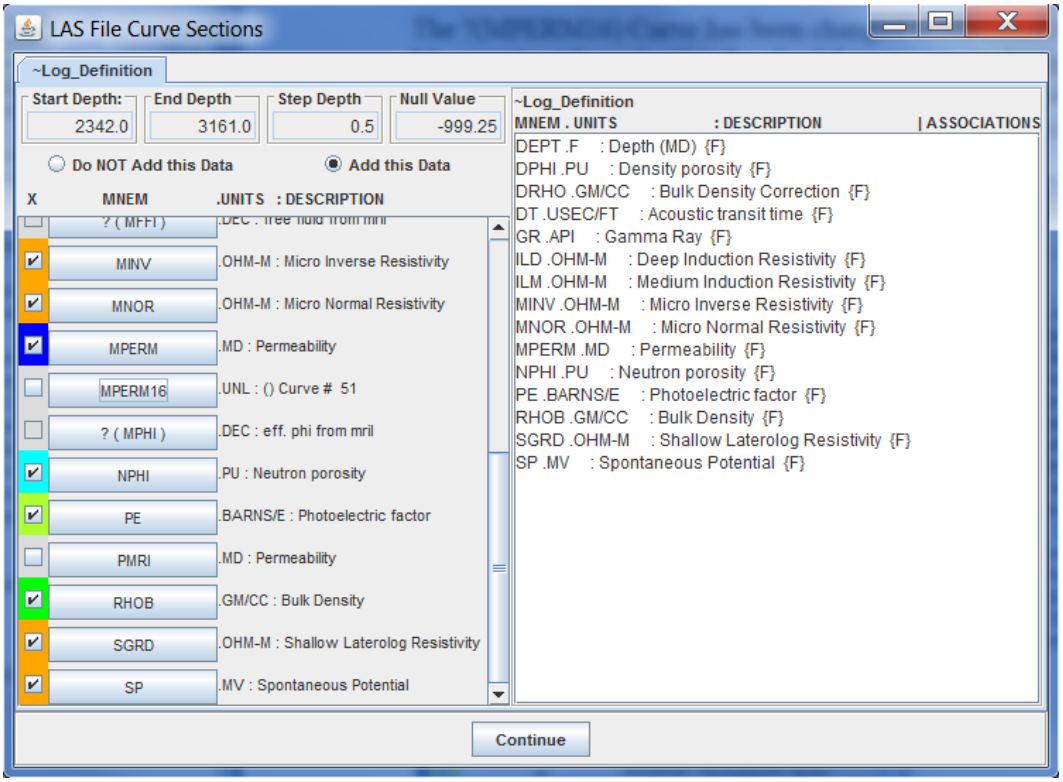
Click on the "?(MPERM16)" Button to display the "Select KGS Standard Tools" Dialog. This dialog provides a list of the KGS "Standard" Curve Mnemonics, from which the user can map an unrecognized log curve to one of the KGS standard curve mnemonics. The KGS "Standard" Curve Mnemonics List was created as a way to standardize the alpha bit soup of Log Mnemonics. Each logging company has their own curve mnemonics to represent similar tools.

The Synthetic Seismic Web App program is a later version of code from the GEMINI Project Synthetic Seismic Web App Module, which needed to standardize the log curves so the curves could be automatically read and assigned a plot track. The "LAS Tool Curve Mnemonics map to KGS Standard Mnemonics" XML File was created to map the log curves from logs that were part of the KGS LAS File Collection which is not a complete list of possible curve mnemonics.

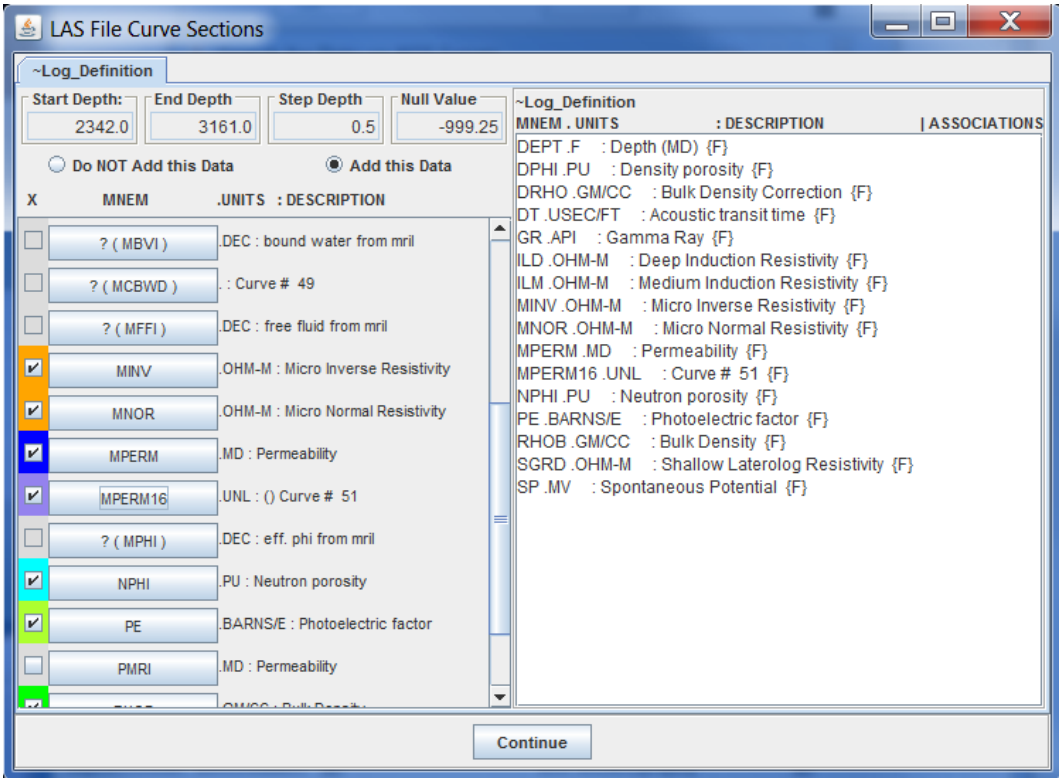
To map the unknown curve mnemonic "?(MPERM16)" you first notice that it similar to the MPERM curve above, which is a permeability curve. In this example both curves will be plotted together, but the Permeability Plot Track can only plot one curve. The web app has the ability to allow the user to plot up to 4 unknown logrithum curves and 4 unknown linear curves. The permeability is usually plotted as logrithmic. Click on the "?(MPERM16)" Button to display the



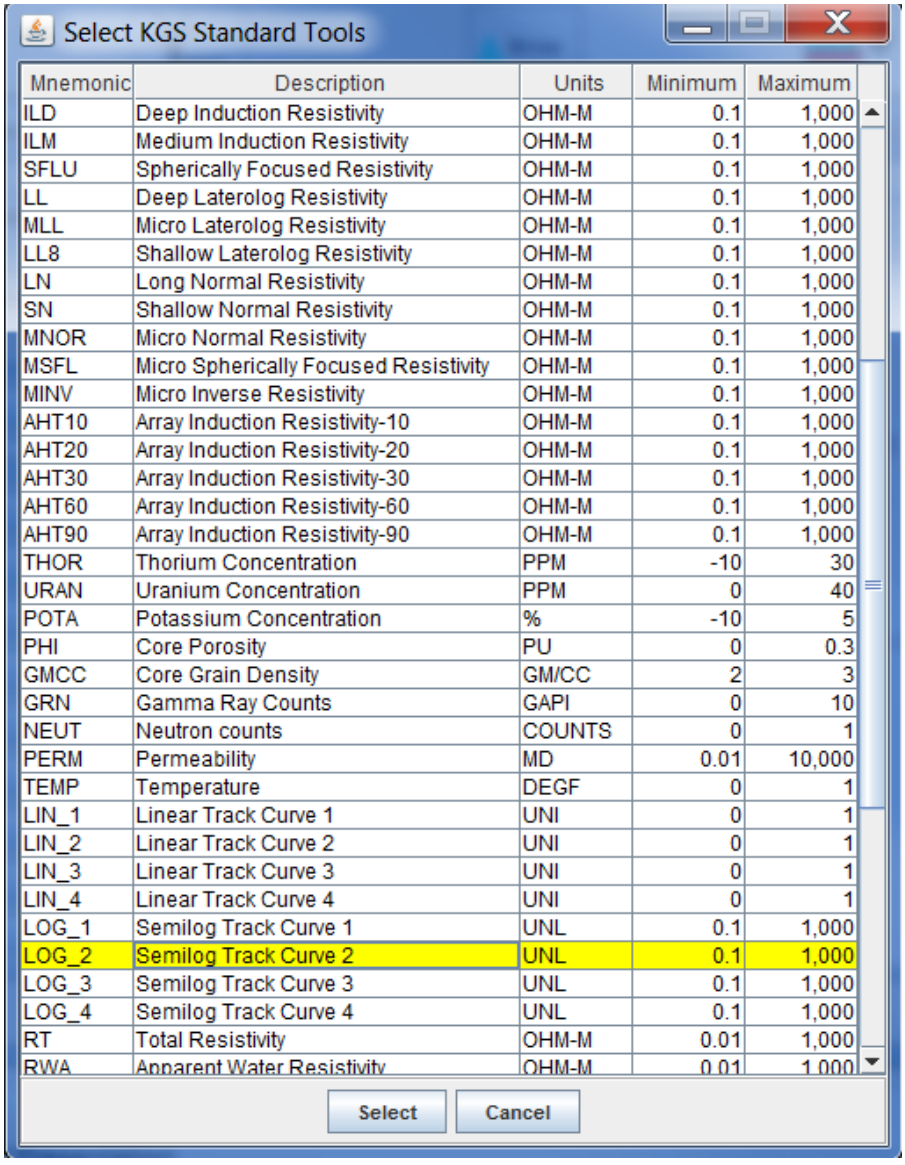
"Select KGS Standard Tools" Dialog. Slide the scroll bar down to the "LOG_1" Mnemonic – Semilog Track Curve 1 and highlight that curve. Click on the "Select" Button to map the "?(MPERM16) to the Semilog Track Curve 1.



The ?(MPERM16) Curve has been changed to MPERM16 removing the ?() around the Curve Mnemonic. Also select the check box next to it, which changes to a dark violet.

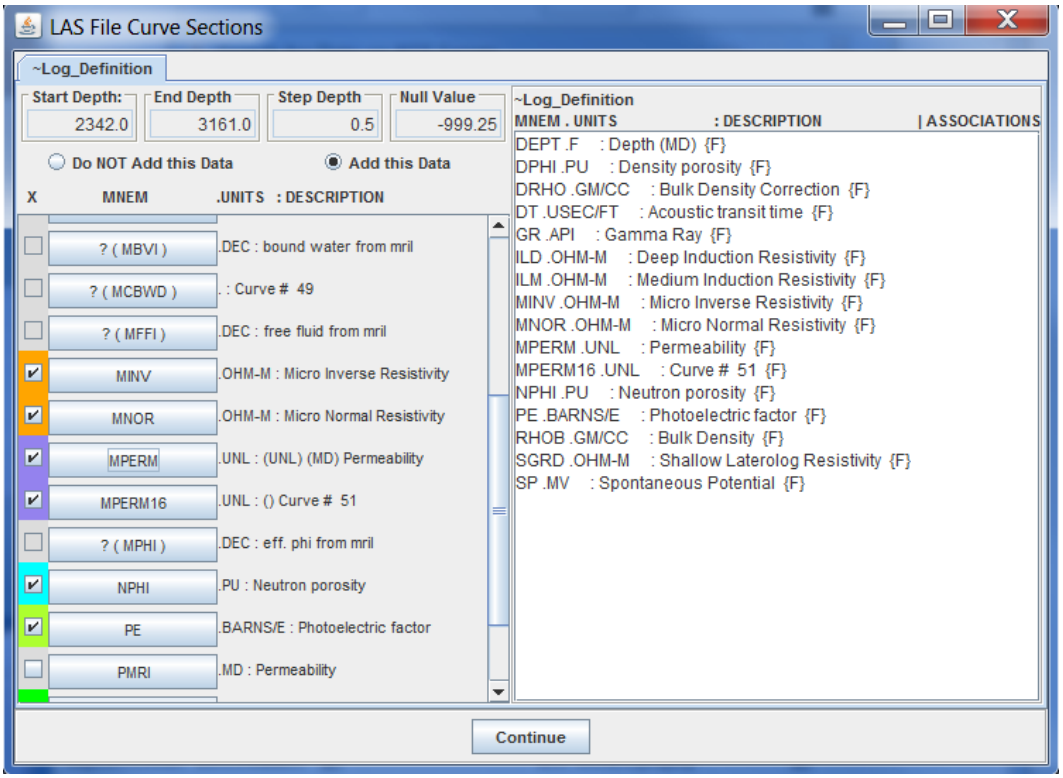


In order to plot both Permeability Curves on the same track, the MPERM must be assigned to the unknown Log Curves with MPERM16. Click on the MPERM Mnemonic Button to display the



Mnemonic	Description	Units	Minimum	Maximum
ILD	Deep Induction Resistivity	OHM-M	0.1	1,000
ILM	Medium Induction Resistivity	OHM-M	0.1	1,000
SFLU	Spherically Focused Resistivity	OHM-M	0.1	1,000
LL	Deep Laterolog Resistivity	OHM-M	0.1	1,000
MLL	Micro Laterolog Resistivity	OHM-M	0.1	1,000
LL8	Shallow Laterolog Resistivity	OHM-M	0.1	1,000
LN	Long Normal Resistivity	OHM-M	0.1	1,000
SN	Shallow Normal Resistivity	OHM-M	0.1	1,000
MNOR	Micro Normal Resistivity	OHM-M	0.1	1,000
MSFL	Micro Spherically Focused Resistivity	OHM-M	0.1	1,000
MINV	Micro Inverse Resistivity	OHM-M	0.1	1,000
AHT10	Array Induction Resistivity-10	OHM-M	0.1	1,000
AHT20	Array Induction Resistivity-20	OHM-M	0.1	1,000
AHT30	Array Induction Resistivity-30	OHM-M	0.1	1,000
AHT60	Array Induction Resistivity-60	OHM-M	0.1	1,000
AHT90	Array Induction Resistivity-90	OHM-M	0.1	1,000
THOR	Thorium Concentration	PPM	-10	30
URAN	Uranium Concentration	PPM	0	40
POTA	Potassium Concentration	%	-10	5
PHI	Core Porosity	PU	0	0.3
GMCC	Core Grain Density	GM/CC	2	3
GRN	Gamma Ray Counts	GAPI	0	10
NEUT	Neutron counts	COUNTS	0	1
PERM	Permeability	MD	0.01	10,000
TEMP	Temperature	DEGF	0	1
LIN_1	Linear Track Curve 1	UNI	0	1
LIN_2	Linear Track Curve 2	UNI	0	1
LIN_3	Linear Track Curve 3	UNI	0	1
LIN_4	Linear Track Curve 4	UNI	0	1
LOG_1	Semilog Track Curve 1	UNL	0.1	1,000
LOG_2	Semilog Track Curve 2	UNL	0.1	1,000
LOG_3	Semilog Track Curve 3	UNL	0.1	1,000
LOG_4	Semilog Track Curve 4	UNL	0.1	1,000
RT	Total Resistivity	OHM-M	0.01	1,000
RWA	Apparent Water Resistivity	OHM-M	0.01	1,000

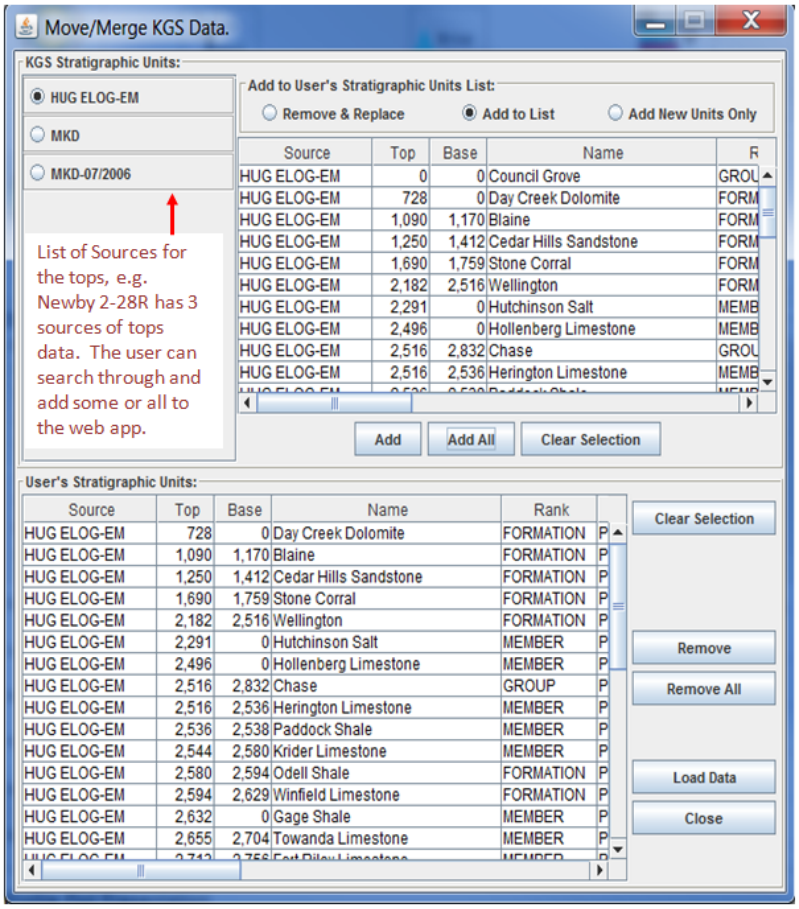
"Select KGS Standard Tools" Dialog. Slide the scroll bar down to the "LOG_2" Mnemonic – Semilog Track Curve 2 and highlight that curve. Click on the "Select" Button to map the "MPERM to the Semilog Track Curve 2.



Click the check box next to the MPERM Mnemonic Button you will notice that it has the same color as MPERM16, which now groups the two curves together. Select the “Continue” Button to load the LAS File into the web app.

Load KGS Well Data – Top Picks

The "Search for Data on KGS Server" Dialog allows the user to download data from the KGS Database & Server to the web app. The "Top Picks" Button will display the "Move/Merge KGS Data" Dialog with available top picks grouped by the sources creating the tops.



"**Add to User's Stratigraphic Units List**" Table shows the tops selected by the source, e.g. "HUG ELOG-EM" Source Tops List.

Radio Buttons

Remove & Replace – move the selected tops and replace any duplicate names
Add to List – move the selected tops to the "User's Stratigraphic Units" Table
Add New Units Only – move on the selected tops that are not already in the "User's Stratigraphic Units" Table

Table Buttons

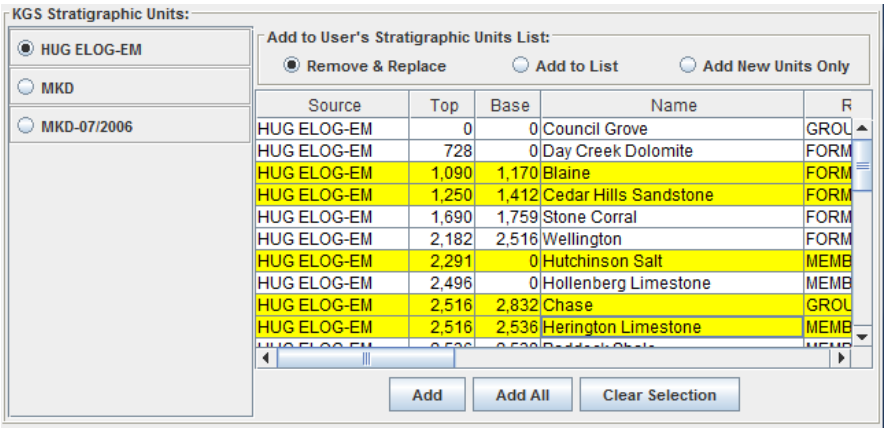
Add – add the highlighted top(s) to the "User's Stratigraphic Units" Table. Note: this table will allow the user to select multiple wells by using the "Ctrl" Key and the left click of mouse.
Add All – copy the list of tops to the "User's Stratigraphic Units" Table.
Clear Selection – remove the highlight on tops selected.

"**Add to User's Stratigraphic Units List**" Table. "User's Stratigraphic Units" Table shows the list of tops that will appear in the web app when the user selects the "Load Data" Button.

Table Buttons

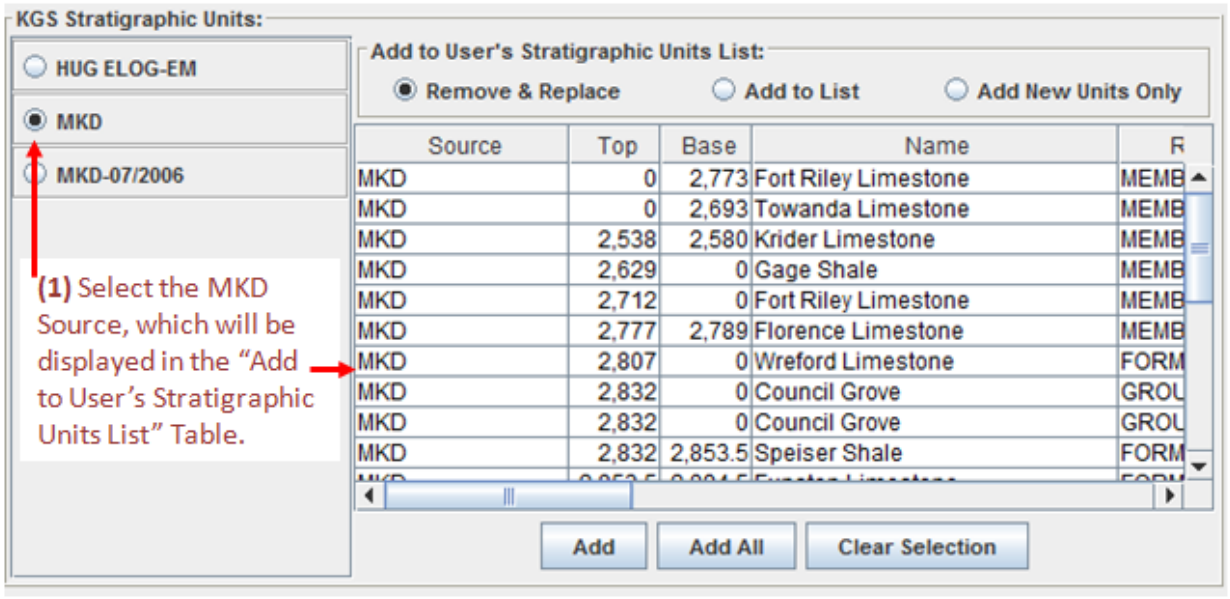
Clear Selection – remove the highlight on tops selected.
Remove – remove the highlighted top(s) from the table. Note: this table will allow the user to select multiple wells by using the "Ctrl" Key and the left click of mouse.
Remove All – remove all tops from the table.
Load Data – transfer the tops list to the web app calling.
Close – Close this dialog

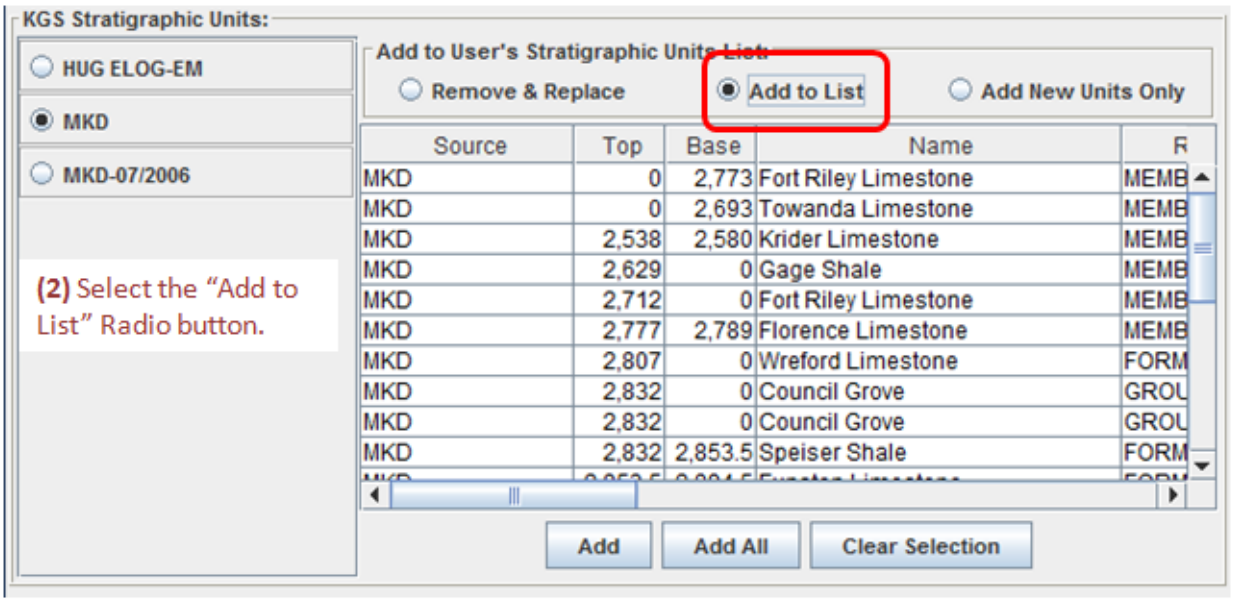
This dialog allows the user to add all or some the tops from each of the sources. Both tables are set up so the user can use the "Ctrl" Key with the left click of mouse to select multiple tops, i.e.

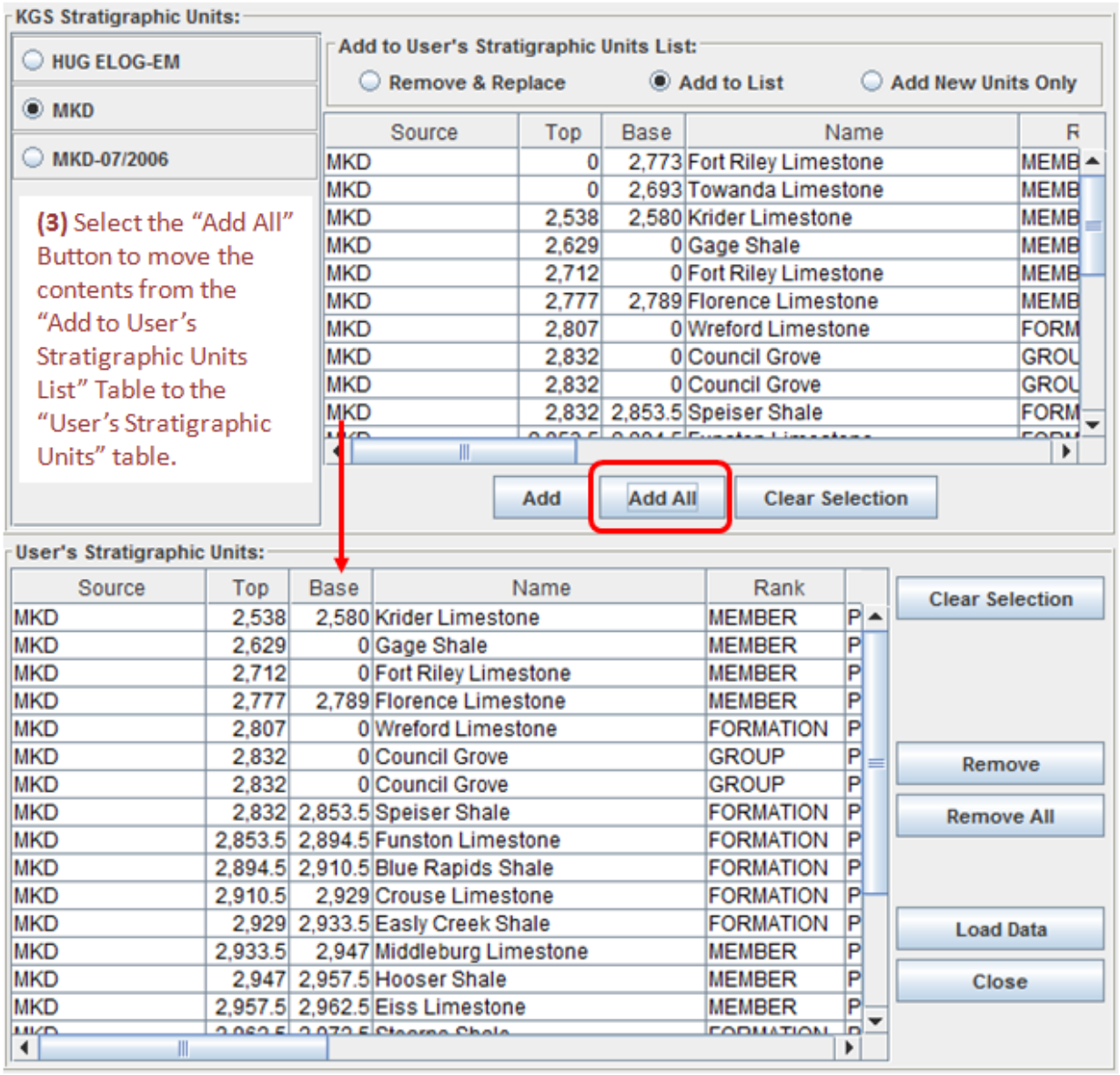


Notice that the only some of the tops are selected. You can then select the Add Button to move only the selected tops to the "User's Stratigraphic Units" Table.

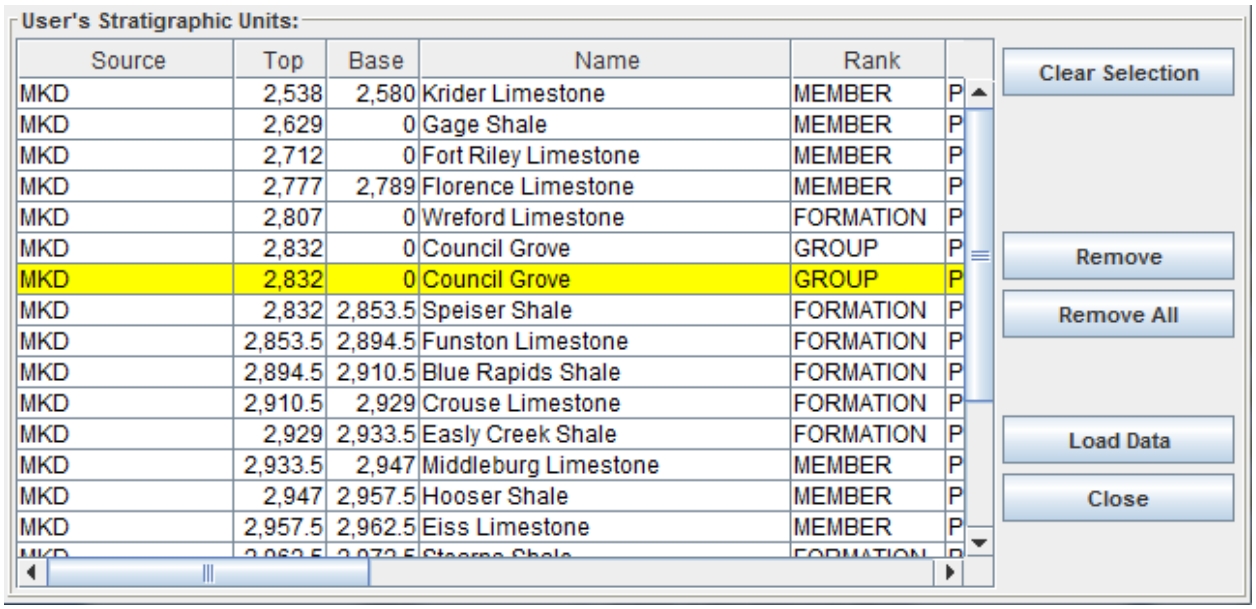
MKD Source Example:



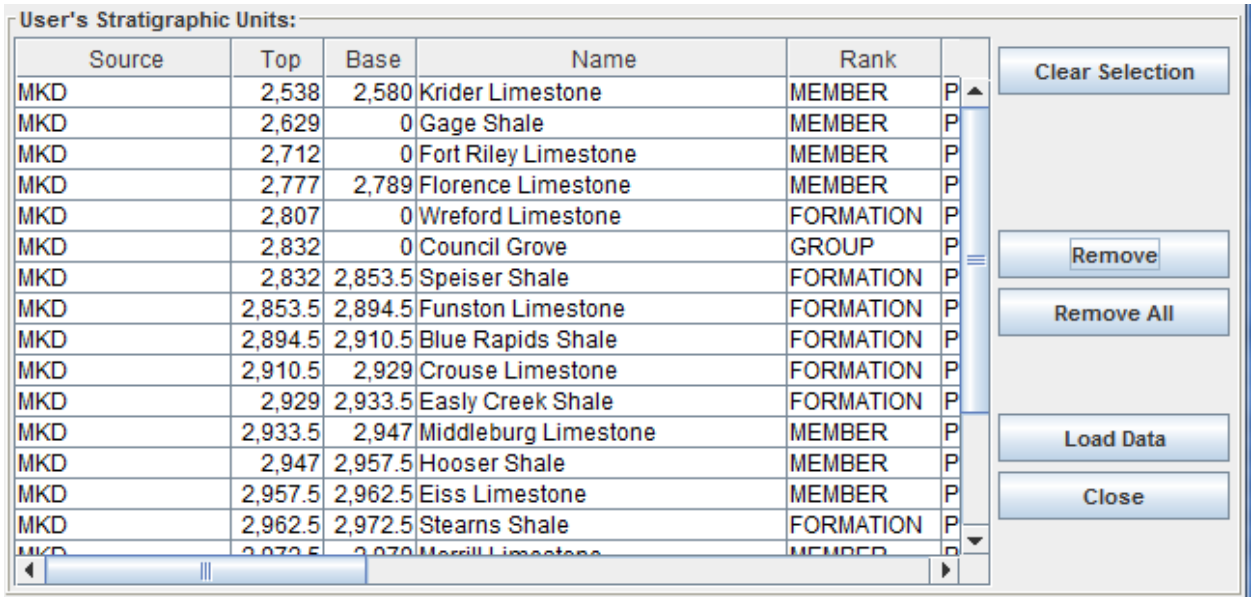




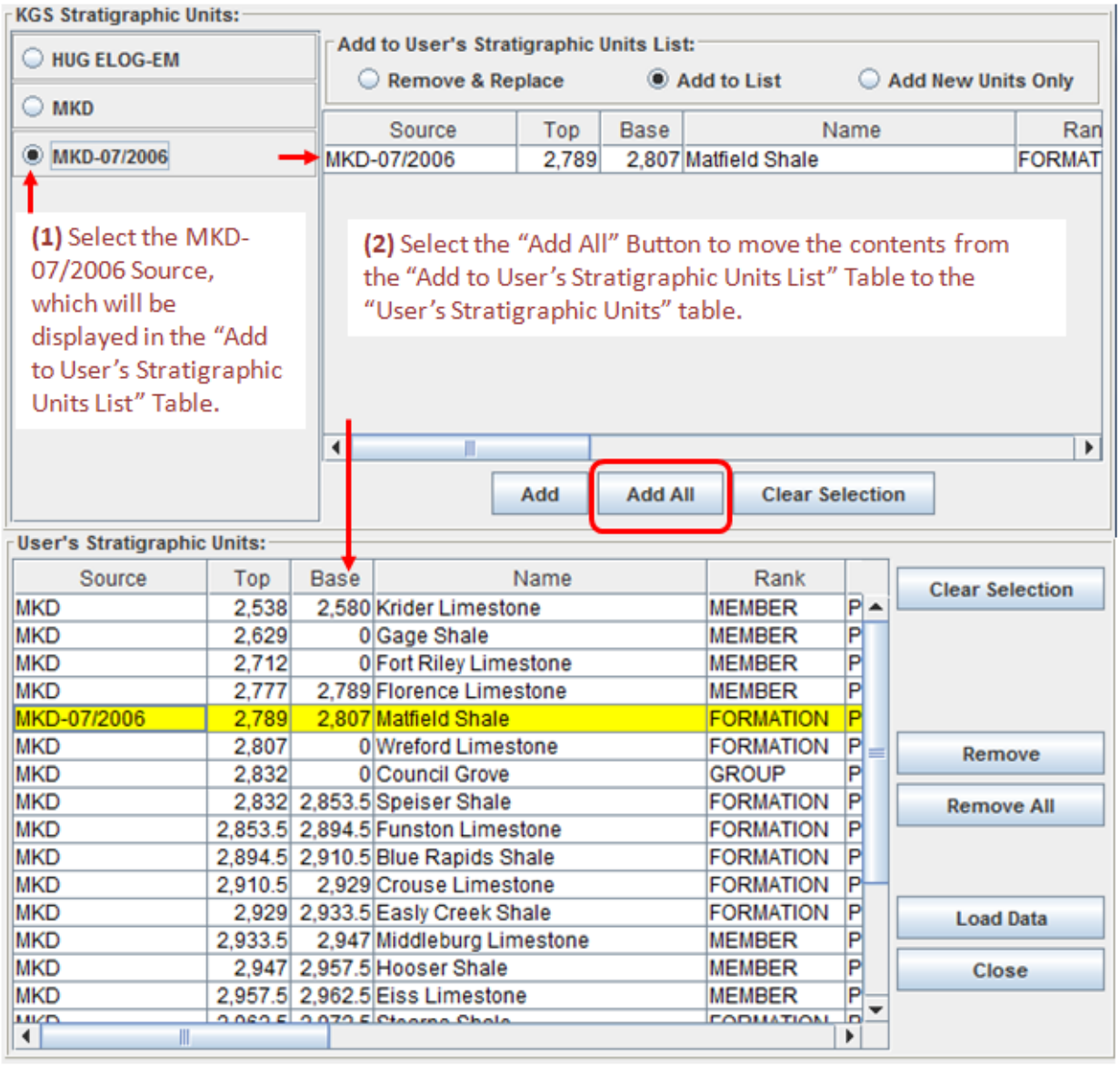
Once the list of tops are in the "User's Stratigraphic Units" Table the user can edit the list by removing any duplicate or invalid tops. Notice that the "Council Grove" Top occurs 2 times in the list. Highlight the one of the "Council Grove" tops.



Now select the "Remove" Button.



The MKD-07/2006 has only one top, so this dialog allows the user to add that top to the "User's Stratigraphic Units" Table. The MKD does not have this top and this is an extra top missing from the MKD data set.



Now with the data set complete select the "Load Data" Button to import the Tops data into the web app.

The Well data will automatically display to the "KIMELEON" dialog and load all the relevant panels, which can be accessed by the icon buttons at the top of the dialog. The "Horizon" icon button is the only panel that will show the Tops data with the summary of colorlith & color image plot tracks. Notice in the image below that the "K-U-Th" icon button is disabled, because there was no Spectral Gamma Ray Log Data present in the LAS File.

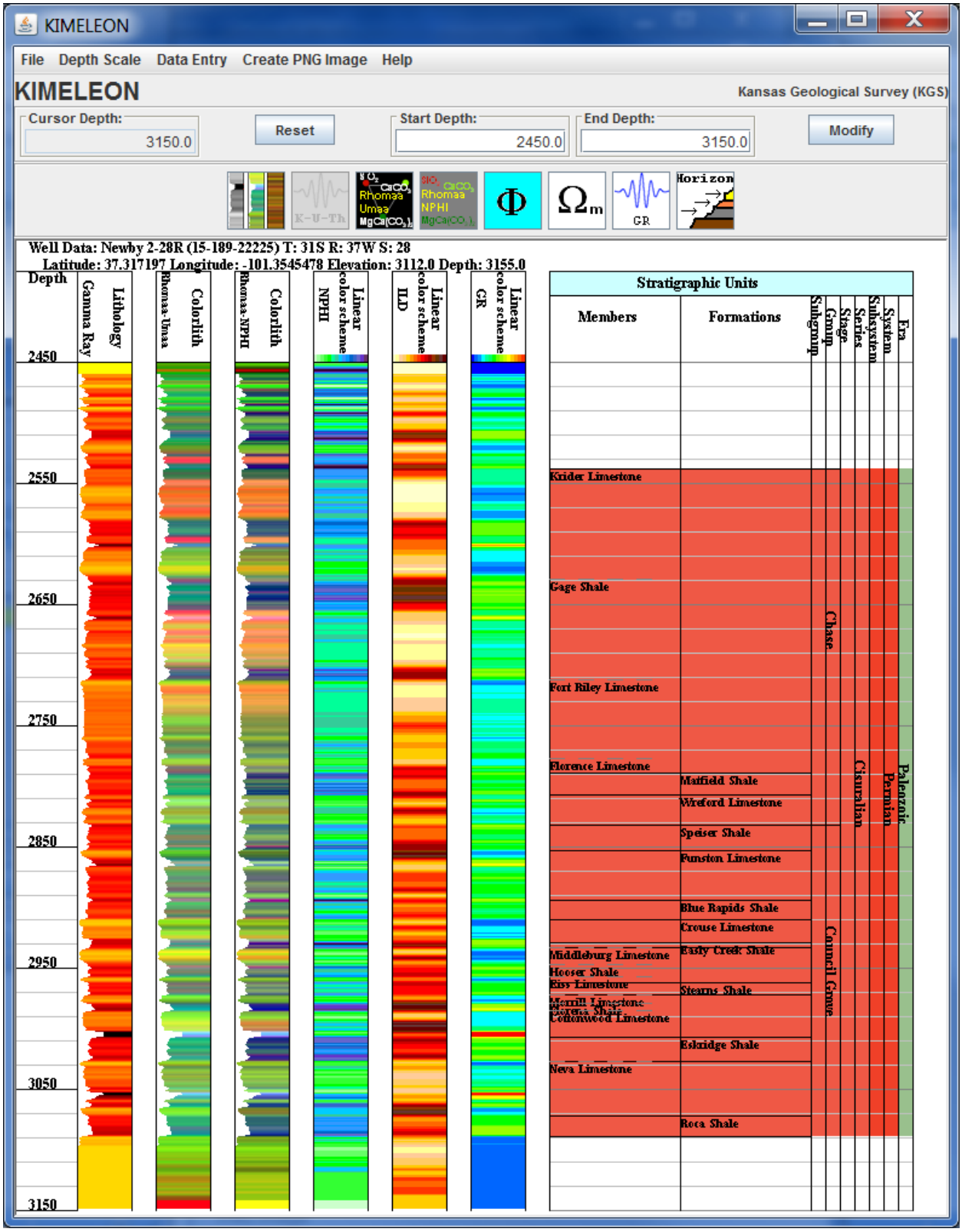


Figure: KIMELEON Dialog with the Newby 2-28R Well Data loaded from the KGS Database & Server.

Importing PC Data - Download Well Data to PC

Download either the ASCII Text Files directly or the Zip files extracting the contents into a directory. The problem with the ASCII Text Files being downloaded directly from a web page is that the web page will alter the contents so it does not retain the basic structure and add HTML text to the file. The preferred method if you have Zip or WinZip is to download the zip files to your PC and extract.

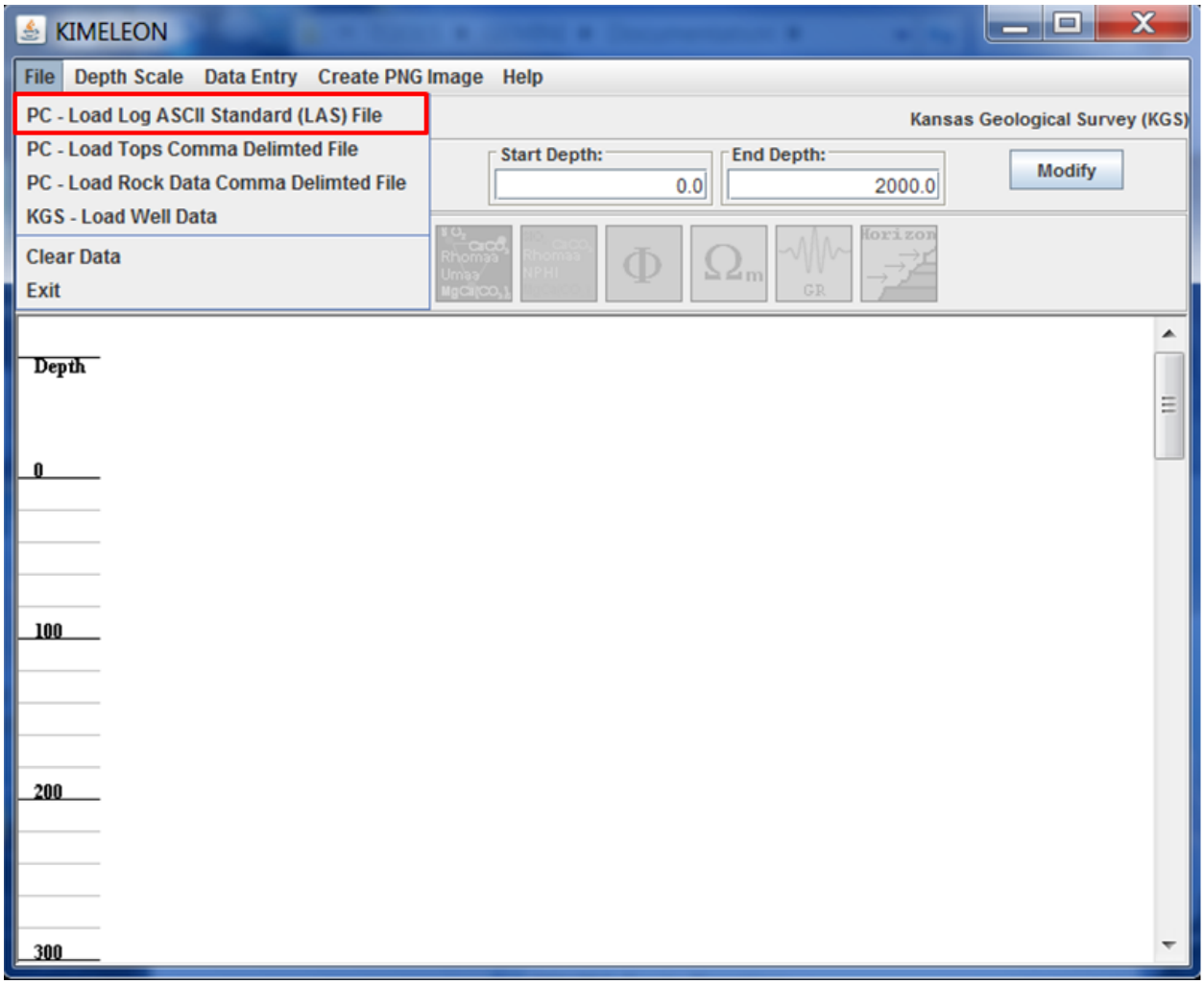
Well Data: Wellington KGS 1-32, Sumner County, Kansas

Type	ASCII Text Files
LAS 2.0	http://www.kgs.ku.edu/Gemini/Tools/documentation/Wellington-KGS-1-32.las
Tops	http://www.kgs.ku.edu/Gemini/Tools/documentation/Wellington-KGS-1-32_Tops.csv
Core	http://www.kgs.ku.edu/Gemini/Tools/documentation/Wellington-KGS-1-32_Core_Data.csv

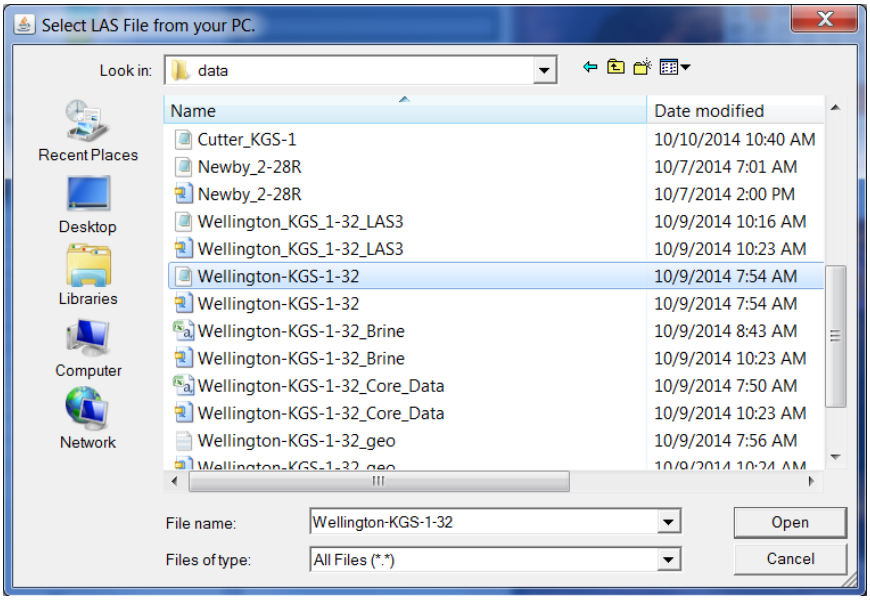
Type	Zip Files
LAS 2.0	http://www.kgs.ku.edu/Gemini/Tools/documentation/Wellington-KGS-1-32.zip
Tops	http://www.kgs.ku.edu/Gemini/Tools/documentation/Wellington-KGS-1-32_Tops.zip
Core	http://www.kgs.ku.edu/Gemini/Tools/documentation/Wellington-KGS-1-32_Core_Data.zip

Importing PC Data – Log ASCII Standard (LAS) version 2.0 File

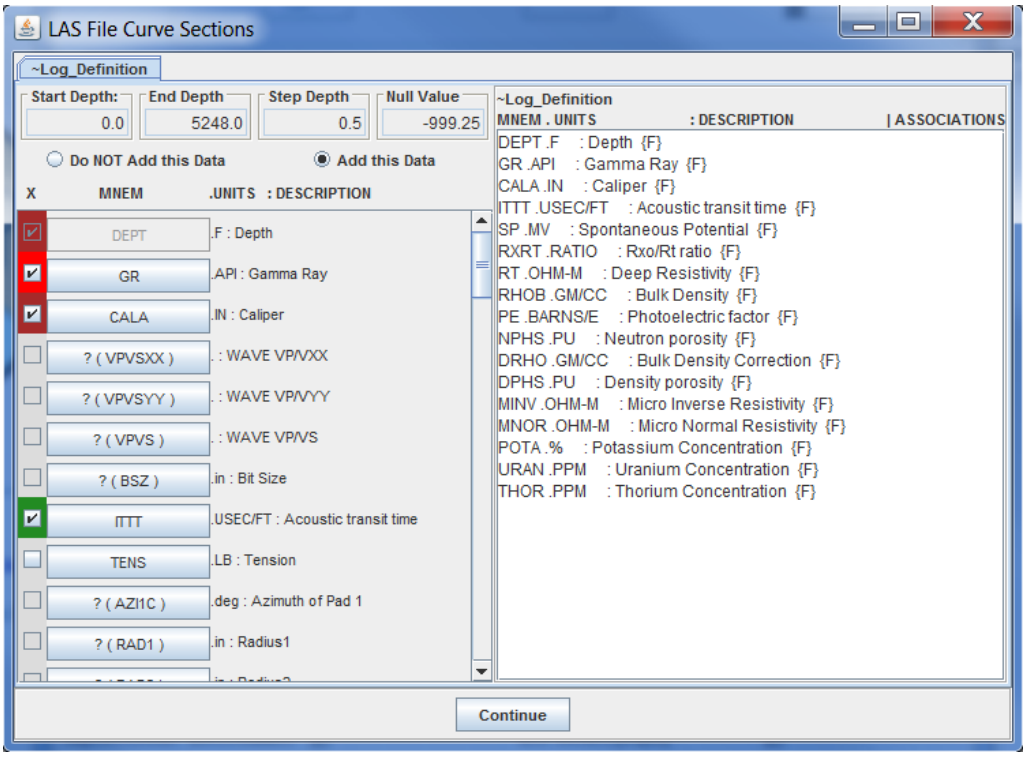
Most of the web apps will use the same input dialogs to import Log ASCII Standard (LAS) version 2.0 or 3.0 files. The Load Data Dialog is basically the same for most of the Web Apps, except they only load a subset of the total data types. In this example a LAS version 2.0 file is being imported into the web app.



Click on the "File" Menu in the menu bar at the top of the "KIMELEON" Dialog, which will display a list of menu options to import well data into the web app. Select the "PC - Load ASCII Standard (LAS) File" menu option. This will display the "Select LAS File from your PC" Dialog. This dialog allows the user to search their PC for the file of interest. In this example it is the LAS version 2.0 file Wellington-KGS-1-32.las, highlighted below. Select the Open button to display the "LAS File Curve Sections" Dialog.



The "LAS File Curve Sections" Dialog allows the user to map unknown LAS Curve Mnemonics to the KGS "Standard" Curve Mnemonics so they will be plotted in the LAS File Viewer Plot. This program reads the "LAS Tool Curve Mnemonics map to KGS Standard Mnemonics" XML File (http://www.kgs.ku.edu/software/gemini/data/las_standard_tools.xml), which will automatically maps the Curve Mnemonics from the LAS file to one of 31 KGS "Standard" Curve Mnemonics.



If a curve Mnemonic is not recognized the program will place a "?" in front of the Mnemonic, e.g. "?(BSZ)" for the ".in : Bit Size" Log Curve. If the user is satisfied with the automatic curve selections, which are checked and color coded, they only need to select the "Continue" Button at the bottom of the Dialog to import the file. The next section will take the user through a series of examples in changing the curve selections and mapping unknown curve mnemonics.

Notice that some of the check boxes are colored with different colors, which shows that the curves were automatically selected, but also to represent the curve type by color.The Curves are colored by type (data units) as follows,

- Orange - OHM-M or Resistivity Logs
- Cyan – PU or porosity Logs, Neutron Porosity, Density Porosity, etc.
- Greenish yellow – BARNS/E or Photoelectric Factor Logs
- Green – GM/CC or Bulk Density Log
- Forest Green – USEC/FT or the Acoustic Transit Time Log
- Red – API, PPM or "%" as Radioactive logs, Gamma Ray, Spectral Gamma Ray, etc.
- Blue – MD or Permeability Logs
- Brown – F, FT or IN or Depth
- Middle yellow – FRAC, or other log curve types.
- Dark Violet – UNI or Unknown Linear Curves
- Medium Violet – UNL or Unknown Logrithum Curves

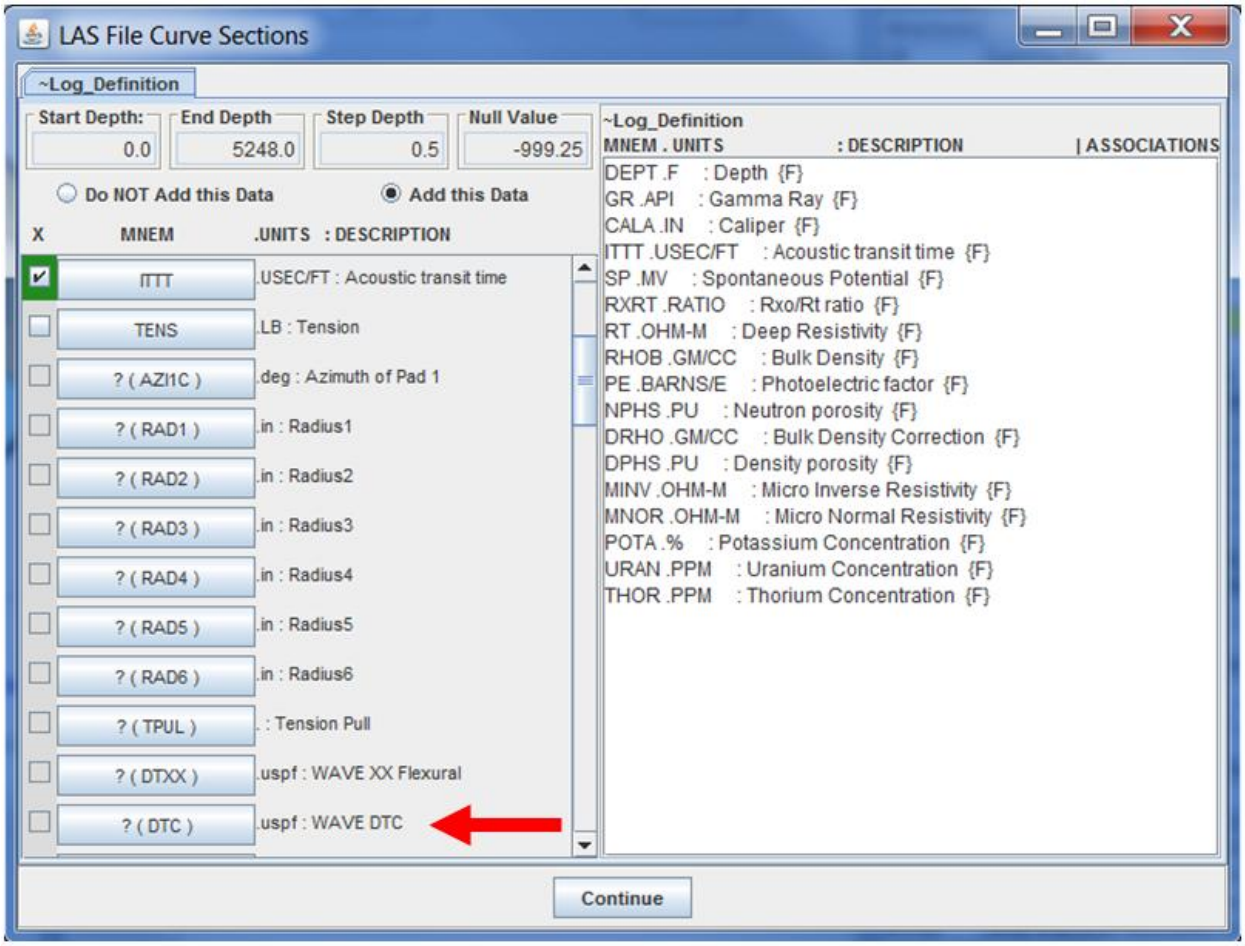
The color coding of the selected curves were added to also help the user visually recognize that a curve was selected or not.

Map Curves & Change Curve Selections

Some logs will have curve mnemonics that are not recognized as one of the KGS "Standard" Curve Mnemonics. The user will need to map the log curve to one of the KGS standard curves if they want to display the curve.

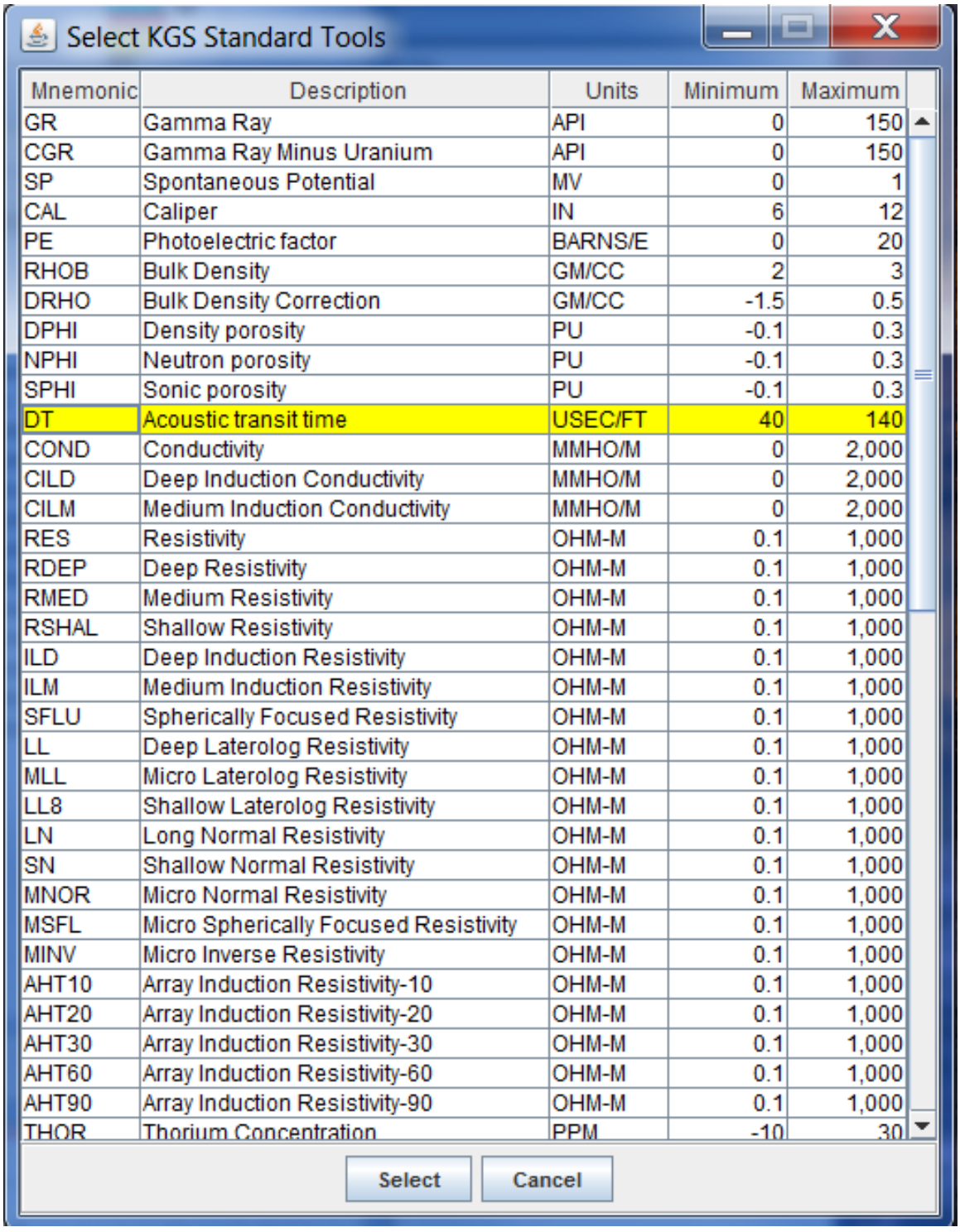
The first example is to map the Acoustic Transit Time (DT),which is labeled as ".uspf : WAVE DTC" log curve in the LAS File. Also notice that the button label "?(DTC)" is not recognized by the LAS FILE VIEWER web app.

Click on the "?(DTC)" Button to display the "Select KGS Standard Tools" Dialog. This dialog provides a list of the KGS "Standard" Curve Mnemonics, from which the user can map an unrecognized log curve to one of the KGS standard curve mnemonics. The KGS "Standard" Curve Mnemonics List was created as a way to standardize the alpha bit soup of Log Mnemonics.

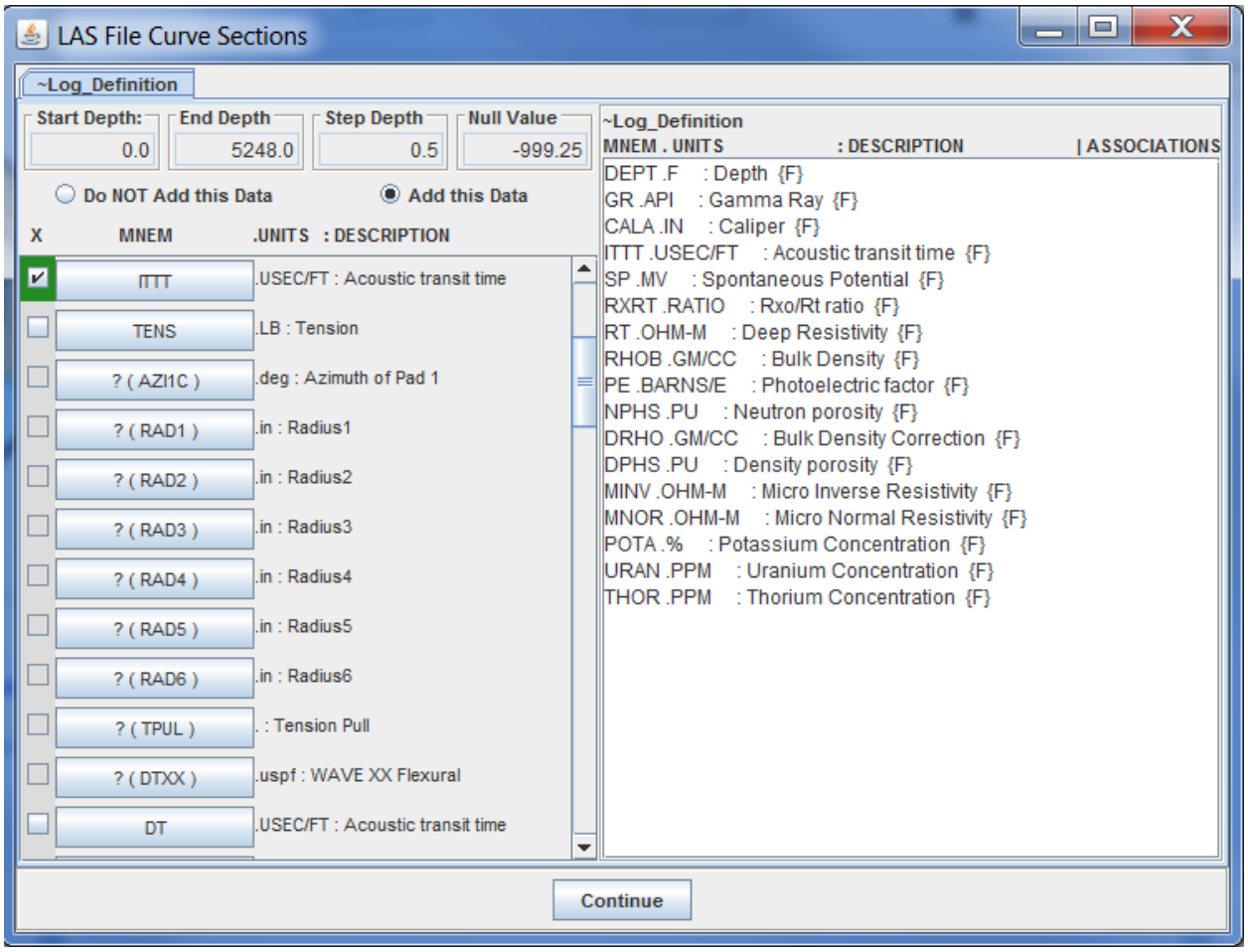


Each logging company has their own curve mnemonics to represent similar tools. The LAS File Viewer program is a later version of code from the GEMINI Project LAS File Viewer Module, which needed to standardize the log curves so the curves could be automatically read and assigned a plot track. The "LAS Tool Curve Mnemonics map to KGS Standard Mnemonics" XML File was created to map the log curves from logs that were part of the KGS LAS File Collection which is not a complete list of possible curve mnemonics.

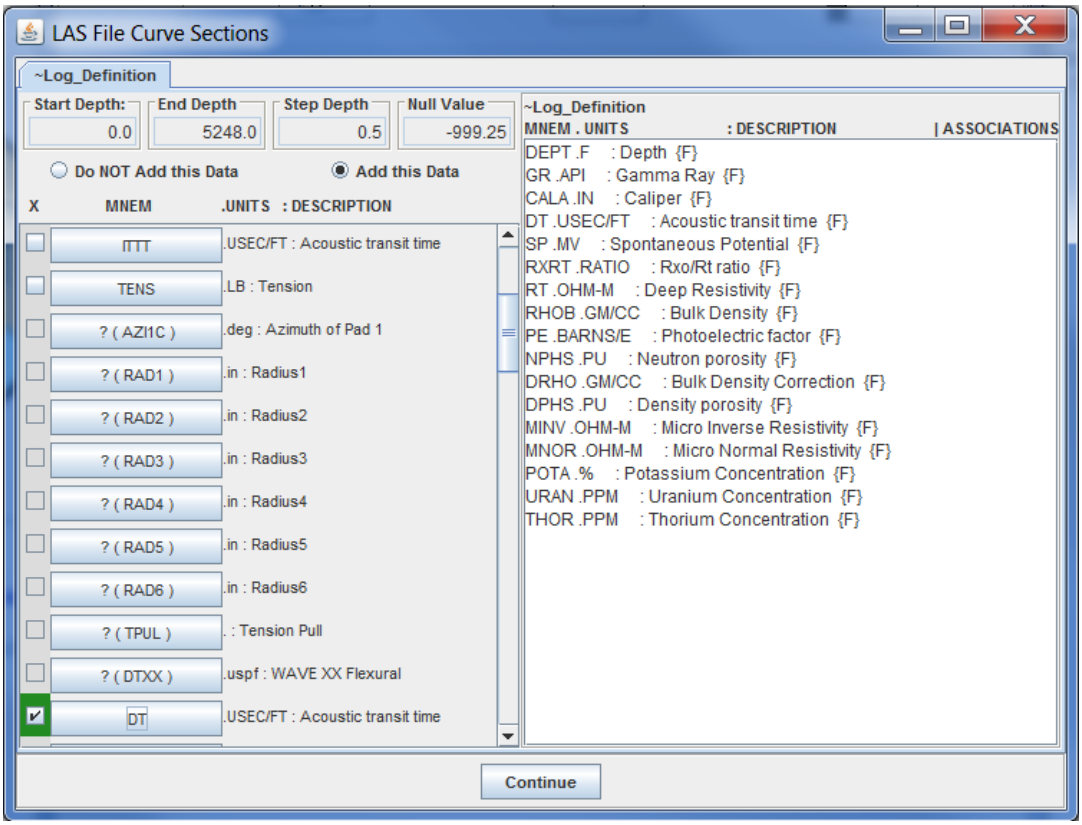
To map the unknown curve mnemonic "?(DTC)" you first notice that the unit is "uspf" (micro seconds per foot) a unit of time. Also the Acoustic Transit Time Curve Mnemonic is similar to the KGS "Standard" Curve Mnemonic "DT". By selecting the "?(DTC)" Button you will display the "Select KGS Standard Tools" Dialog.



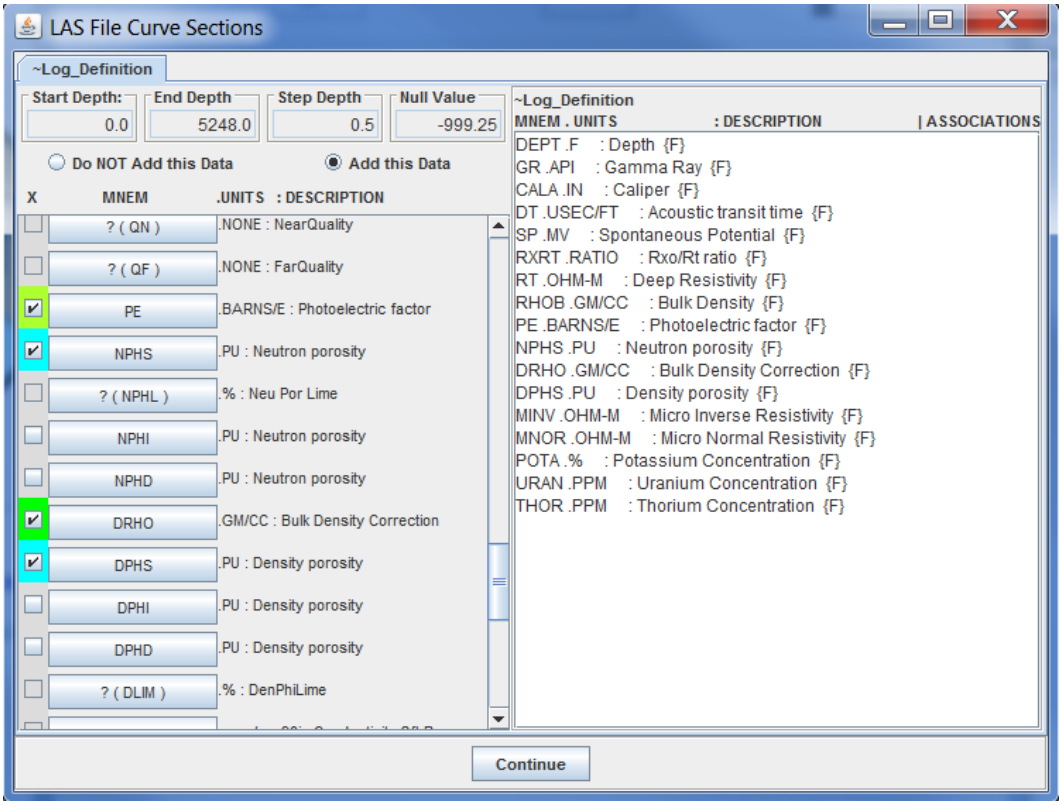
Highlight the “DT” Mnemonic Row and click on the “Select” Button to map the “?(DTC)” Curve Mnemonic to “DT” KGS Standard Curve Mnemonic.



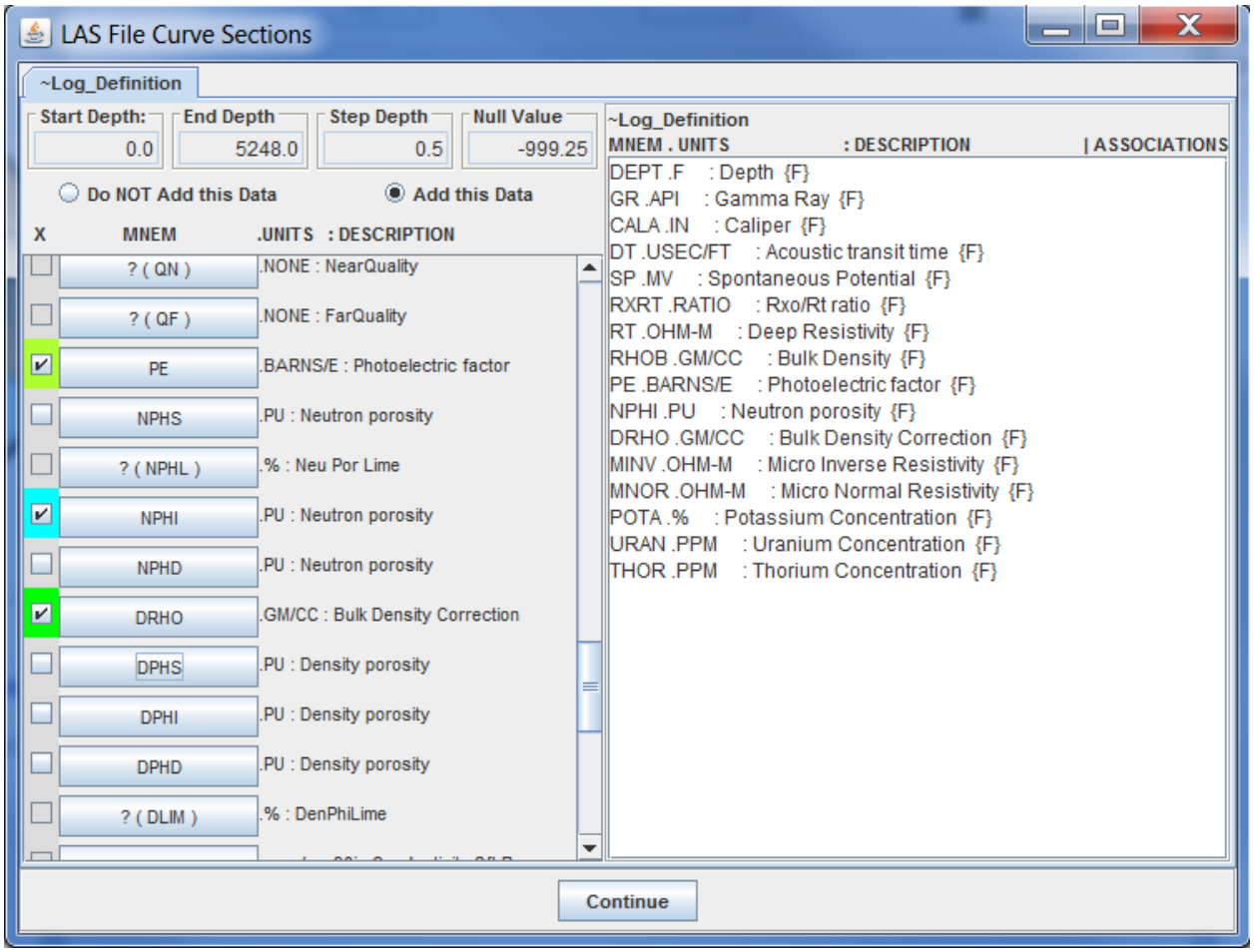
The "?(DTC). .uspf : WAVE DTC" has changed to "DT.usec/ft : Acoustic transit time". We want to change the selected "ITTT" Log Curve to "DT" Log Curve. The reason is that "ITTT" is the wrong curve type for the Acoustic Transit Time. The program found the curve mnemonic as similar to the "DT" Standard Curve Mnemonic, but this curve will not plot correctly in the LAS File Viewer Plot. Just click on the green check box in front of the "ITTT" Mnemonic Button to deselect the curve and then click on the check box in front of the "DT" Mnemonic Button to select it. Also notice that the ~Log_Definition Text Area was modified to show the change.



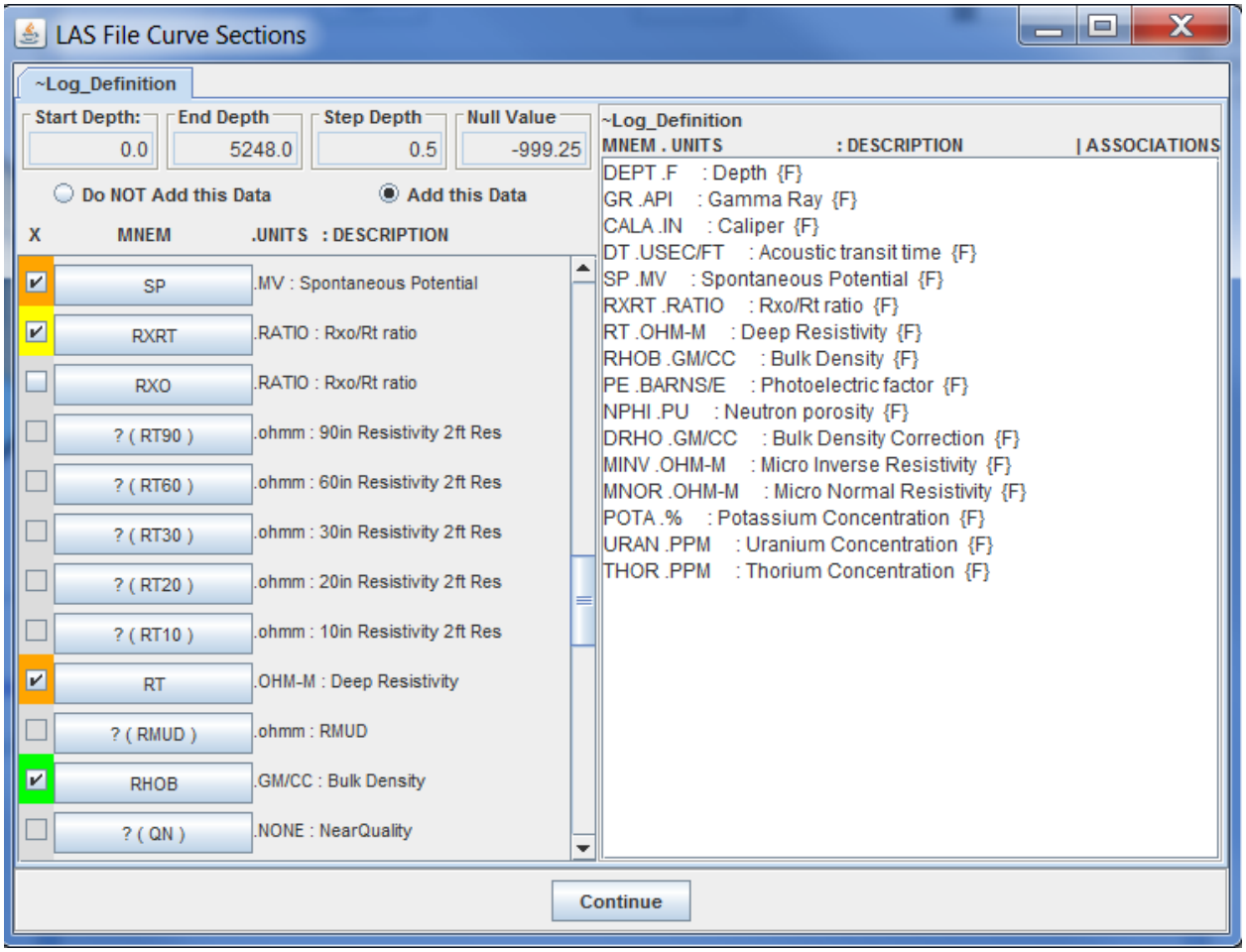
Moving the scroll bar down to the porosity curves, Neutron Porosity, and Density Porosity.



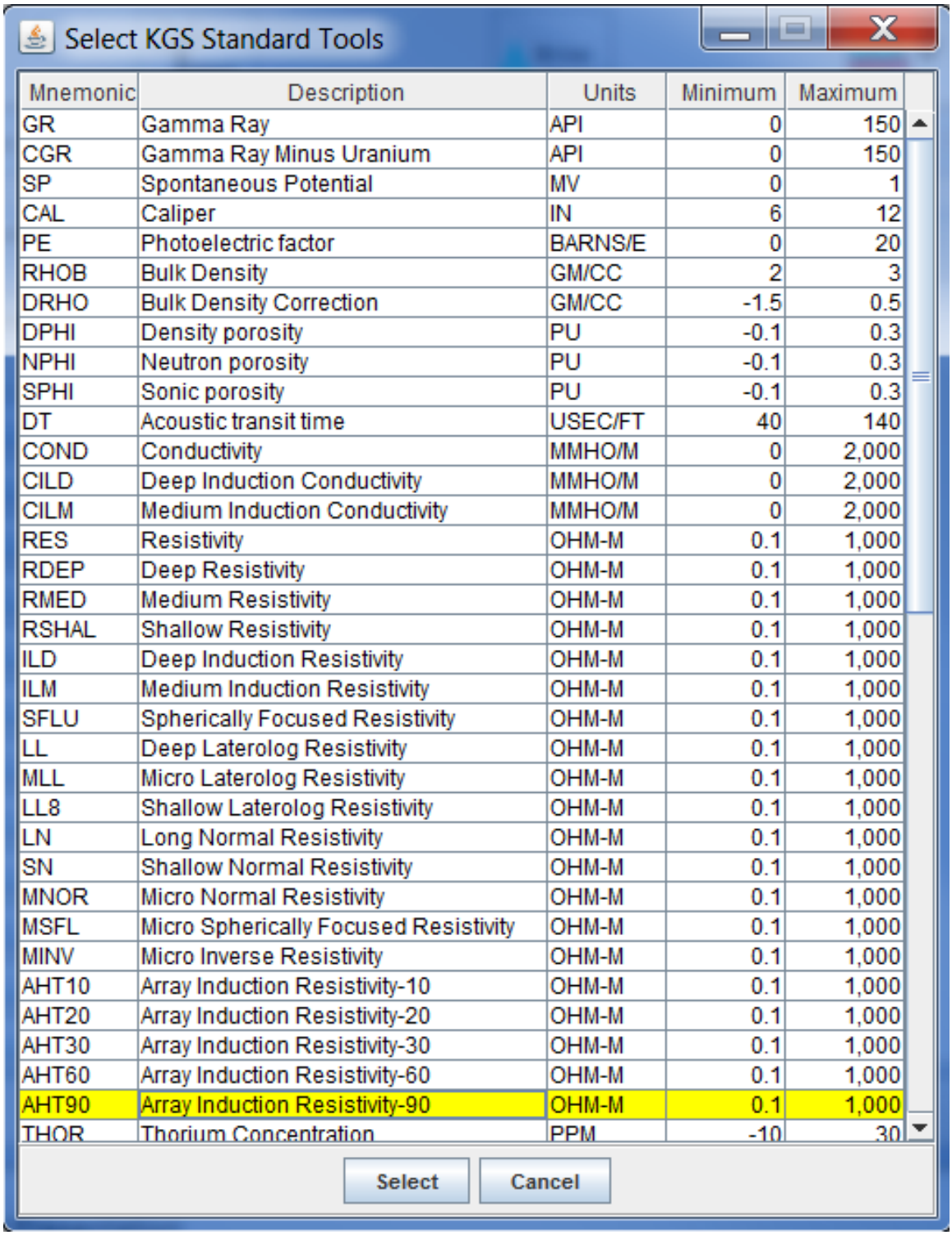
The LAS File Read will select the first curve that it recognizes and selects and color codes the curve. In this case the Neutron porosity mnemonic selected is “NPHS”, which is a valid curve, but the “NPHI” curve is desired so like the Acoustic Transit Time, you can deselect the “NPHS” and then select the “NPHI” Curve. Also the “DPHS” Density Porosity Curve can be deselected since the “RHOB” Bulk Density Curve has been selected. The reason for deselecting the Density Porosity Curve, if the Bulk Density Curve is present, is to force the LAS FILE VIEWER program to recompute the Density Porosity using a Limestone Matrix. If the Neutron Porosity, Bulk Density, Gamma Ray with/without a Photoelectric Factor Logs are present then the program will automatically compute a Lithology Composition Plot, but the Density Porosity has to be computed with a Limestone Matrix or the Lithology Composition Plot will not be computed corectly.



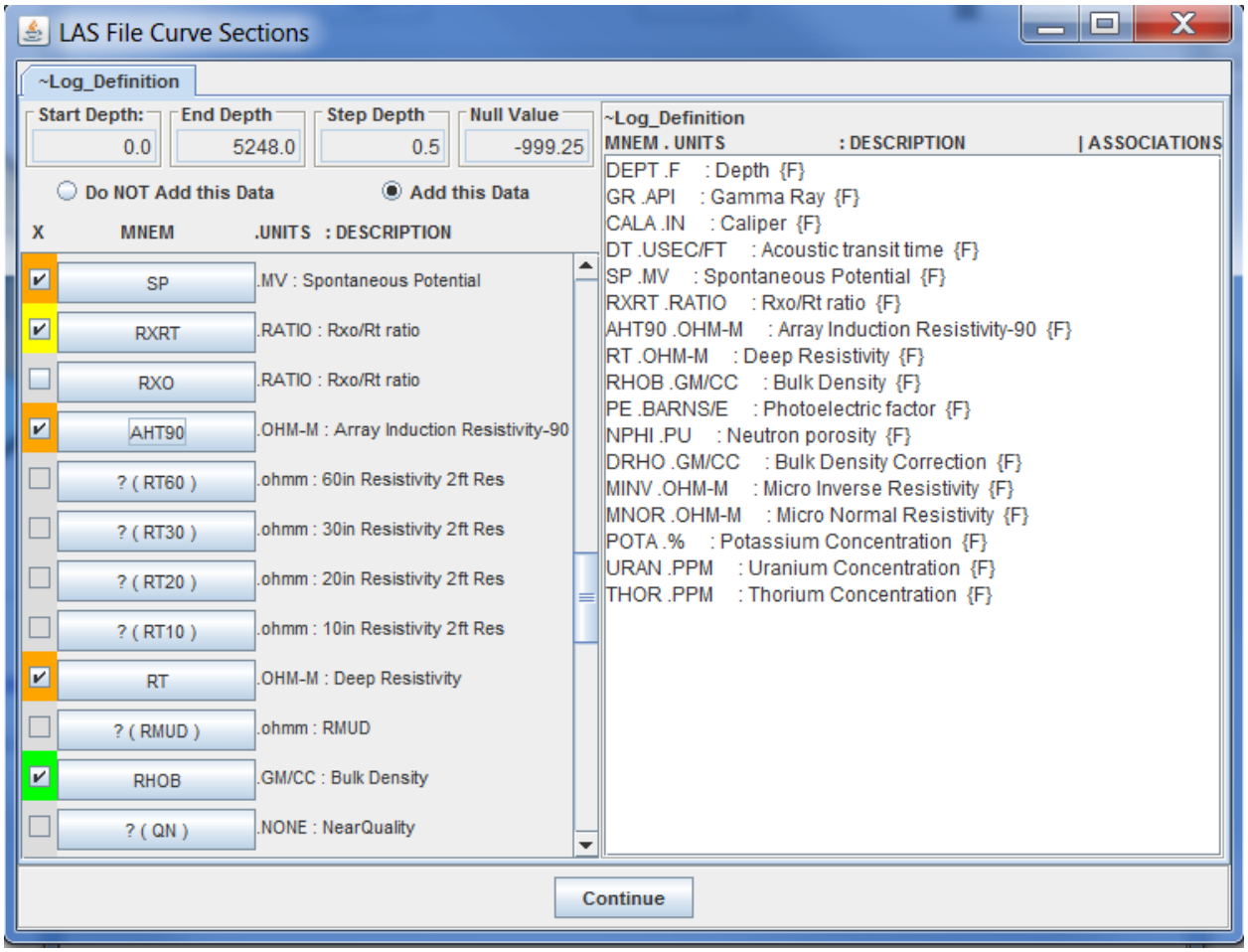
The above dialog represents the changes made for the neutron/density porosity logs. The last curves to be modified are the Array Induction Logs. Haliburton uses a different curve mnemonic for these logs. Move the scroll bar up to find the Array Induction Logs, RT90, RT60, etc.



Like the Acoustic Transit Time the "?(RT90).ohmm: 90in Resistivity 2ft Res" through "?(RT10).ohmm : 10in Resistivity 2ft Res" are not recognized. These curves can be map to the "AHT90 Array Induction Resistivity-90" to "AHT10 Array Induction Resistivity-10" KGS Curves Respectively. Click on the "?(RT90)" Mnemonic Button to display the "Select KGS Standard Tools" Dialog.

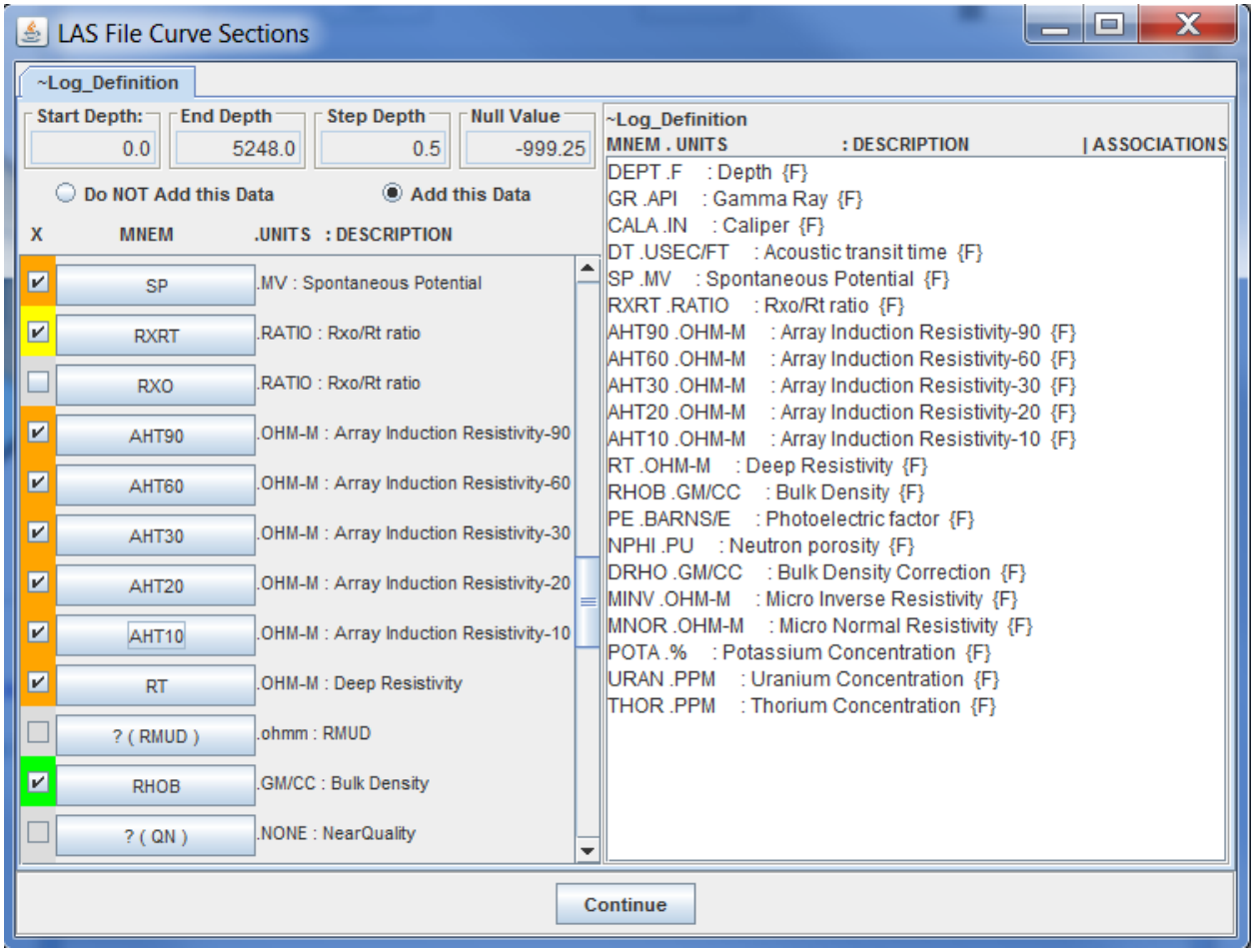


Highlight the AHT90 and click on the “Select” Button.



The "(?AHT90).ohmm : 90in Resistivity 2ft Res" has changed to "AHT90.OHM-M : Array Induction Resistivity-90" and the orange check box is selected. The rest of the Array Induction Log Curves each are mapped to the respective KGS Mnemonic Curve as follows,

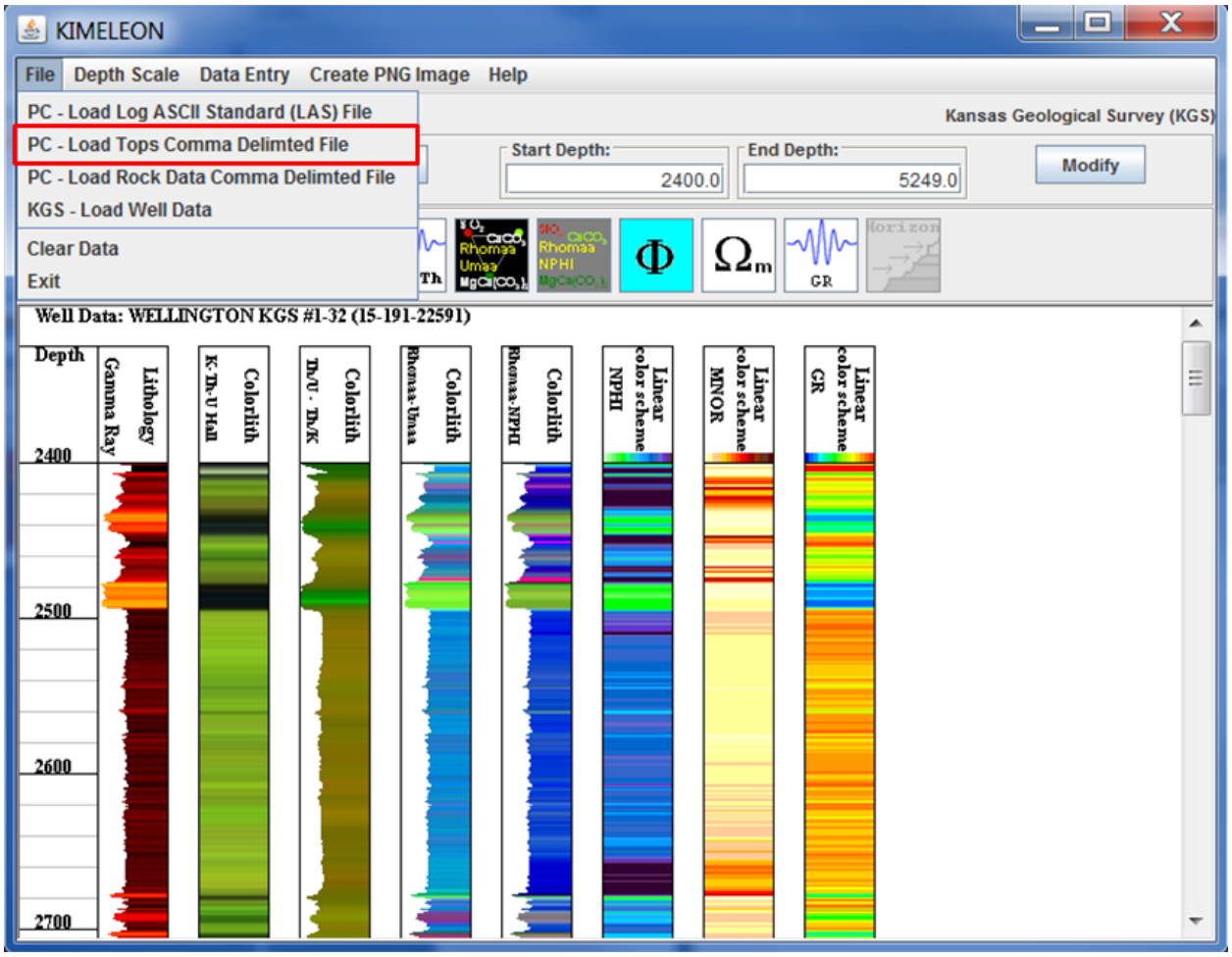
(?RT90).ohmm : 90in Resistivity 2ft Res to AHT90.OHM-M : Array Induction Resistivity-90
(?RT60).ohmm : 60in Resistivity 2ft Res to AHT60.OHM-M : Array Induction Resistivity-60
(?RT30).ohmm : 30in Resistivity 2ft Res to AHT30.OHM-M : Array Induction Resistivity-30
(?RT20).ohmm : 20in Resistivity 2ft Res to AHT20.OHM-M : Array Induction Resistivity-20
(?RT10).ohmm : 10in Resistivity 2ft Res to AHT10.OHM-M : Array Induction Resistivity-10



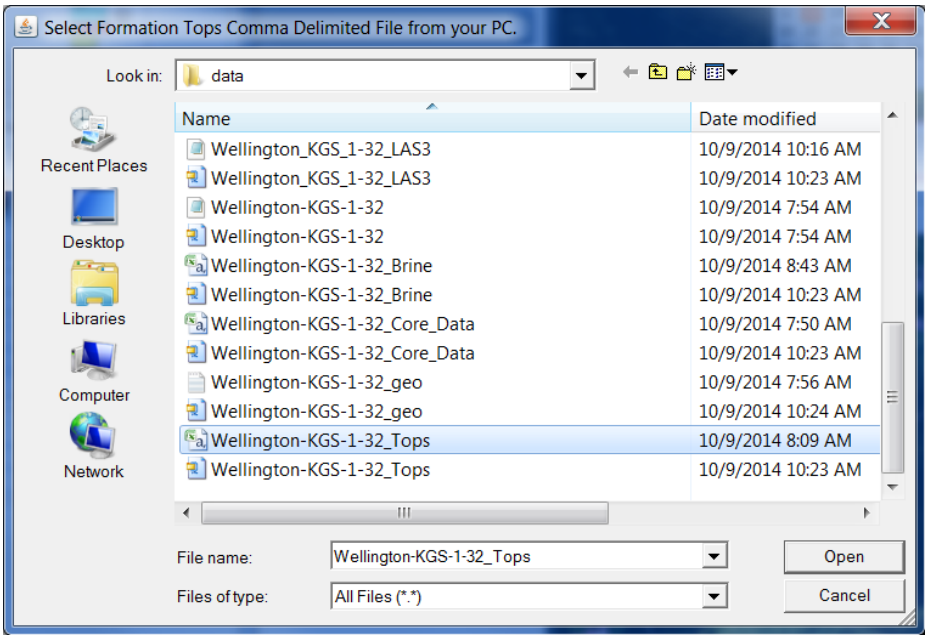
Select the Continue Button to read and parse the LAS log curves selected into the LAS FILE VIEWER Web App. Notice that the “Data Source Filenames:” Panel lists the LAS version 2.0 File that was just read in as well as the type of data, i.e. Log Data from LAS Data Type.

Importing PC Data – Tops CSV (Comma Separated Values) File.

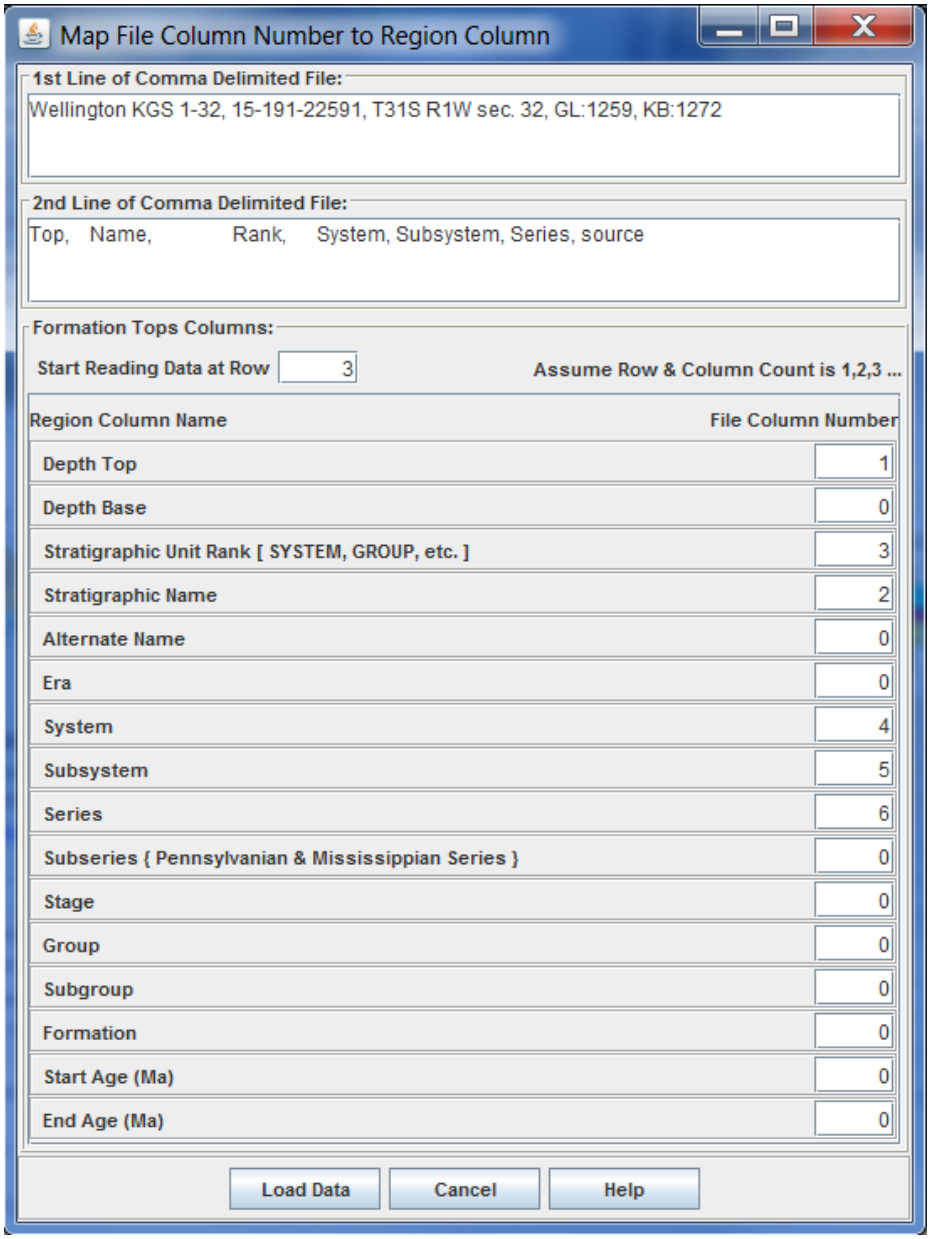
Most of the web apps will use the same input dialogs to import tops CSV (Comma Separated Values) file. The Load Data Dialog is basically the same for most of the Web Apps except they only load a subset of the total data types. In this example a Tops CSV file is being imported into the web app.



Click on the "File" Menu in the menu bar at the top of the "KIMELEON" Dialog, which will display a list of menu options to import well data into the web app. Select the "PC - Load ASCII Standard (LAS) File" menu option. This will display the "Select Formation Tops Comma Delimited File from your PC" Dialog. This dialog allows the user to search their PC for the file of interest. In this example it is the Tops CSV file Wellington-KGS-1-32_Tops.csv, highlighted below. Select the Open button to display the "Map File Column Number to Region Column" Dialog.



The “Map File Column Number to Region Column” Dialog allows the user to map the file columns number to the web app tops data structure. In this example the file has the well information in line one of the Tops CSV File and line two of the Tops CSV File has the file data columns. In this case the chosen file columns match the Tops Mnemonics for the tops data structure. The File Column Number is automatically assigned to the Region Column Names. The user only needs to select the “Load Data” Button to parse the Tops Data into the web app.



Tops CSV (Comma Separated Values) File Structure.

The Wellington KGS 1-32 Tops CSV example has two introduction lines, the first line is the well header information and the second line is the actual column labels for the tops data, illustrated below,

```
Line 1  Well Header Info   Wellington KGS 1-32, 15-191-22591, T31S R1W sec. 32, GL:1259, KB:1272
Line 2  Data Column Labels Top,    Name,               Rank,      System, Subsystem, Series, source
Line 3  Data Start         620,    Chase,              GROUP,     Permian, ,  Wolfcampian, PG
                           748,    Towanda Limestone,  MEMBER,    Permian, ,  Wolfcampian, PG
                           1595,   Wabaunsee,          GROUP,     Carboniferous, Pennsylvanian, Upper, PG
                           1622,   Root Shale,         FORMATION, Carboniferous, Pennsylvanian, Upper, PG
                           1662,   Stotler Limestone,  FORMATION, Carboniferous, Pennsylvanian, Upper, PG
                           1920,   Severy Shale,       FORMATION, Carboniferous, Pennsylvanian, Upper, PG
                           1980,   Topeka Limestone,   FORMATION, Carboniferous, Pennsylvanian, Upper, PG
                           2312,   Lecompton Limestone, FORMATION, Carboniferous, Pennsylvanian, Upper, PG
                           2402,   Heebner Shale,      MEMBER, Carboniferous, Pennsylvanian, Upper, PG
                           2703,   Stalnaker Sandstone, BED, Carboniferous, Pennsylvanian, Upper, PG
                           3039,   Kansas City, GROUP, Carboniferous, Pennsylvanian, Upper, PG
                           3169,   Stark Shale, MEMBER, Carboniferous, Pennsylvanian, Upper, PG
```

Figure: Partial Contents of the Wellington-KGS-1-32_Tops.csv File.

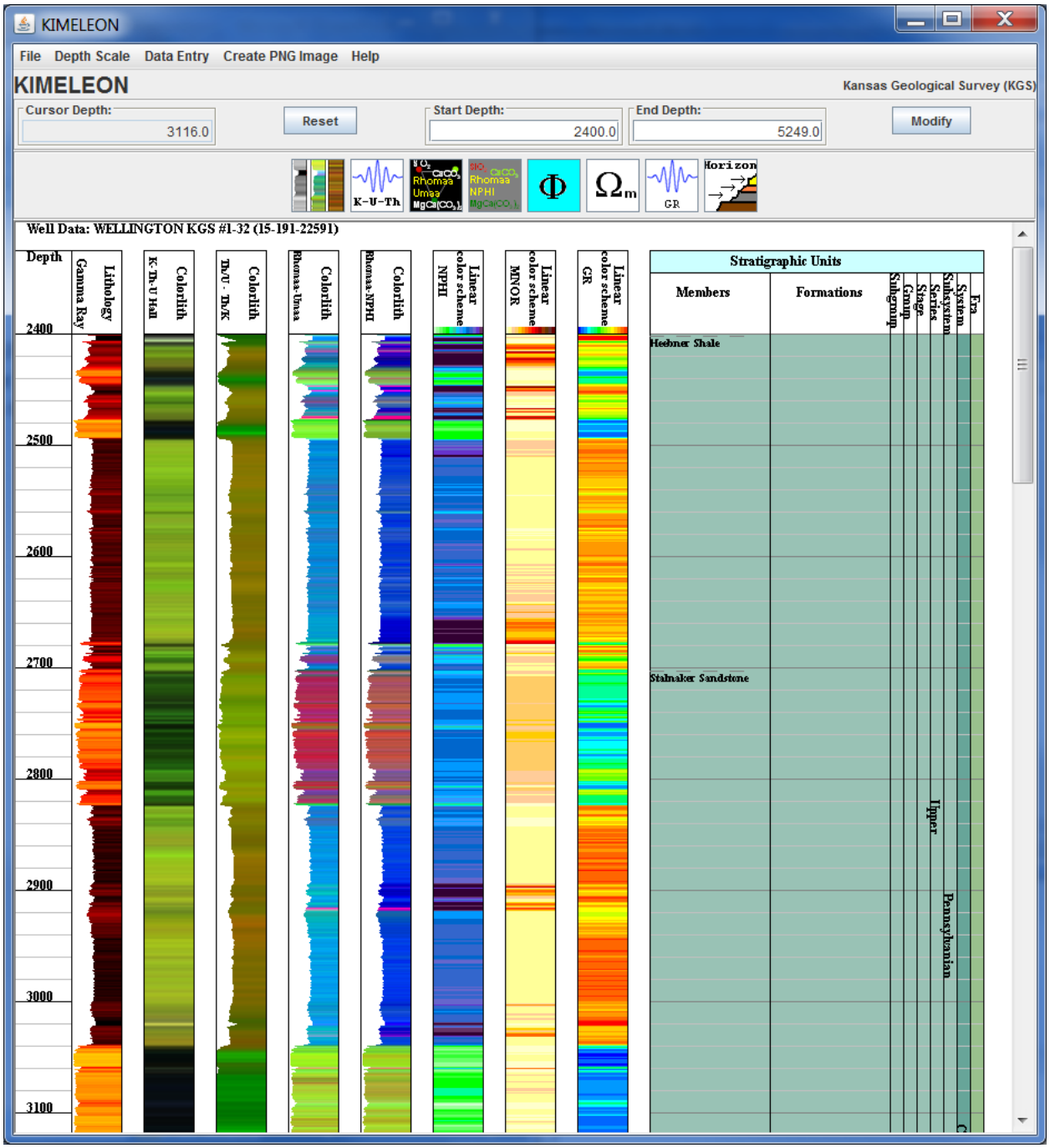
The "Map File Column Number to Region Column" Dialog allows the user to map the data in the Tops CSV File to the web app data structure variables. The program first reads the first and second line of the CSV File looking for the data column headers. The lines are each parsed to single out the data column headers and to match those headers to the tops data structure. The program then assigns the column number to the Region Column Name starting at column 1,2,3, … if the file column name used matches the expected region column name. The Column Names matrix used to parse the file column variables are listed below,

Depth Top	Top	Start
Depth Base	Base	End
Stratigraphic Unit Rank [SYSTEM, GROUP, etc.]	Rank	
Stratigraphic Name	Name	
Alternate Name	Alt Name	
Era		
System	Sys	
Subsystem	subsys	
Series	Ser	
Subseries { Pennsylvanian & Mississippian Series }	Subseries	Subser
Stage	Stg	
Group	Grp	
Subgroup	subgrp	
Formation	Form	
Start Age (Ma)	Start Age	
End Age (Ma)	End Age	

The Wellington KGS 1-32 Tops CSV File example above line 2 has only the Top, Tops Name, Rank, System, Subsystem, Series and Source as the column name variables. The program was able to map each of the column headers to the tops data structure, except Source, i.e.

Column	File Column Label	Tops Data Name
1	Top	Depth Top
2	Name	Stratigraphic Name
3	Rank	Stratigraphic Unit Rank
4	System	System
5	Subsystem	Subsystem
6	Series	Series
7	Source	

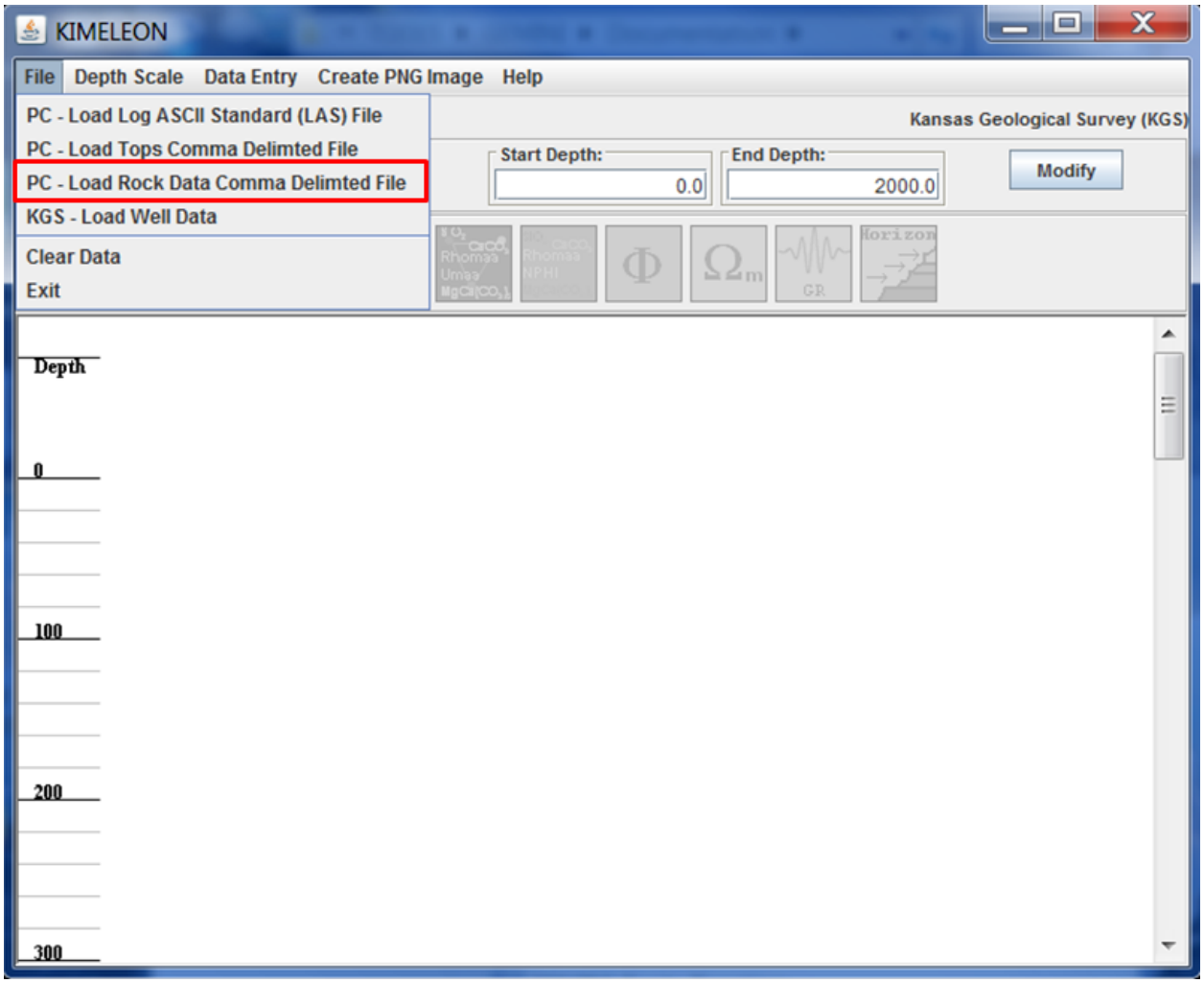
When the user selects the “Load Data” Button on the “Map File Column Number to Region Column” Dialog the data is parsed into the web app.



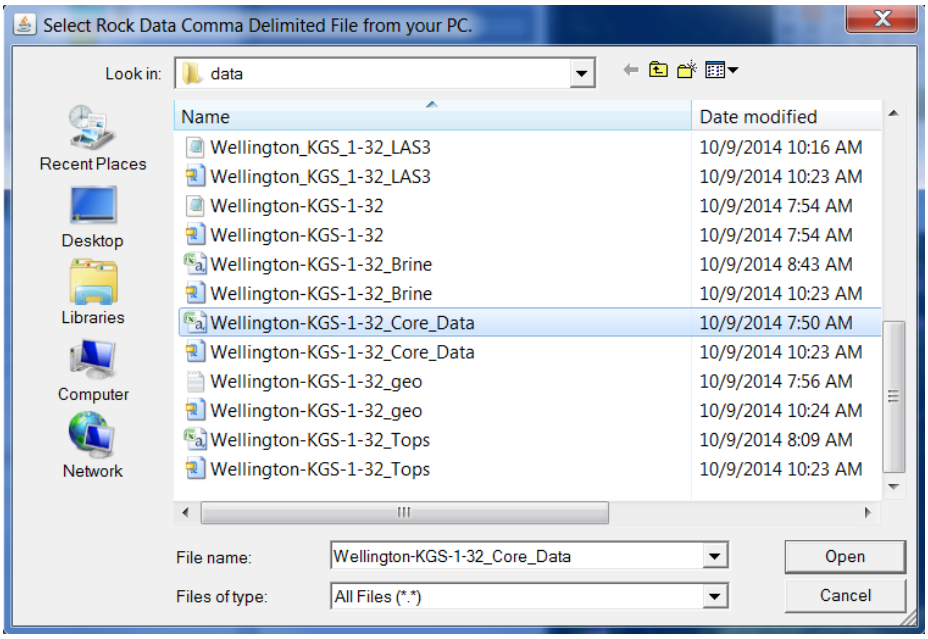
The Well data will automatically display to the “KIMELEON” dialog and load all the relevant panels, which can be accessed by the icon buttons at the top of the dialog. The “Horizon” icon button is the only panel that will show the Tops data with the summary of colorlith & color image plot tracks.

Importing PC Data – Core CSV (Comma Separated Values) File.

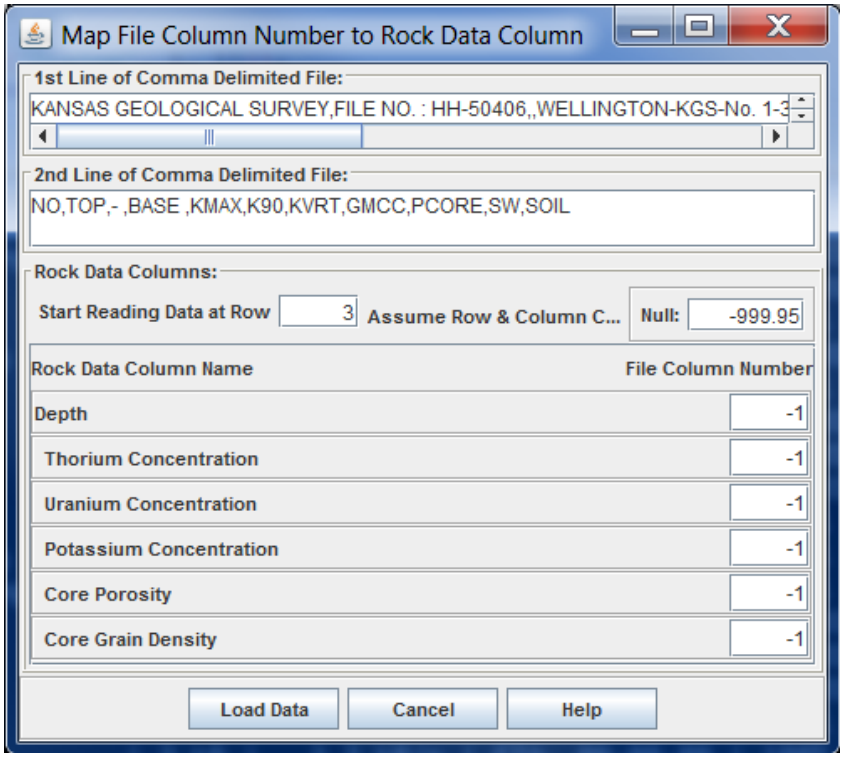
Most of the web apps will use the same input dialogs to import Core Data CSV (Comma Separated Values) file. The Load Data Dialog is basically the same for most of the Web Apps, except they only load a subset of the total data types. In this example a Core Data CSV file is being imported into the web app.



Click on the "File" Menu in the menu bar at the top of the "KIMELEON" Dialog, which will display a list of menu options to import well data into the web app. Select the "PC - Load Rock Data Comma Delimited File" menu option. This will display the "Select Rock Data Comma Delimited File from your PC" Dialog. This dialog allows the user to search their PC for the file of interest. In this example it is the Core CSV file Wellington-KGS-1-32_Core_Data.csv, highlighted below.



Select the Open button to display the "Map File Column Number to Rock Column" Dialog.



The "Map File Column Number to Rock Data Column" Dialog allows the user to map the file columns number to the web app core data structure. This dialog maps imports the core data and

loads the data into the LAS File Data Structure so the curves can be plotted as color image and/or colorlith plot tracks.

Core Data CSV (Comma Separated Values) File Structure.

The Wellington KGS 1-32 Core Data CSV example has two introduction lines, the first line is the well header information and the second line is the actual column labels for the core data, illustrated below,

Line 1 Well Header Info
Line 2 Data Column Labels
Line 3 Data Start

```
KANSAS GEOLOGICAL SURVEY,FILE NO. : HH-50406,,WELLINGTON-KGS-No. 1-32,FIELD : WELLINGTON,
NO,TOP,- ,BASE ,KMAX,K90,KVRT,GMCC,PCORE,SW,SOIL
2-29,3627.55,-,3628.00,0.02,<.01,<.01,2.69,0.3,90.9,0.0
2-39,3638.40,-,3638.90,0.01,<.01,<.01,2.70,0.6,80.5,0.0
3-0,3660.40,-,3660.75,2.00,0.08,2.29,2.62,4.7,82.5,0.0
3-1,3661.70,-,3662.00,2.72,1.74,0.02,2.61,6.8,75.1,0.0
3-2,3662.50,-,3663.00,3.70,2.96,4.55,2.59,11.1,45.5,22.5
3-3,3663.00,-,3663.50,25.36,9.94,29.36,2.60,14.1,41.2,29.2
3-4,3664.30,-,3664.75,12.42,8.97,3.84,2.62,8.0,97.6,0.0
3-5,3665.00,-,3665.60,4.20,3.40,3.38,2.61,7.4,98.6,0.0
3-6,3666.00,-,3666.25,8.64,0.40,<.01,2.58,5.5,46.0,10.7
3-7,3667.20,-,3667.70,6.56,5.97,1.93,2.60,5.8,93.9,0.0
3-8,3668.50,-,3669.00,21.77,10.68,5.78,2.59,12.0,82.4,0.0
3-9,3669.30,-,3669.80,20.30,20.03,10.96,2.60,11.8,70.4,0.0
3-10,3670.00,-,3670.60,64.64,60.27,35.99,2.61,13.1,75.8,0.0
3-11,3671.00,-,3671.50,9.68,8.11,2.41,2.79,19.7,50.2,23.9
3-12,3672.30,-,3672.80,14.08,13.60,7.96,2.77,22.7,48.0,27.1
3-13,3673.40,-,3673.90,13.37,12.95,8.20,2.79,24.3,50.1,24.4
3-14,3674.00,-,3674.50,21.85,21.24,9.30,2.77,22.9,52.8,28.2
3-15,3675.30,-,3675.80,22.31,19.92,11.61,2.78,26.4,58.8,25.2
```

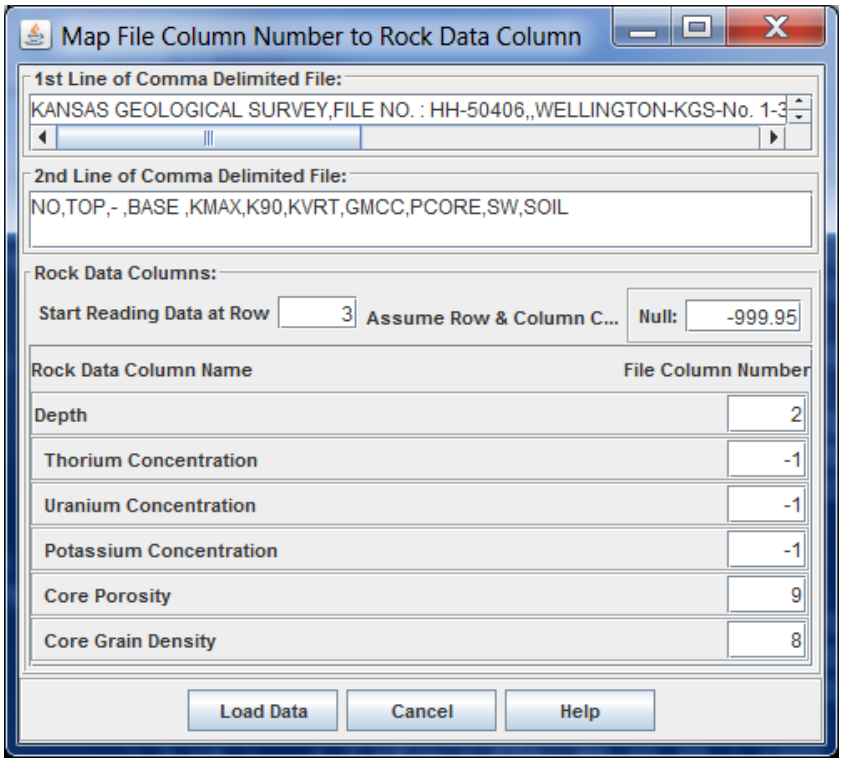
Figure: Partial Contents of the Wellington-KGS-1-32_Core_Data.csv File.

The "Map File Column Number to Rock Data Column" Dialog allows the user to map the data in the Core Data CSV File to the web app data structure variables. The program first reads the first and second line of the CSV File looking for the data column headers. The lines are each parsed to single out the data column headers and to match those headers to the core data structure. The program then assigns the column number to the Rock Data Column Name starting at column 1,2,3, … if the file column name used matches the expected rock data column name. The Column Names matrix used to parse the file column variables are listed below,

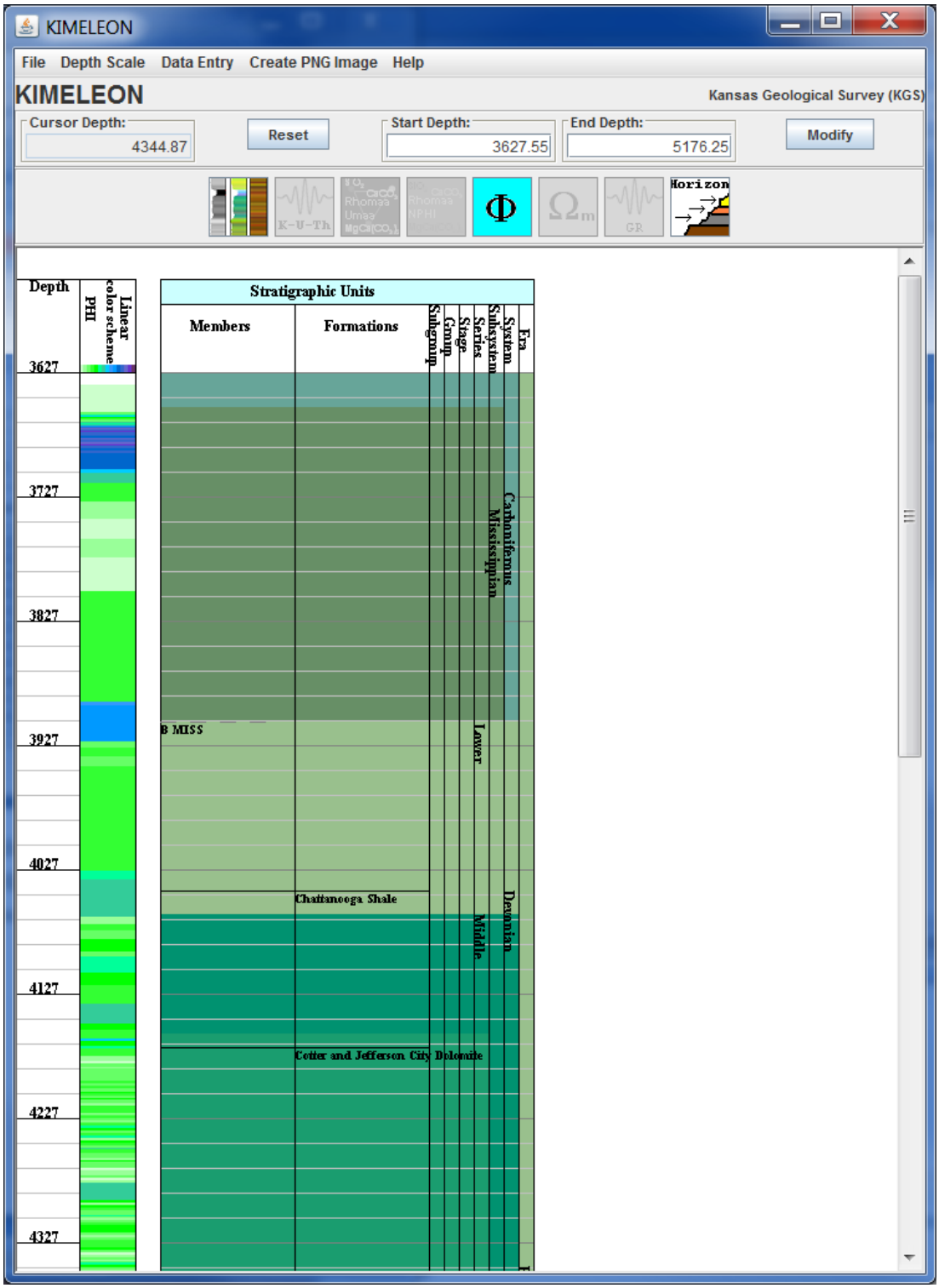
Mnem	Description
Depth	Depth Top
THOR	Thorium Concentration
URAN	Uranium Concentration
POTA	Potassium Concentration
PHI	Core Porosity
GMCC	Grain Density

The Wellington KGS 1-32 Core Data CSV File example above line 2 has only the Top, Base KMAX, K90, KVRT, GMCC, PCORE, SW and SOIL as the column name variables. The user will only be able to map a limited number of column headers to the core data structure, i.e.

Column	File Column Label	Core Data Name
1	NO	
2	TOP	Depth
3	-	
4	BASE	
5	KMAX	
6	K90	
7	KVRT	
8	GMCC	Grain Density (gm/cc)
9	PCORE	Whole Core Porosity
10	SW	
11	SOIL	



When the user selects the "Load Data" Button on the "Map File Column Number to Rock Data Column" Dialog the data is parsed into the LAS File Viewer Program, where the Core Data CSV file name is entered into the "PC ASCII Files:" Panel as well as the data type source. The user can import the tops CSV file as a reference to the porosity core data.

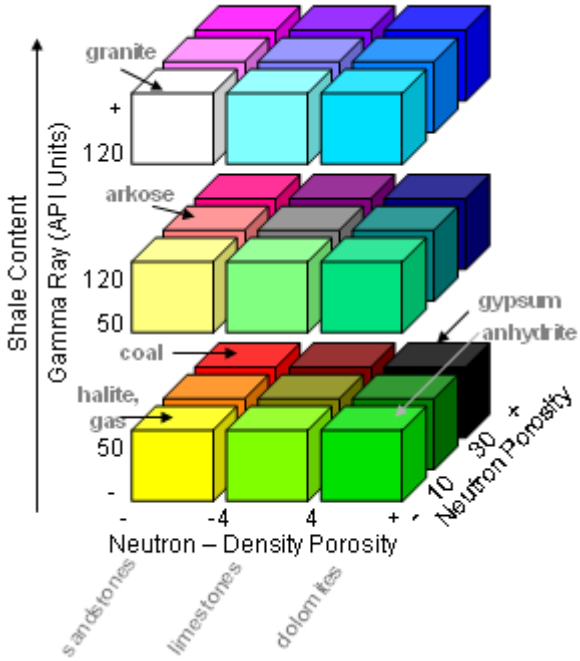


The Well data will automatically display to the “KIMELEON” dialog and load all the relevant panels, which can be accessed by the icon buttons at the top of the dialog. The “Horizon” icon button is the only panel that will show the Tops data with the summary of colorlith & color image plot tracks.

KIMELEON History

Peter L. Briggs[(1)] identified a method to assist geologist in well log interpretation by creating a color log presentation. His method provided a means to combine three different log curves from one well into one image track that varies along the depth by assigning each curve to a specific primary color of red, green and blue. His method assumed that the primary colors would appear to the human eye as orthogonal and miscible where the resulting color image would preserve all the information of the original log curves. The color image presentation of well log data reduced the number of displays competing for the interpreter's attentions by uniting the three log curves into one display and relieved the burden of mentally combining data from several separate displays. Overall the color log images presented log data to the user in a form that differs from the conventional log presentation and relied on the human perceptions and pattern recognition skills.

David R. Collins & John H. Doveton[(2)] extended this technique to identify lithology by using the neutron & density porosity and gamma ray logs, by noting that several porosity log readings gave direct indications of the rock mineralogy. The neutron and density logs were first overlaid on a common scale of equivalent limestone porosity units and their relative disposition considered together with the gamma ray log. Shales have high neutron porosity (due to bound water), relatively low density reading and a high gamma ray value. Limestones have low gamma ray value, and a coincident neutron and density porosity. Dolomites have a low gamma ray value, a relatively low density reading and a relatively high neutron reading. Sandstones have a low gamma ray value, a relatively high density reading and relatively low neutron reading.

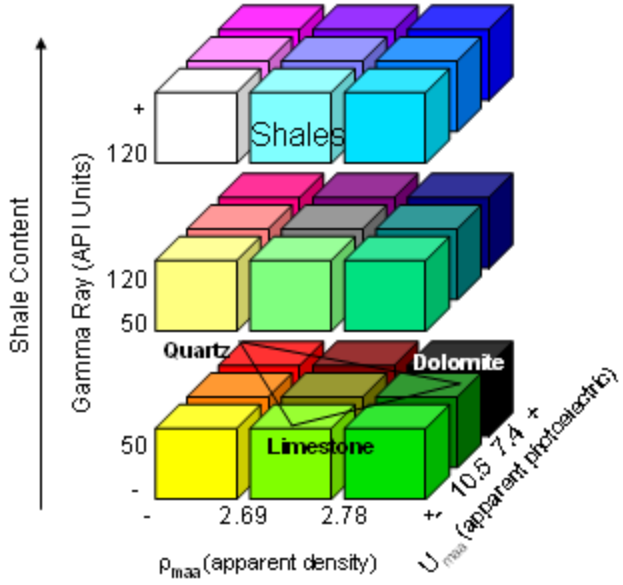


They based the lithology identification on three decision rules:

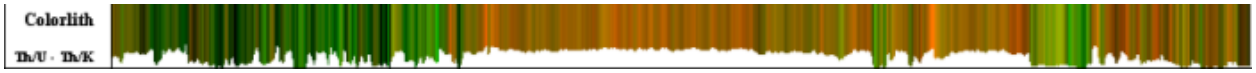
1. Is the gamma ray reading low, intermediate or high?
2. Is the density reading higher than, approximately equal to, or less than the neutron reading?
3. Do the density and neutron readings indicate a low, intermediate, or high porosity?

They extended the 27 possible responses to a color cube whose orthogonal axes match the rules. The design rules of the cube were geared to a basic discrimination between the potential reservoir lithology of sandstone, limestone, and dolomite, and their distinction from shale. They also noted that other lithologies have characteristic log responses which made additional identifications possible.

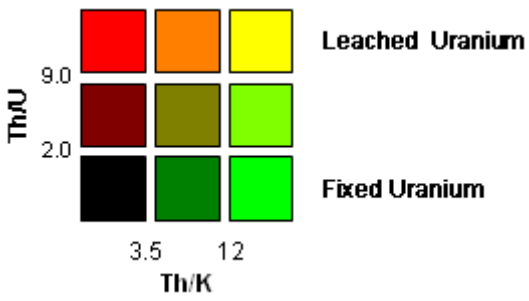
David Collins [3] in a USGS paper discusses the visualization of subsurface geology as achieved by COLORLITH, a software system developed at the Kansas Geological Survey in an effort to provide low-cost, high- resolution, interpretation, and visualization of well log data from a single well or multiple wells. The COLORLITH system was designed to run on UNIX workstation environments written in FORTRAN77. The input was digital LAS log data and the output was written to a PostScript file. COLORLITH was specifically designed to analyze and display gamma ray and litho-density logs. The COLORLITH computes the apparent density (Rhomaa) and the apparent photoelectric factor (Umaa) from the litho-density logs, Photoelectric factor, Bulk Density and the Neutron Porosity log curves.



KIMELEON extends both the Porosity Difference Method and the Rhomaa-Umaa Method that is computed in COLORLITH system. Both of the earlier versions done by Doveton & Collins[2,3] use a 3 X 3 X 3 color cube to create a color image track. KIMELEON extends the color cube to 256 X 256 X 256 colors to create the color image track which increases the sensitivity to the log responses and will bring out more subtle changes in the lithology over the depth. This new system is web based and is written in JAVA and allows the user to directly interact with the data in real time. The digital LAS files can be retrieved from the user's PC or from the KGS server and plotted to a well profile plot.

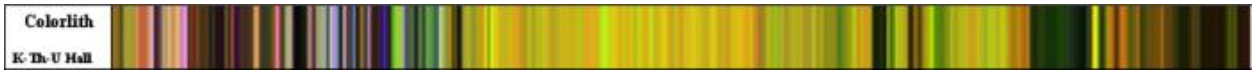


Colorlith has been developed over the past 20 years from Briggs to Doveton & Collins and has been defined by Schlumberger as *"A system for color-coding three- dimensional information. This system is used in wire line log analysis to provide color shading in which the final color is determined by the values of three curves. One curve dictates the intensity of red, a second the intensity of green, and the third the intensity of blue. The final resulting color is the result of the three input curves. The input curves may be raw curves from the field or computed curves. When used for correlation work on cross sections, the curves must have been normalized to remove the effects of incorrect calibrations and borehole problems."* The colorlith or Briggs Cube is considered an excellent method for condensing the wire line log curves into one track to visualize the lithologies of a well. Another method used and developed by Doveton [4] is the spectral gamma ray or Th/U and Th/K ratio cross plots introduced with the KGS #1 Braun in Ellis County Kansas.



The spectral gamma ray log can be used to estimate volumes and types of clay minerals, and is also useful for identifying fractures that have uranium salts precipitated in them by ground-water. Significant potassium and thorium concentrations in carbonates are also found in clay minerals and may show on porosity logs as shales. The spectral gamma-ray log helps to differentiate the radioactive carbonates from shales and clays. Several case studies of the use of spectral gamma-ray logs in Kansas show how the data can be cross-plotted using digital recording applications to identify facies. Natural gamma radiation in rocks is almost entirely attributable to potassium-40 and the radioactive isotopes of the uranium and thorium families. The concentrations of the three main radioactive elements Potassium, Uranium and Thorium in the formation can often be used to give an indication of the mineralogy and/or geochemistry. Thorium may be associated with an increase of terrigenous clays. Uranium is frequently associated with the presence of organic matter in black shale deposits. In sandstone, high Potassium may be caused by the presence of potassium feldspars or micas.

Th/K	Mineral
0.5 to 0.6	Feldspars
0.6 to 2.0	Micas
2.0 to 3.5	Illite
3.5 to 12.0	Smectite
12.0 to 28.0	Kaolinite-Chlorite
28.0+	Heavy Th-Bearing Minerals



Another colorlith technique proposed by Matt Hall[5] uses the Spectral Gamma- Ray logs, Potassium (red), Thorium (green) and Uranium (blue). His method maps the gamma ray spectrum to the visible end of the electromagnetic spectrum. The gamma-ray emissions from the decay of potassium-40 nuclei have the lowest energy, the potassium log is represented by shades of red, thorium by green, and uranium by blue. He noted that logs are represented by monochrome variable density displays. Low relative amplitudes translate to low color values and are displayed as dark colors, and high amplitudes are displayed as bright, saturated colors. The colors are then combined additively in a RGB spectrum producing a composite image.

The "micro-electrical imaging" technique replaces the original current measurement of the electrodes from a high precision form to normalized, quantization form with the measurements being significantly reduced. The purpose is to produce an image with color levels and contrasts that make it easier for the interpreter to analyze. Colors are represented as dark have been chosen to represent high conductivities because shales are often more conductive and darker-colored than other lithologies.

Normalization of the image over a given depth range can enhance the contrast of the image. The number of data points over the given depth range is subdivided equally into each color bin. This is the non-linear process and a great degree contrast that helps spotting image details in areas where sample values differ little from each other. These images often appear somewhat harsh in contrast.

Quantization procedure is very similar to dynamic normalization, but generally the assignment of colors is made using the dynamics of the entire length of the log. The number of data points is distributed by magnitude into equal bins. This often results in an image where intermediate colors abound and few extreme colors such as dark brown or cream occur, except for unusual distribution of the input data. The image is often pleasant to the eye but may lack details in certain area.

Author: John R. Victorine jvictor@kgs.ku.edu

References:

(1) Color display of well logs, Peter L. Briggs, Mathematical Geology, Volume 17, Number 4, May 1985

(2) Color Images of Kansas Subsurface Geology from Well Logs, D. R. Collins and J. H. Doveton, Computer & Geosciences, Vol. 12, No. 4B, pp.519-526 1986

(3) Visualization of Subsurface Geology from Wireline Logs, David R. Collins, Digital Mapping Techniques '98-Workshop Proceedings U. S. Geological Survey Open-File Report 98-487

(4) The Dakota Aquifer Program Annual Report, FY89 Kansas Geological Survey, Open-File Rept. 90-27 Annual Report, FY89-Appendix B (http://www.kgs.ku.edu/Dakota/vol3/fy89/app_b.htm)

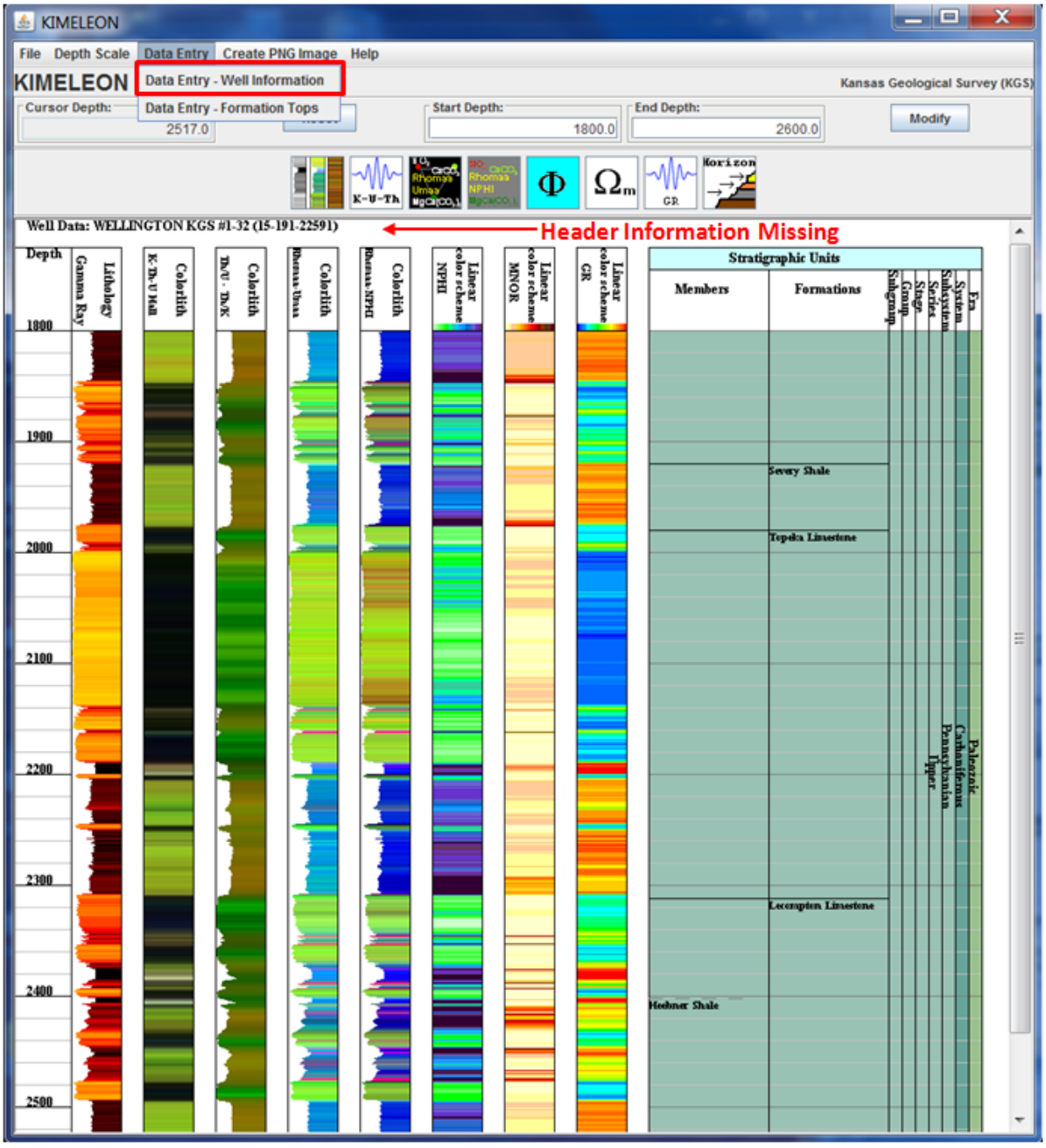
(5) Composite Colour Display of Spectral Gamma-Ray Logs, by Matt Hall, Canadian Well Logging Society, Dec 2005, v.24

(6) Geological Well Logs Their use in Reservoir Modeling, by Stefan M. Luthi, pg 84-86, ISBN 3-540-67840-9, © 2001 Springer-Verlag Berlin

Data Entry Dialogs

Edit Header Information Dialog

The Well Header Information Summary is displayed at the top of the KIMELEON Plot panels.



It is obvious that there are fields missing in the plot panel, i.e. Status, Latitude & Longitude, etc. Select the “Data Entry” Menu, then select the “Data Entry - Well Information” menu option to display the Edit Header Information Dialog, which will allow the user to edit the header information that is in the program.

The data displayed holds the initial information stored in the Log ASCII Standard (LAS) file and the Geologist Report ASCII Delimited file if the user loads the files from their PC. If the user loads the Log ASCII Standard (LAS) File from the KGS Server then the Well Header Information is automatically downloaded from the KGS Well Header Database Table.

Search KGS Database for Well Header Information Button
Displays a "Search for Data on KGS Server" Dialog that allows the user to .

Identification Panel
KGS & PC Primary KEY – Identification Numbers for the well
API-Number – API Number of Well
Well Status - Status, i.e. OIL, GAS, etc.
Name – Lease Name & Number

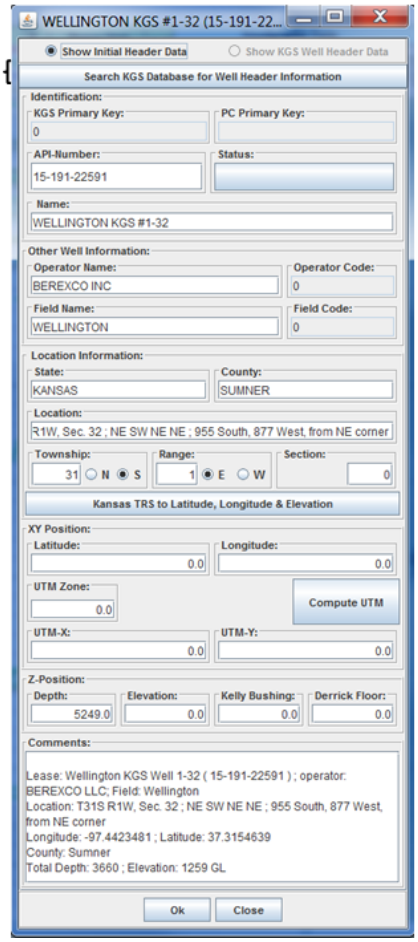
Other Well Information Panel
Operator Name & KGS Database KEY
Field Name & KGS Database KEY

Location Information Panel
State Name
County Name
Location
Township Range Section

XY Position
Latitude
Longitude
UTM Zone
UTM X Position
UTM Y Position

Z-Position
Depth – Total Depth of Well
Elevation – by Ground Level
Elevation – by Kelly Bushing
Elevation – by Derrick Floor

Comments – User Comments, not saved to the LAS version 3.0.



Header Information Source Buttons:
- **Show Initial Header Data** – Shows the Header Information initially loaded into Program.
- **Show KGS Well Header Data** – Shows the Header Information loaded from KGS Database.

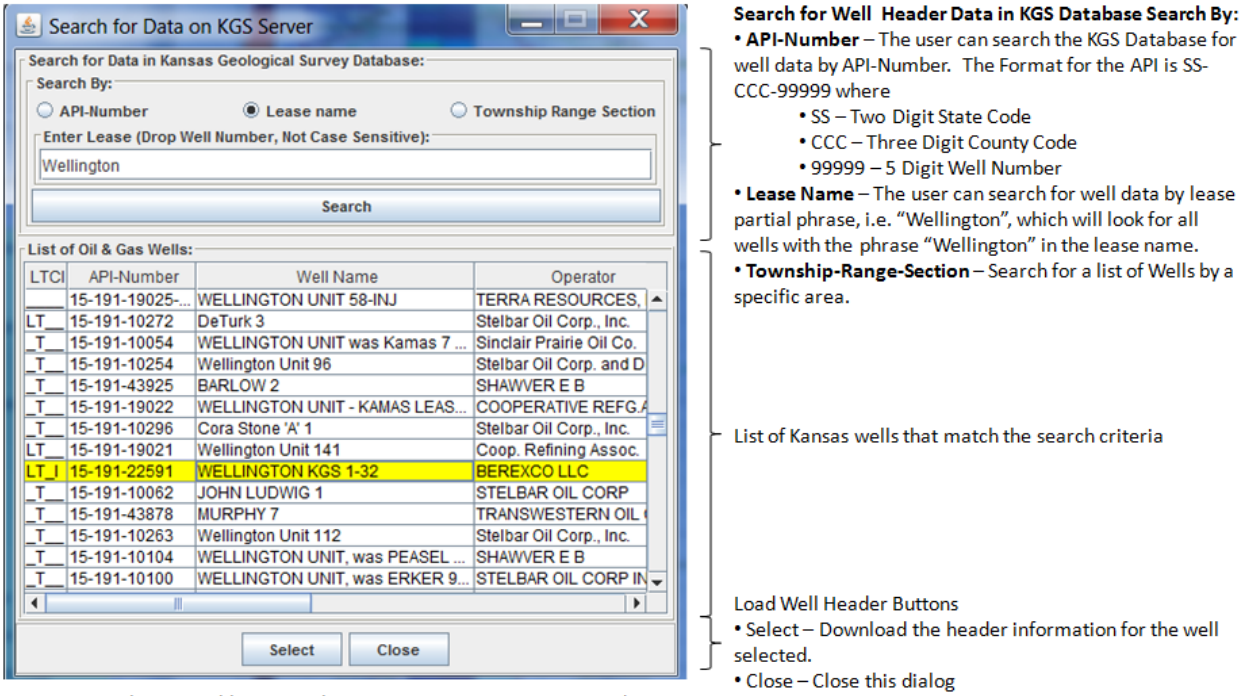
Buttons:
Status – Displays "Select Status of Data" Dialog, user searches for the well status list for status of well.
Kansas TRS to Latitude, Longitude & Elevation – The buttons calls a KGS database routine to compute the Latitude, Longitude and Elevation from the Township, Range and Section.
Compute UTM – This button calls a UTM Java Math Package to convert Latitude & Longitude into UTM X, Y Coordinates.
OK – Transfer Data Values to Program
Close – Close this Dialog

NOTE: Initially the Basic Header information is loaded from the LAS version 2.0 file and other fields like Comments, Location are loaded from the Geologist Report Header Section.

The Header Information Dialog displays the contents of the header information data structure. The user can edit the fields and select the "Ok" Button to transfer the information back to the LAS File Viewer Program and any summary information will be updated in the LAS File Viewer Control and Plot.

As this example illustrates there are missing fields in the header information data. The user can select the "Search KGS Database for Well Header Information" Button, which will display a "Search for Data on KGS Server" Dialog that will allow the user to build a query that will download all wells that match the query.

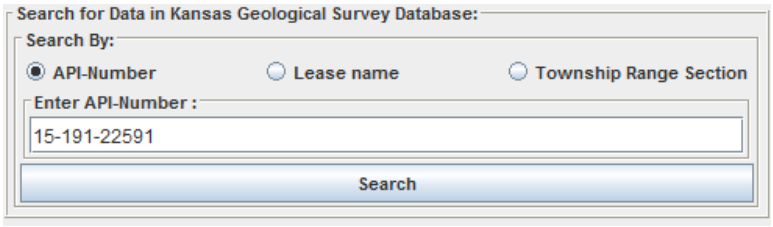
This will display the "Search for Data on KGS Server" Dialog, see image below. This dialog allows the user to search the KGS database for well header data. In this example, the well of interest will be the Wellington KGS 1-32.



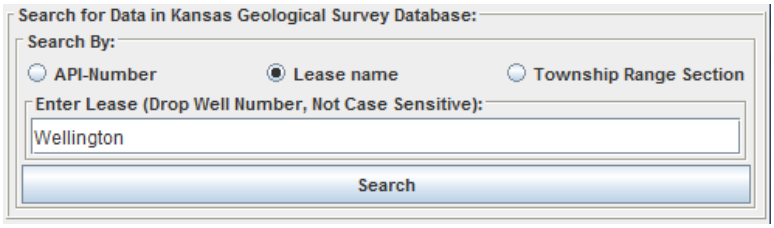
NOTE: LTCI Column in Table: L-LAS Files; T-Formation Tops; C-Measured Core Data; I-Core Images

As the Summary image suggests there are 3 methods for searching for the well header information within this dialog,

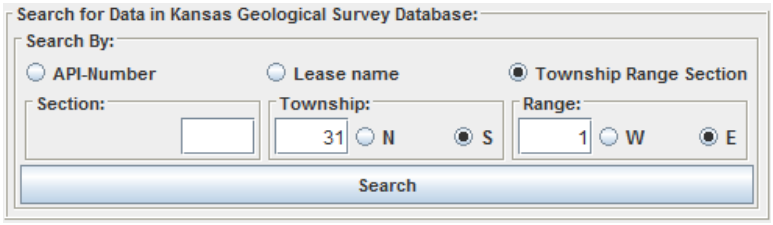
- By API-Number – KGS has a specific format for the API-Number, i.e.SS-CCC-99999 where SS is the state code for Kansas 15, CCC is the county code for Wellington KGS 1-32 it is 191 for Sumner County and the 5-Digit Well Number for the Wellington KGS 1-32 is 22591.



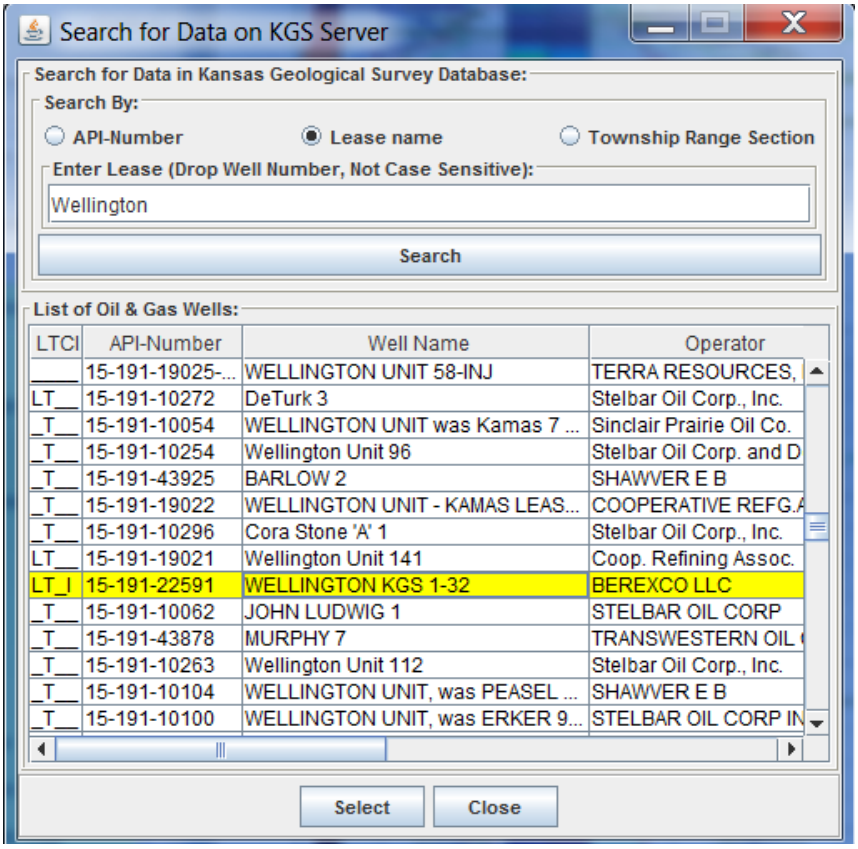
- By Partial Lease Name – The stored procedure used to retrieve the well header information allows the user to enter a partial phrase, in this example Wellington. The program places a '%' in front and back of the phrase and sends the request to the Database, i.e. "%Wellington%".



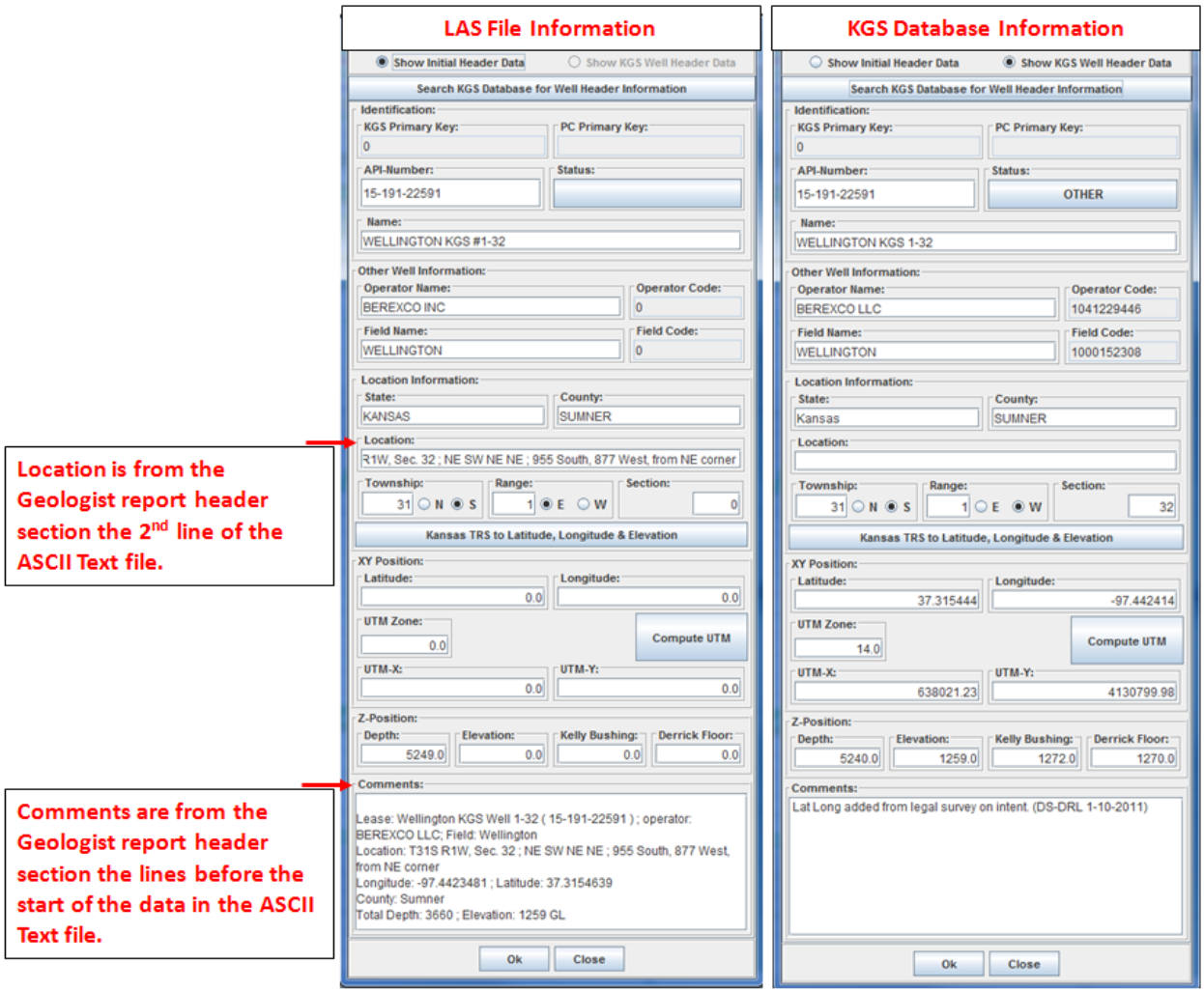
- By Township Range Section – This search is by location in Kansas, this search also allows the user to enter just the Township and Range to search for wells, e.g. to look for the Wellington KGS 1-32, enter Township as 31 set the S (South) Radio button and Range as 1 set the E (East) Radio button.



The user only needs to enter the above data and select the "Search" Button to display the list of Wells in the Kansas Database that match the search criteria. In the image below the Lease Name "Wellington" is entered to search for all wells in Kansas with the Phrase Wellington in it. The user searches through the list until they find the well of interest. In this example it is the Wellington KGS 1-32, which is highlighted.



The user clicks on the "Select" button to transfer the header information to the Edit Header Information Dialog.



The "Show KGS Well Header Data" radio button will become enabled if the KGS well header information has been downloaded. The user can move between the initial header information by selecting the "Show Initial Header Data" radio button the KGS well header information by selecting the "Show KGS Well Header Data" radio button.

There a number of buttons on the panel that will allow the user to change or compute data in the header information. The "Kansas TRS to Latitude, Longitude & Elevation" Button computes the latitude, longitude and elevation from the township, range and section by making an Oracle PL/SQL Stored Procedure, e.g.

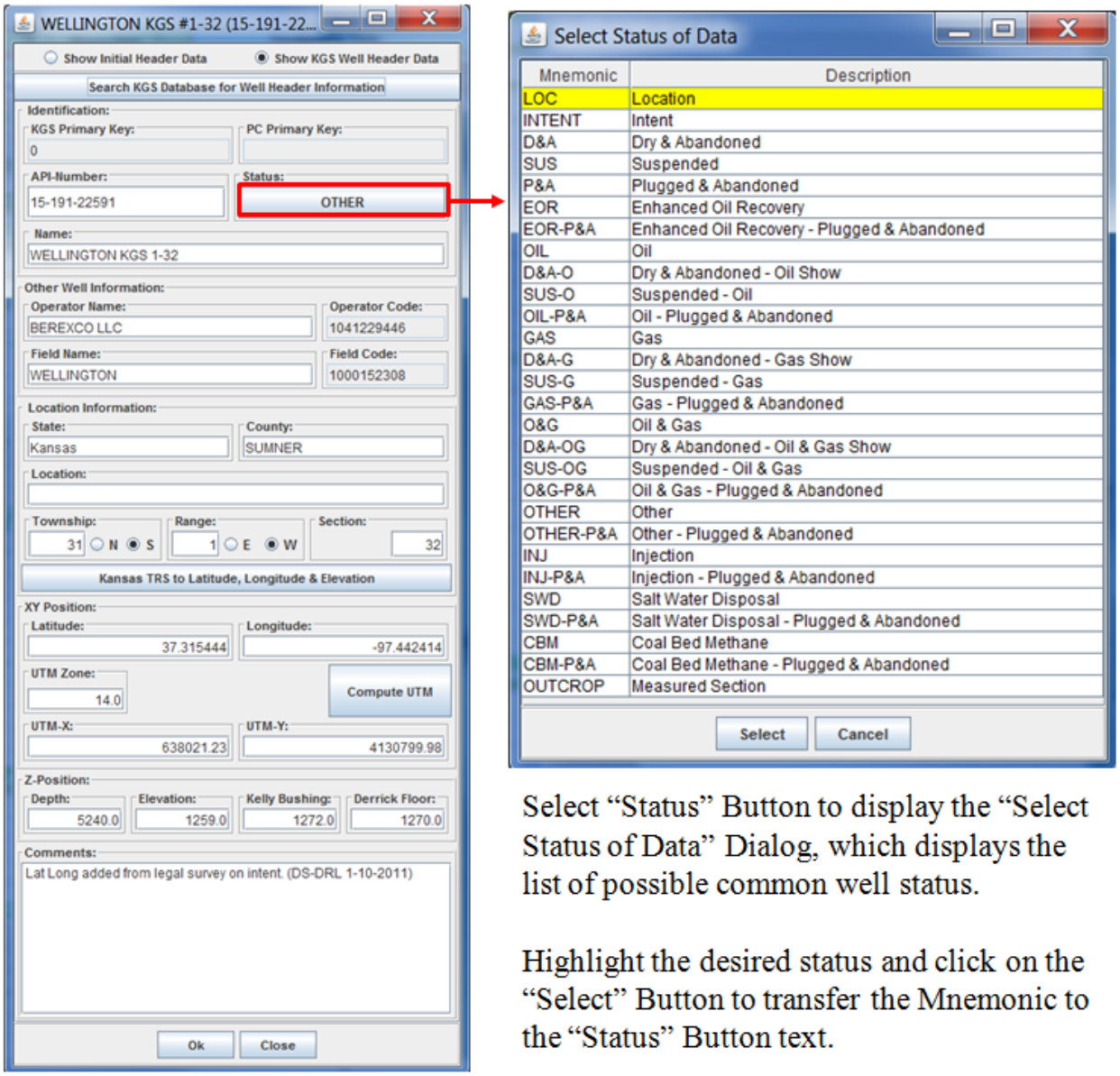
http://chasm.kgs.ku.edu/ords/iqstrat.TRS2LL_pkg.getXML?iTownship=31&sTownship=S&iRange=1&sRange=E&iSection=32

The call will return a XML with the latitude, longitude and ground level elevation.

```
<?xml version="1.0"?>
<!DOCTYPE headers [
<!ELEMENT headers (data*)>
<!ATTLIST headers records CDATA #IMPLIED>
<!ELEMENT data (info*,
                other?,
                loc?,
                xy?,
                z?,
                comments?,
                misc?,
                cnt?)>
<!ELEMENT info  EMPTY>
<!ATTLIST info  kid   CDATA #IMPLIED
                well_kid   CDATA #IMPLIED
                key   CDATA #IMPLIED
                type  CDATA #IMPLIED
                api   CDATA #IMPLIED
                name   CDATA #IMPLIED
                status CDATA #IMPLIED
                error  CDATA #IMPLIED>
<!ELEMENT other EMPTY>
<!ATTLIST other operator  CDATA #IMPLIED
                oper_kid  CDATA #IMPLIED
                field     CDATA #IMPLIED
                field_kid CDATA #IMPLIED>
<!ELEMENT loc EMPTY>
<!ATTLIST loc state     CDATA #IMPLIED
              state_cd  CDATA #IMPLIED
              county    CDATA #IMPLIED
              county_cd CDATA #IMPLIED
              loc       CDATA #IMPLIED
              town      CDATA #IMPLIED
              town_dir  CDATA #IMPLIED
              range     CDATA #IMPLIED
              range_dir CDATA #IMPLIED
              section   CDATA #IMPLIED>
<!ELEMENT xy  EMPTY>
<!ATTLIST xy  latitude  CDATA #IMPLIED
              longitude CDATA #IMPLIED
              zone      CDATA #IMPLIED
              utm_x     CDATA #IMPLIED
              utm_y     CDATA #IMPLIED>
<!ELEMENT z   EMPTY>
<!ATTLIST z   depth     CDATA #IMPLIED
              gl        CDATA #IMPLIED
              kb        CDATA #IMPLIED
              df        CDATA #IMPLIED>
<!ELEMENT comments (#PCDATA)>
<!ELEMENT misc EMPTY>
<!ATTLIST misc user      CDATA #IMPLIED
               access    CDATA #IMPLIED
               source    CDATA #IMPLIED
               date      CDATA #IMPLIED>
<!ELEMENT cnt EMPTY>
<!ATTLIST cnt  las       CDATA #IMPLIED
               tops      CDATA #IMPLIED
               core      CDATA #IMPLIED
               images    CDATA #IMPLIED>]>
<headers records="1">
  <data>
    <loc town="31" town_dir="S" range="1" range_dir="E" section="32" />
    <xy latitude="37.311703" longitude="-97.339619" />
    <z gl="1277" />
  </data>
</headers>
```

The “UTM” Button will compute the UTM XY coordinates from the latitude & longitude. The analysis uses A Working Manual by John P. Snyder, U.S. Geological Survey Professional Paper 1395, USG Printing Office, Washington, DC, 1987 (http://pubs.er.usgs.gov/djvu/PP/PP_1395.pdf).

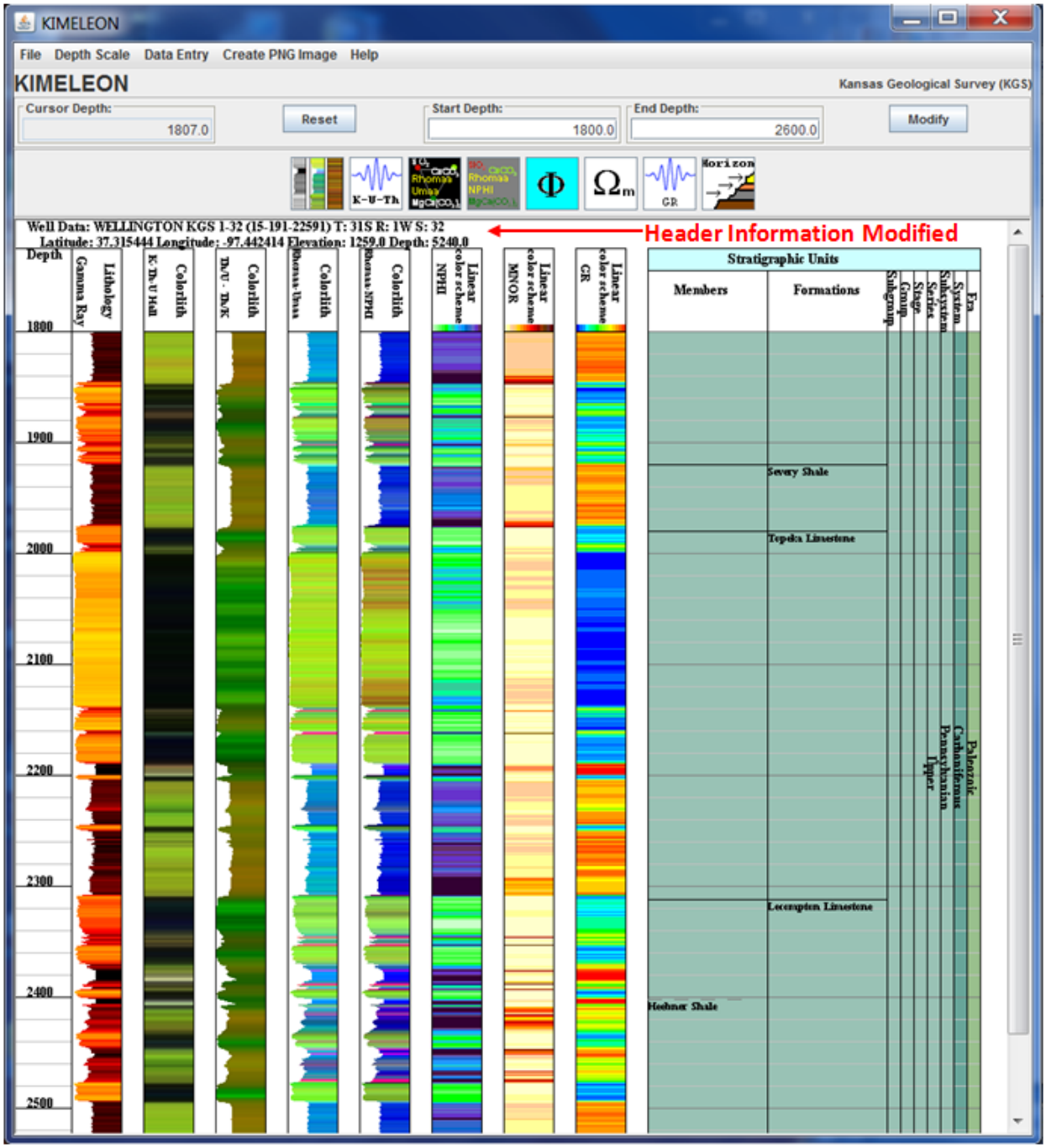
The Status button allows the user to change the well status.



Select “Status” Button to display the “Select Status of Data” Dialog, which displays the list of possible common well status.

Highlight the desired status and click on the “Select” Button to transfer the Mnemonic to the “Status” Button text.

Select the “Ok” Button to update the Header Information in plot panel.

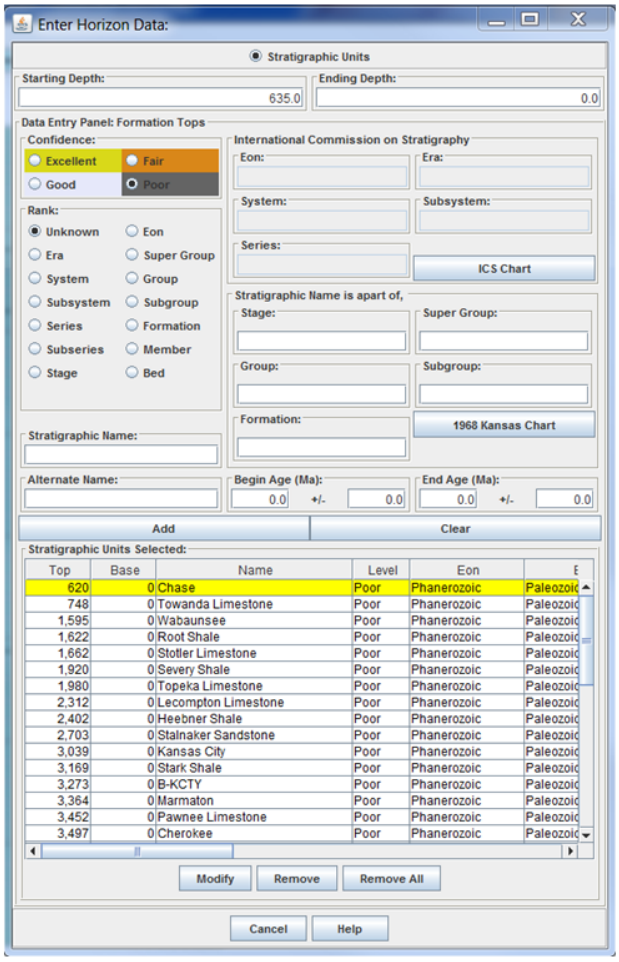


Adding & Modifying Tops

Enter Horizon Data - Stratigraphic Units Panel

The Stratigraphic Units Panel allows the user to Add, Modify or Remove Stratigraphic Units. There are two files that are used to assist in mapping Stratigraphic Units to a specific top name.

- The 2010 International Commission on Stratigraphy Stratigraphic Units and RGB color for the Stratigraphic Units XML File (http://www.kgs.ku.edu/software/gemini/data/ISC.xml) are used to display the tops in the Stratigraphics Plot Track by Age (RGB Color).
- The Kansas Geological Survey (KGS) Stratigraphic Succession in Kansas, edited by D.E. Zeller, December 1968, updated 2012 (http://www.kgs.ku.edu/software/gemini/data/kansas.xml) will help map the Kansas Top Names to Stratigraphic Units, System, Sub-System, Series, etc. and to map the top depth of one top pick to the base depth of another top pick.



The KGS Stratigraphic Succession of Kansas edited by D. E. Zeller, Dec. 1968, updated 2012 (http://www.kgs.ku.edu/PRS/Ozark/TYPE_LOG/Stratigraphic/index.html).

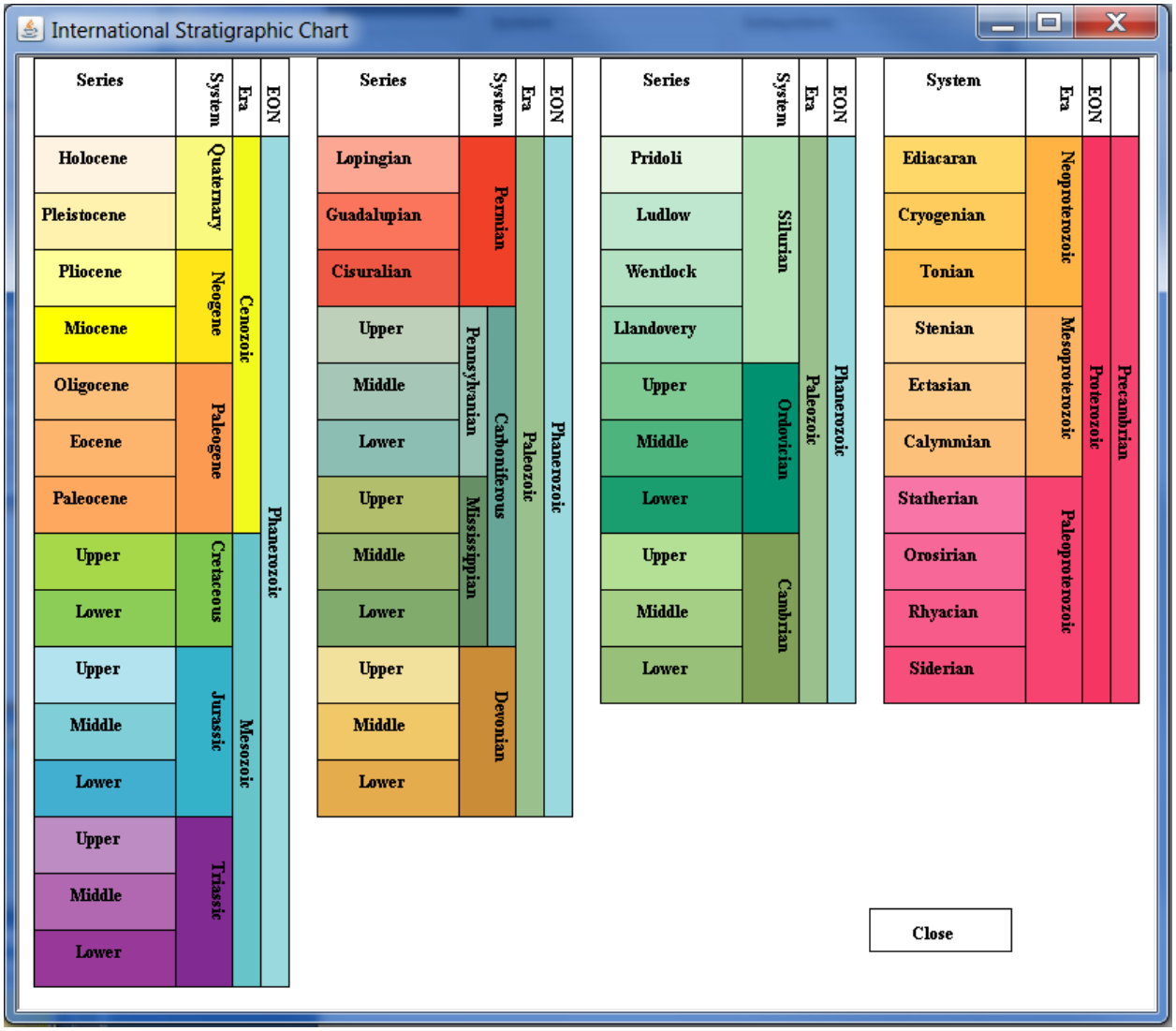
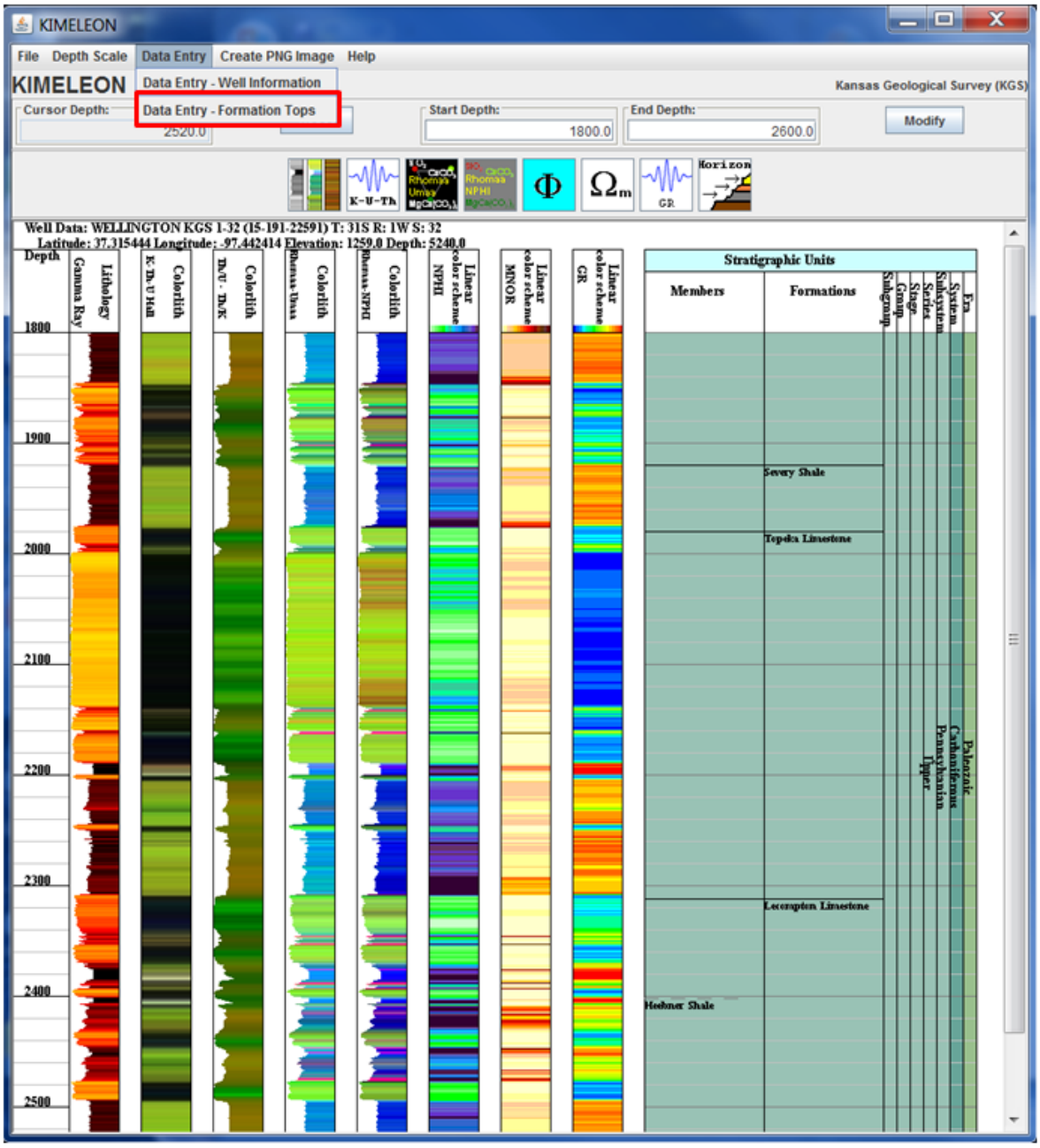


Figure: The 2010 International Commission on Stratigraphy Stratigraphic Units and RGB colors for the Stratigraphic Units.

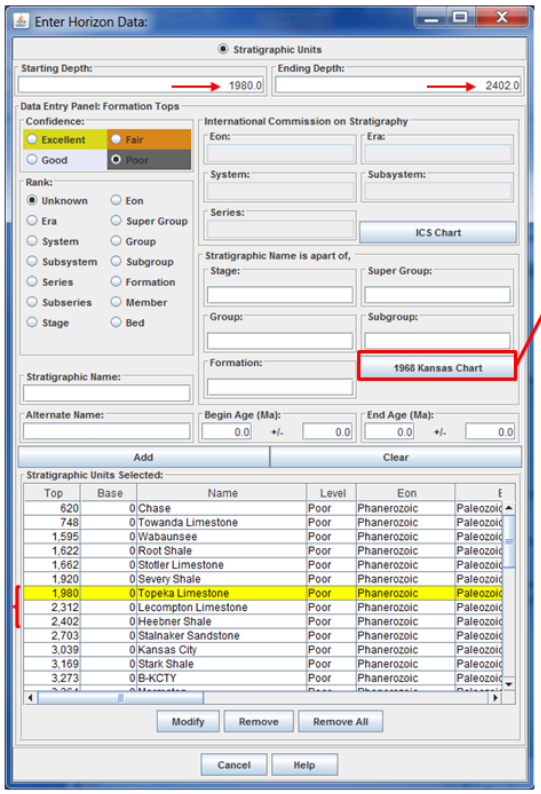
Add Shawnee Group to the Stratigraphic Units List

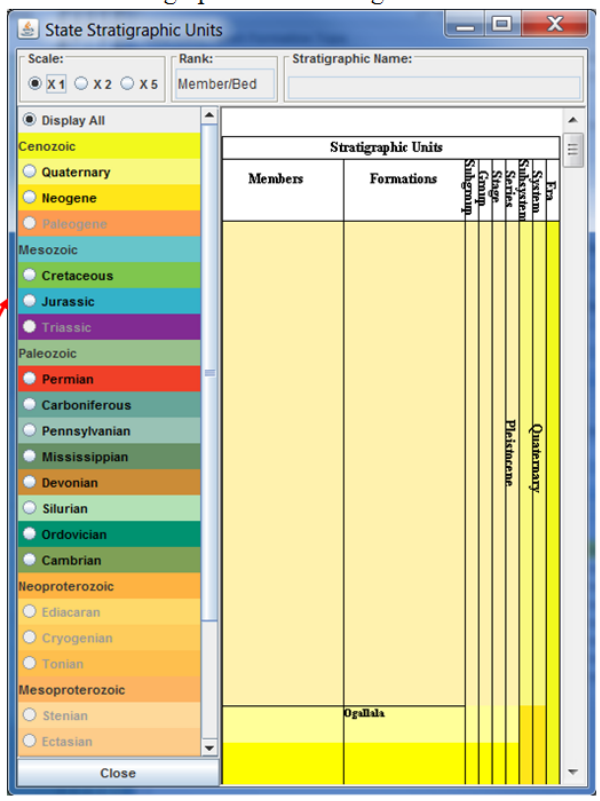
This first example is to add a Shawnee Group, which is part of the KGS Stratigraphic Succession in Kansas. Select the "Data Entry" Menu and then click on the "Data Entry - Formation Tops" menu option to display the "Enter Horizon Data" Dialog with the "Stratigraphic Units" dialog.



The user can manually enter the tops with as much information as they wish to display. If the stratigraphic unit is part of the Kansas Stratigraphic Units List all necessary fields can be loaded by using the "1968 Kansas Chart" button to display the list of Kansas Stratigraphic Units.

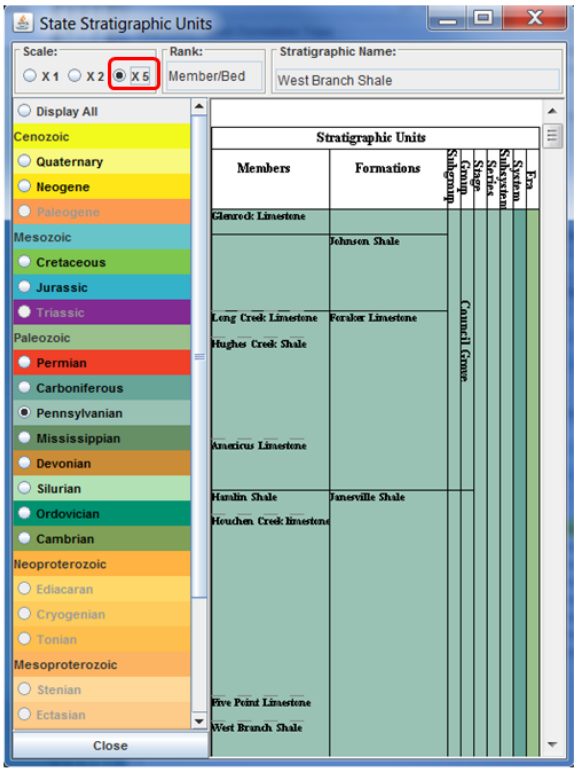
The Topeka Limestone, Lecompton Limestone and the Heebner Shale belong to the Shawnee Group, set the Starting Depth text field to 1980 and the Ending Depth text field to 2402.
Click on the "1968 Kansas Chart" Button to display the State Stratigraphic Units Dialog.

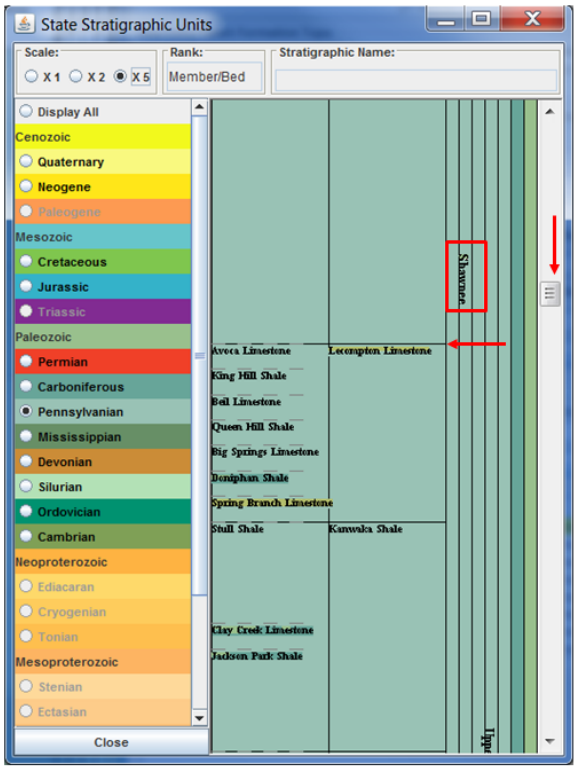




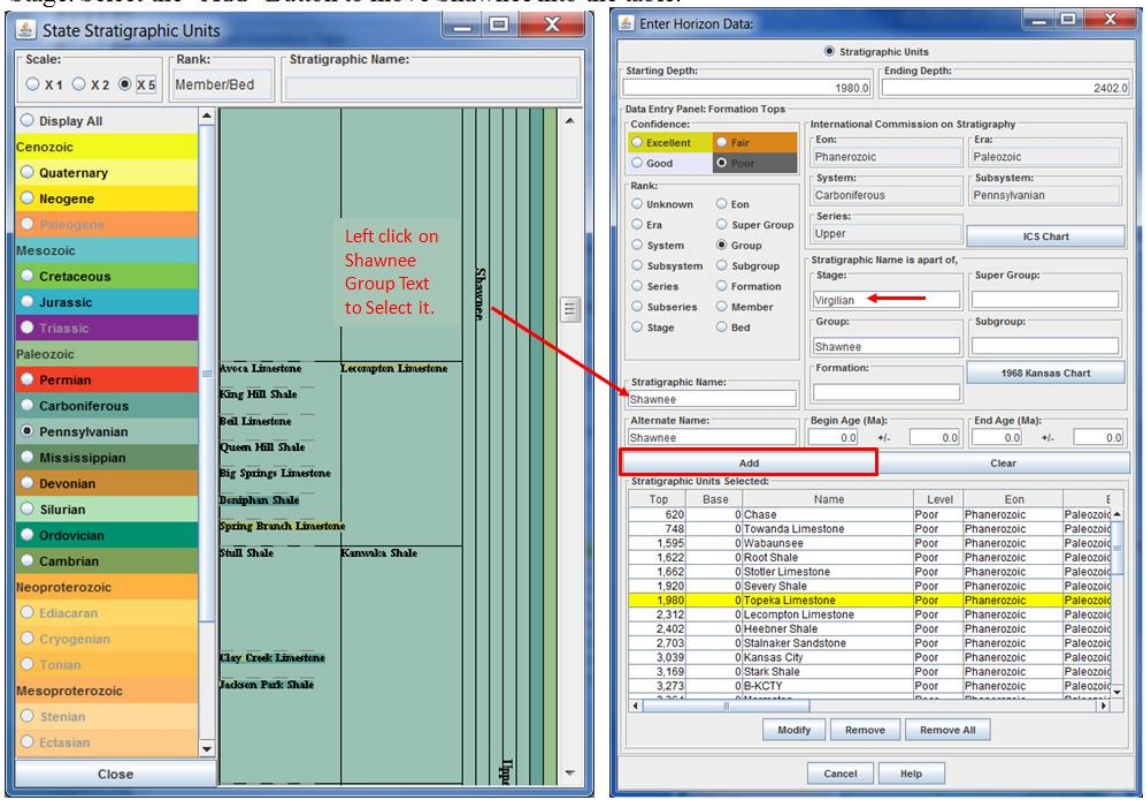
Change the Scale to X5, select the "Pennsylvanian" radio button.

Scroll down to the Lecompton Limestone Formation. Notice it is part of the Shawnee Group.

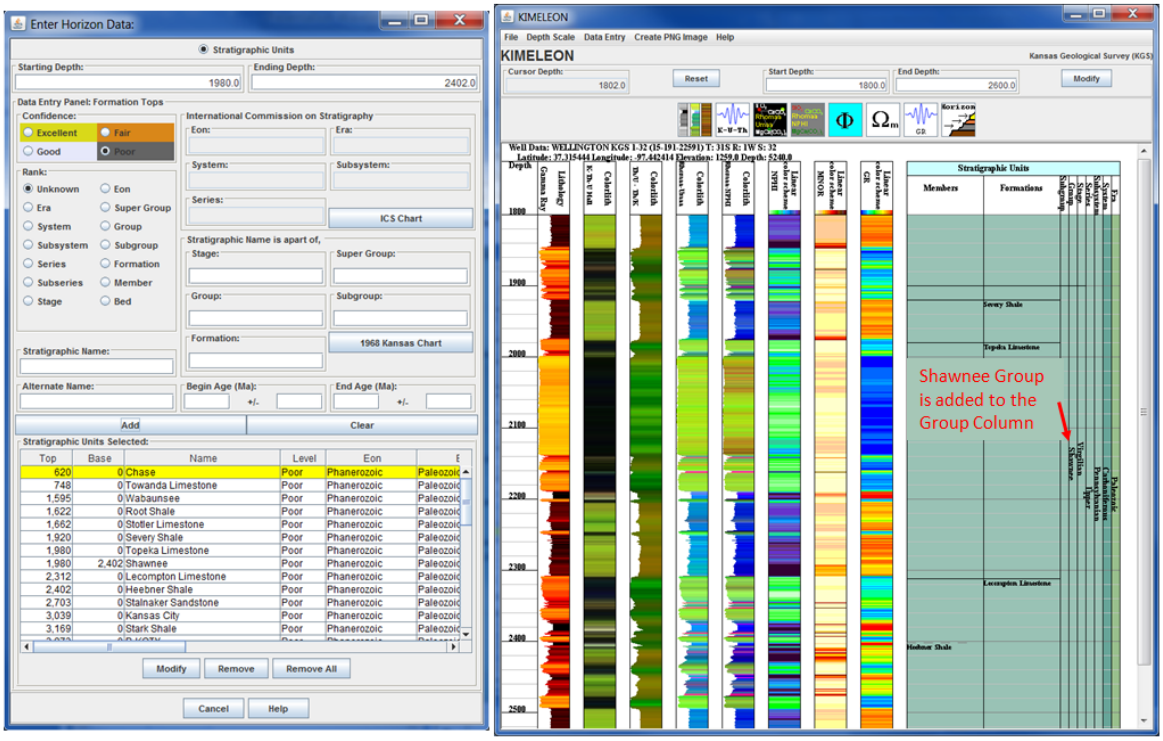




Left mouse click on the Shawnee Group text to transfer all the Stratigraphic Units to the "Stratigraphic Units" Panel on the "Enter Horizon Data" Dialog. Notice also that the Shawnee Group belongs to the Virgilian Stage. Select the "Add" Button to move Shawnee into the table.



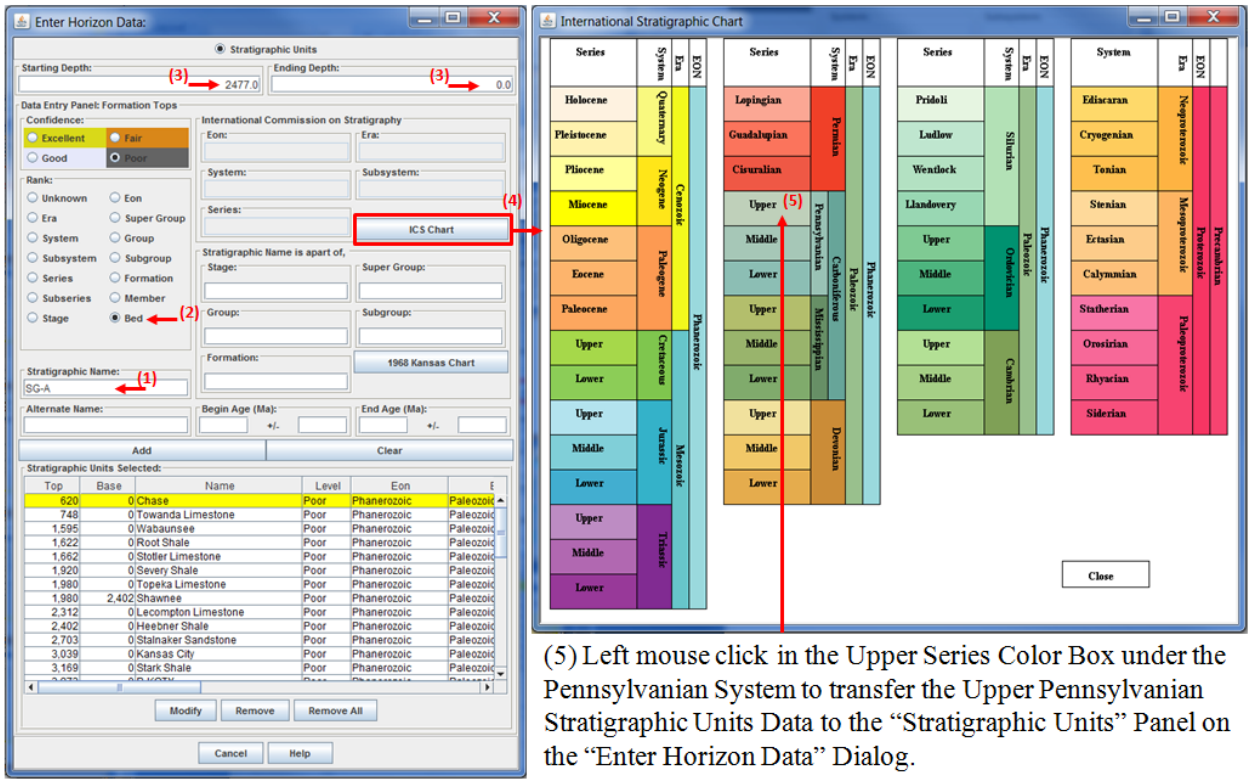
Notice that the Shawnee Group is added to the Group Column of the Stratigraphic Units Plot Track. Shawnee was added to the "Stratigraphic Units Selected" table, see the highlighted top in the table.



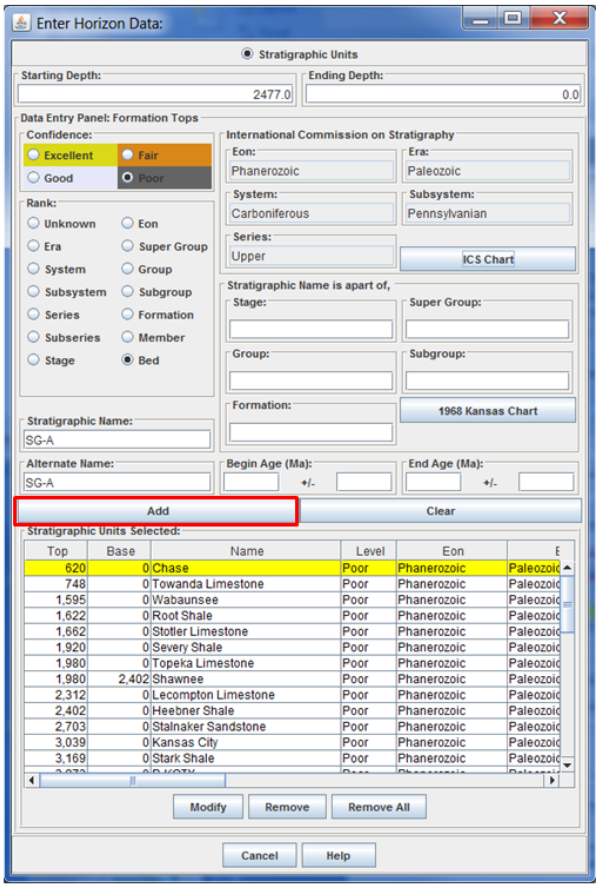
Add Unknown Bed (SG-A Bed) to the Stratigraphic Units List

This second example is to add an unknown bed (SG-A Bed) to the Stratigraphic Units List, which is not part of the KGS Stratigraphic Succession in Kansas. This example will enter the basic information to the Depth Range text fields, the Stratigraphic Name text filed and setting the Rank as a BED. The Stratigraphic Units will be provided by the International Commission on Stratigraphy Dialog by selecting the "ICS Chart" Button. The "International Stratigraphic Chart" Dialog displays the stratigraphic units as a series of colored boxes, each stratigraphic unit is has the recommended RGB (Red-Green-Blue) Color defined by the International Commission on Stratigraphy. The user only needs to click the colored box to select all the stratigraphic data associated with the selected stratigraphic unit and transfer the data back to the "Stratigraphic Units" Panel in the "Enter Horizon Data" Dialog.

(1) Add SG-A to the "Stratigraphic Name" Text field.
(2) Select the Bed Radio Button in the Rank Panel
(3) Set the Starting Depth to 2477.0 and the Ending Depth to 0.0 Limestone Depth Range.
(4) Click on the "ICS Chart" Button to display the International Stratigraphic Chart Dialog.



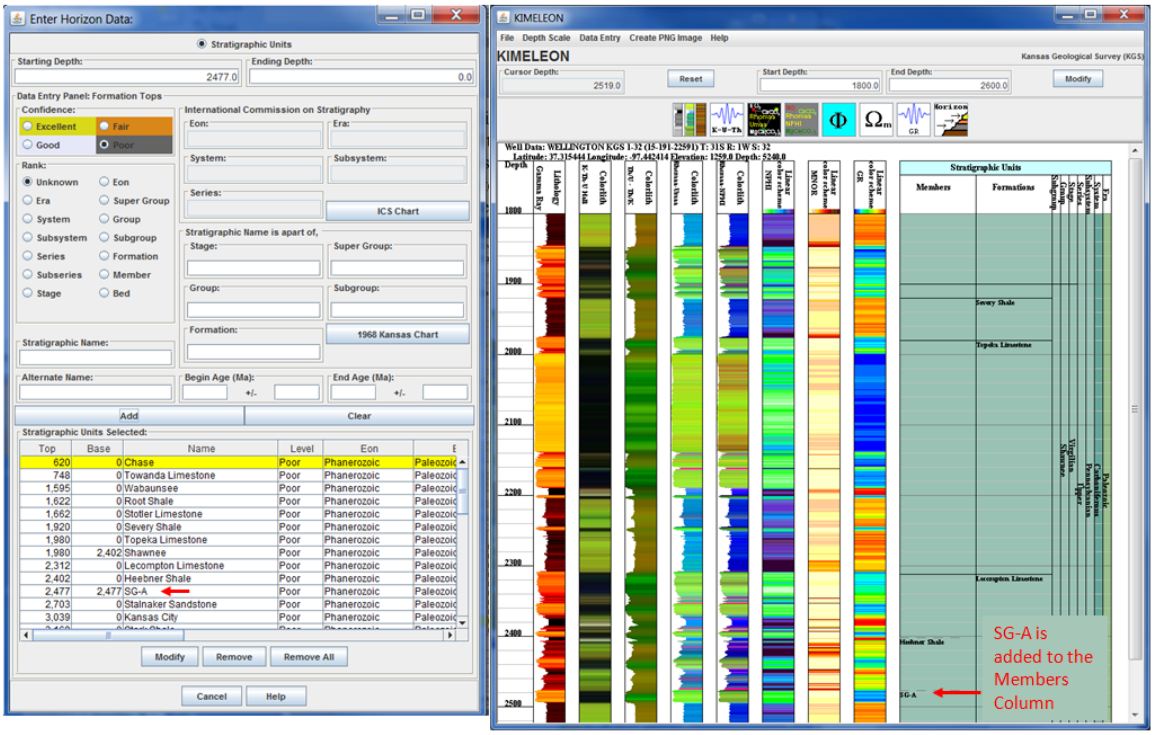
(5) Left mouse click in the Upper Series Color Box under the Pennsylvanian System to transfer the Upper Pennsylvanian Stratigraphic Units Data to the "Stratigraphic Units" Panel on the "Enter Horizon Data" Dialog.



Notice that the Stratigraphic Units Data from the ICS Chart is transferred to the "International Commission on Stratigraphy" Panel.

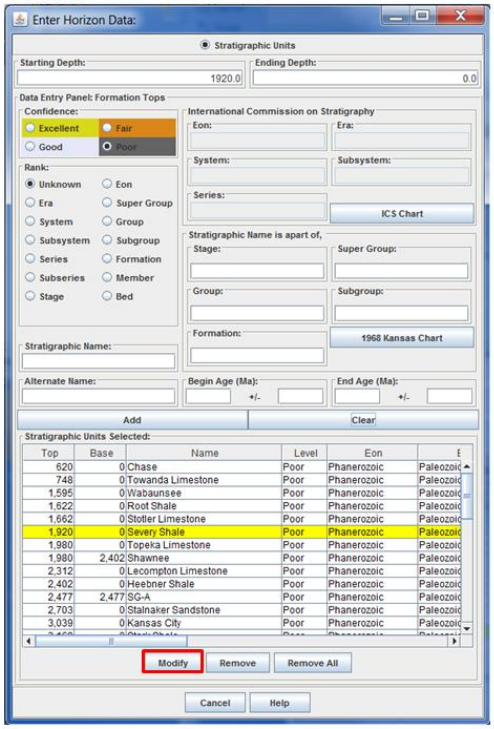
Now Select the "Add" Button to transfer the Stratigraphic Units Data for the SG-A Bed to the "Stratigraphic Units Selected" Table.

Notice that the SG-A Bed is added to the Members Column of the Stratigraphic Units Plot Track. SG-A Bed was added to the "Stratigraphic Units Selected" table, see the highlighted top in the table.

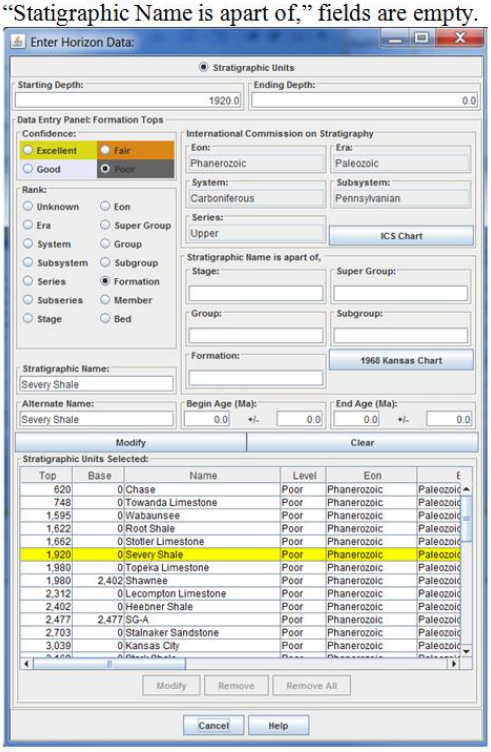


Modify data for the Severy Shale Formation in the Stratigraphic Units List

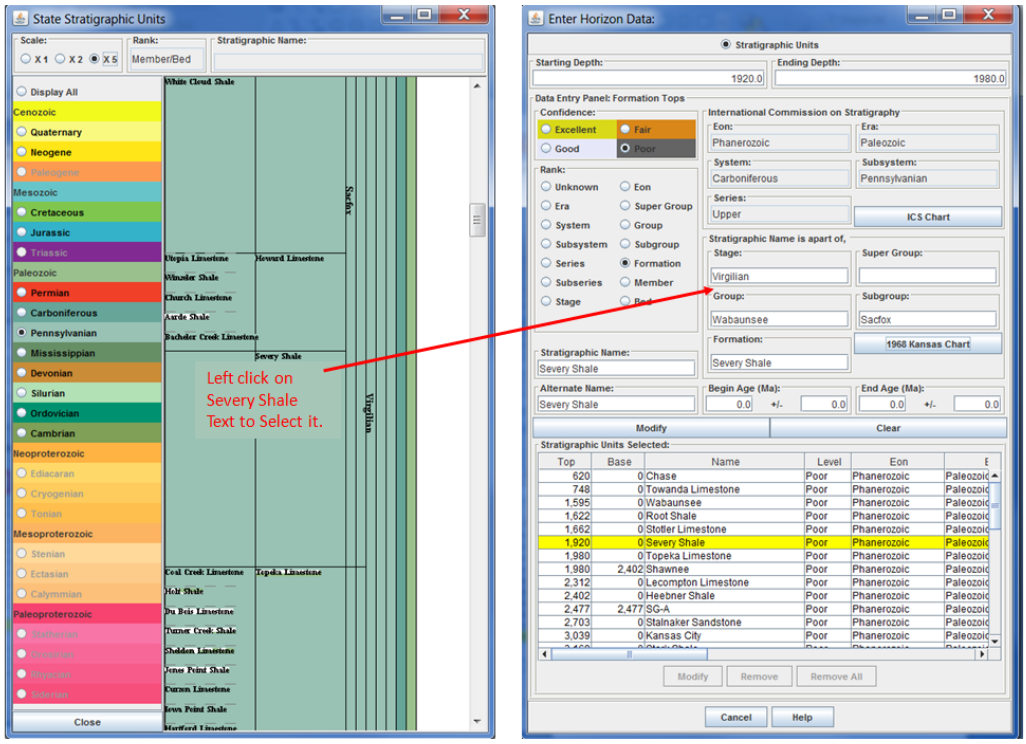
Highlight the Severy Shale, select the "Modify" Button.

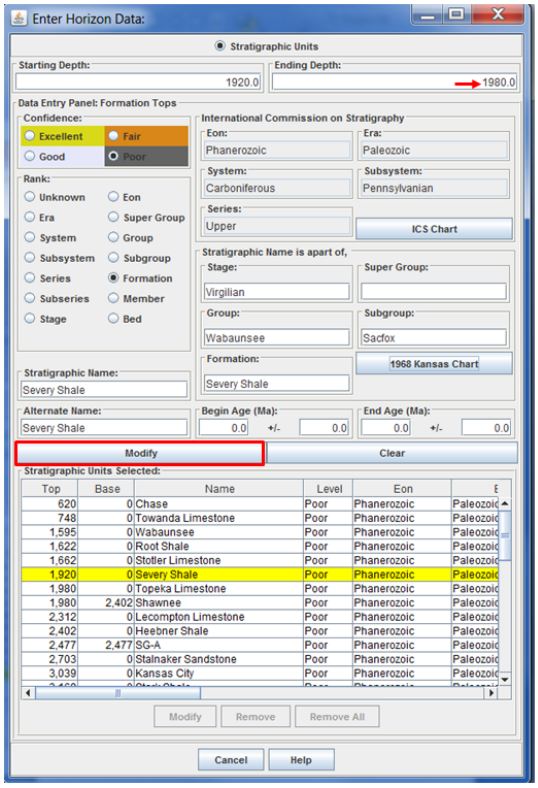


Notice the Stratigraphic Units Data are loaded into the Stratigraphic Units Panel Fields and the "Statigraphic Name is apart of," fields are empty.



Left mouse click on the Severy Shale text to transfer all the Stratigraphic Units to the "Stratigraphic Units" Panel on the "Enter Horizon Data" Dialog. Notice also that the Severy Shale belongs to the Wabaunsee.

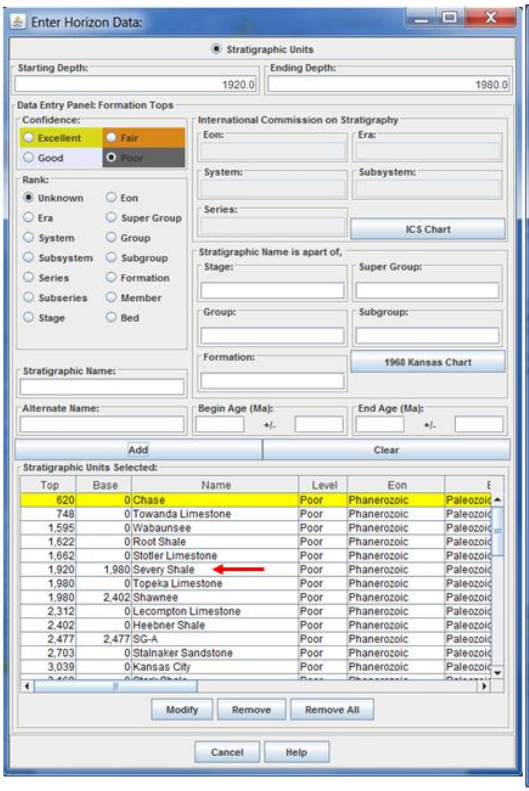


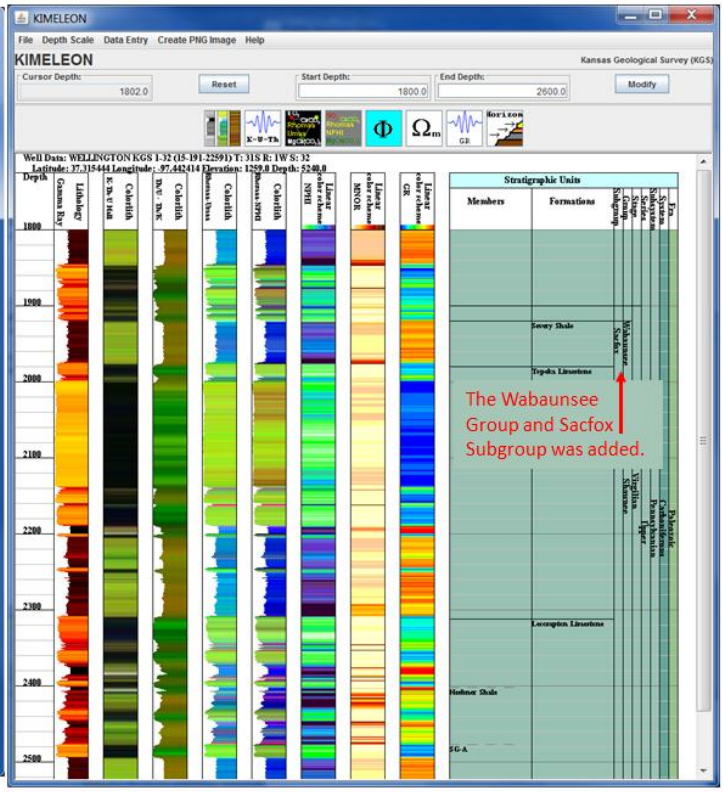


Change the Ending Depth to 1980.0, which is the start Depth of the Topeka Limestone and the next Formation.

Now Select the "Modify" Button to save the changes and modify the contents of the "Severy Shale" Stratigraphic Units in the "Stratigraphic Units Selected" table.

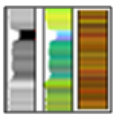
Notice that the Wabaunsee Group & the Sacfox Subgroup were added.





KIMELEON Colorlith & Color Image Tracks

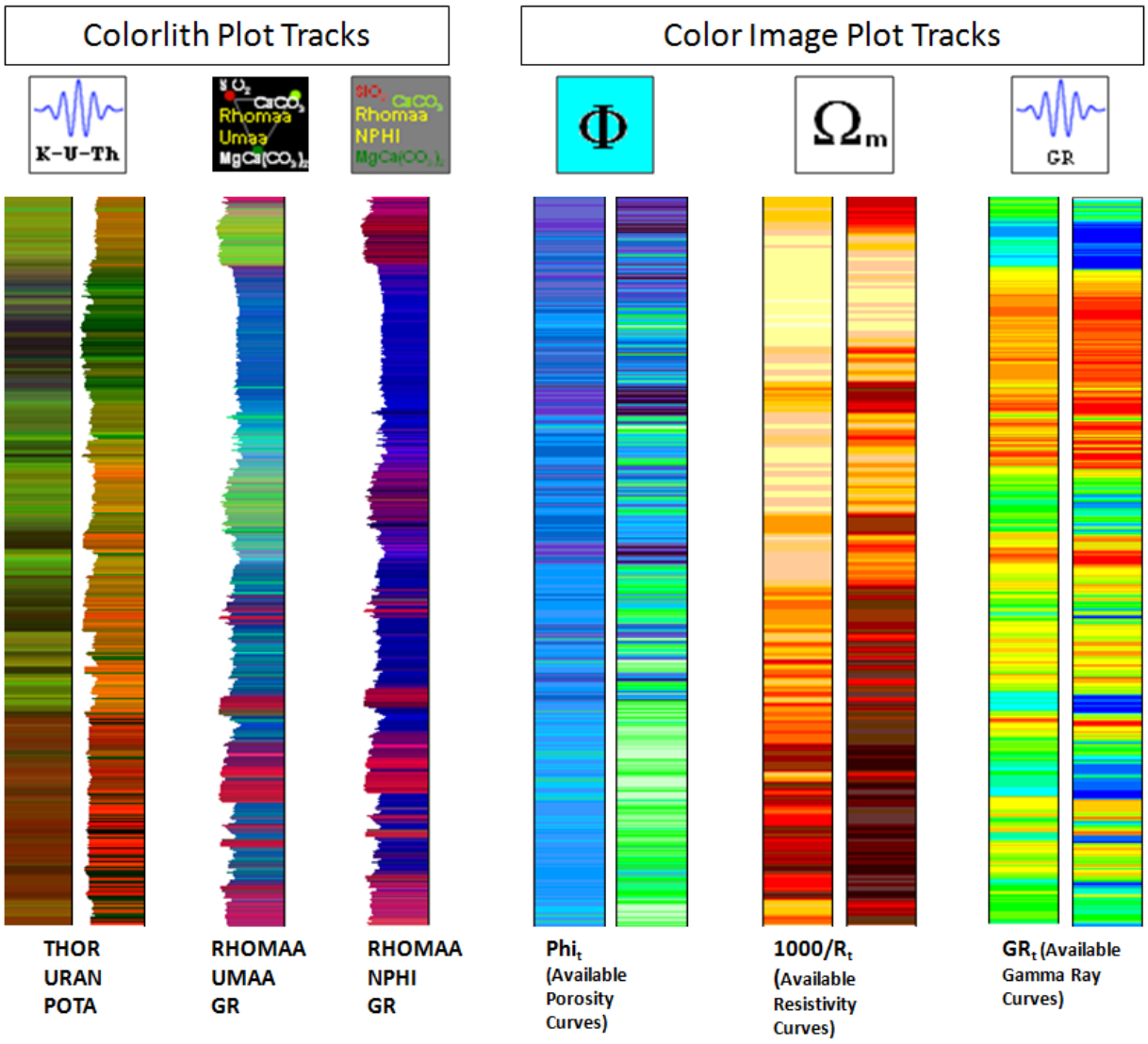
The KIMELEON Plot Panels allows the user to modify the colorlith & color image plot tracks.

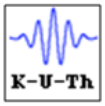


Summary of all image Colorlith & Color Image Plot Tracks

Summary of all image Colorlith & Color Image Plot Tracks against formation tops picks.

There are two types of Image Tracks, the Colorlith, which maps 3 log curves to the each Red, Green and Blue color and the Color Image Tracks that uses up to 16 individual colors to plot a single log curve values.





Spectral Gamma Ray Image Panel – Thorium (Th), Uranium (U) and Potassium (K) Log Curves and the K-Th-U Hall Colorlith and Spectral Gamma Ray Ratio Colorlith Plot Tracks.

Rhomaa-Umaa Image Panel – Apparent Grain Density (RHOmaa), Apparent Photoelectric (Umaa) and Gamma Ray (GR) Log Curves and the Rhomaa-Umaa Colorlith Plot Tracks.

Rhomaa-NPHI Image Panel – Apparent Grain Density (RHOmaa), Neutron Porosity (NPHI) and Gamma Ray (GR) Log Curves and the Rhomaa-NPHI Colorlith Plot Tracks.

Porosity Image Panel – Any Available Porosity Log Curve Type and the Linear & Non-Linear Color Image Plot Tracks.

Conductivity Image Panel – Any Available Resistivity Log Curve Type and the Linear & Non-Linear Color Image Plot Tracks.

Gamma Ray Image Panel – Any Available Gamma Ray Log Curve Type and the Linear & Non-Linear Color Image Plot Tracks.

Colorlith Plot Tracks

The Colorlith format uses 3 log curves and maps each log curve to a red, green or blue color. Each color has a range from 0 to 255, where 0 the darkest color value ("black") and 255 is lightest color value ("white"). The initial minimum & maximum log curve values have been set by previous authors[2,3,4,5], which initially suggests lithology by color. This program was designed to over write the color limits by log curve minimum and maximum to change the basic presentation of the RGB track to bring out subtle color changes by depth. There are three sets of log curves that are presented in the colorlith format, which are fixed curves and cannot be altered. The log curves types are as follows,

- Spectral Gamma Ray Log Curves K-Th-U Hall Colorlith Plot Track, which uses all the spectral gamma ray log curves to create the RGB color schema, which was suggested by Matt Hall[5] to map the "energy" levels of the gamma-ray emissions to the visible spectrum.
    - POTA – Potassium Concentration (potassium-40 nuclei having the lowest energy) assigned a red color range initially from 0 to 5 %.
    - THOR – Thorium Concentration (thorium nuclei having the next highest energy) assigned a green color range initially from 0 to 20 ppm.
    - URAN – Uranium Concentration (uranium nuclei having the highest energy) assigned a blue color range initially from 0 to 30 ppm.
- The Spectral Gamma Ray Ratio Curves Th/U and Th/K Colorlith Plot Track, which maps each ratio to a specific color scheme suggested by Doveton [4].
    - Th/U – Thorium/Uranium Ratio assigned a red color range initially from 0.57 to 24.5.

    - Th/K – Thorium/Potassium Ration assigned a green color range initially from 1.02 to 24.5.
- The Litho-Density Log Curves with Photoelectric Factor (PE) Colorlith Plot Track, which uses the Bulk Density (RHOB), Neutron Porosity (NPHI) and the Photoelectric Factor (PE) log curves to compute the RHOmaa-Umaa curves, the limits suggested by Doveton [(4)].
    - RHOmaa – Apparent Grain Density computed from RHOB and NPHI log curves are mapped to the red color range initially from 2.6 to 2.87 gm/cc.
    - Umaa – Apparent Photoelectric computed from PE, RHOB and NPHI log curves are mapped to the green color range initially from 4.3 to 13.6 barnes/cc.
    - GR – Gamma Ray log curve mapped to the blue color range initially from 0 to 150 API.
- The Litho-Density Log Curves without Photoelectric Factor (PE) Colorlith Plot Track, which uses the Bulk Density (RHOB) and Neutron Porosity (NPHI) log curves to compute the RHOmaa curve, the limits suggested by Doveton & Collins [(2,4)].
    - RHOmaa – Apparent Grain Density computed from RHOB and NPHI log curves are mapped to the red color range initially from 2.6 to 2.87 gm/cc.
    - NPHI – Neutron Porosity log curve mapped to the green color range initially from 0.0 to 0.3 PU.
    - GR – Gamma Ray log curve mapped to the blue color range initially from 0 to 150 API.

Color Image Plot Tracks

The Color Image Plot Tracks[(6)] uses one curve to plot its magnitude over a 16 color range. The KIMELEON web app sets up 3 color image track types; Porosity, Conductivity and Gamma Ray in both linear and non-linear color scheme. There is only one log curve per type and is automatically selected by a hierarchy depending on the log curves available, which can be modified by the user. The linear color image plot track assigns the color by its magnitude; there are 16 colors within the curve type minimum and maximum value, the minimum and maximum log curve value for each color is divided equally within the overall minimum and maximum values, i.e. for gamma ray the overall minimum and maximum value is 0 and 150 API respectively, divide the range by 16 and you get about 9.375 so the 1st color interval is from 0 to 9.375, the 2nd color interval is from 9.375 to 18.75 etc. up to 16th color interval set from 140.625 to 150. The non-linear color image plot track first sorts all the data for the selected log curve by magnitude dividing all the log values equally among the 16 color intervals and then resorts the log curve values by depth. This value is only dependent on the depth range and not on the curve limits. The KIMELEON web app has set up three color image plot types as follows,

1. Porosity Log Color Image Plot Track, the user can select from the following curve types,
    a. DPHI – Density Porosity
    b. NPHI – Neutron Porosity
    c. SPHI – Sonic Porosity
2. Conductivity (1000.0/Resistivity) Log Color Image Plot Track, the user can select from the following log curve types,
    a. RES – General Resistivity
    b. RDEP – Deep Resistivity
    c. RMED – Medium Resistivity

d. RSHAL – Shallow Resistivity
e. ILD – Deep Induction Resistivity
f. ILM – Medium Induction Resistivity
g. SFLU – Spherically Focused Resistivity
h. LL – Deep Laterolog Resistivity
i. MLL – Micro Laterolog Resistivity
j. LL8 – Shallow Laterolog Resistivity
k. LN – Long Normal Resistivity
l. SN – Shallow Normal Resistivity
m. MNOR – Micro Normal Resistivity
n. MSFL – Micro Spherically Focused Resistivity
o. MINV – Micro Inverse Resistivity
p. AHT10 – Array Induction Resistivity -10
q. AHT20 – Array Induction Resistivity -20
r. AHT30 – Array Induction Resistivity -30
s. AHT60 – Array Induction Resistivity -60
t. AHT90 – Array Induction Resistivity -90

3. Gamma Ray Log Color Image Plot Track, the user can select from the following log curve types,
    a. GR – Gamma Ray
    b. CGR – Gamma Ray Minus Uranium

References:

(1) Color display of well logs, Peter L. Briggs, Mathematical Geology, Volume 17, Number 4, May 1985

(2) Color Images of Kansas Subsurface Geology from Well Logs, D. R. Collins and J. H. Doveton, Computer & Geosciences, Vol. 12, No. 4B, pp.519-526 1986

(3) Visualization of Subsurface Geology from Wireline Logs, David R. Collins, Digital Mapping Techniques '98-Workshop Proceedings U. S. Geological Survey Open-File Report 98-487

(4) The Dakota Aquifer Program Annual Report, FY89 Kansas Geological Survey, Open-File Rept. 90-27 Annual Report, FY89-Appendix B (http://www.kgs.ku.edu/Dakota/vol3/fy89/app_b.htm)

(5) Composite Colour Display of Spectral Gamma-Ray Logs, by Matt Hall, Canadian Well Logging Society, Dec 2005, v.24

(6) Geological Well Logs Their use in Reservoir Modeling, by Stefan M. Luthi, pg 84-86, ISBN 3-540-67840-9, © 2001 Springer-Verlag Berlin

Changing the Colorlith Plot Track Limits & Log Curve Limits

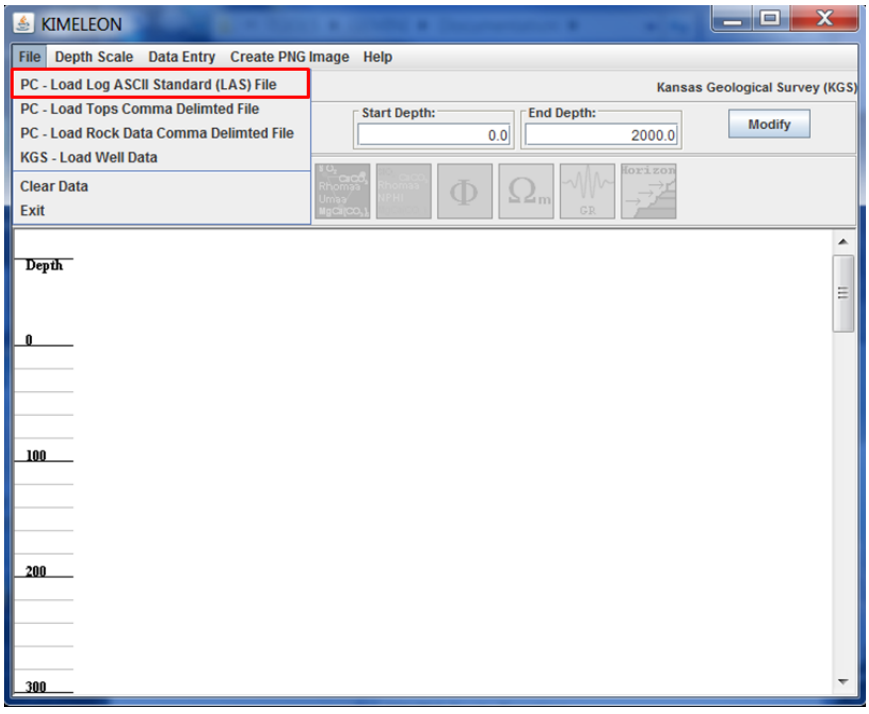
Each of the image icons above opens a specific log type plot panel that allows the user to change the limits of the log curve plots as well as the limits controlling the colorlith and color image plot tracks. This example will use the Braun 1 Log ASCII Standard (LAS) version 3.0 file, which can be downloaded from the following URL's,

Well Data: Braun 1, Ellis County, Kansas

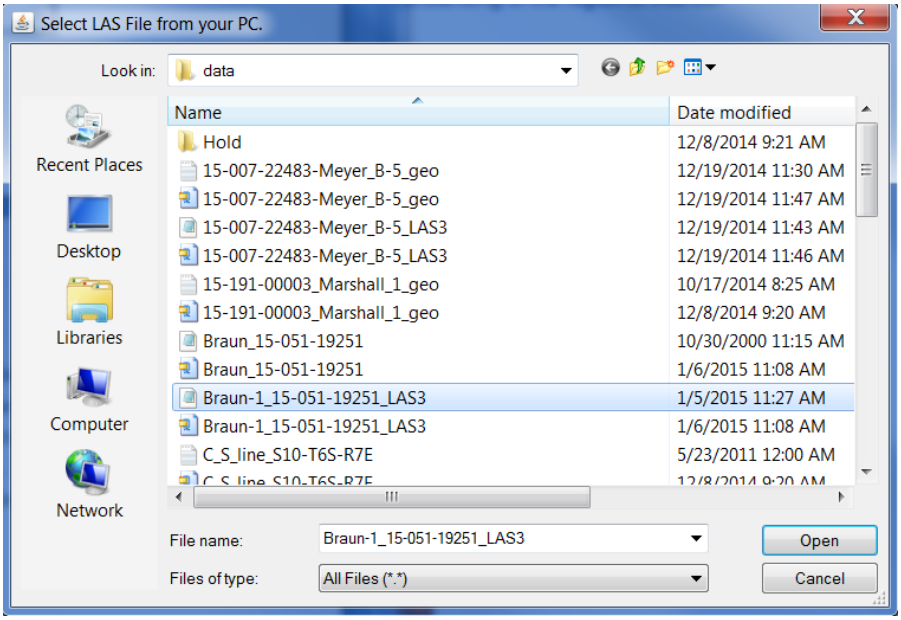
Type	ASCII Text Files
LAS 3.0	http://www.kgs.ku.edu/Gemini/Tools/documentation/Braun-1_15-051-19251_LAS3.las

Type	Zip Files
LAS 3.0	http://www.kgs.ku.edu/Gemini/Tools/documentation/Braun-1_15-051-19251_LAS3.zip

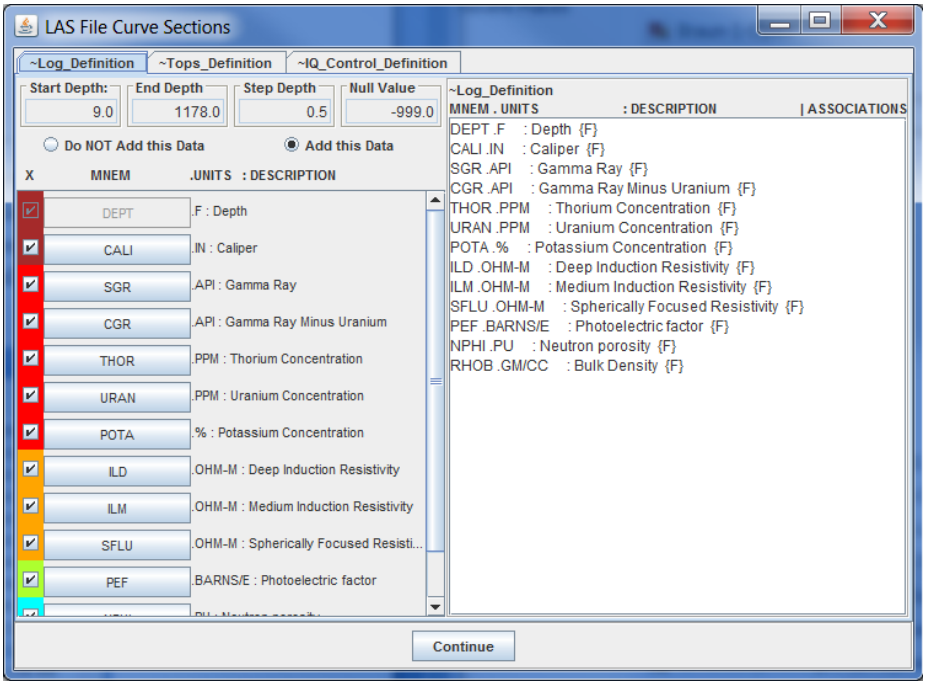
Download either the ASCII Text Files directly or the Zip files extracting the contents into a directory. The problem with the ASCII Text Files being downloaded directly from a web page is that the web page will alter the contents so it does not retain the basic structure and add HTML text to the file. The preferred method if you have Zip or WinZip is to download the zip files to your PC and extract. The Braun-1_15-051-19251_LAS3.las file contains both the Log & Tops Data.



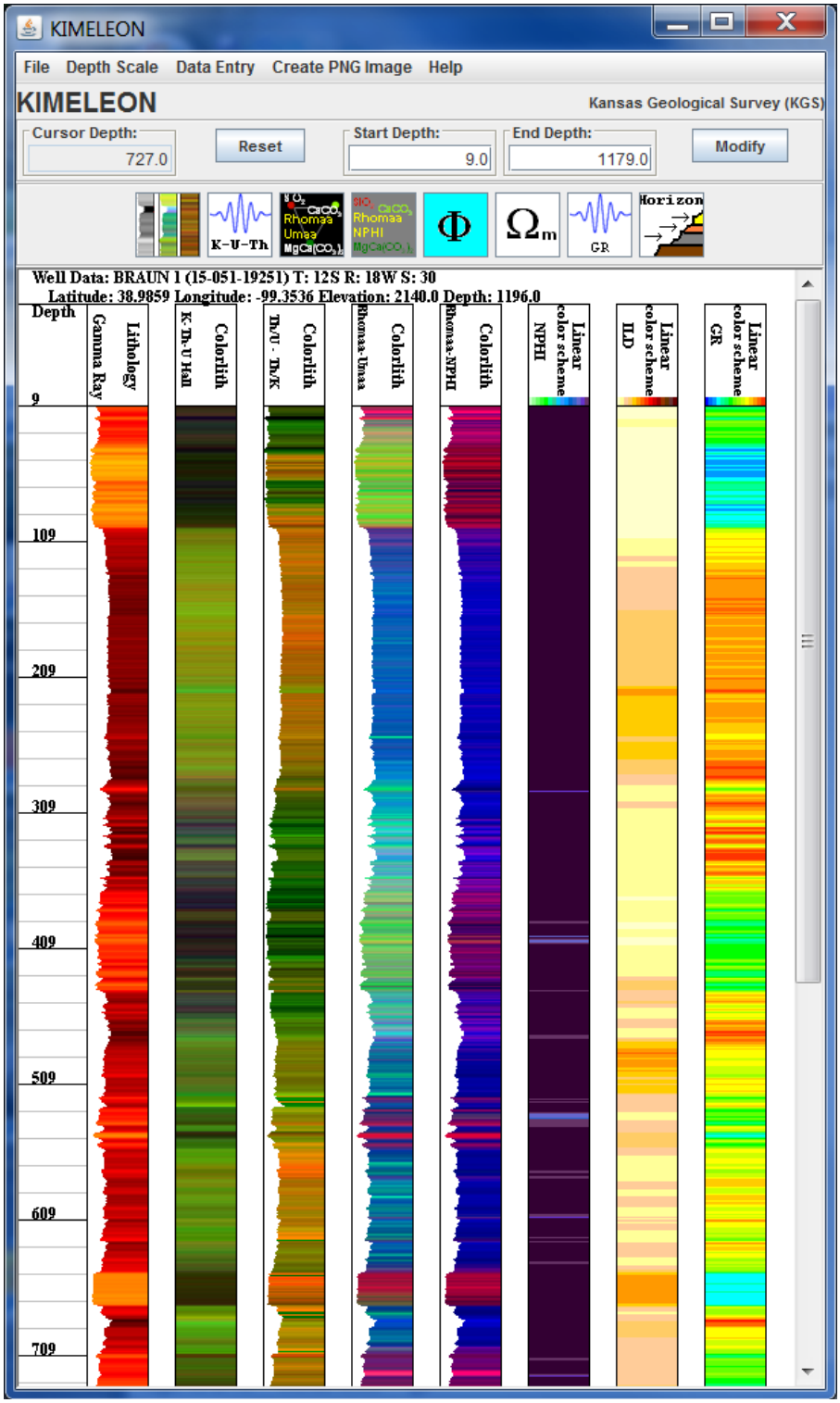
Click on the “File” Menu in the menu bar at the top of the “KIMELEON” Dialog, which will display a list of menu options to import well data into the web app. Select the “PC - Load ASCII Standard (LAS) File” menu option. This will display the “Select LAS File from your PC” Dialog. This dialog allows the user to search their PC for the file of interest. In this example it is the LAS version 3.0 file Braun-1_15-051-19251_LAS3.las, highlighted below. Select the Open button to display the “LAS File Curve Sections” Dialog.



The “LAS File Curve Sections” Dialog allows the user to map unknown LAS Curve Mnemonics to the KGS “Standard” Curve Mnemonics so they will be plotted in the LAS File Viewer Plot.

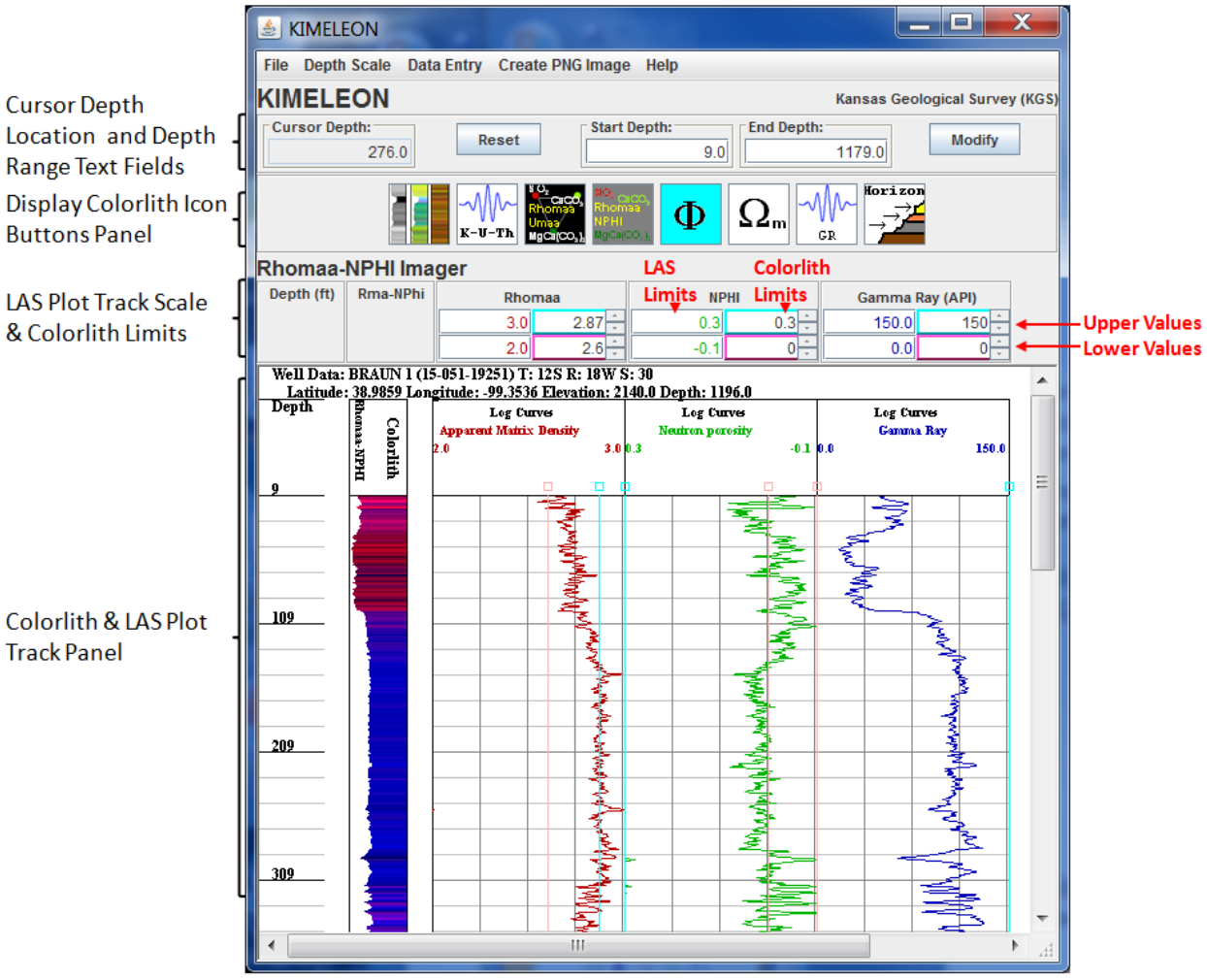


This program reads the “LAS Tool Curve Mnemonics map to KGS Standard Mnemonics” XML File (http://www.kgs.ku.edu/software/gemini/data/las_standard_tools.xml), which will automatically maps the Curve Mnemonics from the LAS file to one of 31 KGS “Standard“ Curve Mnemonics. This file has all the curve correctly mapped so select the “Continue” button to load the log and tops data into the KIMELEON web app.

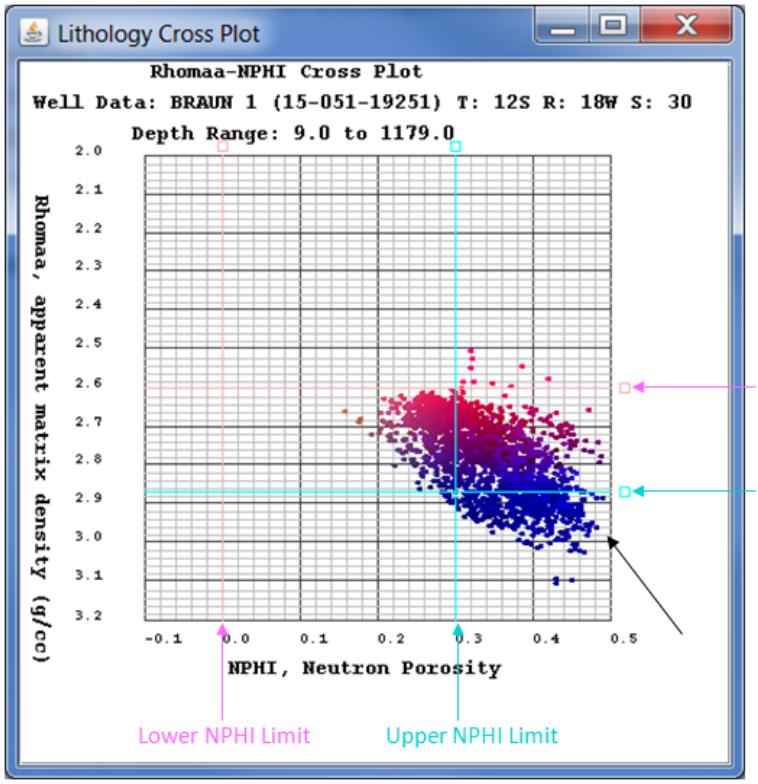


Rhomaa-NPHI Icon Button

Select the "Rhomaa-NPHI" Icon Button to display the "Rhomaa-NPHI Image" Panel and the Rhomaa-NPHI 2D Plot Panel.



The 2D Plot Panel only displays for the "Rhomaa-Umaa" and "Rhomaa-NPHI" Icon Image buttons. The Colorlith limits colors cyan and pink match the Colorlith Limits text fields.



Colorlith Curve Limits

- Cyan color is the upper limit.
- Pink color is the lower limit.

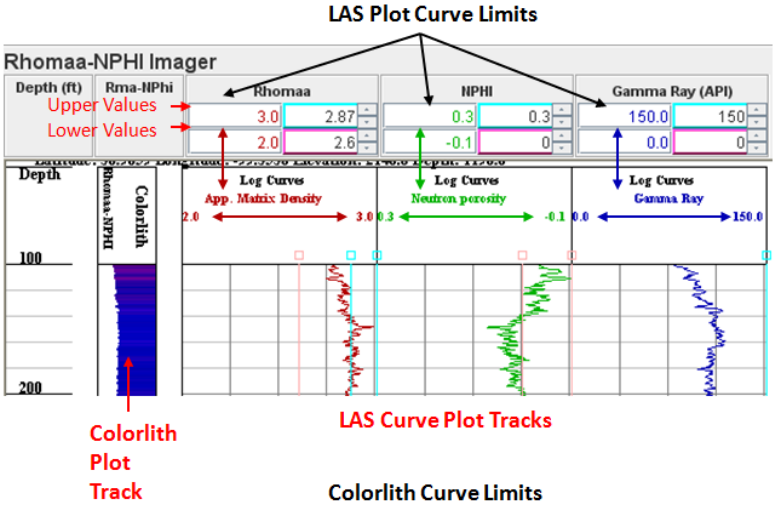
If curve data falls outside of curve limit range the curve data is redefined to be the maximum or minimum of the limit.

Color of data is the (Red, Green, Blue) equivalent of the data (Rhomaa, NPHI, Gamma Ray) values respectively within the limits of the colorlith color values.

The points displayed in the plot fall within the depth range specified on the Kimeleon Control Panel.

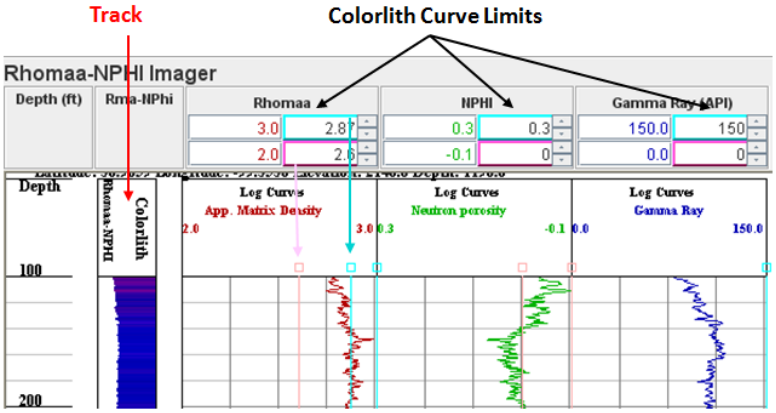
LAS Plot Curve Limits

- Each Log Curve has a default curve limit, user can modify the limits.
- Color of the Plot limit matches the color of the Log Plot & Labels.
- Color of the Log Curve represents the color used in the tri-color RGB colorlith presentation, i.e.
  - Red – Rhomaa Log Curve
  - Green – Neutron Porosity Log Curve
  - Blue – Gamma Ray Log Curve

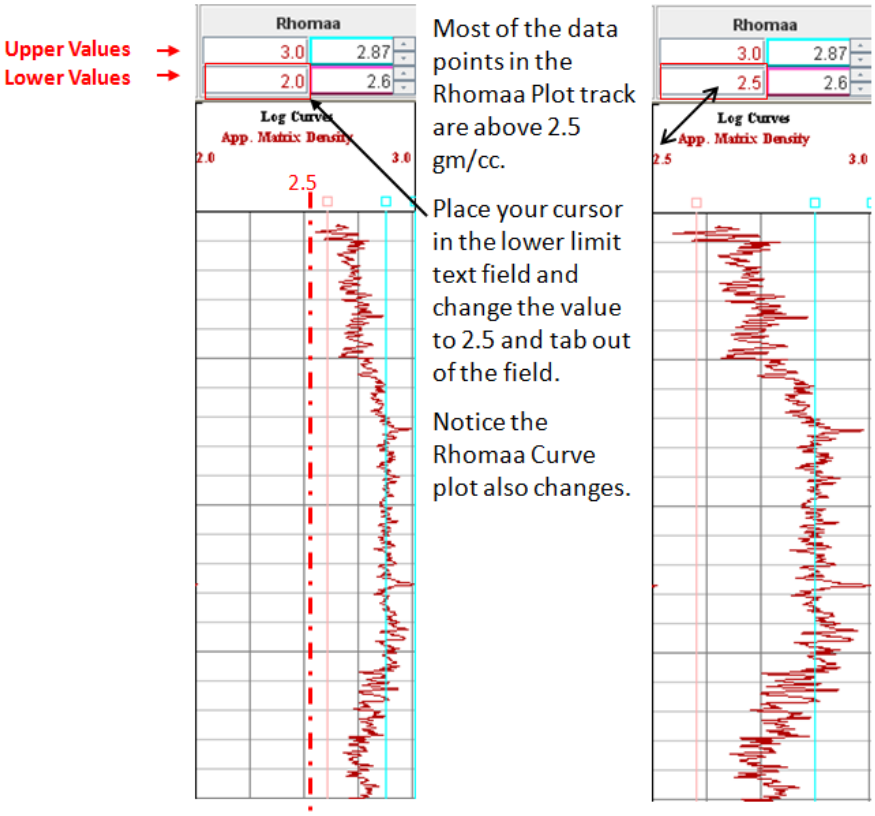


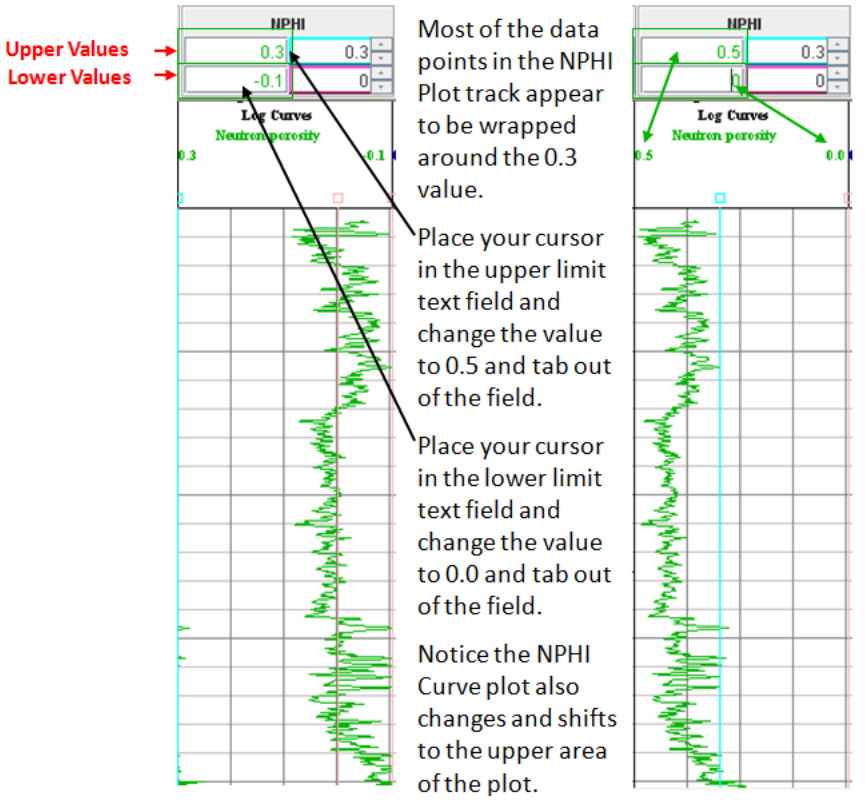
Colorlith Curve Limits

- Each Log Curve has a default colorlith plot limit, user can modify the limits.
- Border Color of the colorlith text field matches the square and line color on the LAS Plot Track.
- Cyan color is the upper limit.
- Pink color is the lower limit.

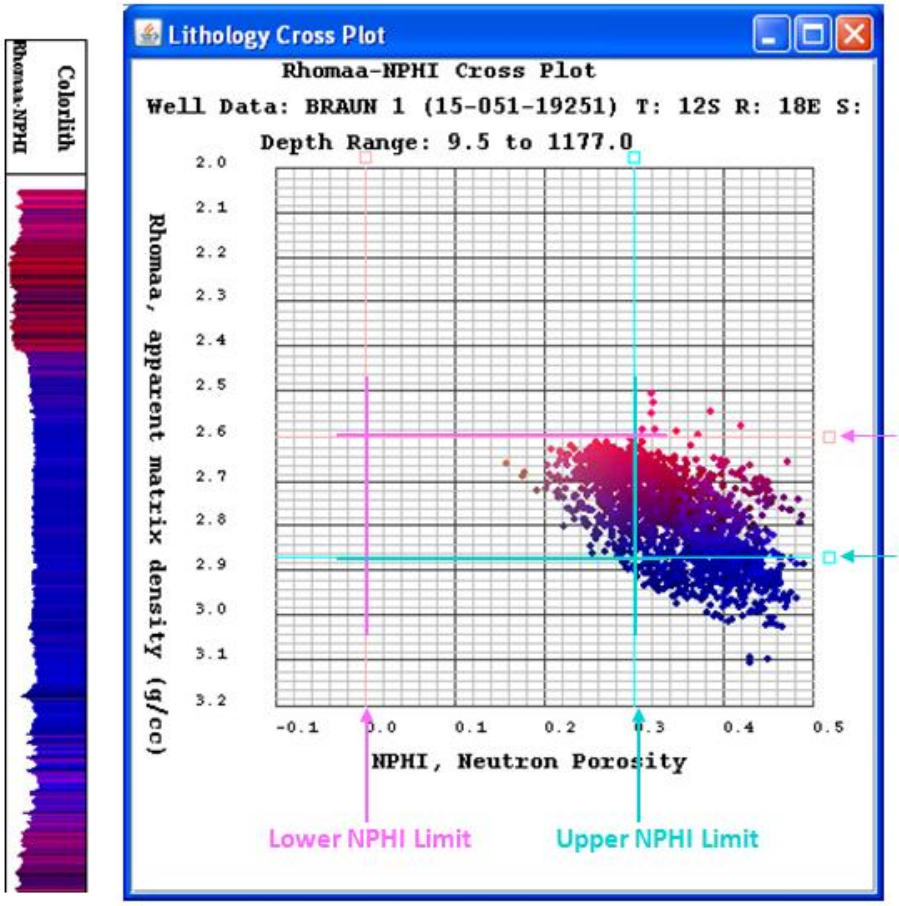


Changing LAS Plot Limits

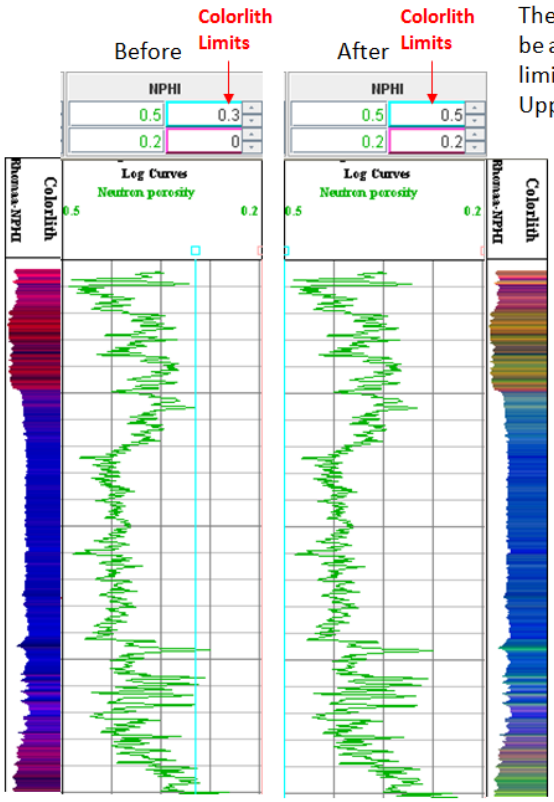




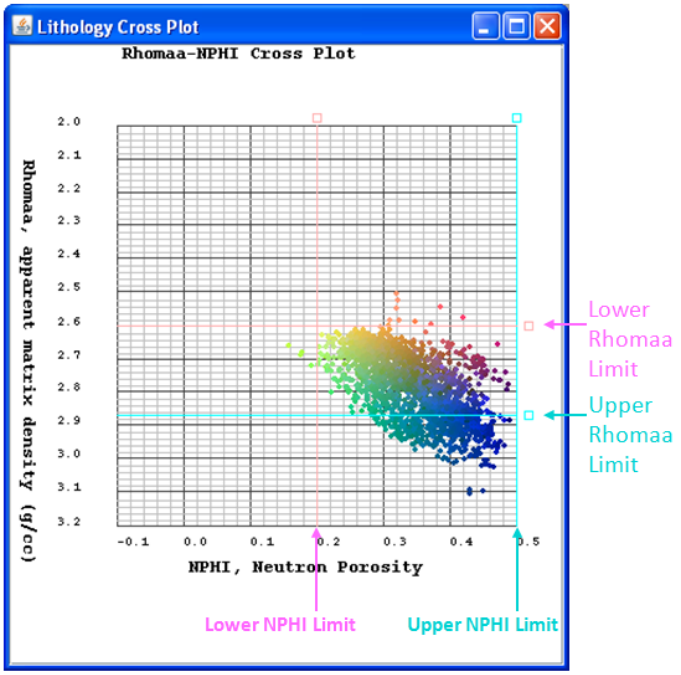
Changing Colorlith Limits

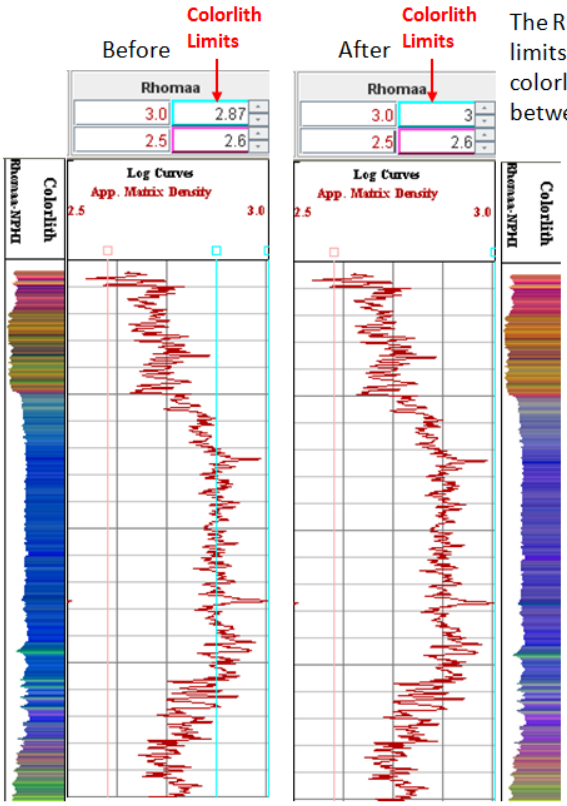


Notice the data in area within the Lower and Upper limits of Rhomaa - NPHI are outside the bulk of the plotted data. The object of this exercise is to move the boundary area around the data.

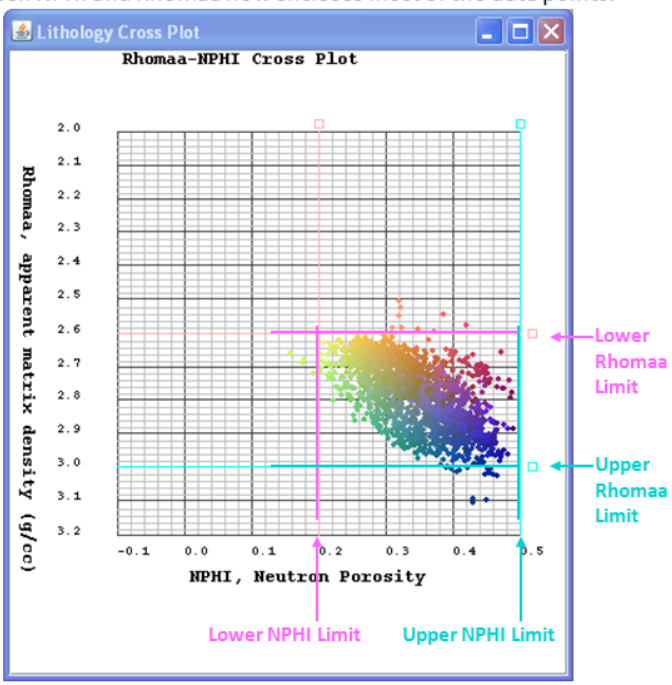


The Rhomaa-NPHI Cross Plot illustrates the cluster of data points to be above 0.2 PU and below 0.5 PU. Change the limits in the colorlith limits text fields and notice in the Cross Plot that the Lower and Upper NPHI Limits now encloses the data points in NPHI space.

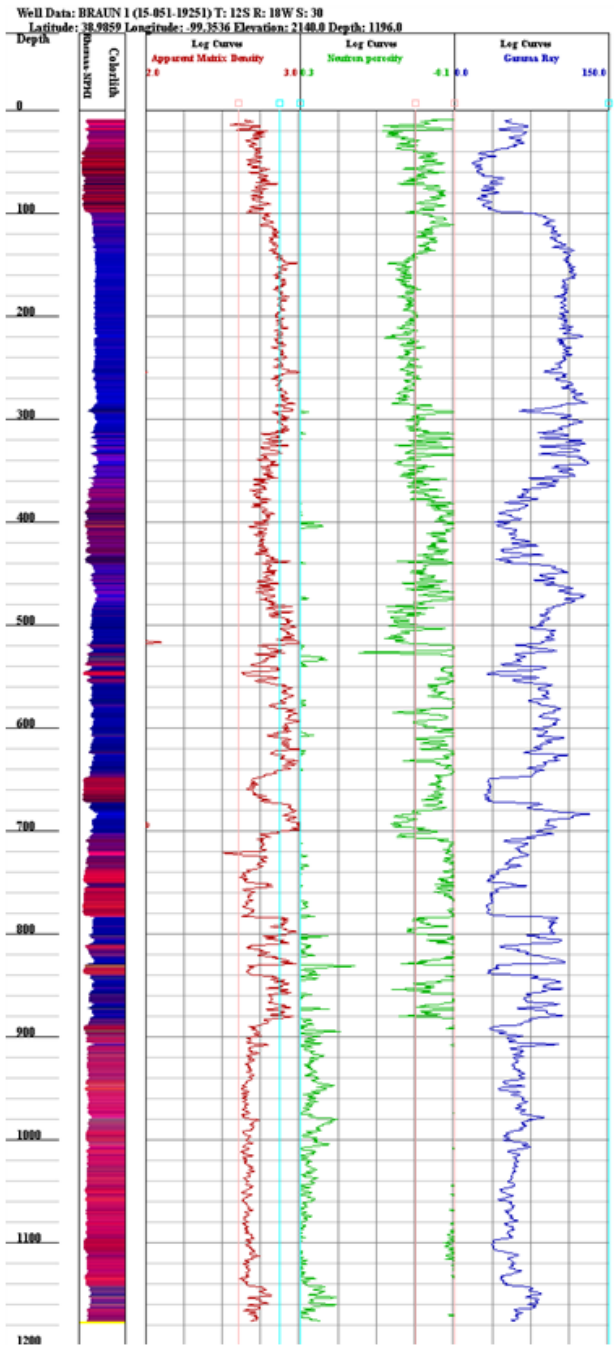




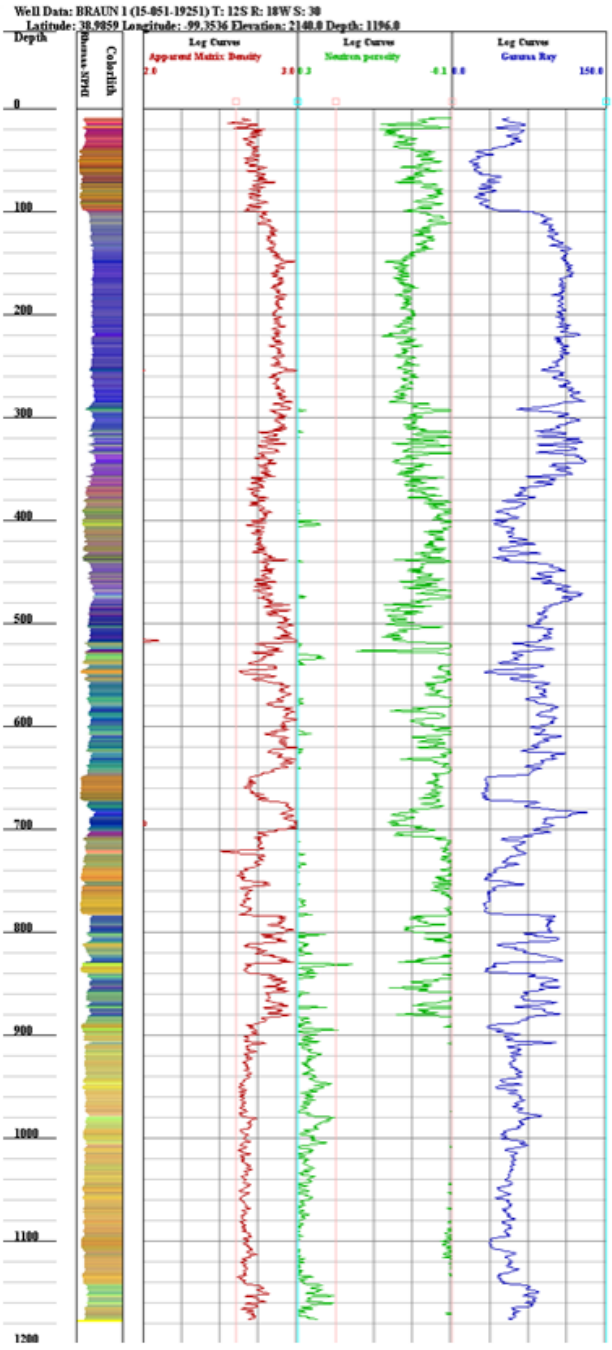
The Rhomaa-NPHI Cross Plot illustrates that the Rhomaa curve limits are only about half of the data points. Increase the upper colorlith curve limit to 3.0 and notice that the boundary area between NPHI and Rhomaa now encloses most of the data points.



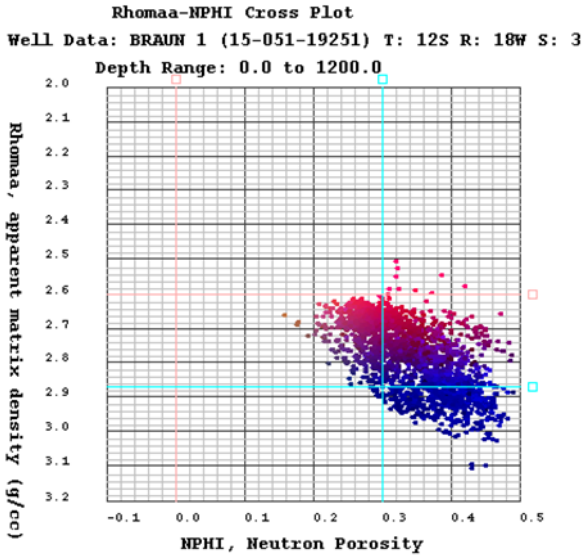
Before Colorlith Limit Changes



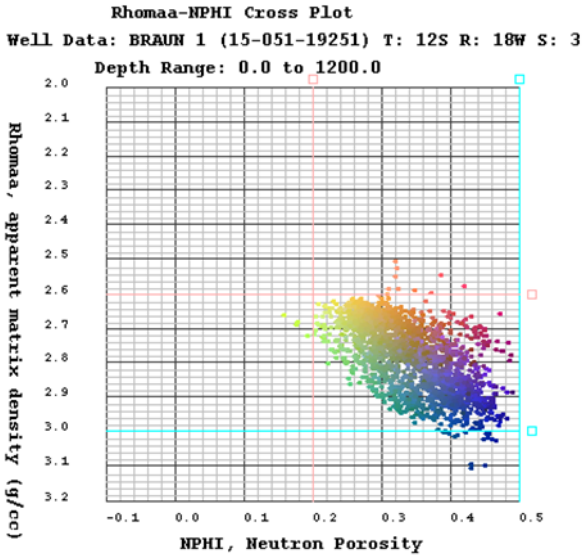
After Colorlith Limit Changes



Before Colorlith Limit Changes

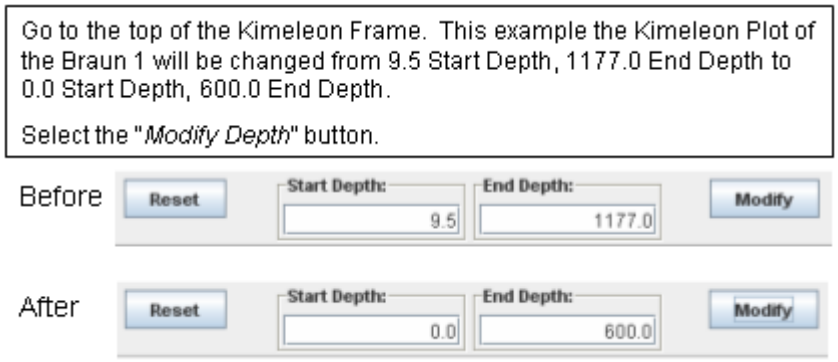


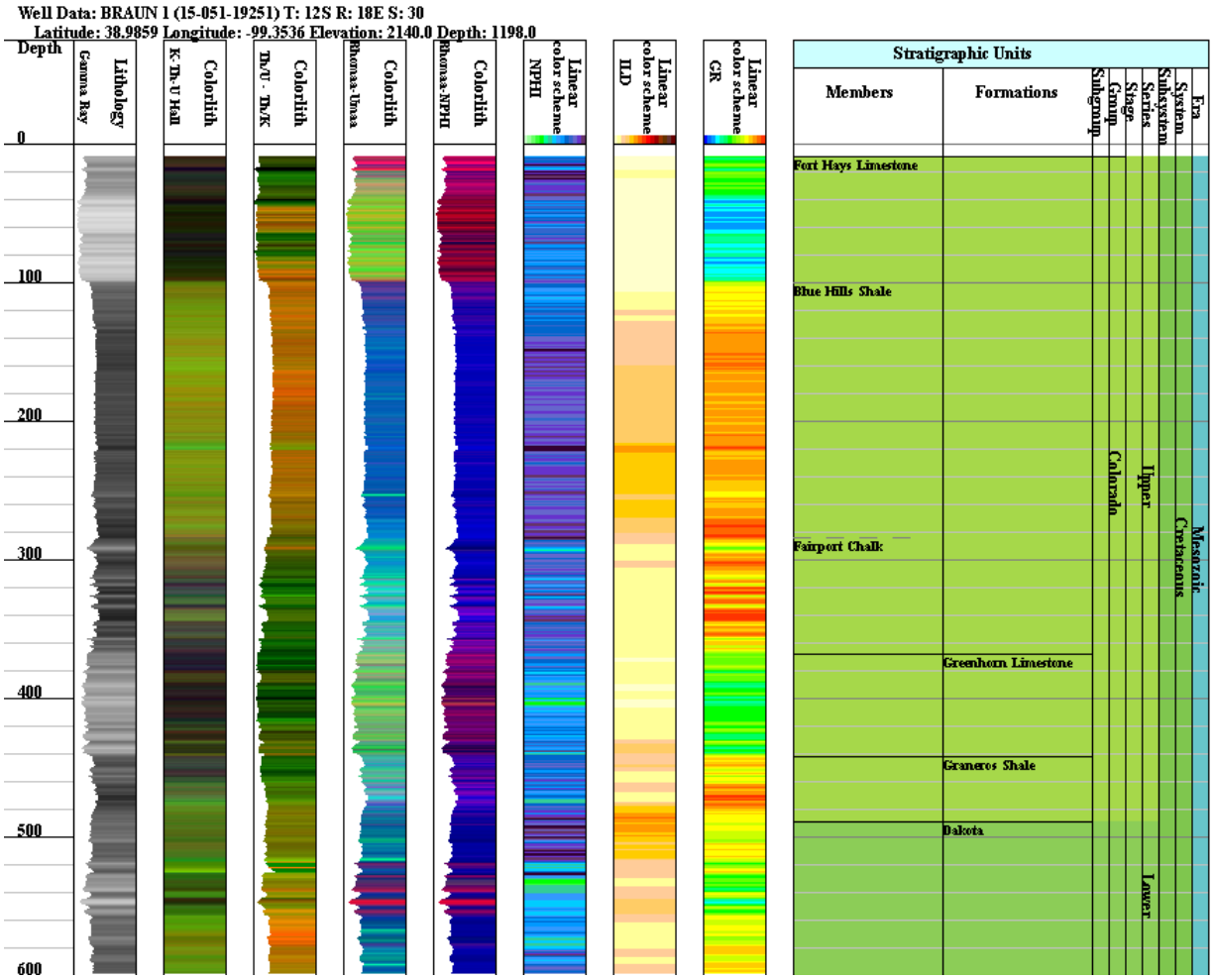
After Colorlith Limit Changes



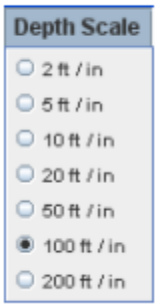
Change Depth Range & Scale

This program allows the user to change the viewing depth range for the plot and to change the feet / inch plot scale to expand or contract the Kimeleon plot.





Before

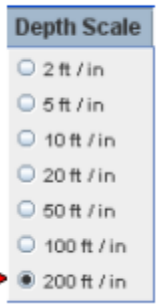


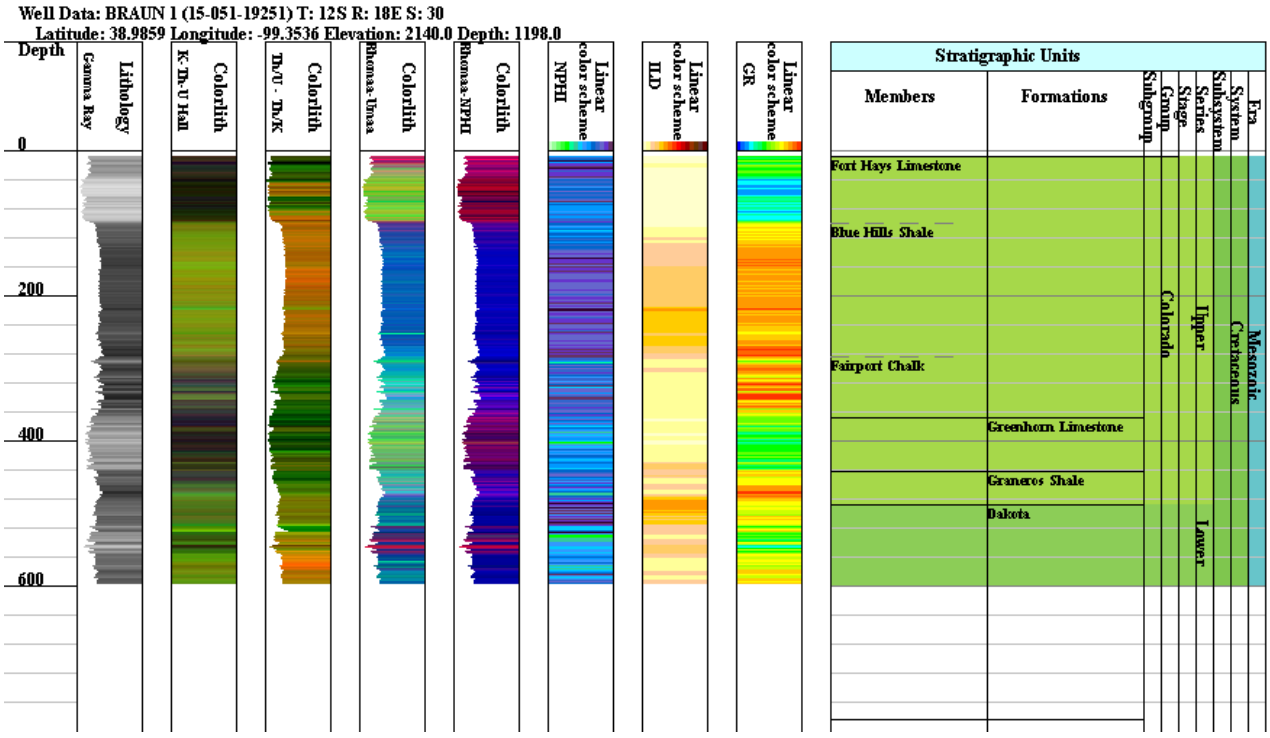
This example the Kimeleon Plot of the Braun 1 will change the depth scale of 100 ft / in to 200 ft / in. Notice that the "*Depth Scale & Range*" Panel shows the Depth Scale to be 100 ft / in.

Go to the "*Depth Scale*" Menu on the "*Kimeleon Control*" Frame. Select the "200 ft / in" radio button.

Notice that the "*Depth Scale & Range*" Panel shows the Depth Scale to be 200 ft / in and the Kimeleon plot has contracted.

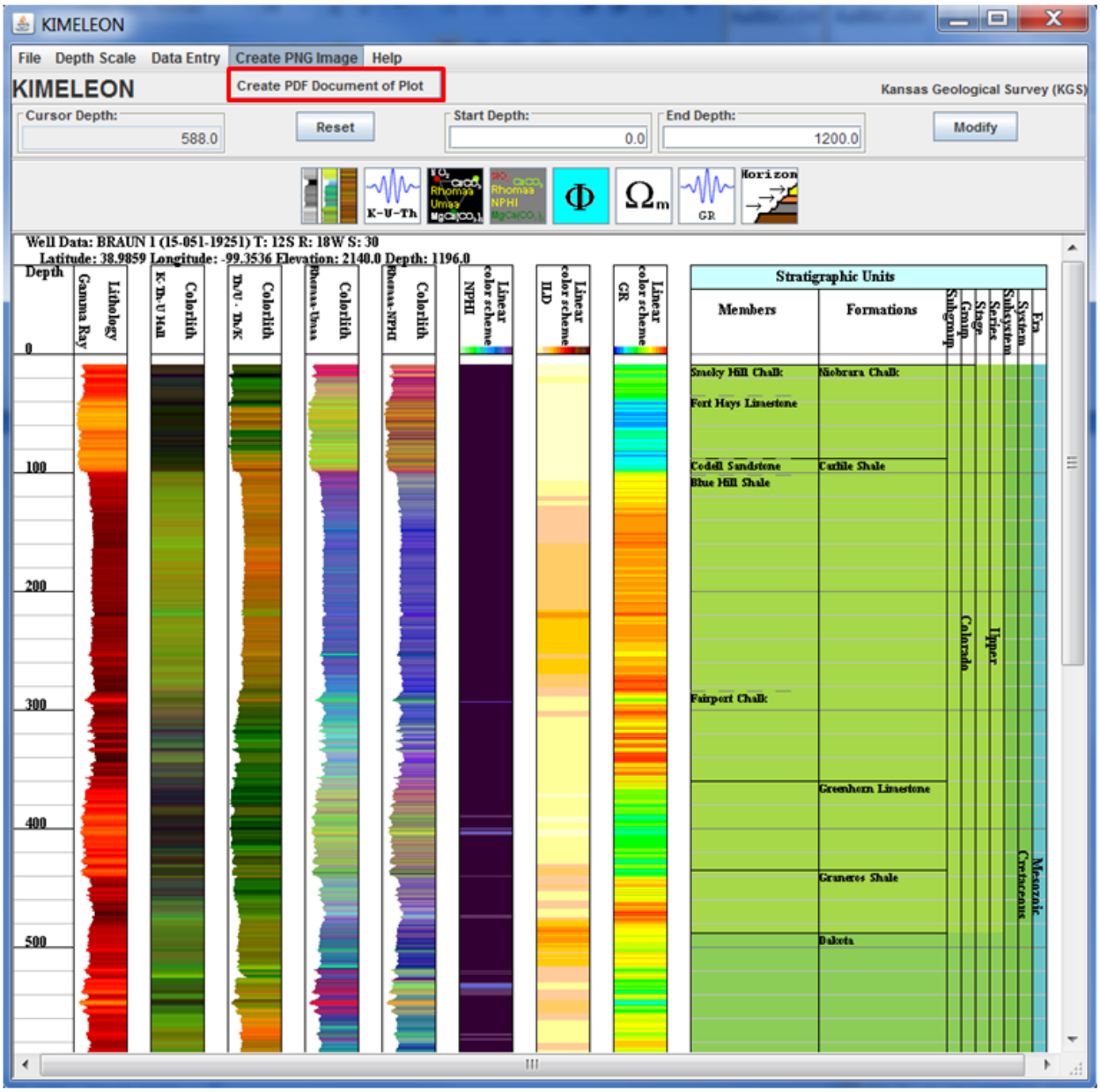
After

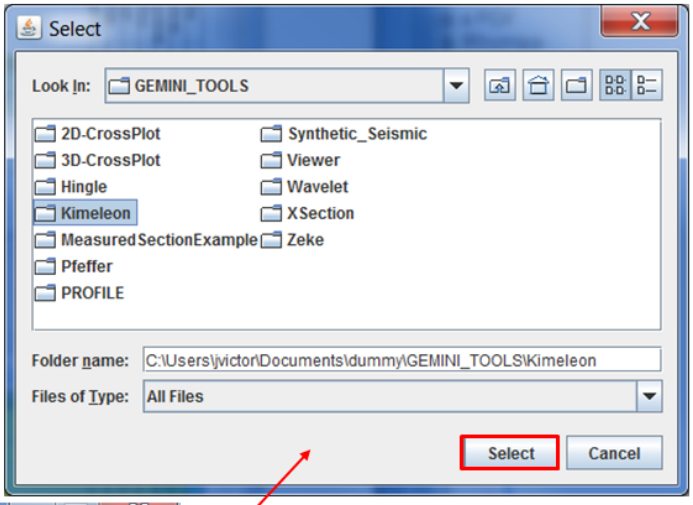




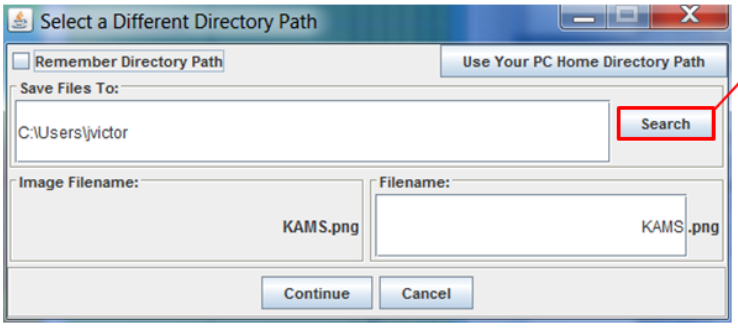
Creating a Portable Document Format (PDF) Document of Plots

Select the “Create PNG Image” Menu and then select the “Create PDF Document of Plot” menu option, which will display the “Select a Different Directory Path” dialog which allows the user to place the Portable Network Graphics (PNG) image file anywhere on their PC. Also when the user selects the “Create PDF Document of Plot” menu option the panel that is displayed is the PNG image that is being created. Only the “Rhomaa-Umaa” & “Rhomaa-NPHI” icon buttons will also create a 2D Plot PNG image with the Plot Panel.

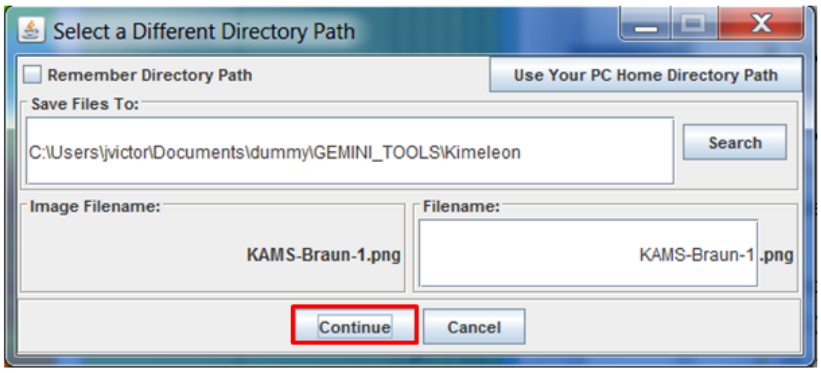




Click on the "Search" button to display the "Select" dialog that allows the user to search the PC for the directory path to save the PNG Files.

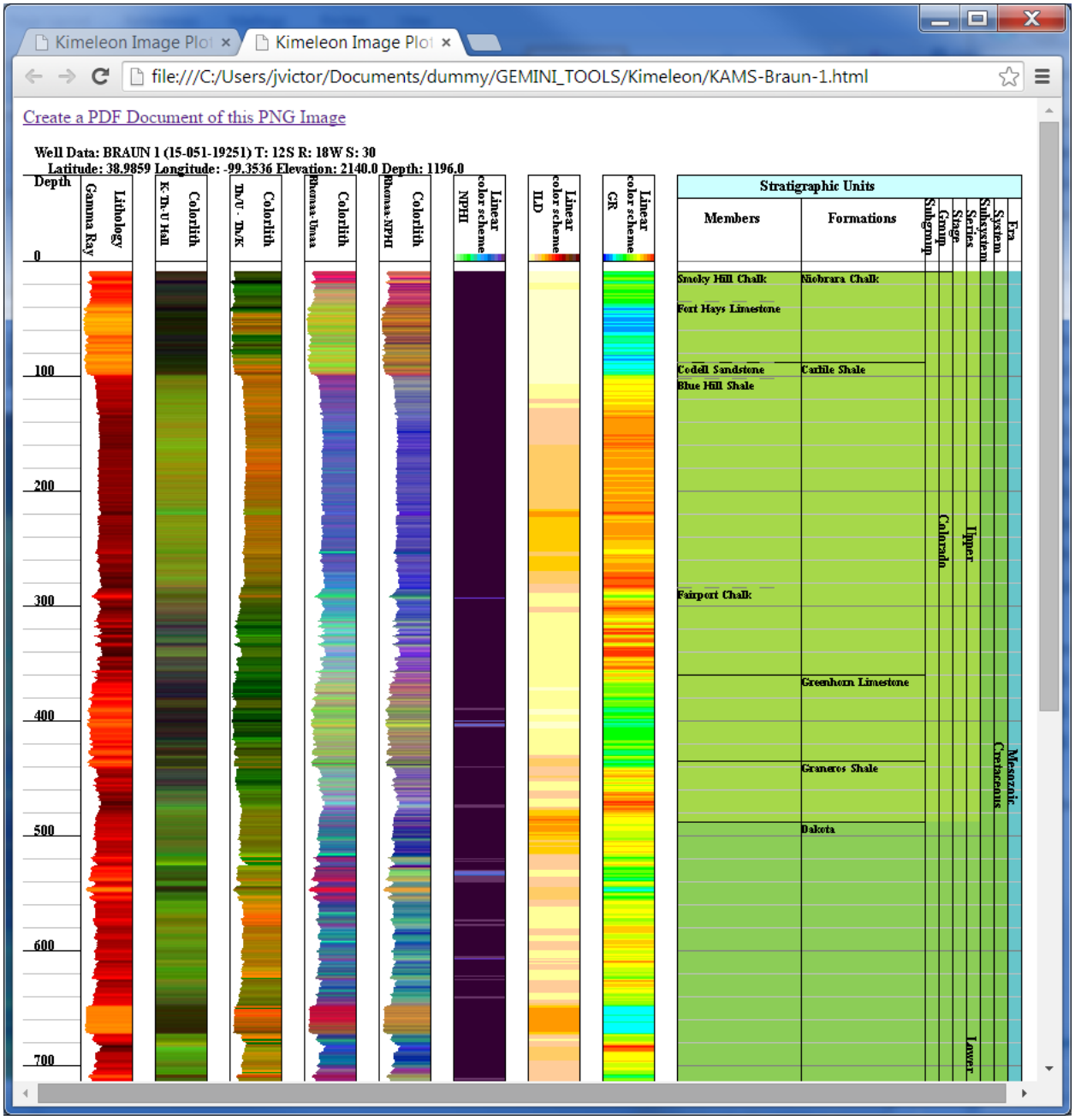


Click on the "Select" button to transfer the directory path to the "Save Files To" text field on the "Select a Different Directory Path" dialog.

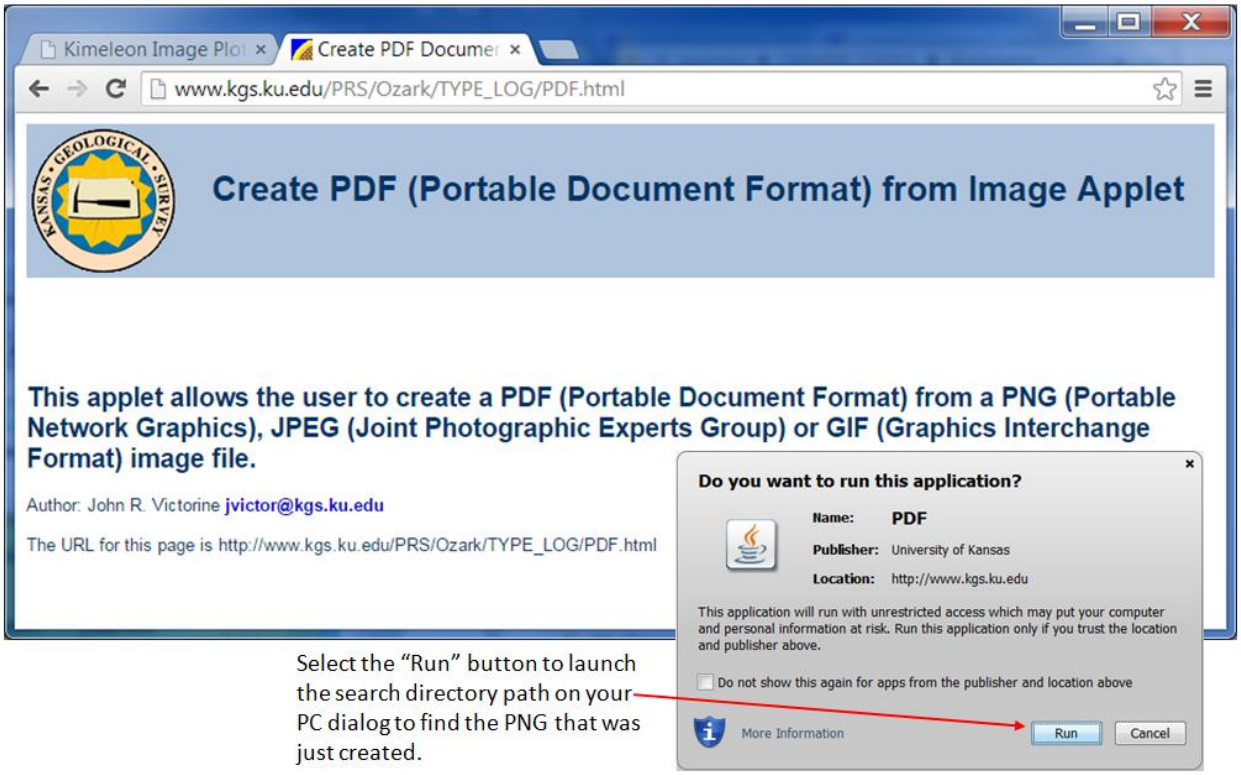


The KAMS Prefix identifies the Mnemonic of the panel that is being saved as a PNG file. "-Braun-1" is being added to "KAMS" to identify the Well with the image type.

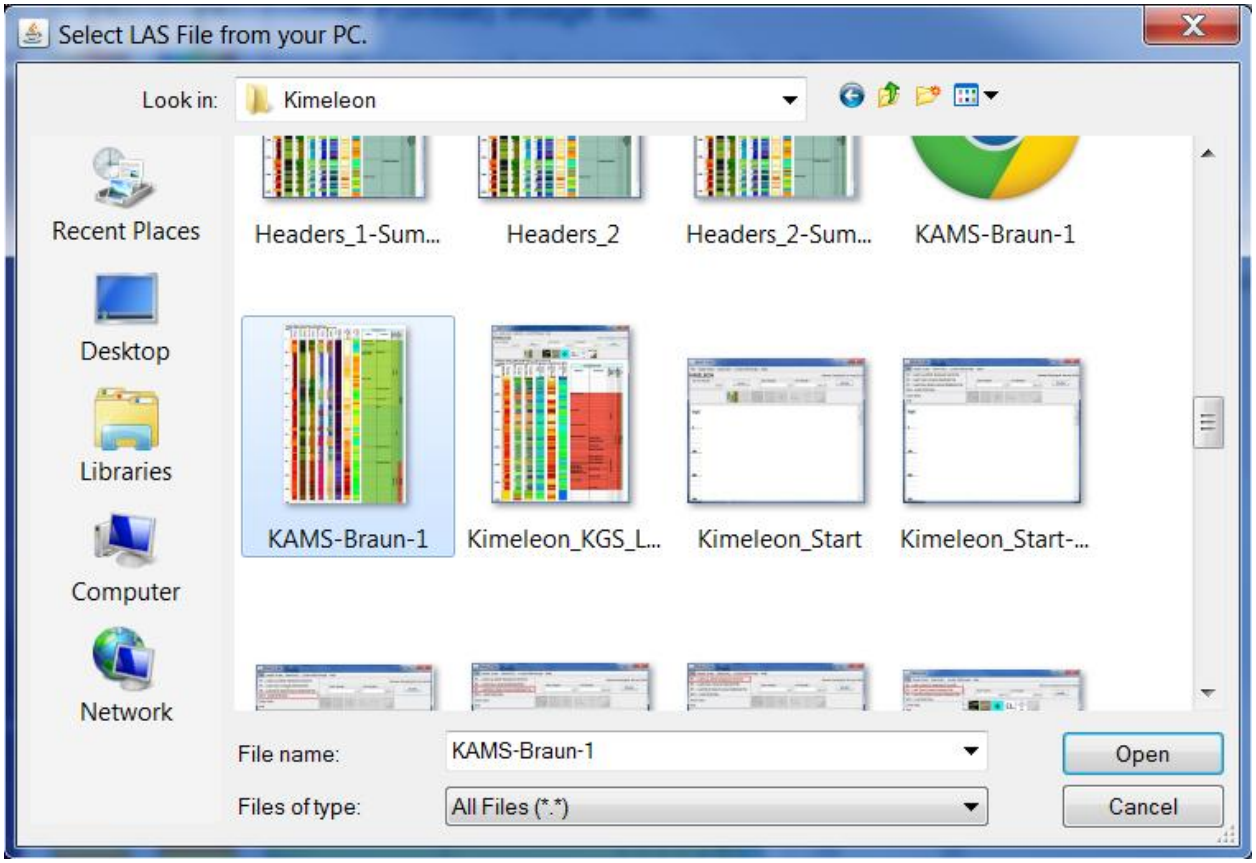
Select the "Continue" button to create the PNG file.

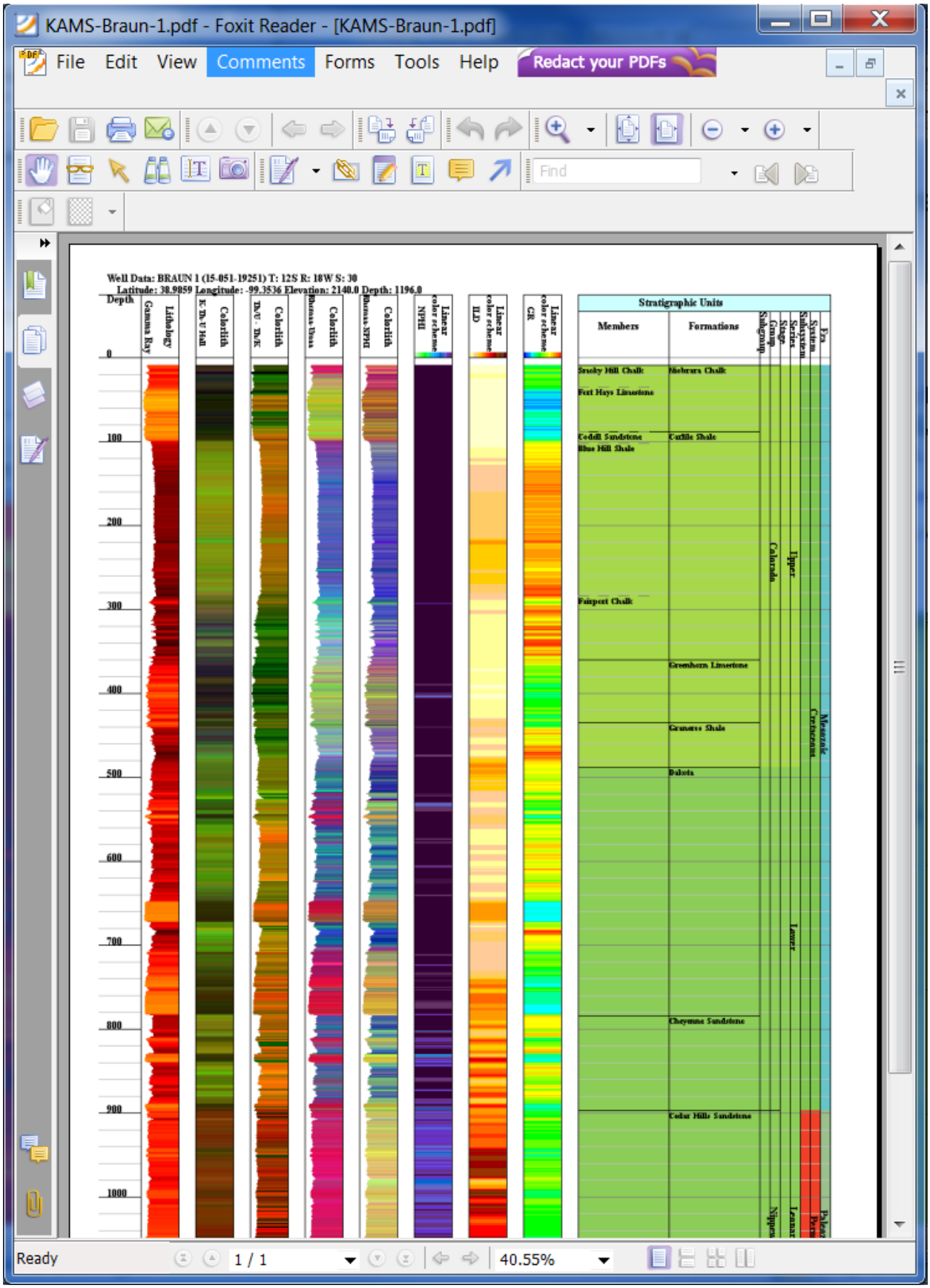


When the PNG image is created a HTML document is also created to show the created PNG image with a link at the top that allows the user to launch the PDF (Portable Document Format) Applet . Click on the “Create a PDF Document of this PNG Image” URL link.



Select the "Run" button to launch the search directory path on your PC dialog to find the PNG that was just created.




KAMS-Braun-1.pdf - Foxit Reader - [KAMS-Braun-1.pdf]
File Edit View Comments Forms Tools Help Redact your PDFs
Find
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Latitude: 38.9859 Longitude: -99.3536 Elevation: 2140.0 Depth: 1196.0
Depth
Gamma Ray
Lithology
Colorfill
Colorfill
Colorfill
Colorfill
Linear color scheme
Linear color scheme
Linear color scheme
Stratigraphic Units
Members
Formations
Smoky Hill Chalk
Fort Hays Limestone
Codell Sandstone
Blue Hill Shale
Fairport Chalk
Greenhorn Limestone
Graneros Shale
Dakota
Cheyenne Sandstone
Cedar Hills Sandstone
Niobrara Chalk
Carlile Shale
Colorado
Upper
Lower
Nippewalla
Ready
1 / 1
40.55%