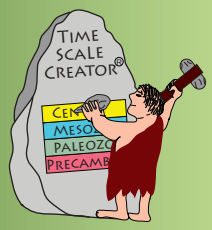
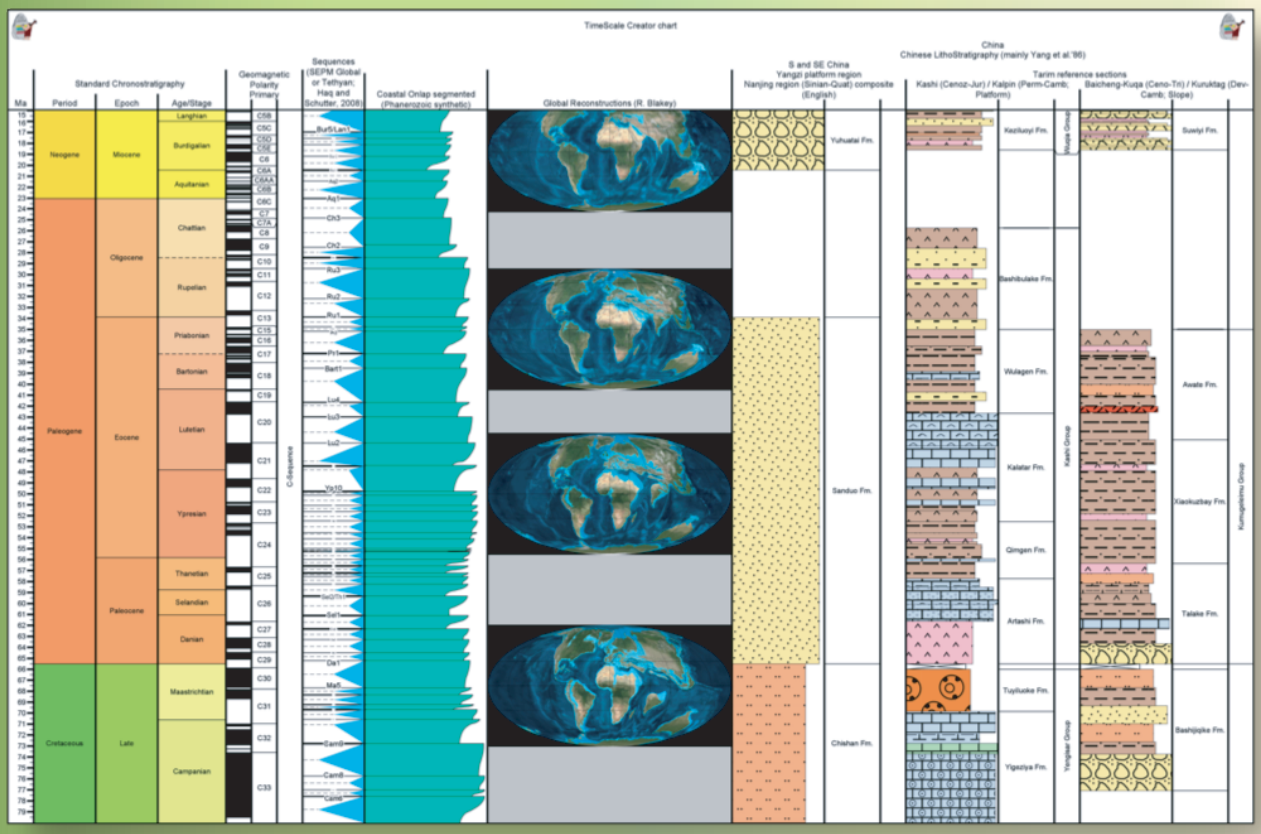
Manuals for TimeScale Creator use, and for making TSC datapacks



Geologic
TimeScale
Foundation



April 2012

Manuals for TimeScale Creator use, and for making TSC datapacks

TSC Version 5.4 (April, 2012)

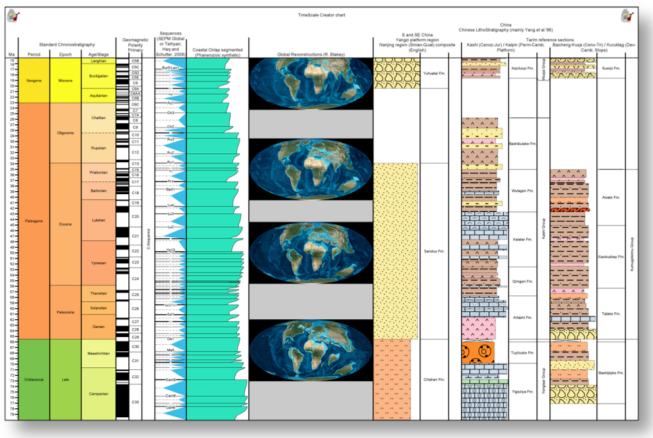


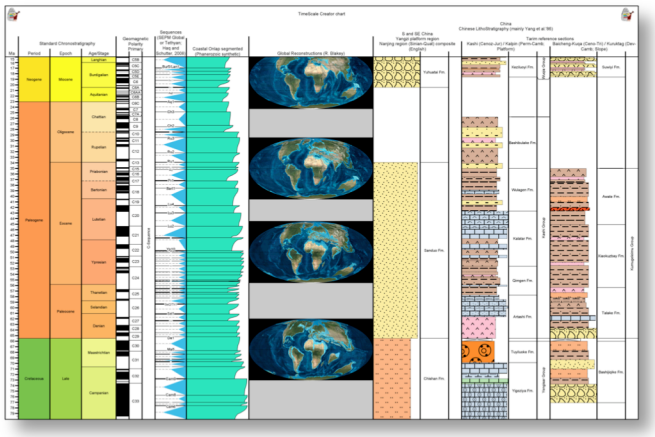
Table of Contents

Part 2: Making Datapacks for TimeScale Creator

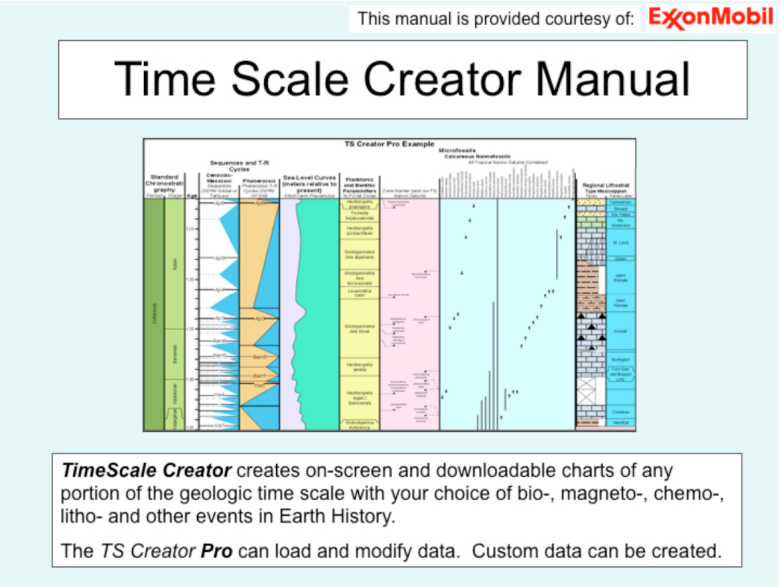
Manuals for TimeScale Creator use, and for making TSC datapacks

Part 1: Using TimeScale Creator

"*TimeScale Creator*" is an extensive time-scale database with visualization software-package in JAVA (which should work on most platforms). Our dream is to create a general portal to Earth history, plus flexibility in user-generated charts. Most of the datasets are oriented toward geologic history, but we include a datapack with aspects of human civilization.



NOTE: Many of the "color-slide" explanations are from a user-friendly PowerPoint manual compiled by Barbara Pavlov at ExxonMobil; which is also mounted on the TSCreator website under "manuals":



Basic Functions of *TimeScale Creator*:

(1) **Screen display** of user-selected time-span and selected columns of geologic time scale information (stages, paleontology, magnetics, sea-level, chemistry, impacts, other planets, etc.). You, the user, can change the vertical-scale, column widths, fonts, colors, titles, ordering, range chart options and many other features. Mouse-activated pop-ups provide additional information on columns and events.

(2) **Save** the final graphic as a SVG (scalable vector graphics) for direct import into Adobe Illustrator or other common drafting software, PDF, etc. You can also save your "settings" to recreate an on-screen chart.

(3) **Upload additional datapacks** of regional geology and transects, high-resolution isotopes, ancient cultural episodes, etc.; plus create and upload your own datasets. Sections in "meters" can be uploaded for cross-plot and depth-age conversion routines.
The ***Pro*** version, after uploading such datapacks, allows you to save the associated graphic files and to re-save merged datasets. The "*Pro*" website has additional specialized datapacks (e.g., Gulf of Mexico, North Sea, image-heavy microfossil sets, etc.).

Internal Database (*approximately 30,000 event-ages in this version*):

There are over 300 stratigraphic columns grouped into categories, mainly spanning the past 550 million years of Earth's history (the Phanerozoic eon with animal fossils). All events are calibrated to *Geologic Time Scale 2004* (Gradstein *et al*., 2004, Cambridge Univ. Press) and *Concise Geologic Time Scale* (Ogg *et al*., 2008, Cambridge Univ. Press). You can download a full listing of columns, plus the main references, from the website. With the publication of Geologic Time Scale 2012 (Gradstein *et al*., June 2012, Elsevier), "Version 6" of TSCreator will have all datapacks re-calibrated to GTS2012.

- **Cenozoic Planktonic Foram zonation of Wade et al. (2011)** -- This suite of revised Paleogene zones and updated major markers and correlations for the Cenozoic has been inserted as the standard zonal column. ***NOTE: The TSCreator 6.0 with GTS 2012 (release in April 2012) will include a completely recalibrated Cenozoic-Cretaceous nannofossil and planktonic foraminifer (and radiolarian) based upon extensive reviews (summer 2011) by Paul Bown, Jackie Lee, Brian Huber and other experts. Plus revised Mesozoic-Paleozoic zonations and calibrations by those subcommissions and other working groups***.

Tour and Exercises

How to use it: *(very brief step-by-step tutorial):*

First, if you haven't already downloaded the program, go to ***www.tscreator.org*** and install either the .jar (JAVA for most platforms) or .exe (a wrapped JAVA that avoids some system problems in some Windows versions). If you have a problem with the program under Windows, then you may need to update the JAVA – see link on the download page of the website.

Tour #1 -- Default settings

(1) **Begin** the program by double-clicking on the ***TS-Creator*** icon.

(2) **An opening screen window** appears, and the internal database is automatically loaded (~70,000 data lines). Stretch this window to fill your particular screen size, because this will determine the "fit to window" size of the output graphic display.

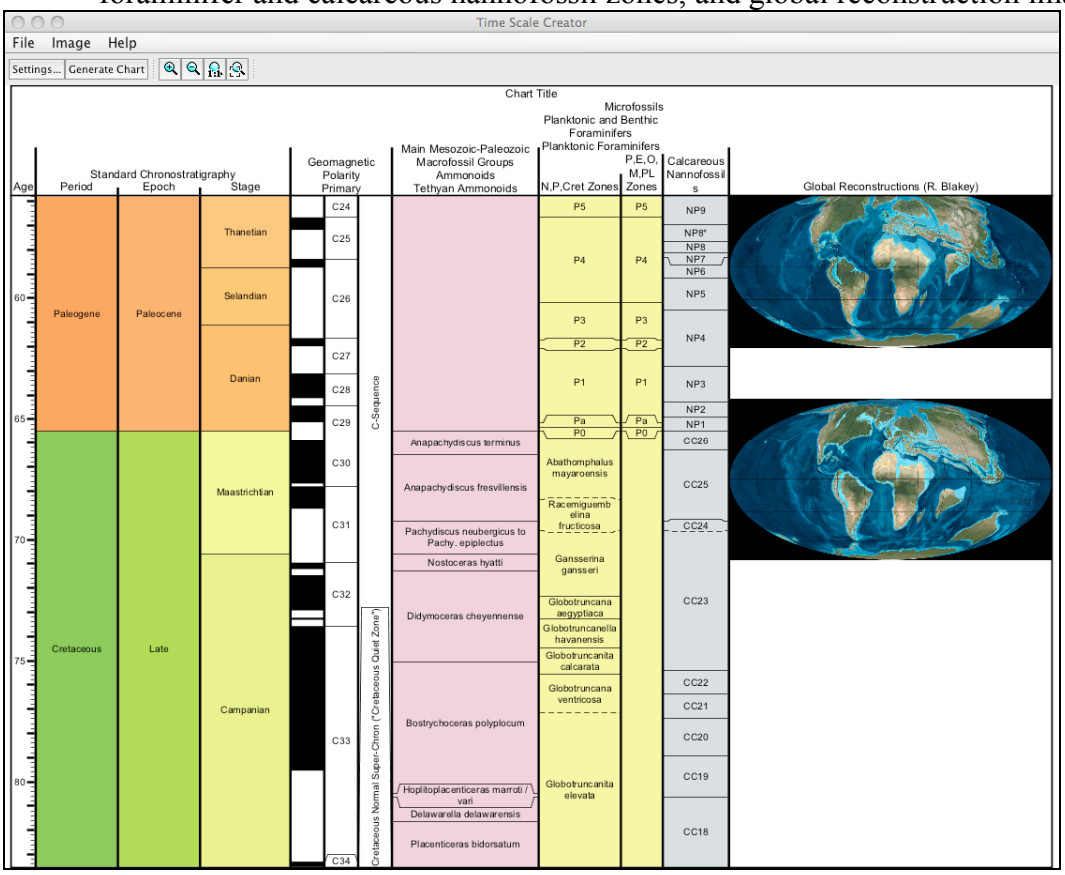
[NOTE: The default screen display is independent of the actual diagram, but you can rescale the image to actual size. The saved SVG graphics will be scaled according to the

scales set by you, and will not be the sizing that you initially see on the screen.] Advanced users can go under the File-menu to append external databases or replace the default suite– We will give examples later.]

(3) Click the "***Settings***" button. This opens a new window. Move this to the side of your main one.
There are 4 tabs (or 5 tabs in the Pro version). Begin with "***Choose Time Interval***". For your first adventure, set the "*Top of Interval*" as "***Thanetian***" stage (55.8 Ma at top), and the "*Base of Interval*" as "***Campanian***" stage (83.5 Ma at base). [*Notice that you can also designate the Top/Bottom of the interval in millions of years*.]

(4) Click "***Generate***". A message about "*Rendering*" should be displayed. The initial run takes about 5 to 10 seconds, but later runs are generally quicker.

(5) VOILA! The image has the default set of zonations – international divisions of geologic time, magnetic polarity chrons, ammonites zones of Tethyan Realm, major planktonic foraminifer and calcareous nannofossil zones, and global reconstruction images.



This is a sampling of the array of biologic, geochemical, sea-level, magnetic and other information that has been cross-calibrated by a generation of earth scientists.

In the supporting databases (an independent array, with output mirrored in this software), the age of all these events are computed according to their observed or statistical occurrence relative to each other, to astronomical-climate cycles and to radiometric-age control. If one calibration is changed, or an age is updated, then all events that depend upon that calibration automatically adjust; therefore, new charts can be quickly produced. It is not yet real-time – these relational databases do not directly feed into values within the visualization system – but this will come in the future.

Tour #2 -- User-selected stratigraphic columns and other options

Now, suppose we wish to plot planktonic foraminifer datums and named global sequences through the late Campanian through mid-Paleogene (75 Ma to 60 Ma).

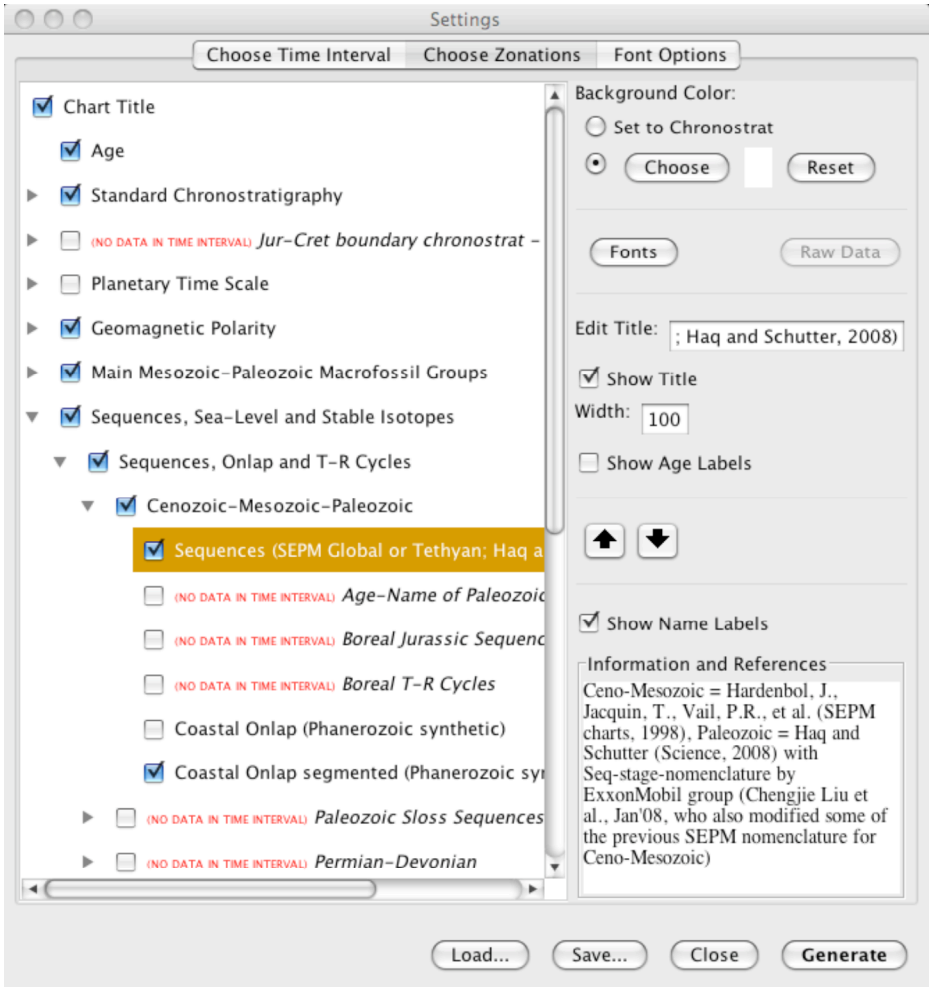
(1) First, click the ***Choose Columns*** tab of the ***Settings*** window. The available stratigraphic columns are indicated. For now, we will turn OFF the Ammonite columns. **Open** *Main Mesozoic-Paleozoic Macrofossil Groups*. Then **open** *Ammonoids*. See the checked blue-box for *Tethyan Ammonoids* – Click the highlighted box to **OFF**.

(2) **Close** the directory of *Main Mesozoic-Paleozoic Macrofossil Groups*; and **Open** *Standard Chronostratigraphy* (top of directory listing). Click the box **ON** next to the *GSSPs* to activate that column. This will display which stages have international-ratified basal definitions or Global Stratotype Section and Points ("GSSP"). Close the directory.

(3) Next, **open** the directory *Microfossils*. Turn OFF the *Calcareous Nannofossils*. Open the sub-directory *Planktonic and Benthic Foraminifers*, then sub-sub-directory *Planktonic Foraminifers.* Highlight the name *Planktonic Foraminifers*, and notice that the main selected sources of data appear in the lower-right box. Click the boxes **ON** next to *Foram Zone Marker* and *Other Foram FAD/LAD.* Notice on our original screen display that the column for *N,P,Cret Zones* was too narrow to adequately display the full zone genera-species names. **Highlight** the <u>name</u> *N,P,Cret Zones*, and notice that a set of options appears on the right panel. In the middle is "*Width*", which has a default of **100**. Change this to **150**, followed by a Return to activate that choice. Turn OFF the *P,E,O,M,PL Sub-Tropical Zones* column, which is not significantly different in this interval.

Notice the sets of options on the right-hand. You can also change the title of the column that is highlighted (*by typing in that window*), font sizes, show age labels (*will appear as tiny numbers at the base of each zone or event*), direction of labels, move the column relative to adjacent ones, change background color, and other simple graphics. Close the Microfossil directory.

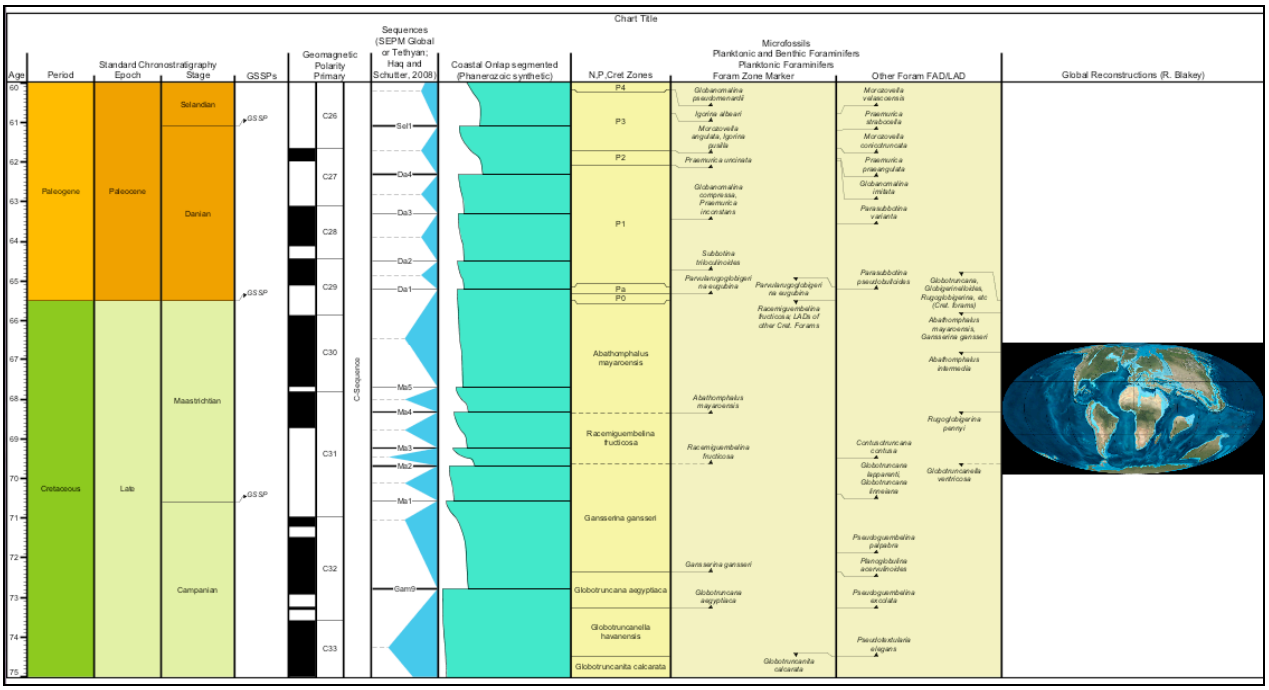
(4) We wish to add major sequences. Turn **ON**, then open the directory ***Sequences, Sea-Level and Stable Isotopes,*** then open the subdirectory ***Sequences, Onlap and T-R Cycles,*** then the sub-subdirectory ***Cenozoic-Mesozoic-Paleozoic***.



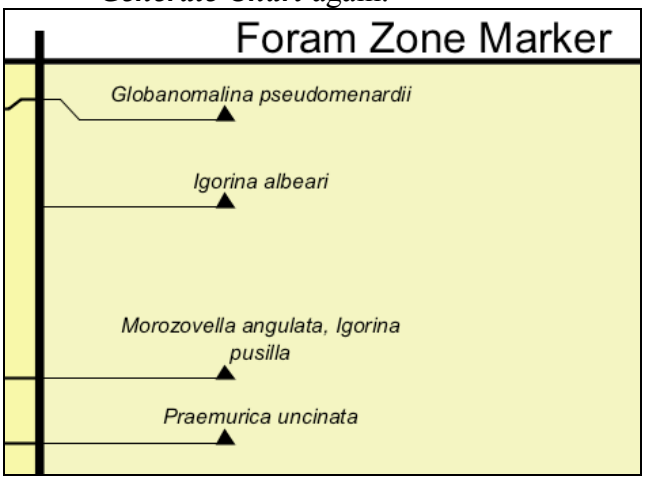
Notice that *Sequences (SEPM Global or Tethyan; Haq and Schutter 2008)*, which are the major sea-level changes, is ON. To avoid crowding, turn **OFF** the "*Coastal Onlap ...*" [*NOTE: Turning on a column within any directory will automatically turn on the full directory-subdirectory path to that column.*] Some column-titles are "default-off" to avoid excessive labels. If you wish to turn ON a title -- **highlight** the line (not the check-box) for *Sequences, Sea-Level and Stable Isotopes* and click ON the "**Show Title**" box (middle of the right-hand menu of options). You can also turn on/off titles for "*Sequences, Onlap and T-R Cycles"*, and *Cenozoic-Mesozoic-Paleozoic*, etc. as desired.

(5) Now, we want to select the time interval and enlarge the vertical scale. Click the "***Choose Time Interval***" tab at TOP of Menu window. Click **ON** the *Millions of Years* option for the Top of Interval, and enter **60**. Then, click ON the *Millions of Years* option for the Base of Interval, and enter **75**. Set the underlying vertical scale to be **2** cm per Myr on printed page (rather than the default of 1 cm per myr).

(6) Click ***Generate***. Depending on your screen size, it will be possible to read the names of the different planktonic foraminifer species that appear or become extinct through this time interval.



(7) To see this information easier, you can either use the Magnifying or Reducing icons on the upper menu, or use a bit of magic – While continuously pressing down the CONTROL key on the keyboard, hold down the left-button on the Mouse (this is for the Mac; it might be pressing right-button on Windows) and sweep over the region that you wish to display on the screen. You can use the side-bars on the display to pan over the magnified image. To return to the full display, either use the fill-screen or 1:1 icon as needed, or tap the ***Generate Chart*** again.



Tour #3 – Pop-ups, Internet access, and selected display options

(1) **Hot-Mouse**

Now, return to the "***Choose Time Interval***" menu under ***Settings***. At the bottom, click **ON** the ***Add MouseOver info***. This will activate pop-up windows of additional information.

(2) Click the ***Choose Columns*** tab, and click OFF the *Global Reconstructions* column to save screen space. Under the *Sequences, Sea-Level and Stable Isotopes* directory, open the sub-sub-directory with the *Sequences (SEPM Global or Tethyan*). Highlight the name to bring

up options on the Right panel. Click ON "***Show Age Labels***" (just below the *Width* box). **Generate**.

(3) ***Age-Labels:*** Notice that all Sequence boundaries now have tiny age-labels next to the displayed names. Using the Control-mouse-sweep, you can enlarge a portion to One can display such ages for any selected zone or datum columns.
Pop-up windows: Move your Mouse-pointer over Sequence boundary "Ma5". As you put the Mouse-pointer over the name "Ma5", notice a red-dot blinks. Click directly on the text "Ma5", and a window will appear with information on the calibration of this sequence boundary.
Now, move the Mouse-pointer over the column title "*Sequences (SEPM Global or Tethyan)*", and a new pop-up window appears with the source of information. This "MouseOver" option is currently installed for all Column headers (either major or minor), Sequence boundaries, and many of the Microfossil zones and datums. Eventually, we will try to provide such background information and hot-links for the other thousands of items.

We will next see how this system acts as a gateway to other data stored around the world in our second and third exercise.

(4) **Internet links** – Move your Mouse-pointer over the title "***Standard Chronostratigraphy***". A red-dot blinks. Click on the title, and another window will appear that says: "[International Commission on Stratigraphy (2006). Click **GSSP** for official boundary (GSSP) definitions, status and nomenclature.]" Click on the blue-highlighted "**GSSP**". Your default browser will be activated and Internet site of the Geologic TimeScale Foundation will be opened. Under its "GSSPs" menu is a table of the definitions of all international divisions of the geologic time scale.

Now, back to the **TimeScale Creator** display -- click on the GSSP arrow next to the base of the Maastrichtian Stage. Another window will open, which says "[The base of the Maastrichtian Stage [click **GSSP** for graphics] is defined …]". When you click on that **GSSP**, then the Internet sub-site for the Maastrichtian will open with a detailed description and links to location map and outcrop graphics.

(5) **Saving Display Parameters** -- If you create a screen display that you like, then under ***Settings***, there are bottom-buttons that enable you to **SAVE** … a "*Settings file*" (in our ***.tsc*** format) that contains the necessary instructions for TimeScale Creator, or to **LOAD …** an earlier one to re-generate that same graphic for an audience or for additional revisions. If you are working on a major diagram, then we suggest using this feature to periodically save intermediate graphics, just in case the operating system has problems.

Selected details on the many other capabilities and display options are briefly illustrated under "*Features*" in the *Help* menu (main window). You can also download other Manuals (*one is compiled courtesy of ExxonMobil*) from the website.

****

Now, let's use *TimeScale Creator* to explore some interesting geologic events, and some of its other capabilities.

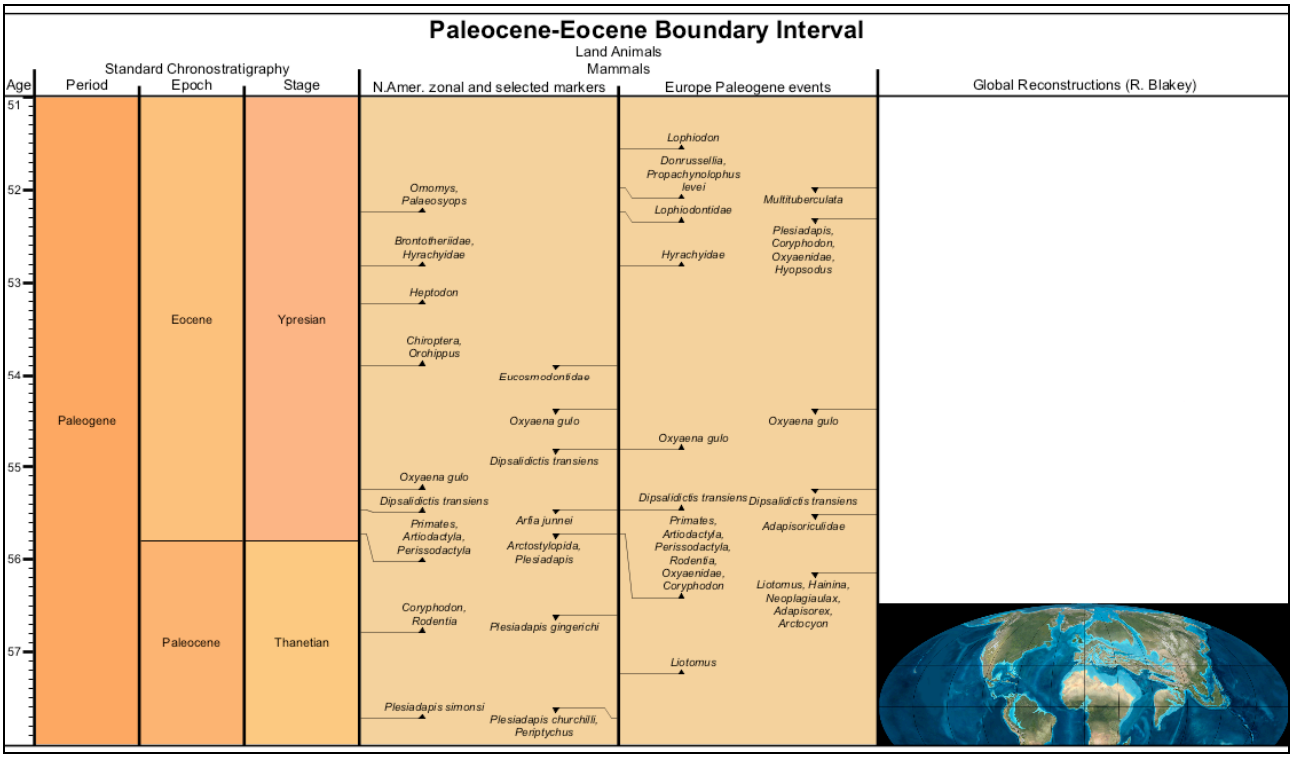
Some of the question sets were designed for undergraduates in historical geology; but you may find them interesting.

EXERCISE #1 – Paleocene/Eocene Global Warming

(1) **Reset display; then focus on Paleocene/Eocene boundary interval**

Under FILE (top-left of menu bar); click "Replace Data with Default Datapack". This will clear all your settings. Set up a diagram with the following: **Age** (use "age" entry) = (51 Ma top) to (58 base); **vertical scale** = 4; ***Geomagnetic Polarity*** – turn OFF; ***Microfossils*** – turn OFF. Open ***Land Animals***, then open ***Mammals*** to turn ON ***N.Amer. zonal and selected markers***, and ***Europe Paleogene events***; and turn OFF all other Mammal columns.

Now, let's add a title in large-font to this chart. Highlight "*Chart Title*" at the top of the Columns menu. On the right-hand panel, change it to read "**Paleocene-Eocene Boundary Interval**". Click the **Fonts** button; and for Column Header, change the Font Size to be 24 and Bold; then Close. ***Generate***.



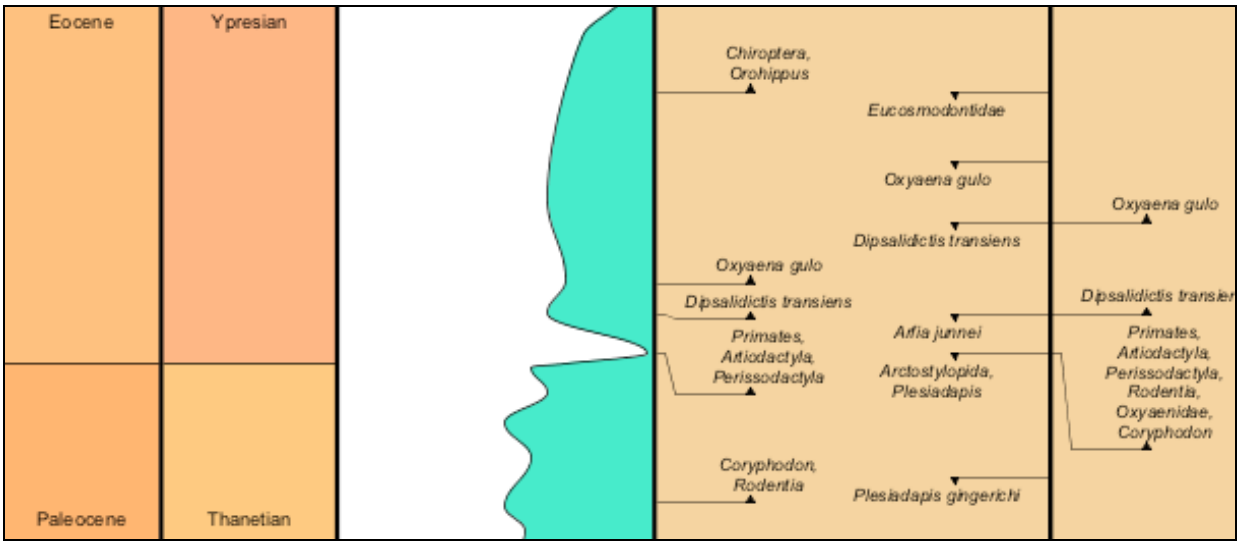
(2) Under both North America and Europe Mammals, you will see that the first appearance of **Primates** (early apes) occurred near the base of the Eocene epoch.

About 1 myr earlier, in North America, you see that ***Coryphodon*** (hippopotomas-looking browsers) and **Rodentia** (mice-squirrel-rabbit family) appeared. However notice that in the Europe column, these animals did not appear until the same time as Primates. Therefore, one might postulate that *Coryphodons* and *Rodentia* had evolved in N. America, then migrated to Europe at the same time that *Primates* appeared on both continents. But,

in the early Eocene, the only way for these animals to walk between North America and Europe was via land bridges to Asia that were near the Arctic-circle – notice the reconstruction. Hippopotomas-like animals could not survive such Arctic temperatures. Plus, the early Primates were tropical creatures that didn't thrive in North America and Europe until their human descendents arrived with warm clothing. Let us investigate this question:

- ***What happened to cause these appearances at the beginning of the Eocene?***

(3) Turn ON ***Sequences, Sea-level*** …, then under it turn OFF *Sequences*, Onlap … turn ON *Stable Isotopes*, open this sub-directory, turn ON the ***Cenozoic Marine Oxygen-18 Composite*** column. **Highlight** the name *Cenozoic Marine Oxygen-18 Composite* to bring up the menu of display options. Change the ***Range*** (initially –1 to 5) to be (-0.3 to 1.5); and click ***Show Scale*** (and make Step as 0.5). Turn off the "Show Title" for *Sequences* ... , and for *Stable Isotopes* ... by highlighting their names, as you did in Tour #3. ***Generate***.

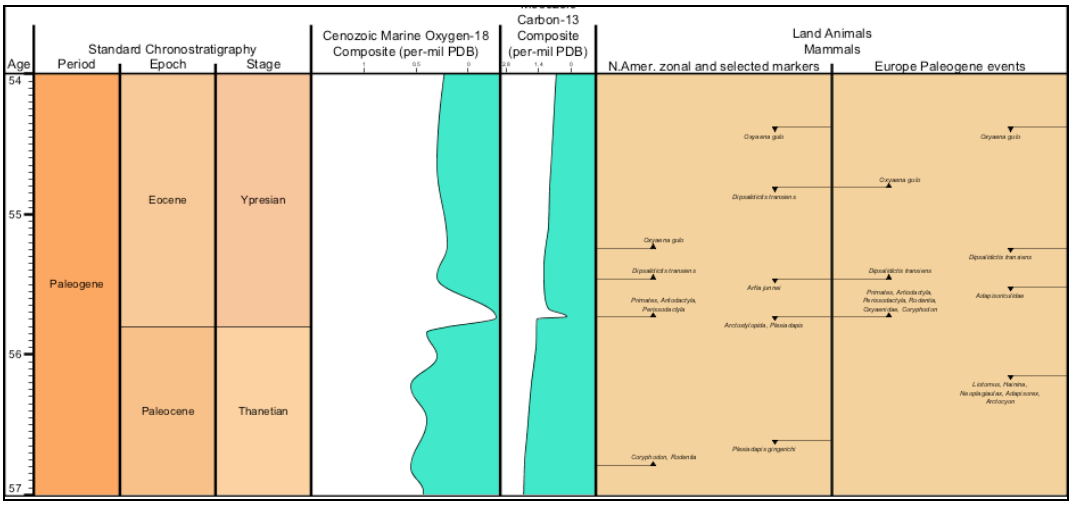


Oxygen-18 is a monitor of deep-sea temperatures, and helps indicate the temperatures in high-latitudes where these deep waters form. In an Antarctic-ice-cap-free world (which was the Eocene situation), a value of "0" is about 10-degrees C, and a value of "1" is about 6°C.

(4) This is interesting. Think about the plot, and answer the following:

- ***What was the general temperature trend of deep-waters from 58 million-years-ago through the earliest part of Eocene?***
- ***What happened to bottom-water temperature at the exact time that Primates appeared in North America and Europe?***
- ***What does this imply about the climate?***

(5) Now, what caused this? Under ***Sequences*** …, then under *Stable Isotopes*, turn ON the *Cenozoic-Mesozoic Marine Carbon-13 Composite*; then, as we did with Oxygen, highlight the name *Cenozoic Marine Carbon-13 Composite* to bring up the menu of display options. Change the Range to be (-1 to 3); Show Scale (and make Step as 1). ***Generate***.



(6) Carbon-13 of organic matter is Negative, because life prefers to use Carbon-12. This is also true for coal and oil, which are derived from organic matter. Therefore, if the global-ocean becomes more "negative", then it means that the organic carbon is being recycled back into the Earth system (especially the atmosphere). A negative shift in the Carbon-13 value by 1 is nearly equivalent to doubling the Earth's carbon-dioxide through release of stored organic-carbon. This episode is known as the "**Thermal Maximum**" of the past 70 million years.

- ***Therefore, when you look at both the carbon and oxygen, what might have happened at the base of Eocene?***
- ***What were the implications for mammals on the continents of North America and Europe?***
- ***This event marked the emergence of modern mammals. Given that coincidence, then what might happen with future global warming?***

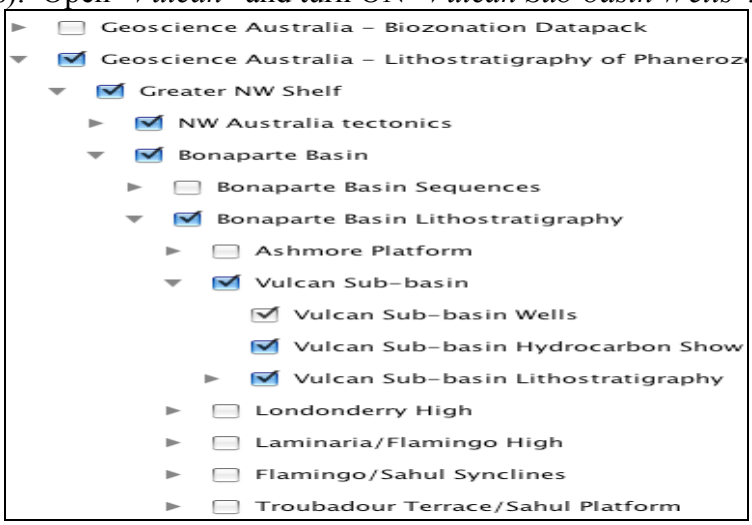
(7) ***Possible cause.*** The bottom directory in *Columns* menu is *Impacts, Volcanism, Tectonics*. Turn it ON; then open it to turn **OFF** *Impacts* and **ON** *Large Igneous Provinces*. Under Choose Time Interval menu, turn ON *Add MouseOver info*. ***Generate***.
The reasons for the ultra-high greenhouse and carbon-release are still debated, it appears that a massive volcanic event "North Atlantic Volcanic Province" that began the Iceland volcanic center was one of the initial triggers, followed by release of methane hydrates (very negative carbon-13 values) from ocean sediments. Click on this event to read the pop-up window, and explore more about its extent.

EXERCISE #2 – Oil in Australia

(1) **Reset display; Download and add Australia Datapack**
Under FILE (top-left of menu bar); click "***Replace Data with Default Datapack***". This will clear all your settings.
Go to the ***www.tscreator.org*** website, under Datapacks menu, download ***Australian biostratigraphy*** datapack (or follow instructions given on accessing from another class server). Unzip the file (unless it was done automatically by your operating system) to get the folder "*Australia_strat_wReconstructions*". This joint product with Geoscience Australia contains lithologic columns for all major Australian basins for the past 2.5 billion

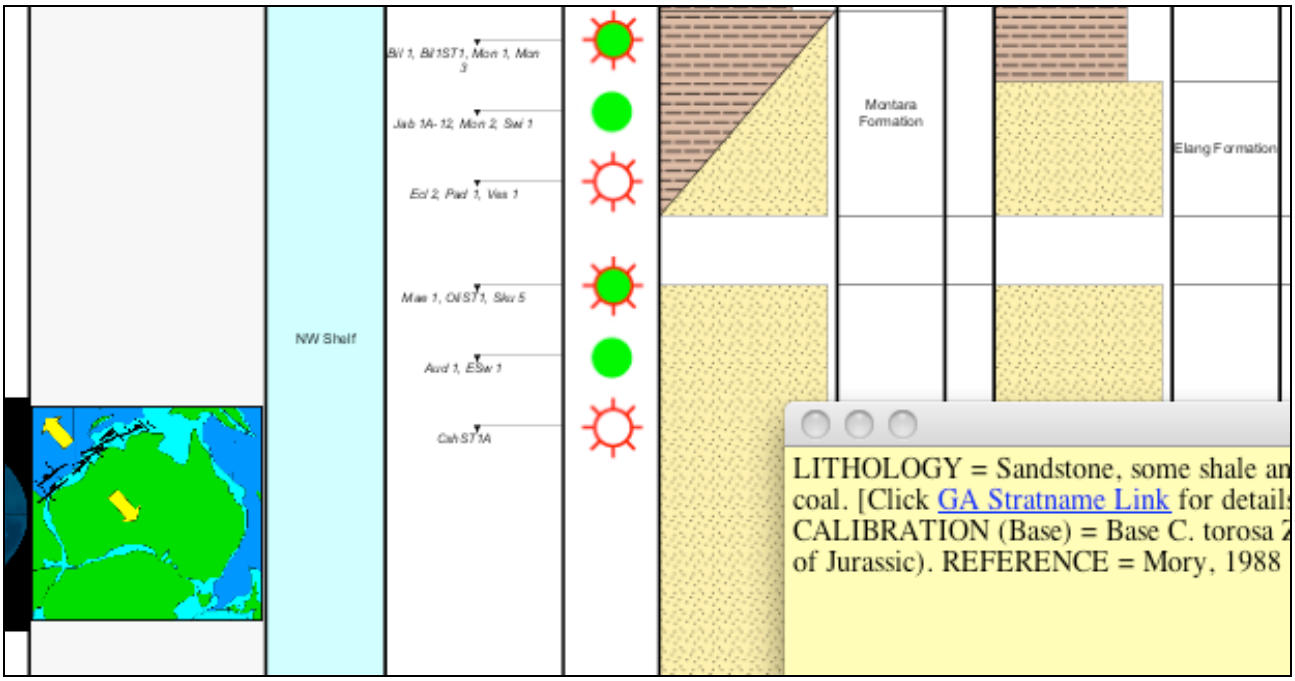
years, plus all major biostratigraphy zonations and sets of tectonic reconstructions (a total of nearly 500 columns!). We will use only a small portion.

FILE (upper-left of top menu), go to *Add Datapack*. Using its finder, locate the folder "*Australia_strat_wReconstructions*", open and load the file called "***Australia_biostrat_and_basins_Dec09.txt***" (near bottom if listed alphabetically, or near top if listed chronologically). It will take a few moments to load.
Choose Time Interval of **143** to **180** Ma; with vertical scale of 1. Under ***Choose Columns***, turn **OFF** "*Main Mesozoic-Paleozoic Macrofossils Groups*", "*Microfossils*", and "*Global Reconstructions*". Under ***Geoscience Australia – Lithostratigraphy of Phanerozoic Basins***, turn ON "*Greater NW Shelf*" (and turn off the other regions). Open "*Greater NW Shelf*" to turn ON "*NW Australia tectonics*" and "*Bonaparte Basin*" (and turn off all other basins). Open "*Bonaparte Basin*" to turn ON *Petrel* and *Vulcan* subbasins (and turn off the other regions). Open "*Vulcan*" and turn ON "*Vulcan Sub-basin Wells*". ***Generate***.



[NOTE: if you get a warning of "Don't Panic" after Generate, then try Generate Chart again. Sometimes JAVA, especially the Windows version, doesn't clear its memory usage very efficiently. SEE LAST PAGE for details. On some inefficient Windows operating systems, you may need to close the JAVA and restart the program.]

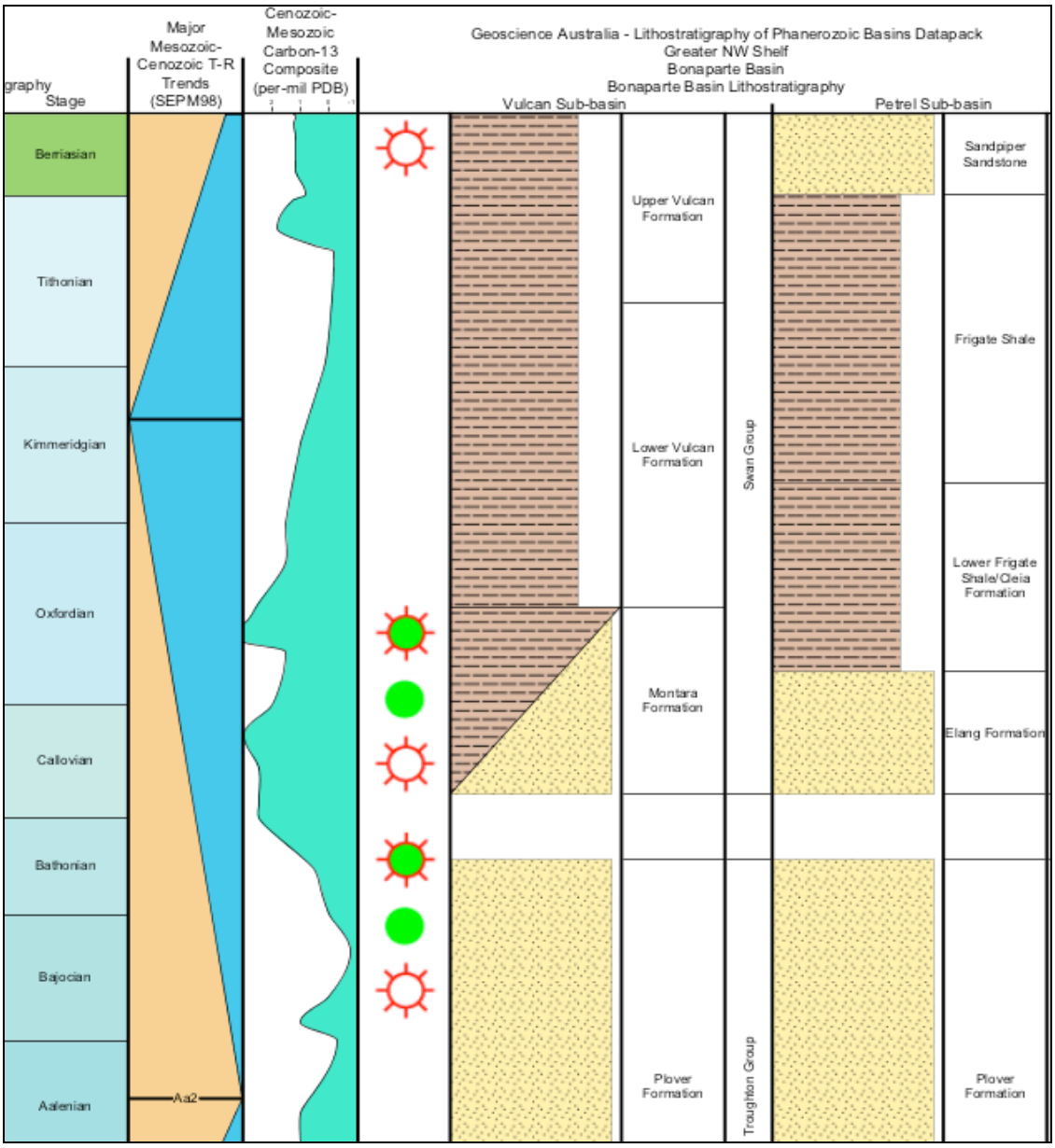
(2) This is a display of the geology of offshore Northwest Australia, an area that becoming a major gas-oil exporter to China and other regions.
Active "***Mouse-Over***", re-Generate, and click on the **Bonaparte-Basin** title. In the pop-up window, click on the basin report. This opens a website at Geoscience Australia, and a summary of that basin is presented. On its right-hand menu, you can click on geologic summaries, sub-basin location maps and other items. Now, back on *TimeScale Creator*, use the mouse to click on one of the rock units. Again, clicking on the hot-link sends a request, in this case as a search-call their Oracle database, for information on the rock formation. You can also do this to the well-names to access a separate Oracle database of well reports. Plus, the tectonic column "light-blue" events are linked to FrOG Tech summary reports on each episode. In this fashion, the on-screen display is a "GATEWAY" into information stored on the Geoscience Australia computer databases.



(3) On the lithology (rock) columns, you see are sands (dotted-yellow) and dark-clays (dashed brown). The red-green stars are oil-gas occurrences. The clayey Frigate Shale and Lower Vulcan Formations are organic-rich source rocks for these Jurassic oil-gas reservoirs; and the oil-gas migrated both up (into Upper Vulcan) and down (into Montara and Elang formation). Let us look at why there was this change from sands to dark shales.

(3) To save space, turn **OFF** *Vulcan wells*, *NW Australia tectonics*, *Global Reconstructions*, and *Geomagnetic Polarity*. Turn **ON** ***Sequences, Sea-Level*** …, turn ON its *Sequences and T-R Cycles* directory and turn ON the *Phanerozoic Compilation*s subdirectory (only). Open that subdirectory to turn ON its *Major Mesozoic-Cenozoic T-R Trends* (only). This is a cartoon of global sea-level changes, in which the Blue-color indicates rising/falling ocean levels. [Turn OFF the *Cenozoic-Mesozoic-Paleozoic*; and to avoid excessive column titles, turn off the titles for *Sequences* ... and other sub-directory titles.]

Now, turn ON *Stable Isotope Curves*, and its *Cenozoic-Mesozoic Marine Carbon-13 Composite*; then, turn ON Show Scale (and make Step as 2). Turn OFF *Carbon-13 and Anoxic Events*. ***Generate***.



- ***What was sea-level doing during the onset and main part of the Lower Vulcan and Frigate Shale?***
- ***What was it doing during the underlying main part of Plover and during the overlying Sandpiper Sandstone or Upper Vulcan?***

(4) **Carbon balance and sea-level.** A rising sea-level causes clays and organic material to be trapped on continental shelves. Before and during the Frigate Shale, notice that the Carbon-13 curve has shifted toward the left (to more positive values). This is opposite what we saw for the base of Eocene.

- ***What does this imply about the global carbon system?***

(5) When sea-level retreated toward the end of the Jurassic, river deltas built outward and dumped their sands onto the continental margins. These became the future oil-gas reservoirs that received the maturing hydrocarbons from the adjacent organic-rich clays. This combination of increased carbon-burial during rising global sea-level of the "Oxfordian-

early Kimmeridgian" time, followed the deposition of sands during the following drop in sea-level led to the oil-gas riches of other regions, including Saudi Arabia, the North Sea and Siberia.

EXERCISE 3 – End of Pyramid civilization

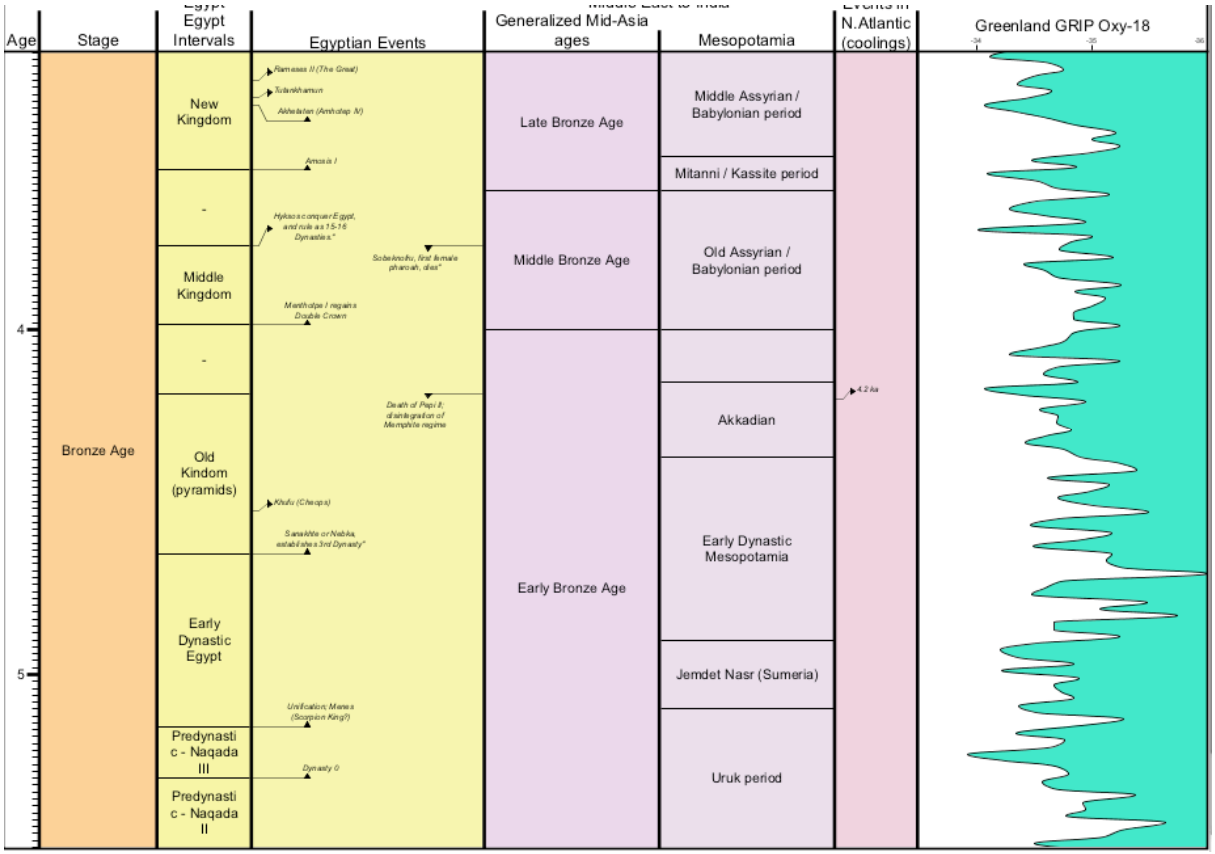
For something complete different!

(1) Load our prototype for a Human Civilization time scale – From the www.tscreator.org datapack page, download the "Past 10,000 Years" datapack. Then, in TS-Creator, under FILE, click "***REPLACE*** *Data with Datapack*", and find/load the file "**Past 10000 years.txt**". This completely replaces the geological scales suite with a new one of selected archeology and ice core information. This database has been compiled from both archeology sources and the independent international drilling of Antarctic and Greenland ice cores. [NOTE: it is only a preliminary sketch of what will become a major dataset in the future.]

(2) Under Settings, choose the interval spanning the Bronze Age (3.2 Ma top; 5.5 Ma bottom); and a **vertical scale** of **10**. Under ***Columns***, turn OFF everything, **except** *Age, Stage, Egypt*, *Egyptian Events* and *Middle East to India*. ***Generate***.

(3) Notice that the end of the Old Kingdom (pyramids) is simultaneous with the end of the Akkadian civilization in Mesopotamia; and there is a gap before the Middle Kingdom and Assyrian. Let us see what may have caused this.

(4) In Settings, click ON *Ice-Rafting* and *Greenland GRIP Oxy-18*. Highlight the name *Greenland GRIP Oxy-18*, and activate the *Show Scale* with a Step of 1. ***Generate***.



(5) A decrease in Greenland Oxygen-18 (shift to right in the diagram) is interpreted to imply that Greenland became warmer. It is thought that warm episodes that affected Greenland probably affected the entire northern hemisphere, including the region of Egypt and Mesopotamia. In contrast, a Greenland cooling is often associated with a surge in glacial icebergs, causing ice-rafting events into the North Atlantic.

- ***What climate event occurred near the beginning of the Old Kingdom?***
- ***What event occurred at the collapse of the Old Kingdom and Akkadian empire in Mesopotamia?***

(6) In Egypt and Mesopotamia, a warmer summer is associated with increased monsoonal rainfall and a higher Nile and Tigris-Euphrates river.

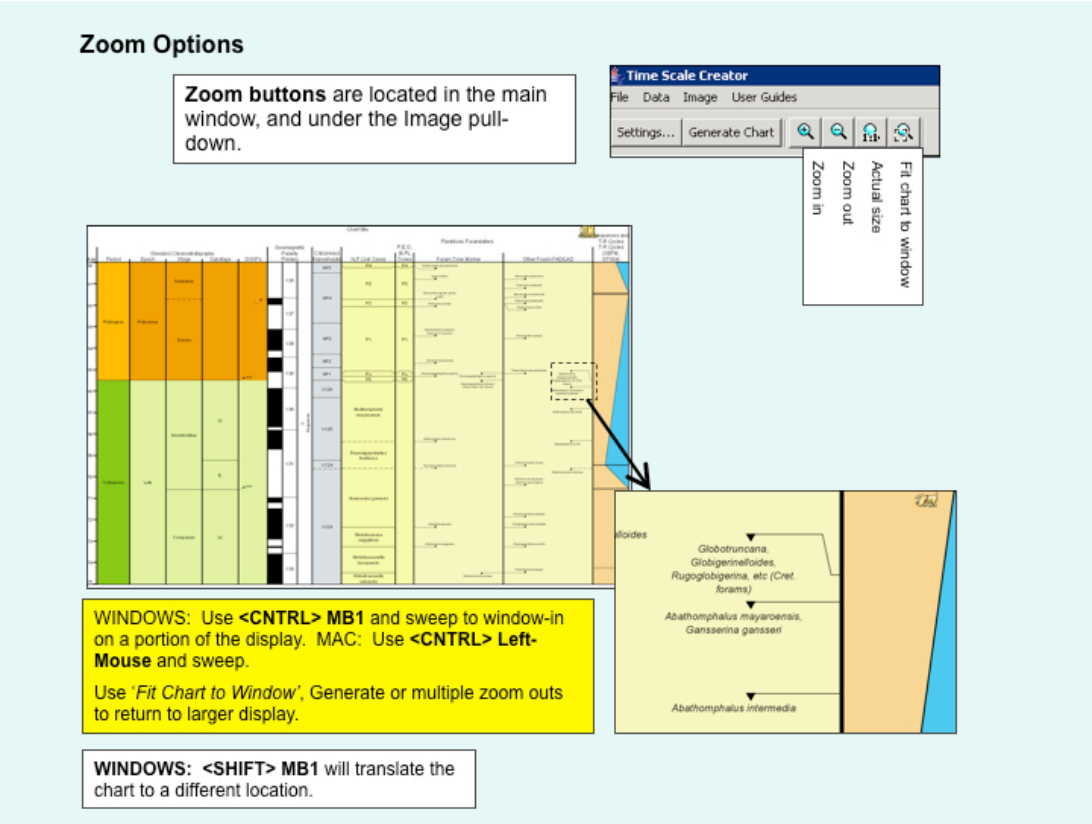
- ***What is a possible scenario for why the Old Kingdom and Akkadian empire simultaneously collapsed?***
- ***Now, if you were in modern Egypt or Iraq, would you prefer global warming, or a cooler climate? It is an interesting question for climate policy.***

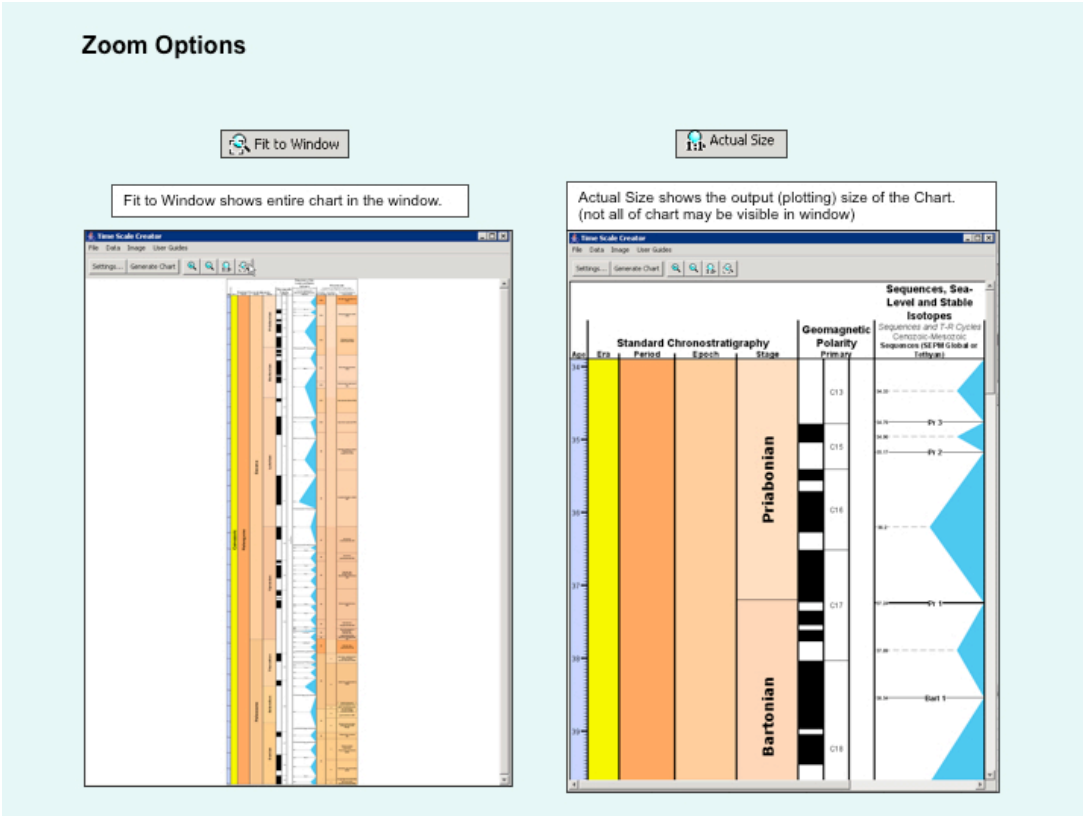
(8) The Egyptian Events are also hot-linked with *Mouse-over*; and you are welcome to explore other civilizations and culture intervals.

****

Some Special Features

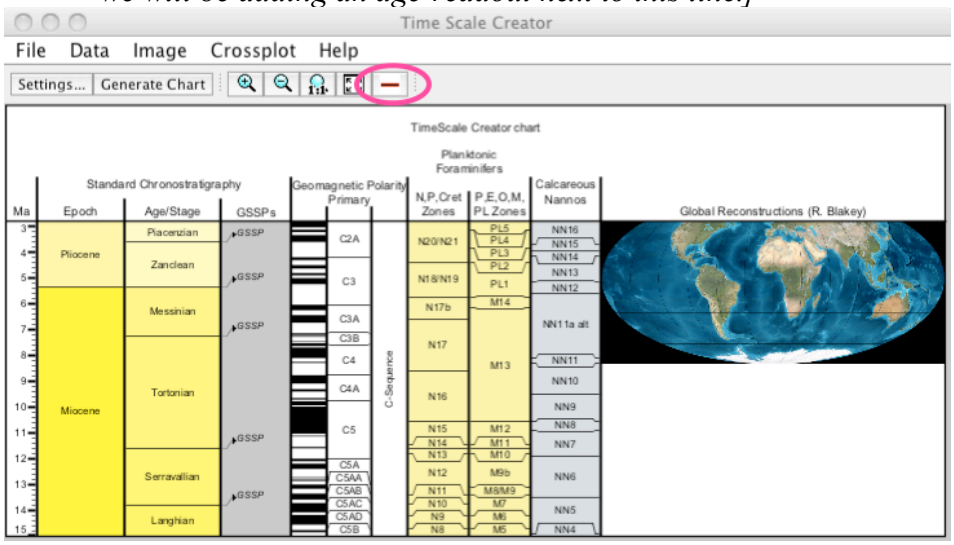
Zoom



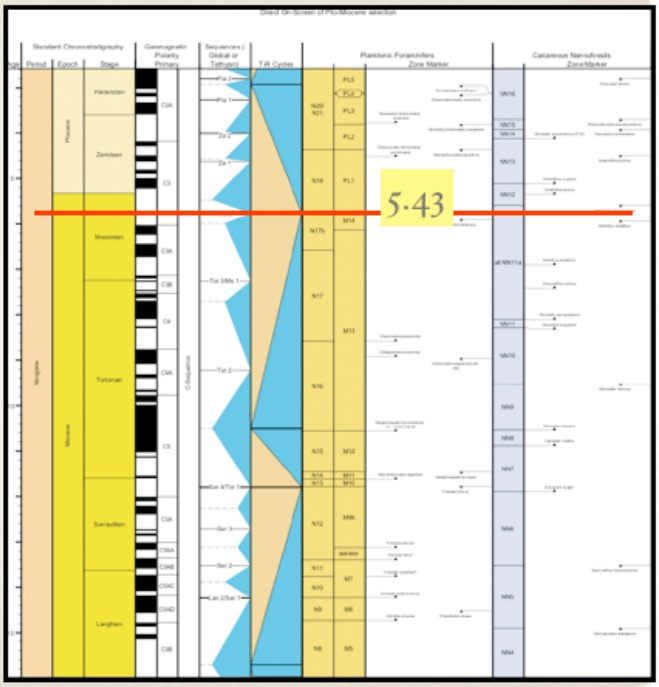


Guide-line

- (*red-line **icon** at top of generated chart window*): Click on icon to turn/off a red-line that will follow the mouse, or be left fixed if the mouse is clicked on the chart. This line will remain fixed when moving across the chart, hence allowing one to see what events/ages are coeval. It also works when a chart is magnified, but currently is reset each time. *[Future – we will be adding an age-readout next to this line.]*



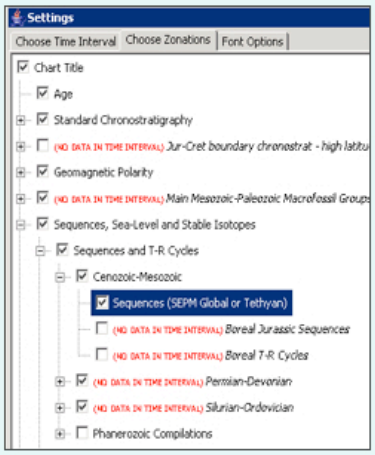
- Tells age
- Can fix, and scan across at higher-zoom



Settings for Columns (other options)

Settings: Choose Zonations Tab

Expand each category to select sub-columns.

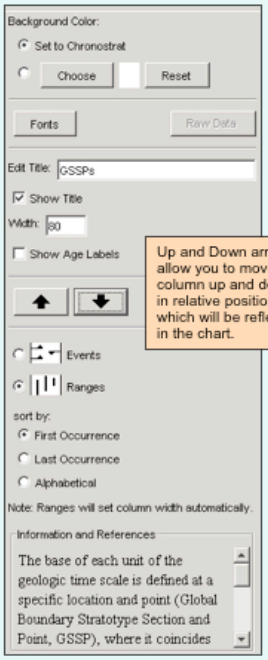


Highlight a column or sub-column to activate its parameters panel

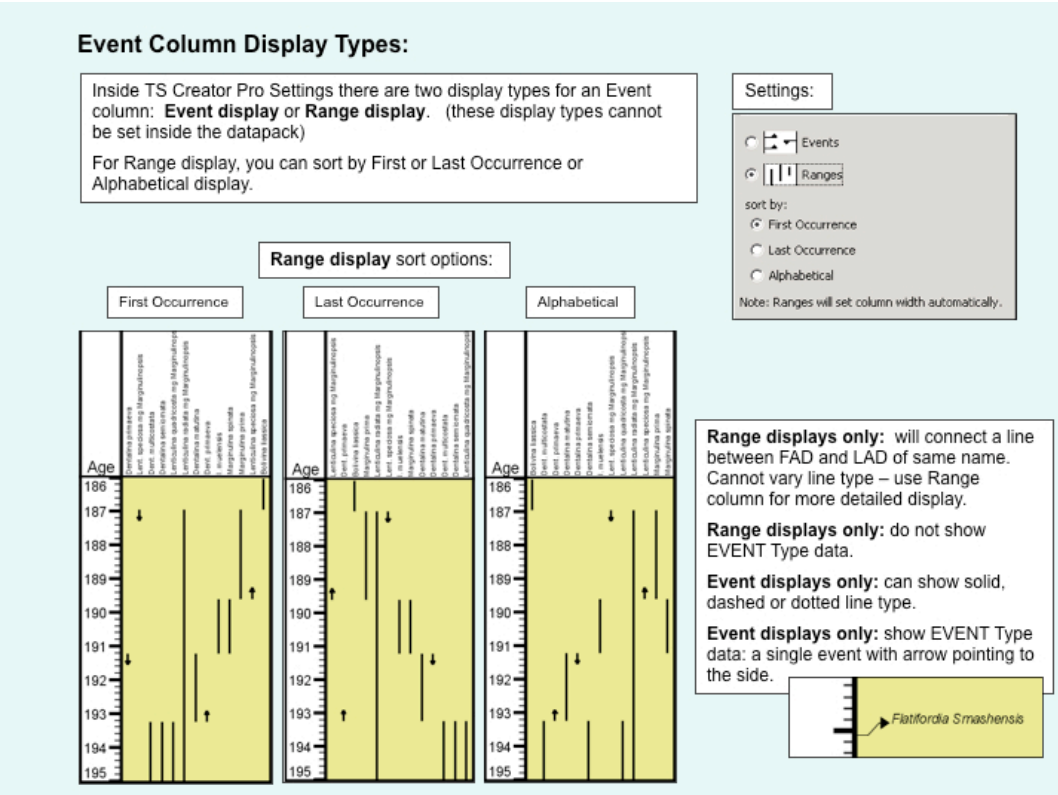
Parameters to Set: (varies with column type)

- Color of background
- Title
- Column width
- Text Fonts
- Age labels
- Relative column arrangement
- Choice of range or event chart display
- Sort criteria

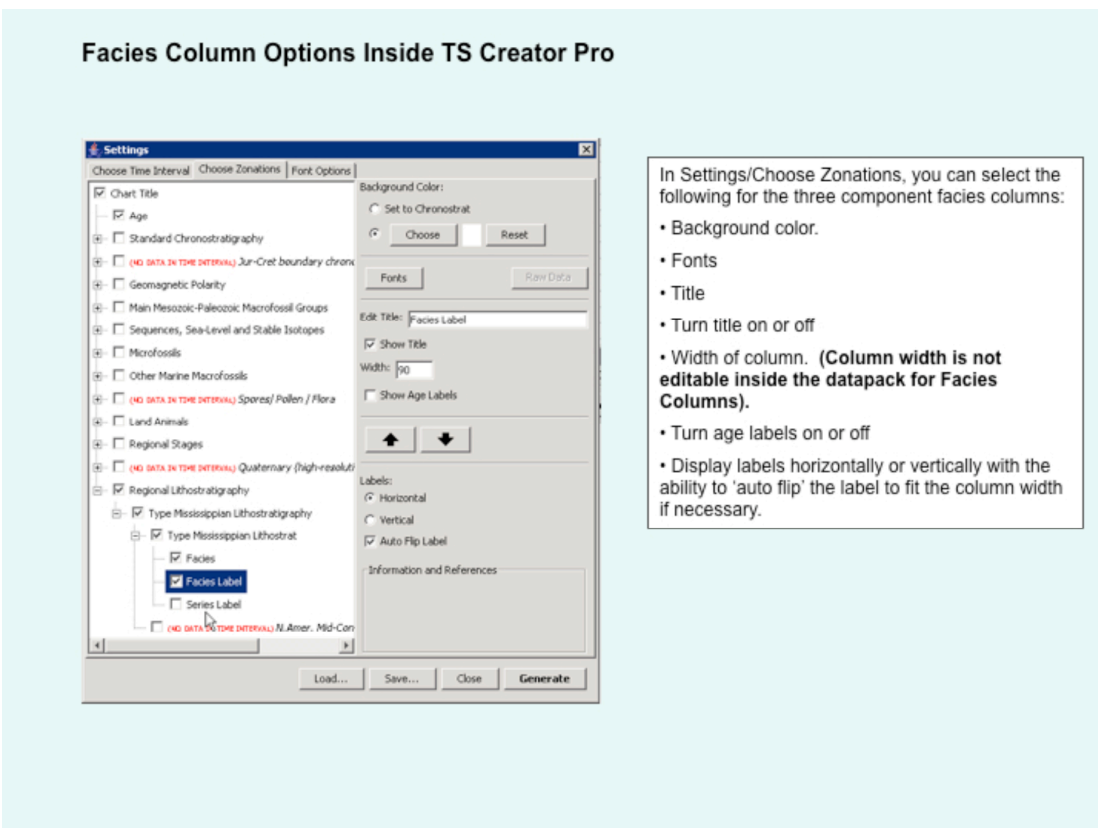
>Also displays popup Information and References



Up and Down arrows allow you to move a column up and down in relative position which will be reflected in the chart.



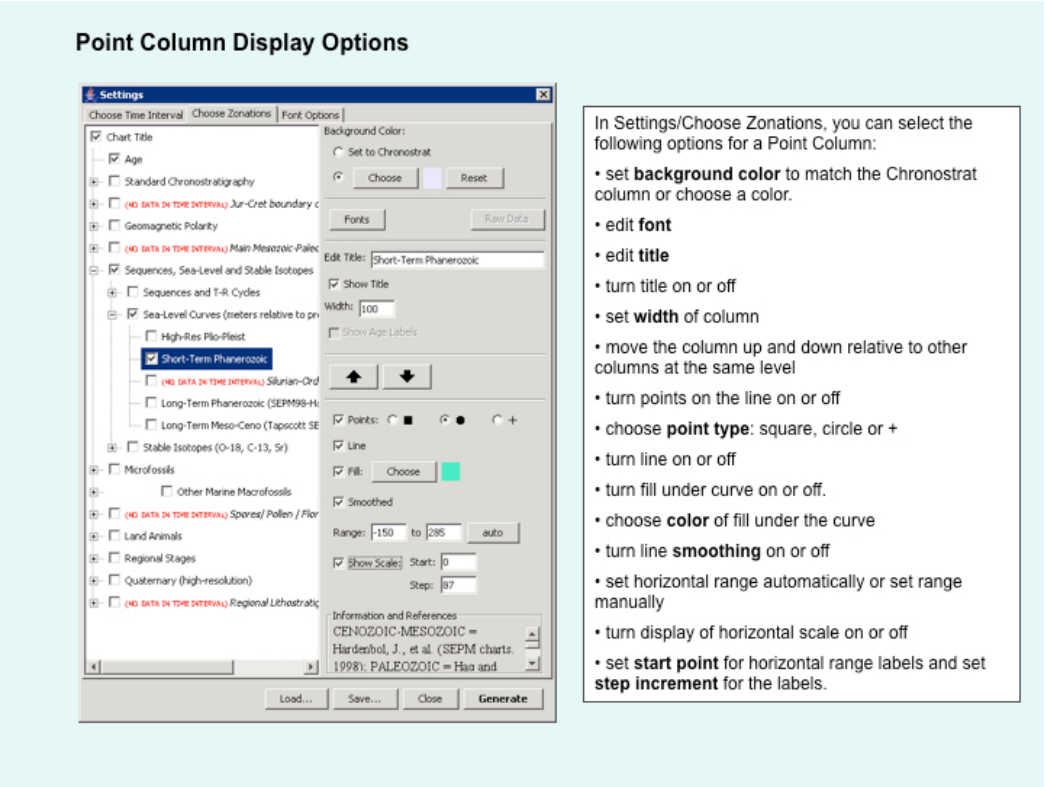
Facies (lithology or rock-stratigraphy) columns



TSCreator 5.0 had a merged USGS-ODP-GeoArabia set of colored facies patterns (about 60). Beginning with version 5.3, we included a set of colors (about 50), the New Zealand facies

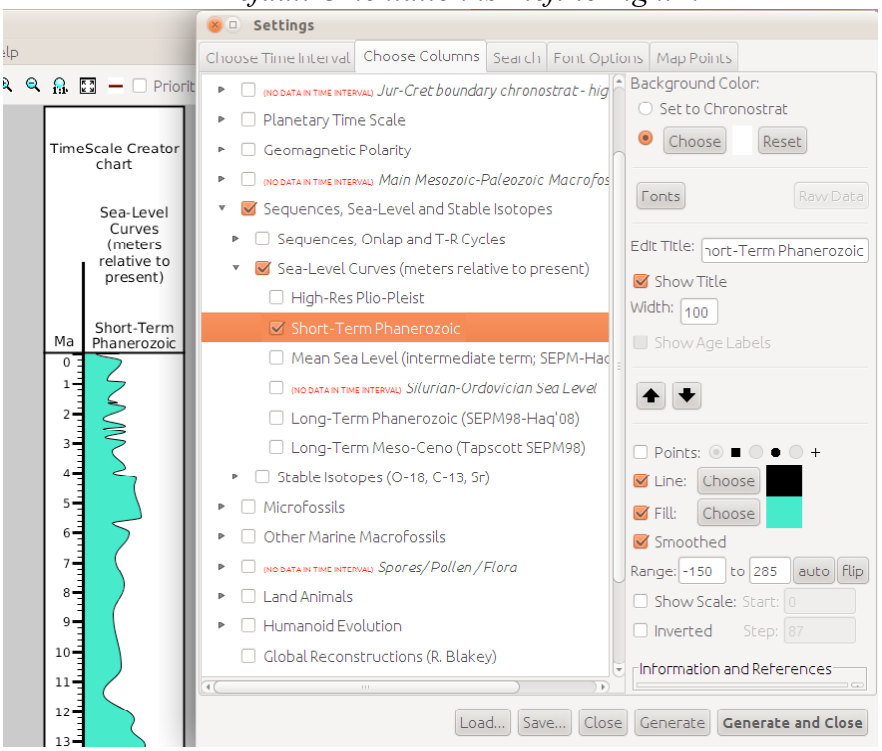
set, the Australian facies set and the standard offshore-Norway facies set. One hopes that the 248 patterns/colors will now satisfy most needs. The full set is diagrammed in "Making Datapacks" within this manual. One calls each pattern according to its name; and please realize that it is only the name for a suitable pattern, not an official rock type (e.g., the "Sandy claystone" pattern is usually fine for a mudstone).

Point-Column Curves



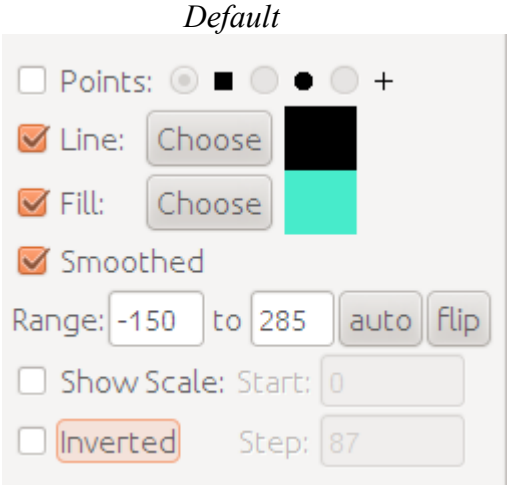
Inverting curves feature enables the user to select between left-to-right or right-to-left orientation.

Default Orientation is "left-to-right":

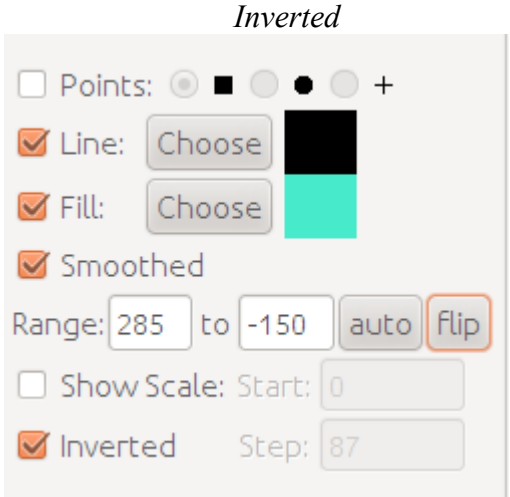


Changing the orientation or simply inverting the curve can be achieved in two ways.

Default

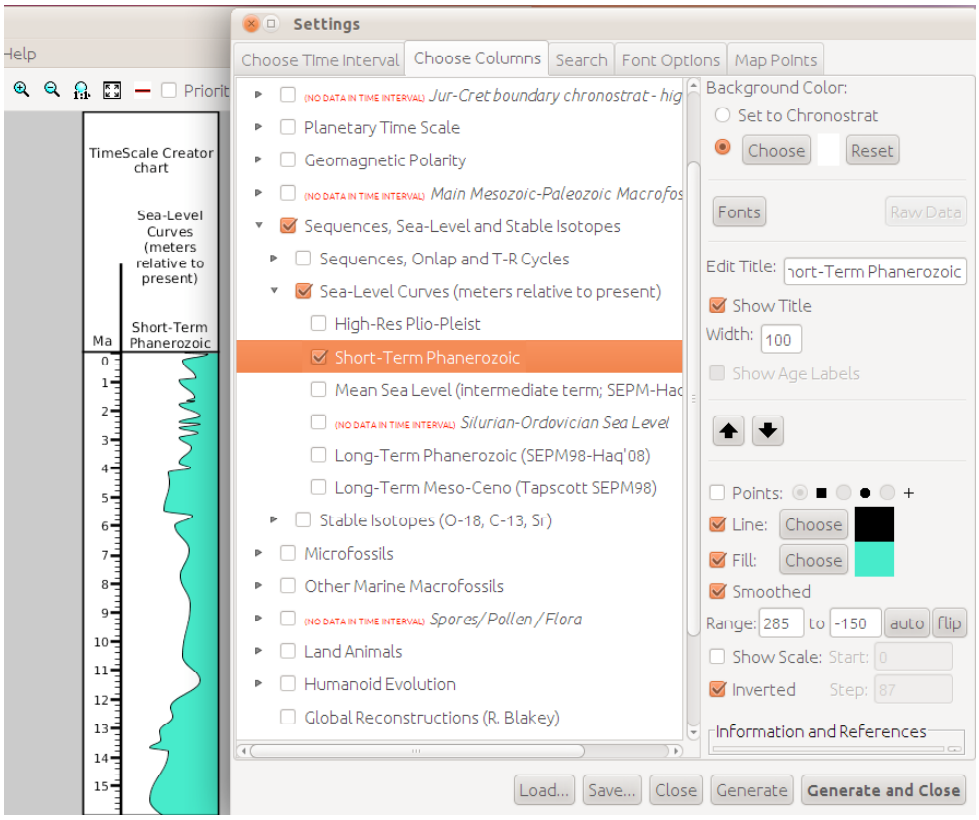


Inverted



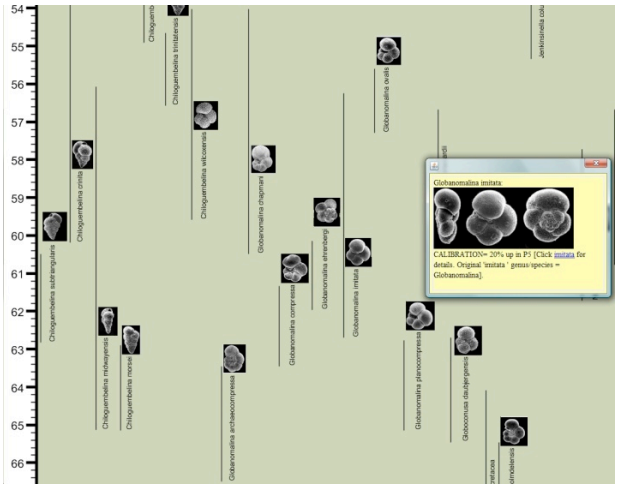
1. Simply click on the flip button and generate the chart.
2. Selecting inverted check box and changing the range values. Compared to default the range values for the inverted selection must range from high to low.

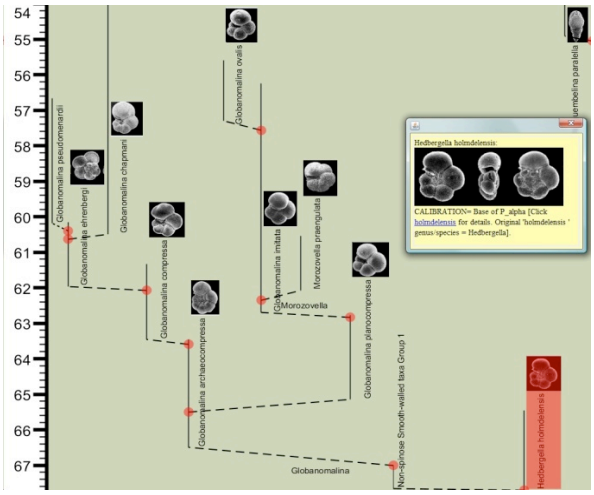
Inverted Orientation (below)


Help
Priorit
TimeScale Creator chart
Sea-Level Curves (meters relative to present)
Ma
Short-Term Phanerozoic
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Settings
Choose Time Interval
Choose Columns
Search
Font Options
Map Points
(NO DATA IN TIME INTERVAL) Jur-Cret boundary chronostrat - hig
Planetary Time Scale
Geomagnetic Polarity
(NO DATA IN TIME INTERVAL) Main Mesozoic-Paleozoic Macrofos
Sequences, Sea-Level and Stable Isotopes
Sequences, Onlap and T-R Cycles
Sea-Level Curves (meters relative to present)
High-Res Plio-Pleist
Short-Term Phanerozoic
Mean Sea Level (intermediate term; SEPM-Hac
(NO DATA IN TIME INTERVAL) Silurian-Ordovician Sea Level
Long-Term Phanerozoic (SEPM98-Haq'08)
Long-Term Meso-Ceno (Tapscott SEPM98)
Stable Isotopes (O-18, C-13, Sr)
Microfossils
Other Marine Macrofossils
(NO DATA IN TIME INTERVAL) Spores/Pollen/Flora
Land Animals
Humanoid Evolution
Global Reconstructions (R. Blakey)
Background Color:
Set to Chronostrat
Choose
Reset
Fonts
Raw Data
Edit Title:
hort-Term Phanerozoic
Show Title
Width:
100
Show Age Labels
Points:
Line:
Choose
Fill:
Choose
Smoothed
Range:
285
to
-150
auto
flip
Show Scale:
Start:
0
Inverted
Step:
87
Information and References
Load...
Save...
Close
Generate
Generate and Close

Evolutionary Tree Outputs

Evolution (phylogeny) diagrams are an enhanced version of the range-output, but with presumed evolutionary linkages between ranges. Below are examples of the two versions using some Paleocene planktonic foraminfers:





Range-only diagram (with popup) ***Evolutionary (phylogeny) output***

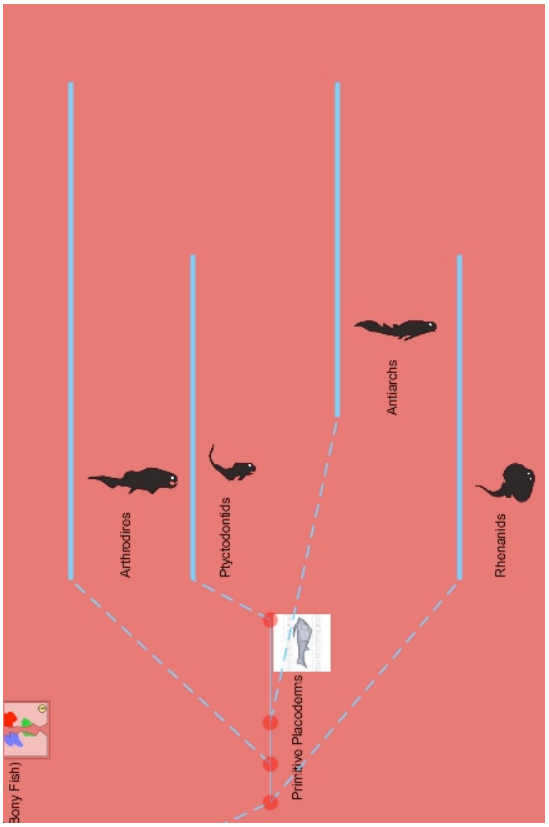
The "red dots" on the Evolutionary display are the nodes where a new "child" organism type branches from its "parent" ancestor -- the hypothesized evolutionary pathways between the organisms.

<u>How to Use</u>

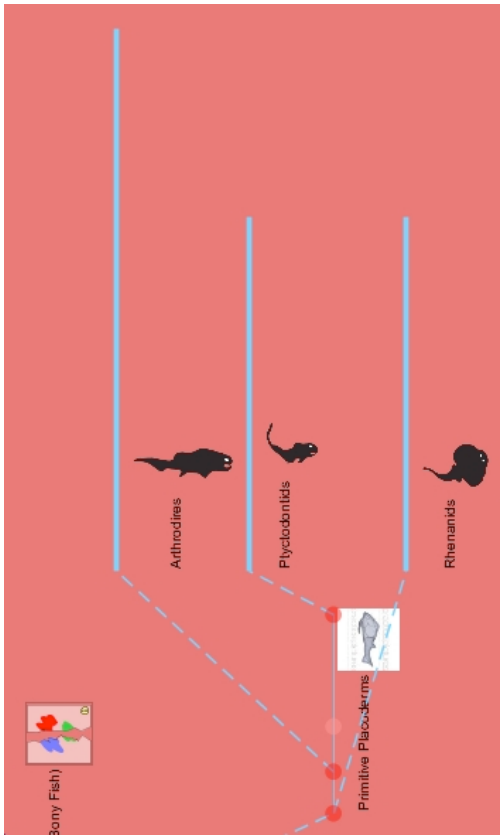
[NOTE: The basic steps of making an evolutionary-branching suite to enhance ranges of taxa is explained elsewhere in this manual.]

Toggling On/Off Specific Branches

In the example on the next page of Fish evolution, the "red-dot" nodes represent evolutionary branches. Initially, unless a priority-setting was included as a default, the entire suite of ranges and branches are displayed within the selected time interval. However, by left-clicking on a branch node, that node will be turned off and the diagram will redraw/rescale omitting that branch. The "red-dot" node is left blinking, able to be re-activated by another left-click.



Antiarch node "on"

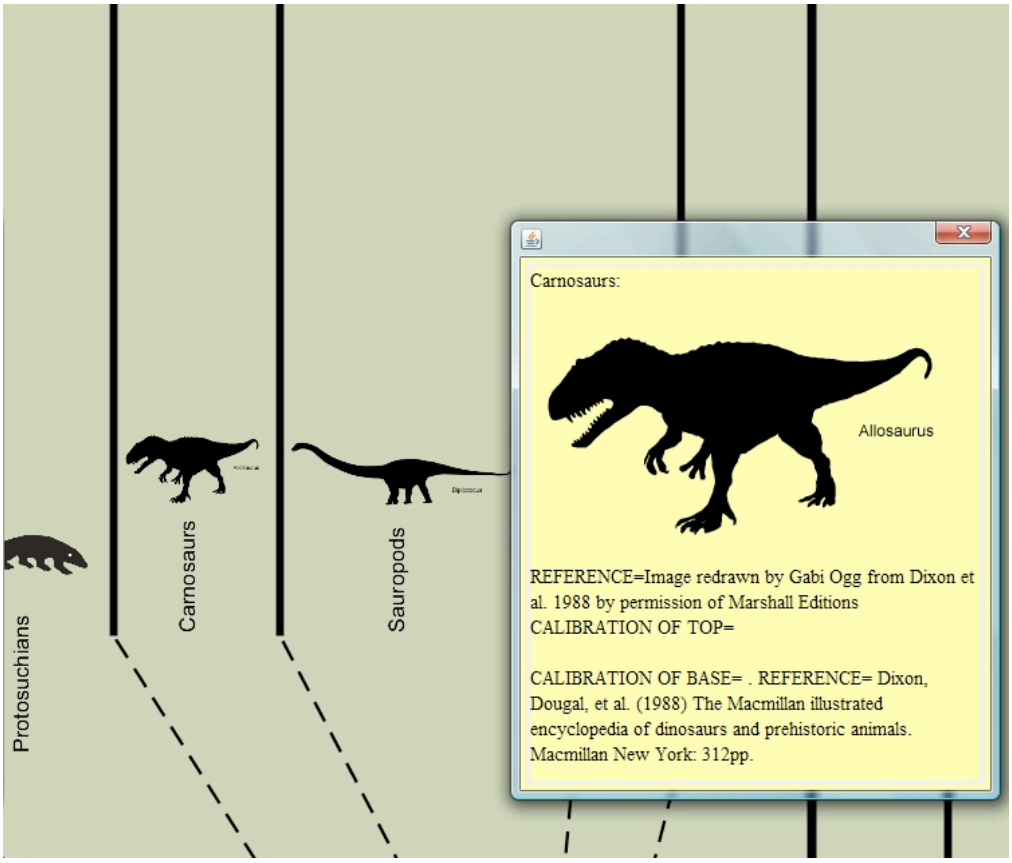


Antiarch node "off"

In the above example of Placodonts fish, in the first image all groups are displayed. We click the Antiarch node to deactiviate it, hiding that range (upper-middle of first diagram) producing the display on the right. Deactivating a node will turn off all of the "child" branches associated with that basal node.

Popups

Like in all datasets, popups or mouse-over options are available for both the ranges and the branch-node items. Below is an example of a popup for the Carnosaur-range from a partially completed dinosaur dataset (*the calibration details and descriptions were not yet included in the pop-ups*).

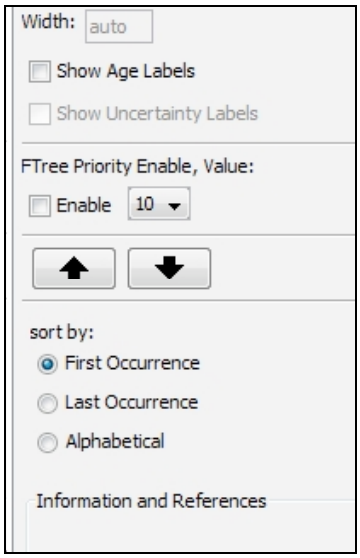


NOTE: Using the Concatenate function of Microsoft Excel, we merge information from different columns, image-names and image-format/sizing and other data into a single complex popup.

To access the information pop-ups at Branching-nodes, one must Right-click the mouse on those "red-dot" nodes.

Priority

Another useful feature of branching display is the ability to filter according to "importance" -- a priority system. In simple terms, if "priority tags" were given to the individual branch-nodes in the dataset, then the user can filter the displayed output according to that priority setting. For example, should a user wish to see only branches of major organisms that were considered "most important" and had been given a "10 priority" in the input dataset, then selecting "*Tree Priority Enable*" with a value of 10 will remove all but those "10-priority organisms". A setting of 8 would display only "8,9 and 10" importance, etc.

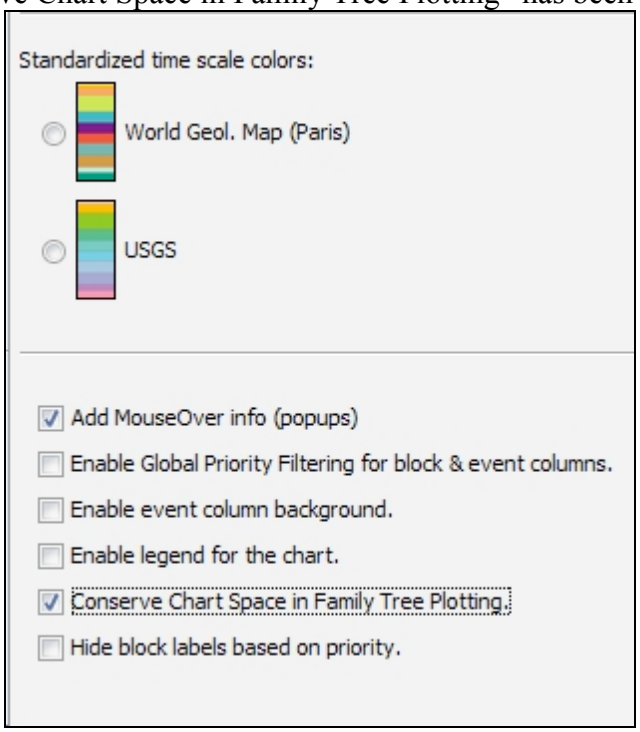


Priority-setting options (*if highlight name for that column in Column Settings menu*)

Space Save

When a group of organisms become extinct, it would "save space" on the display if later evolutionary groups would fill the resulting "blank space above". This is similar to "new branches growing over older ones" in a tree.

This display feature, a "space save" option, is located in the main settings menu – see next diagram, where "Conserve Chart Space in Family Tree Plotting" has been activated.



Using the convenient features listed above, users can manipulate charts to their own particular taste, while displaying no superfluous data and saving space simultaneously

Changing Fonts

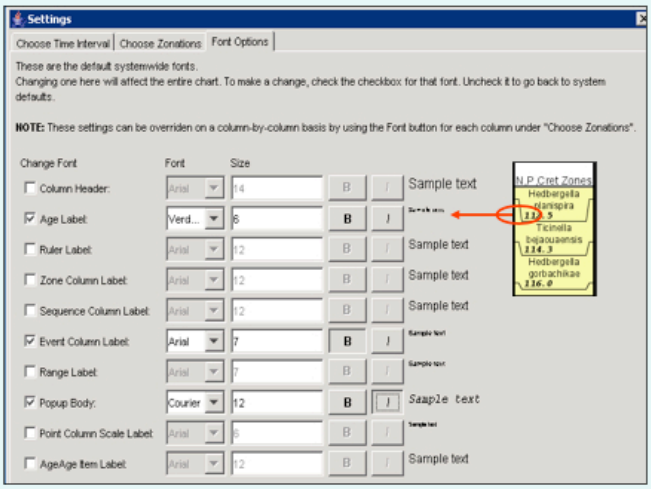
Master control -- if one selects the "Font Options" from the "TOP-Bar TABs":

Settings: Fonts

Font Options tab: change font appearance for all columns in the chart. These settings can be overridden on a column-by-column basis by using the Font button for each column (and sub-columns) under the Choose Zonations tab.

Text affected:

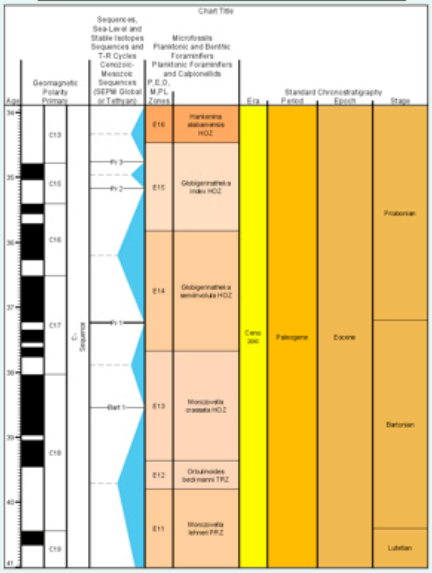
- **Column Header**: all Column Header Text.
- **Age Label**: age labels inside any column (except the Age column)
- **Ruler Label**: age labels inside the Age column
- **Zone Column Label**: text inside Block columns and Chron and Facies Label and Series columns
- **Sequence Column Label**: text inside Sequence and Trend columns
- **Event Column Label**: text inside Event columns with Event displays. (does not affect Event columns with Range displays)
- **Range Label**: fossil names in the header of an Event column with a Range display
- **Popup Body**: the Popup window text
- **Point Column Scale Label**: the scale range values in the header of a Point column



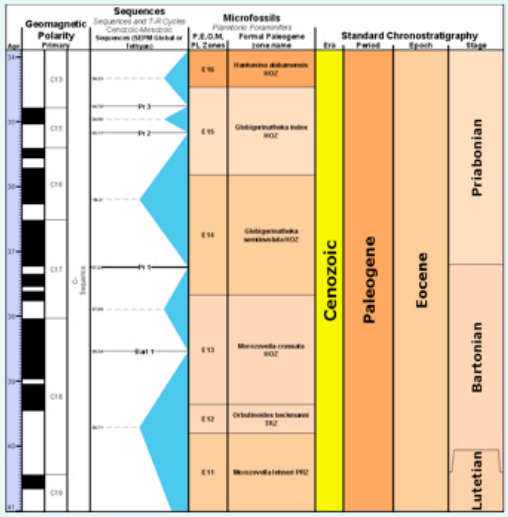
Note: You can find the **column type** for each column listed in Choose Zonations by examining the datapack in Excel.

Settings: Fonts

Default chart: all fonts are the same size



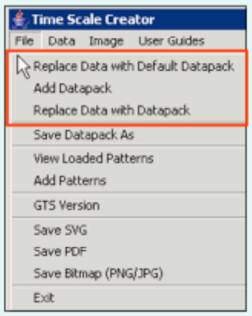
Edited chart: varying font size, type and other parameters results in a more readable chart.



NOTE: You can also select any "column" in that menu, and change its header or internal font sizes and type.

Loading Datapacks

Loading Datapacks



Loading Options for Datapacks:

- **Replace Data with Default Datapack:** The default datapack is loaded automatically when the program starts. If the data has been modified in the Editor or another datapack loaded and the default datapack is needed, use this option. It will discard all current data and reset all settings to default.
- **Add Datapack:** Load another datapack, appending its columns into the currently loaded datapack. Use this for custom or updated data.
- **Replace Data with Datapack:** Load another datapack while discarding all current data and settings. If the new datapack does not have a Standard Chronostratigraphy/Stage column, the Top and Base of Interval settings inside Settings will be blank. TS Creator Pro does not read the range of ages in any other column in a datapack.

Public-provided datapacks are located on our website for downloading; and more are with the PRO set. They include:

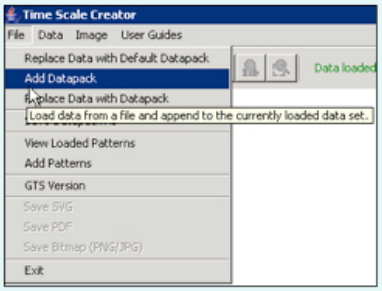
Australia_events, Russian zones, New Zealand time scale, Penns_outcrop_negative

See the DATAPACK page on our website.

Add Datapack:

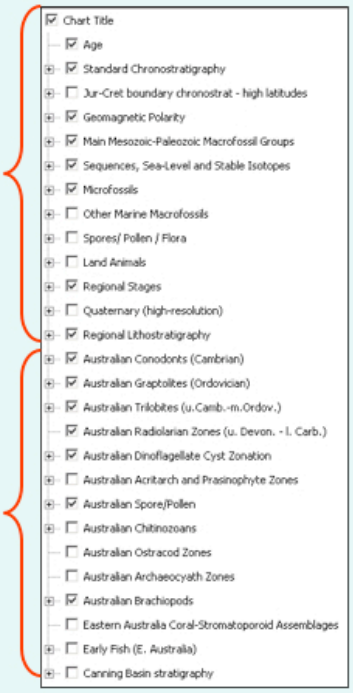
How does data get appended to the already loaded datapack?

The datapack added is appended to the bottom of the already loaded datapack.

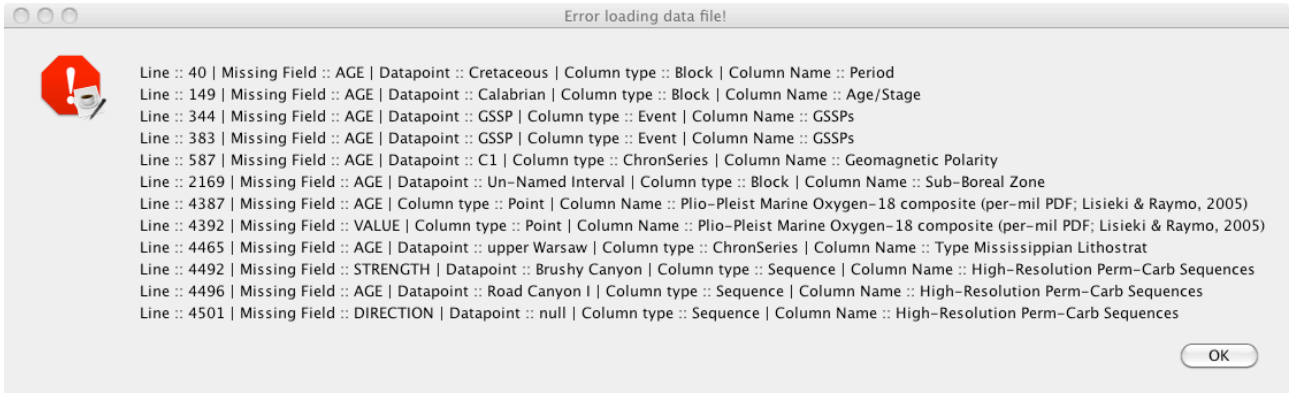


Default datapack columns

Added datapack columns



- **Datapack error messages and tolerant loading** – A common complaint has been that the error messages are not very informative when loading new self-made datasets, and that the program then stops loading. The new error messages specify which column (and often entry) has a problem, and continues through the full new dataset to give a complete list of identified problems. The following 5000-line set had about a dozen errors, and the system gives the name of that column (and type), and which item had a problem (e.g., a missing "AGE" value)



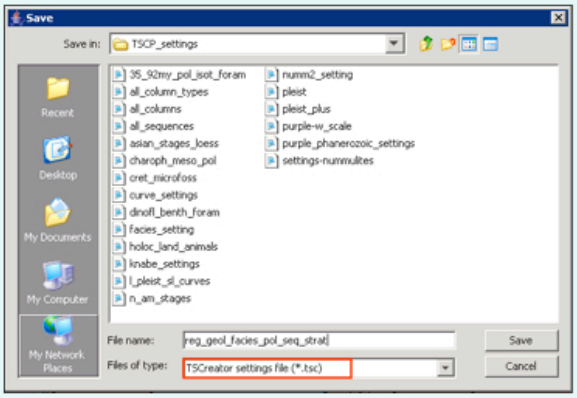
In addition, all of the columns "without identified errors" will continue to load; and one can display all of these error-free columns.

Saving Display Parameters (Settings) – Once you've created a screen display that you like, then under ***Settings***, there are bottom-buttons that enable you to **SAVE …** a "*Settings file*" that contains the necessary instructions for TimeScale Creator to recreate that display, or to **LOAD …** an earlier one to re-generate that same graphic for an audience or for additional revisions. If you are working on a major diagram, then we suggest using this feature to periodically save intermediate graphics, just in case the operating system has problems. This setting option is also useful to standardize diagrams (fonts, arrangements, etc.).

Saving Settings

After Chart settings have been selected/edited, to **save the settings** that will re-create the Chart, click on **Save** in the Settings window. This brings up a Save window. The Settings file has the extension **'.tsc'**. Create a 'settings' subdirectory to store all Settings files. Use detailed names for each Settings file for future reference. Example: l_pleist_sl_curves.tsc

To load a Settings file, open Settings and click on **Load**. The Settings file will load all settings needed to re-create the Chart (assumes the same datapack is loaded).



Hint: When working on a detailed chart, save settings throughout the creation of the chart for back reference.

Saving Charts

Saving the Output Chart to a File

Charts can be saved as **SVG, PDF, or Bitmap (PNG/JPG) files.**

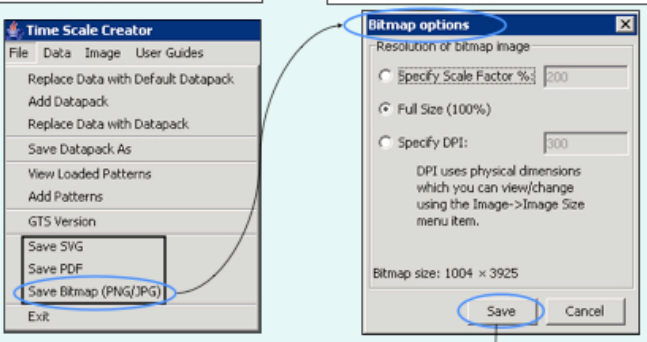
Bitmap options include ability to specify a scale factor or specify DPI.

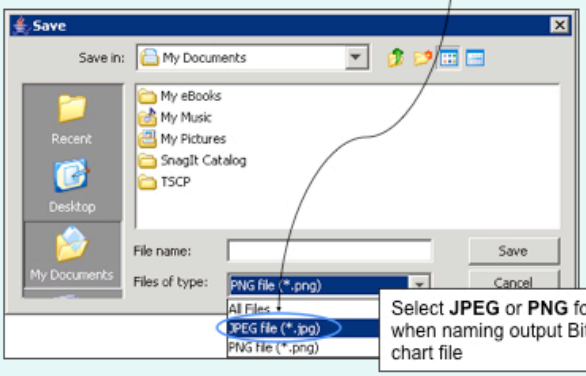
.SVG is a scalable vector graphics file which can be directly imported into most graphics software for plotting. (ex. Adobe Illustrator) Individual elements (color, text, line, etc.) of this format can be edited. Columns can be merged. High quality PDFs and JPGs can be created in Adobe Illustrator from the .SVG file.

.PDF is a universal format that is easy to email. Image quality is very good. Downside is that **PDF files take a long time to build** in TS Creator Pro.

.JPG is a raster image file that can be read into PowerPoint, ArcGIS and Easycopy (for montaging). JPG files can be loaded directly into **Petrel**.

.PNG (portable network graphics) is also a raster image file, but is a newer Bitmap format that produces better quality files compared to JPGs. Petrel 2007 will have a .PNG import format.

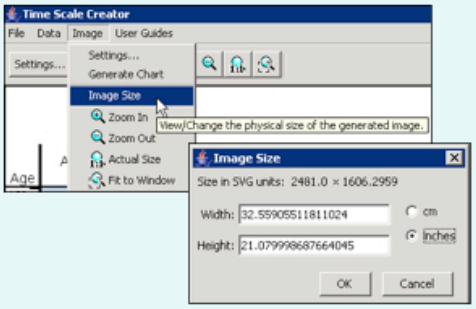




Select **JPEG** or **PNG** format when naming output Bitmap chart file

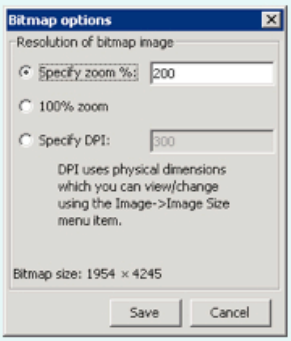
Output Dimensions and Resolution

To obtain **output size** of the chart: click on **Image / Image Size**. Size of chart in inches or centimeters can be set here or changed with Bitmap zoom options. (ratio of height to width remains constant)



Hint: (for JPGs)

- **300 DPI** JPG produces **high resolution** charts suitable for import into PowerPoint (and printing from there). Drawback is a **large file size**.
- **100% zoom** JPG is **lower resolution** but smaller file size.

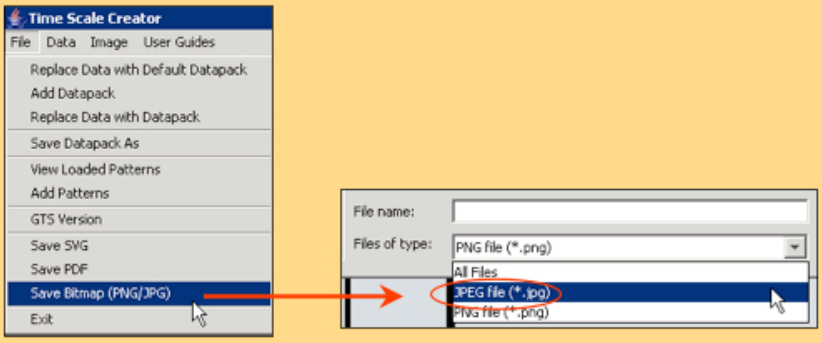


Resolution of bitmap image:

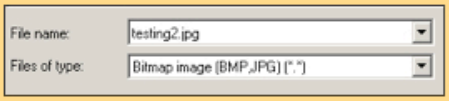
- **Specify zoom %** means apply a scale factor to output
- **100% zoom** means plot at full size
- **Specify DPI** allows increasing resolution (and size) of output graphic. DPI (dots per inch) is the number of pixels divided by the size of the image in inches. (**warning:** setting DPI above 300 may yield a memory error)

Using TS Creator Pro Images in Petrel

1. Export final display as a Bitmap. (File/Save Bitmap). Select file type JPEG.

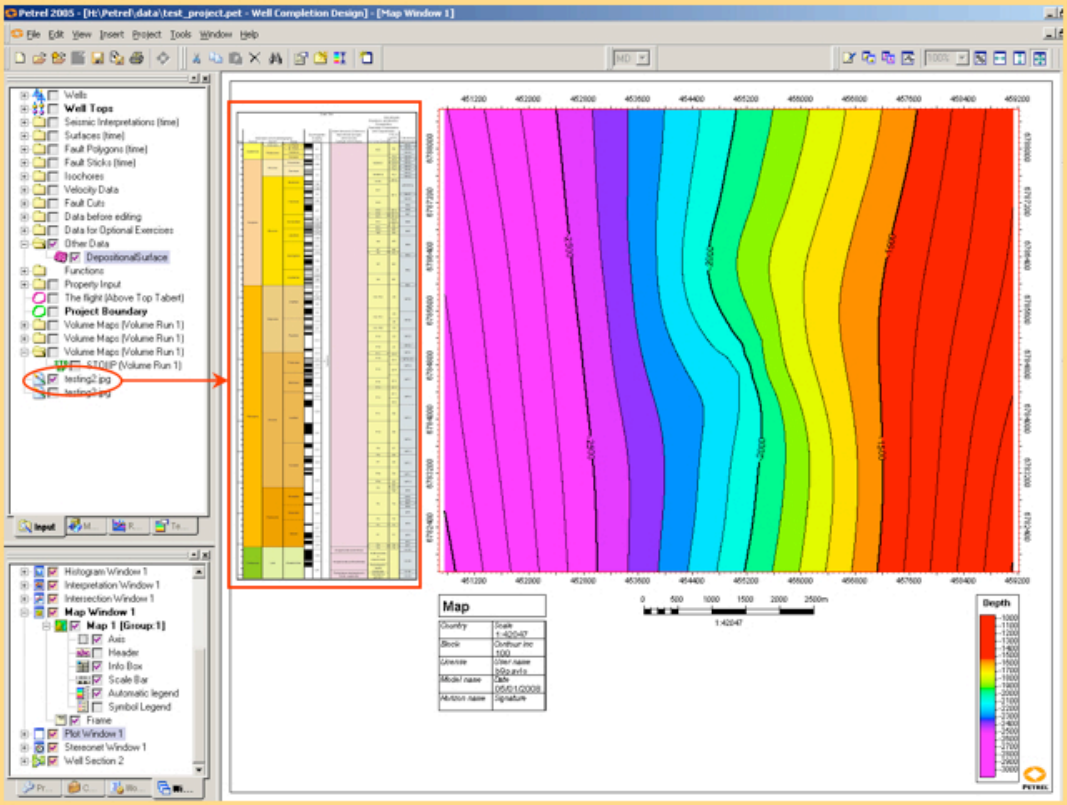


2. Import the JPEG into Petrel. (File/Import) Use file type 'Bitmap image (BMP, JPG)'.



3. Open a compatible window (Function, Histogram, Interpretation, Intersection, Map, Plot, or Stereonet) Add plot to window.

TS Creator Pro JPEG Imported into Petrel Map Window



****

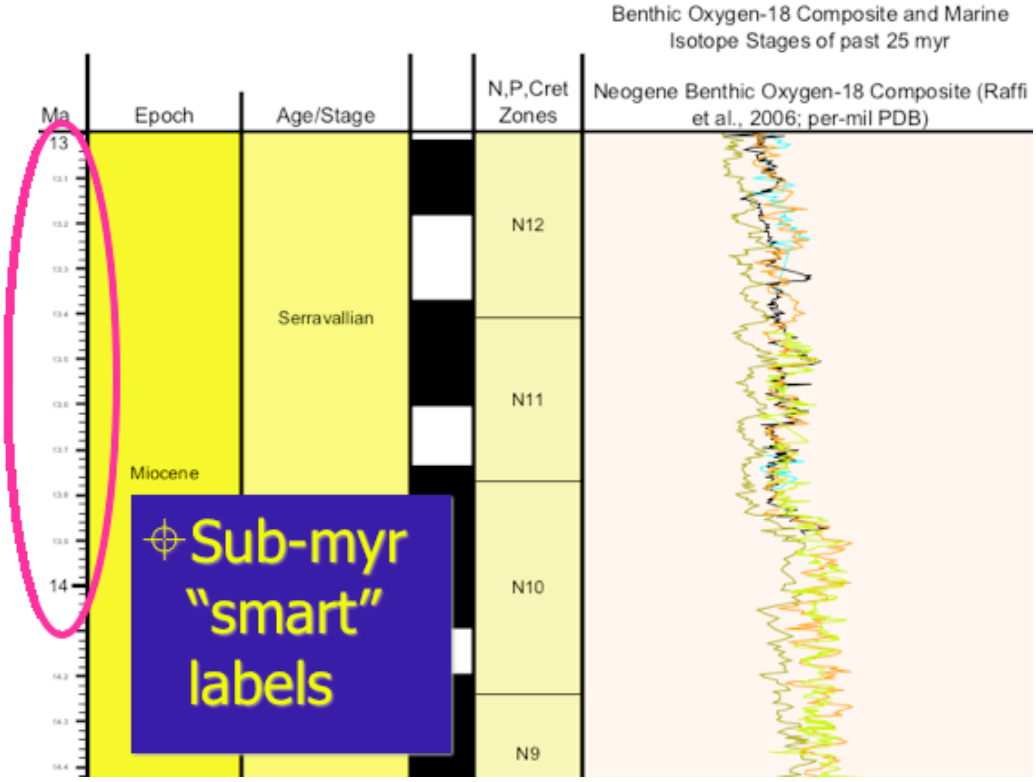
Other User-Interface, Display and Input items

- **Corporate/TSC icons on generated chart** – On the upper corners, the default icons are displayed on the screen and saved charts (TSC cave man if using public version; or TSC and company-icon if using Pro).
- **Column selection** – Clicking ON for a column within a subdirectory automatically activates the entire subdirectory/director path to it.
- Names for **Ranges** appear at top/bottom of the range, rather than a distant list at the top. Images can be added to these displayed names (see later "adding images" section).

- **Encryption of datasets** -- The option to encrypt a file is in Menu "Data->Protect a File". This is made available only for PRO Version. [*NOTE: With 5.0, all public datapacks are now encrypted; and the Public TS-Creator will only work with such encrypted datapacks. The* ***Public TS-Creator*** *will still read and display self-made .txt datasets that are non-encrypted; but only* ***up to 3000 characters*** *(and a* ***limit of 3*** *such files*).]

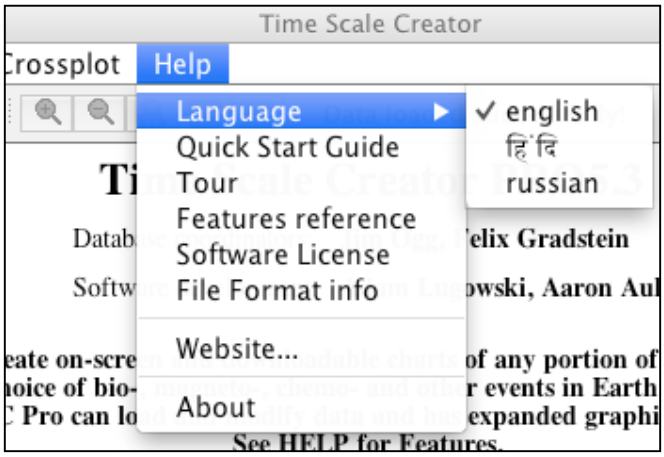
Age-Scale at sub-myr intervals

If one selects a high-resolution scale (e.g., 10 cm/myr); then the age-scale automatically adds additional sub-million-year intervals – See below.

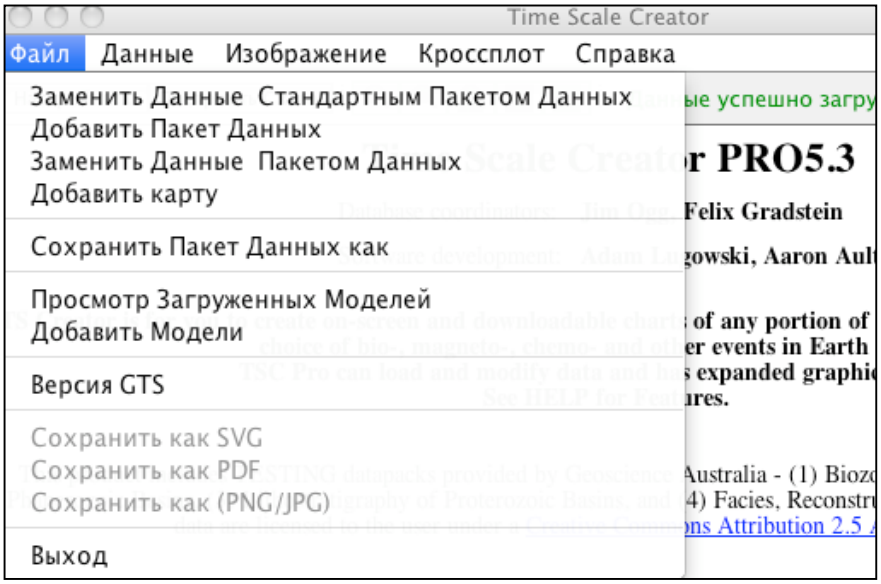


NOTE: The above example also shows that one can **super-impose curves** (if specified in the loaded datapack; e.g., the *Cenozoic isotope* datapack on the Public website)

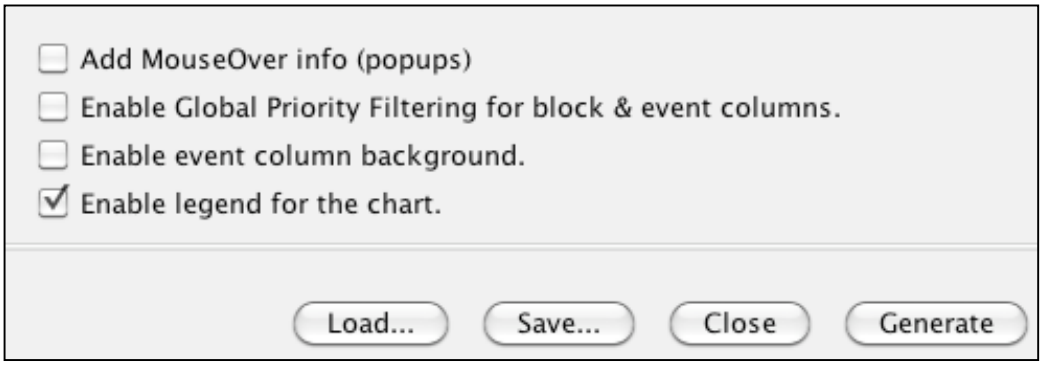
Other languages



Select language. The program will restart to load the translated set of menus (example on below). At this point, we've only included Russian, Portuguese, Spanish and Hindi. If you would like to volunteer to help with another language, we will send you the Excel listing of the 80-odd menu commands. *[NOTE: the internal databases are still in English, e.g. "Oxfordian", plus some of the more specialized menus]*



Other options – bottom of Settings menu

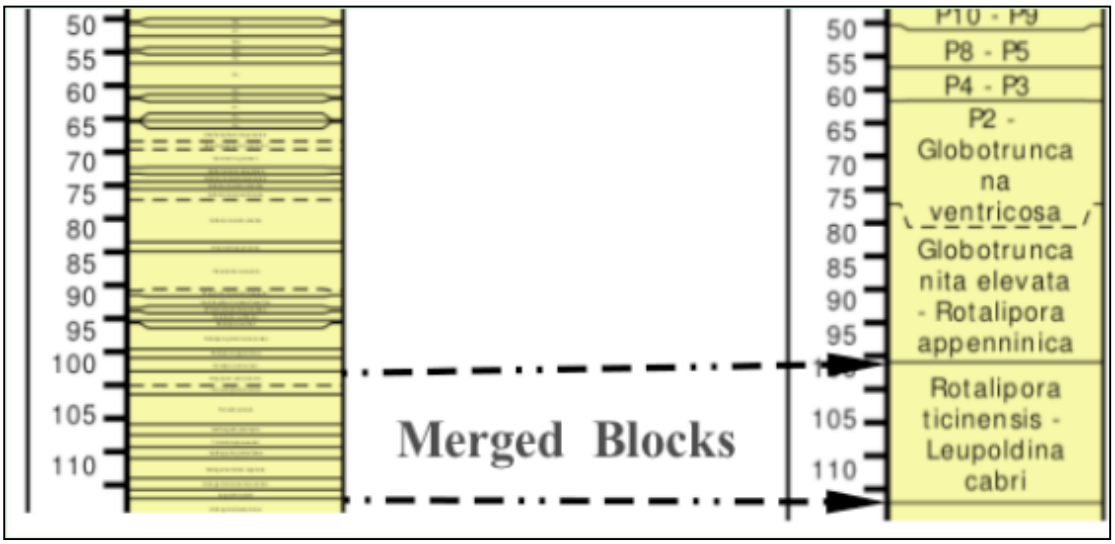


The expanded settings options are (1) whether to "globally" activate "smart crowding-avoidance", (2) to extend stage-colors as the background to FAD/LAD columns, and (3) to place legends (sources of column information) at the bottom of the chart. The later is currently default-on. These new features are explained below.

(1) "Crowding-avoidance and Priority setting

(a) Blocks

When using a low-resolution scale-setting, a set of close-spaced zone-blocks can become a messy set of unreadable tiny-labeled intervals. We have now included an option that will automatically merge blocks, and make a combined name (top-block, DASH, bottom-block) to allow a more readable output. Here is an example of foraminifer zones before/after the crowding-avoidance:



When using mouse-over to examine the Pop-ups for more details when using this crowding-avoidance, you will find that the information has been combined:

One can activate this option "globally" (the main SETTING menu), or for any selected (highlighted) block-column (a priority-filtering option has been added to the other controls)

In datapacks, one can specify a control on block-merging by:

0 (*the default, no control on merging*)

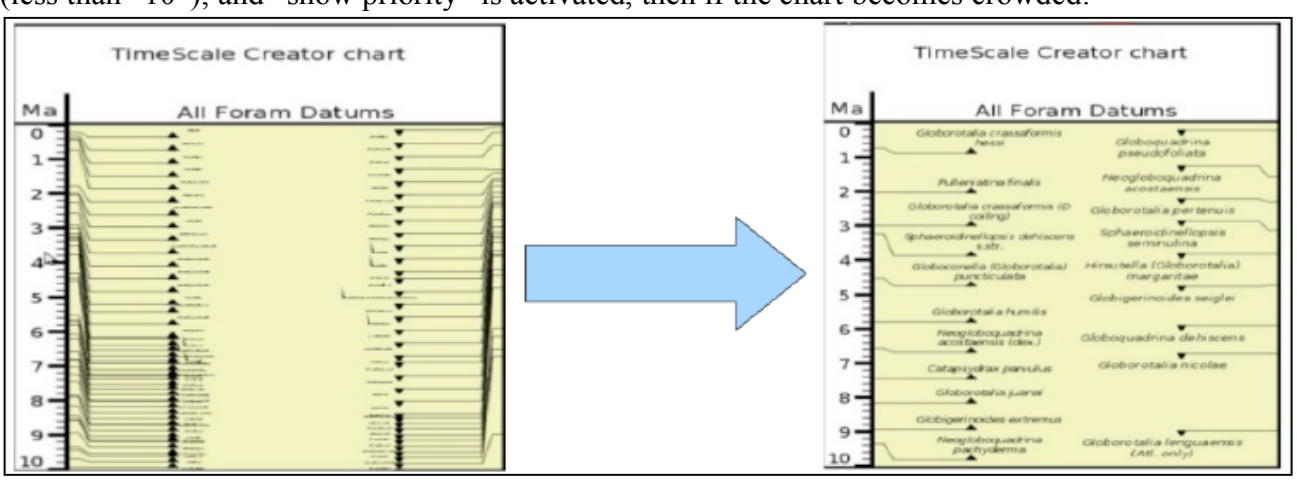
1 (*will be either top or bottom of a merged block*) or

2 (*always stays as a separate zone, never merging*).

(b) Events (FAD/LAD)

When one has a mixture of events of major, medium and minor importance and wishes to indicate these on output (or to not show minor ones if crowding results at the selected scale), then we've included the possibility to denote a 9-level hierarchy that utilizes boldness/colors.

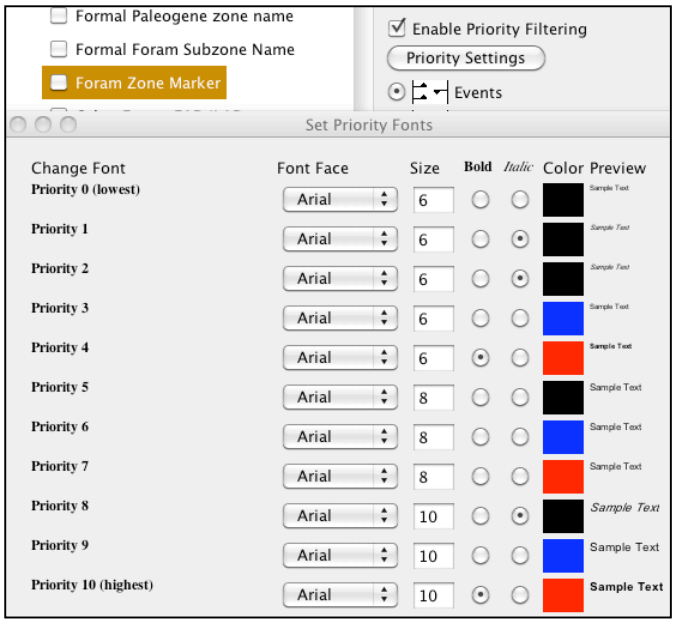
If there is a combination of major-markers (indicated by "10" priority) and lesser markers (less than "10"); and "show priority" is activated, then if the chart becomes crowded:



One can activate this option "globally" (the main SETTING menu), or for any selected (highlighted) event-column (a priority-filtering option has been added to the other controls)

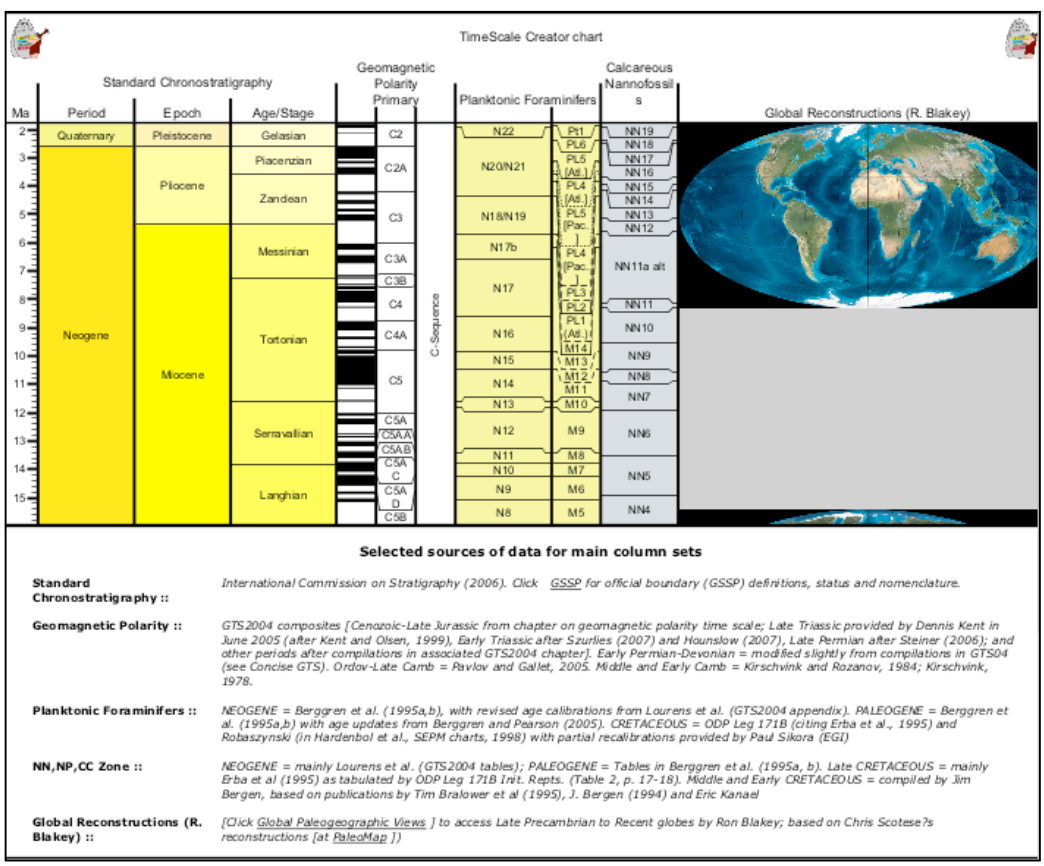
This event-priority option can also be used to color-code datums in a mixed taxa column. When highlighting that column, the options include "priority settings" where one can select a font-

color and font-type.



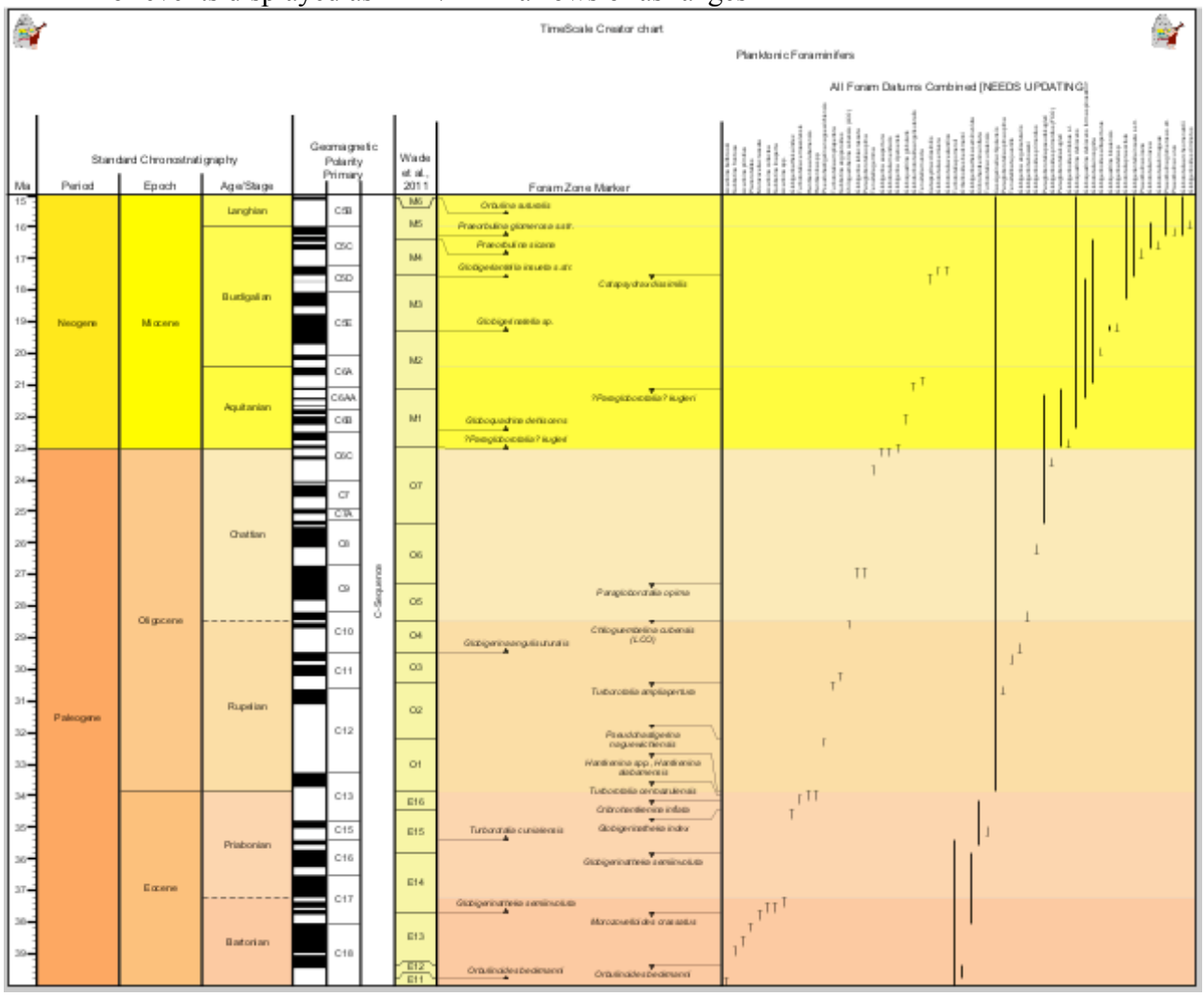
Legends at base of Chart

Use the main Settings screen to activate.



Stage-color background for Event columns *(activated as "global" from main Settings screen, or for each individual column):*

For events displayed as FAD/LAD arrows or as ranges



Don't panic -- Crowding; "out of memory", etc.

Have fun exploring the data sets and graphic options, and we hope that you will find this suite useful for reference and generating base-graphics for your research and teaching.

NOTE: The free public TimeScale Creator does not allow you to save charts after a datapack has been added. Only the PRO version allows saving charts after uploading other datasets. See our PRO page for other features, and how to get the PRO version (which comes with a large selection of datapacks).

A word of advice during exploring – there are numerous close-spaced Foram and Nanno events in the Neogene in the current database (and an abundance of Sequences in the glacial-pulsed **Pleistocene**), so the auto-adjust software sometimes has problems to display these details unless a vertical scale of at least **4** cm per 1 million years. A similar high-density of detail occurs with the brief North American ammonite zones in the Campanian-Turonian interval and ammonite

subzones within much of the Jurassic-Cretaceous. Therefore, we have placed some of this dense-detail into "additional" columns with the lesser-used secondary events, plus shorten the genera names for the ammonites and other taxa.

You can also turn on "Global Priority" in the Main Settings menu (described above)

A MEMORY problem that may occur -- The default Java installation on some operating systems limits the amount of memory a program can use. This Java default may cause the program to occasionally display **out of memory** (especially with large or information-heavy displays after several iterations). **DON'T PANIC!** If this happens, a message will appear on the screen -- you can still save the *Settings* file to regenerate the on-screen display, and usually can save the non-displayed SVG graphic file to be opened in another graphics program or Firefox-type browser. If "***Out of Memory***" appears, then the *TimeScale Creator Pro* will also explain how to increase the Java memory allocation. In many cases, hitting "***GENERATE***" again will solve the problem! If that doesn't work, then before you restart *TSCreator* to clear Windows-memory, save your current settings (See above for SAVE/LOAD) to not loose much time.

In addition, on Window machines, the screen refresh will becomes slower and slower – again, the same JAVA problem in not clearing memory – so, save settings, then close and re-start JAVA and *TS-Creator* again.

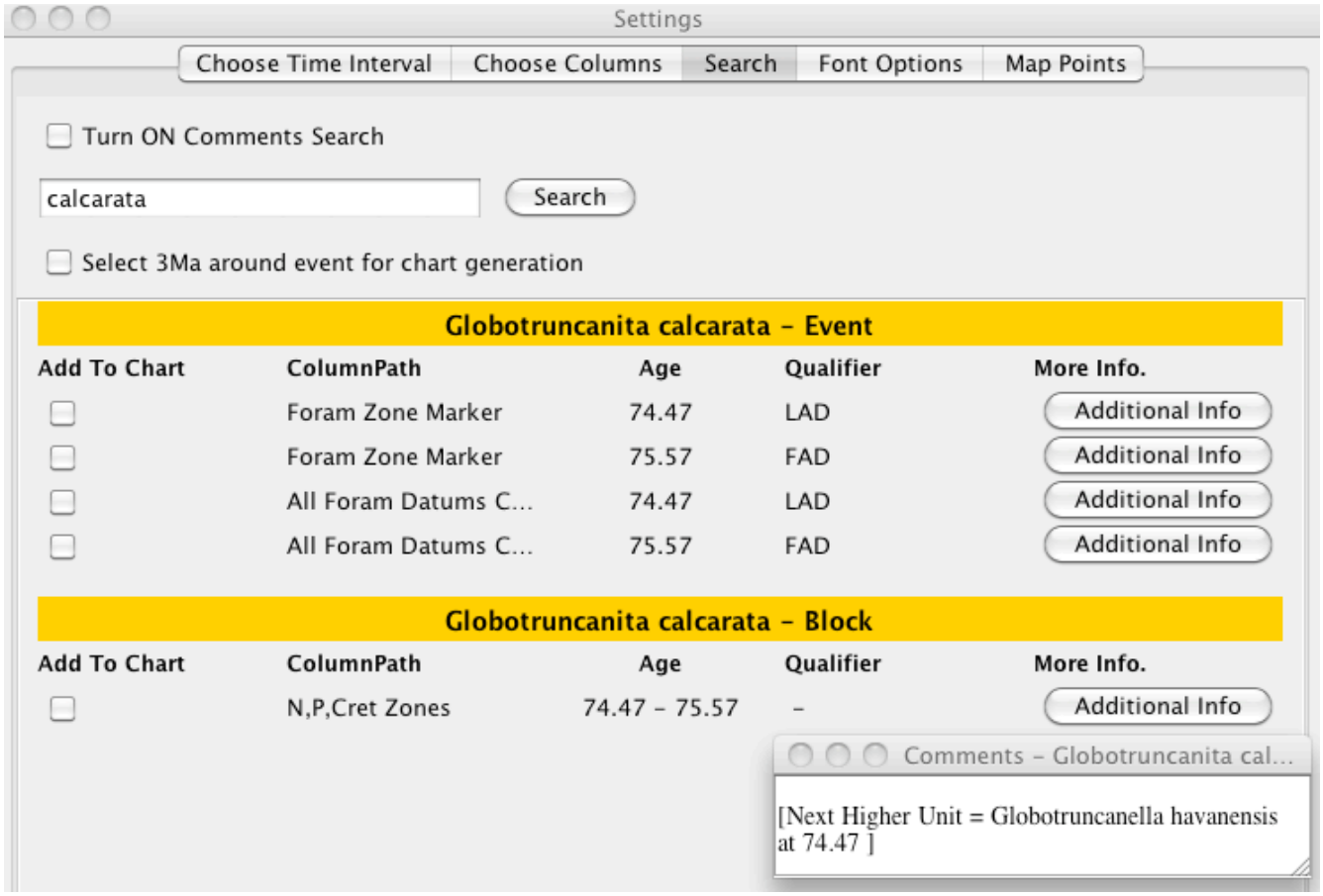
TS Creator -- Search Functionality

User Manual

[Search function developed by Gangi Palem; Purdue University]

INTRODUCTION

The 'Search' functionality enables finding information within the TS-Creator datapacks and consolidating results.



This document provides a brief description about the usage of the 'Search' tab and the different functionalities. Note: This user manual uses the internal datapack for explaining the usage, but any combination of datapacks can be added and simultaneously searched.

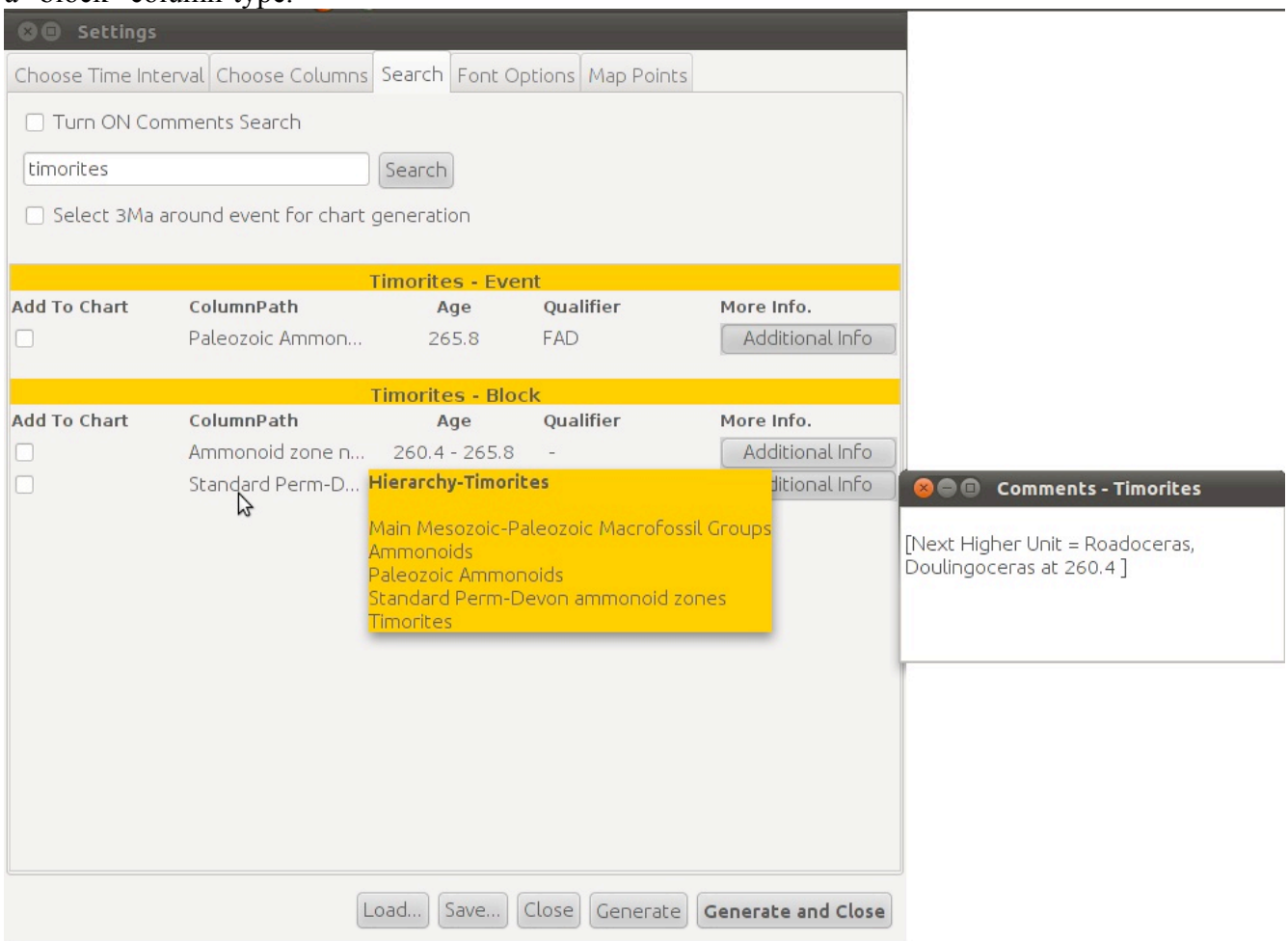
The SEARCH button is found under Settings window, as shown above.

USAGE SCENARIOS

1. **Basic Search** for an event. (e.g., Timorites)

Input the desired WORD or PHRASE to be located in the text field. Start the search process by EITHER a click on the "***Search***" button OR by pressing "***Enter***" on the keyboard. The search string "**timorites**" is not case sensitive (i.e., "timorites" and "Timorites" both work the same way). A search for "**timorites**" will also find cases where that word is followed by a comma, by a period, or by a double-quote mark.

In this example, the search returns and displays two results - one in which Timorites occurred in an 'event' column-type as a First-Appearance Datum (FAD), and the other as a zone in a “block” column-type.



Results of a search with the string “***timorites***”.

Passing the mouse over “ColumnPath” indicates the hierarchy (nested subdirectory with this event). Clicking Additional Info brings up the pop-up on the Right; including the name and age of the next higher zone.

<u>Format of Search Results:</u>

Header (YELLOW BAND) – Full name of item, and column-type
Add To Chart – explained in a following section
ColumnPath – Brief summary (truncated); use Mouse-over to display full subdirectory path
Age – either datum level, or span of zone
Qualifier – type of event (see “What is Searched” below)
More Info. (toggle button) – Details on event/interval, depending on type (dashed/dotted; priority if any; next higher zone/chron; comments, etc.). Click on tab to **display**; click-again to **hide** (*multiple windows can be displayed*).

<u>What is Searched:</u>

Column names – if the word is in the title of a column, or of a subdirectory.
Event columns – returns if it is a FAD, LAD or EVENT; and age.
Block columns – name of a zone or equivalent; and age-span.

Range columns – returns ages for onset, relative-abundance changes (rare, common, etc.), termination.
Chron columns – returns age of base, and polarity (N,R,Int); pop-up has next higher chron.
Facies columns – name of formation or group, returns lithology-pattern and interval; pop-up has next higher unit.
Sequence columns – returns SB and MFS for that named sequence; pop-up has next higher unit.
Transect columns – if name is in a Label (returns age); or comment of a polygon (if activated; returns lithology-pattern).

Searching using a Word:

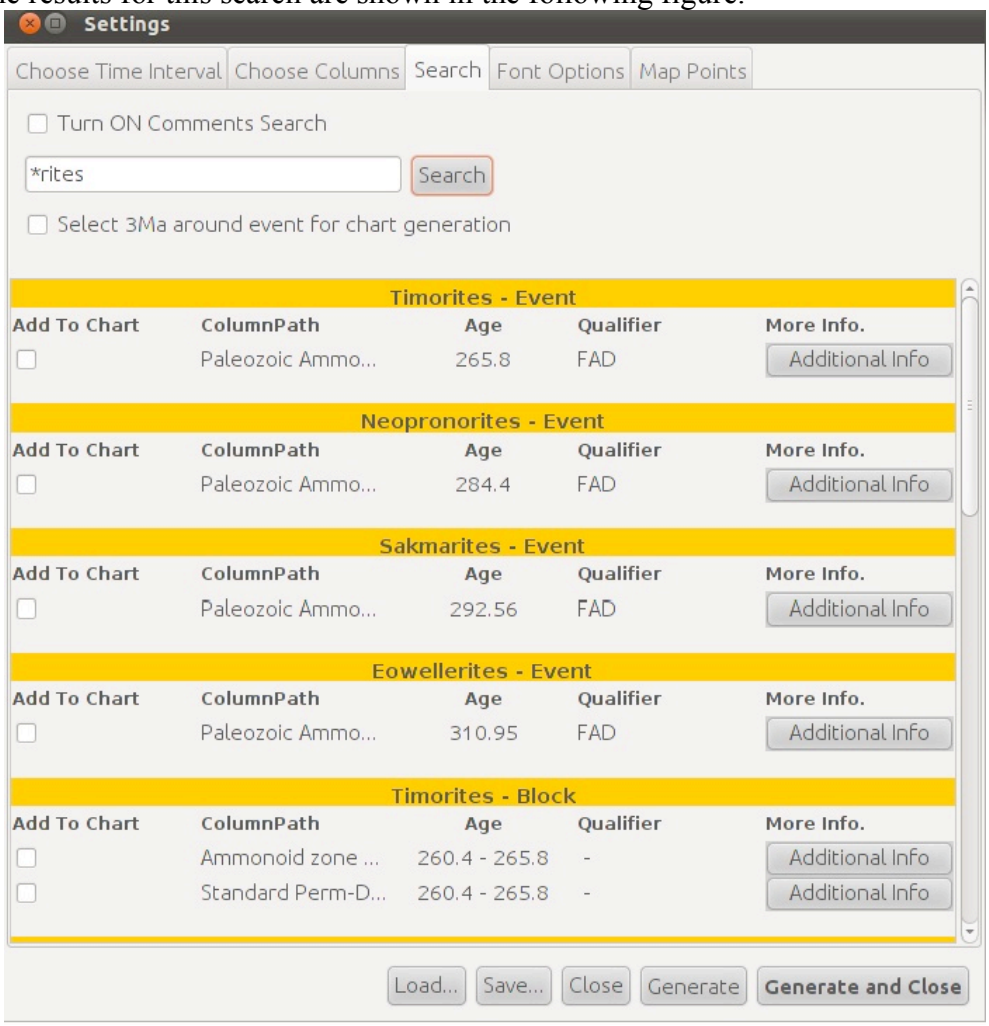
The search returns all events that include that word as part of name.

Example: A search for "*jurassica*" will return all the events, which contain *jurassica* as a "stand-alone" word. Therefore, results like "*Lagenammina jurassica, Reophax metensis*", "*Senoniasphaera jurassica*" are returned; but NOT results like "*Globigerina helvetojurassica*".

2. **Searches** using wild-characters (e.g., *****rites)

If the user does not remember the full spelling of a particular event, or wishes to find all occurrences of a string; then one can search with the partial name by inserting an asterix ***** at the beginning and/or ending.

A search with " ***rites** " returns all the events, facies, chrons, blocks, etc. which end with "*rites*". The results for this search are shown in the following figure.



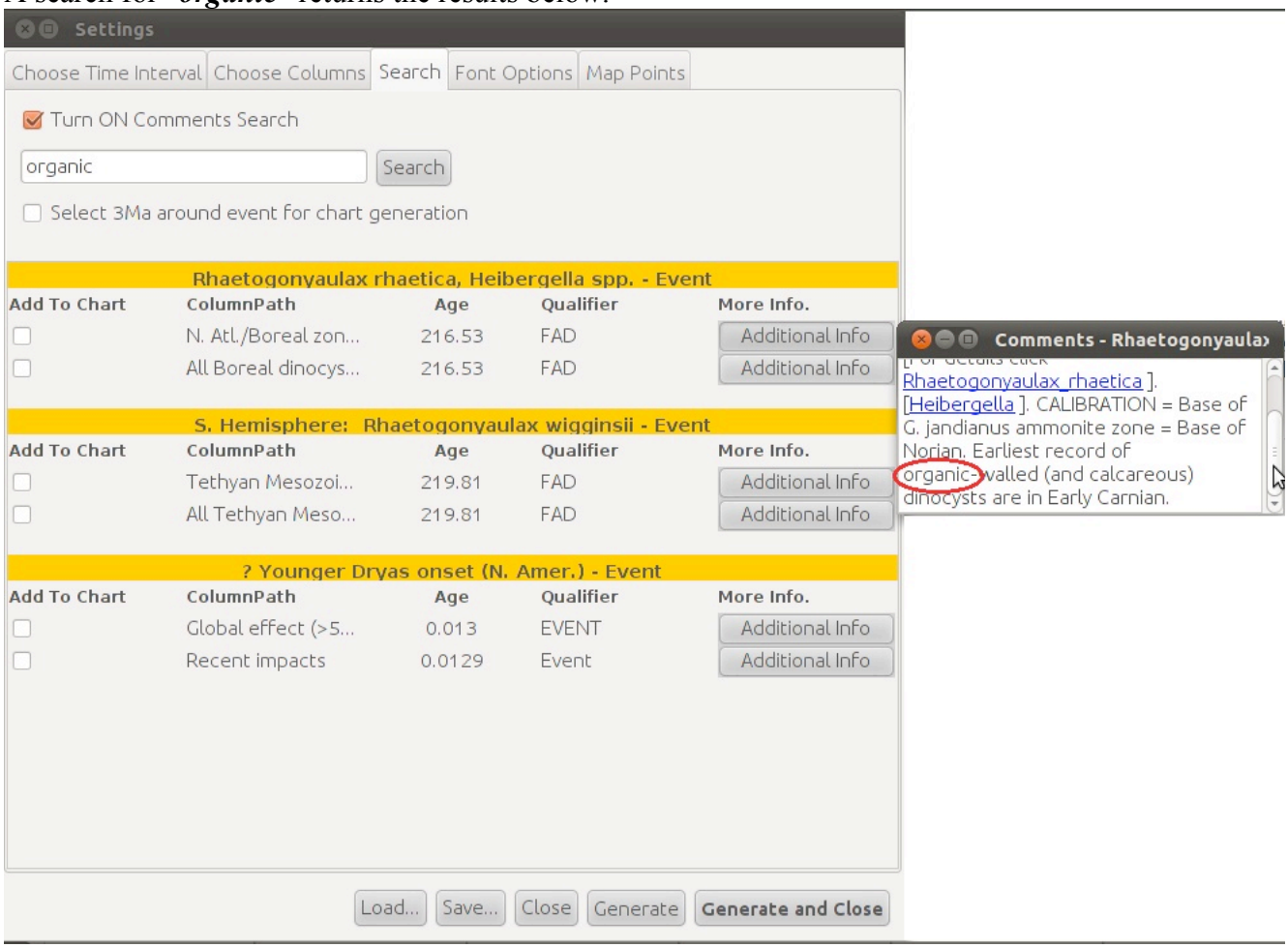
The SLIDER-Scale on Right indicates that even more results are waiting below the window.

NOTE: The " * " is not only limited to only the beginning or end. Searches can be done as: *rites, tim*, ti*es, ti*m*es etc. and many other imaginable types!

3. **Comments Search** (e.g., find all occurrences of *organic*)

Selecting the "***Turn ON Comments Search***" checkbox above the Search-text-entry enables a search in the entire datapack of both names of events and if the word/string are found in any Comment fields for those events.

A search for "***organic***" returns the results below.



AUTO-CHART GENERATION

(1) Column selecting

The **Add To Chart** check-box enables the user to select the column that contains this event and add it to the TimeScale-Creator chart. Note that this also turns-on the parent column set for that embedded sub-column.

(2) Auto-Time-Interval

The "***Select 3myr around event for chart generation***" checkbox (just below the Search-string field) will cause the TimeScale Creator chart to default to span a 6 myr interval -- 3-myr before and 3-myr after the selected event, interval or set of event/intervals. The checkbox can be selected before or after the results are displayed.

E.g: The "*Timorites*" event age is 265.8 Ma. If the "*Select 3Ma...*" checkbox and "*Add to Chart*" checkbox are both selected, then the age on the Settings "TimeInterval" panel is changed to 262.8 Ma – 268.8 Ma and the column containing Timorites is selected on the "Choose Columns" panel. Upon "Generate", a chart from 262.8 Ma – 268.8 Ma will be displayed as shown in the following figure.

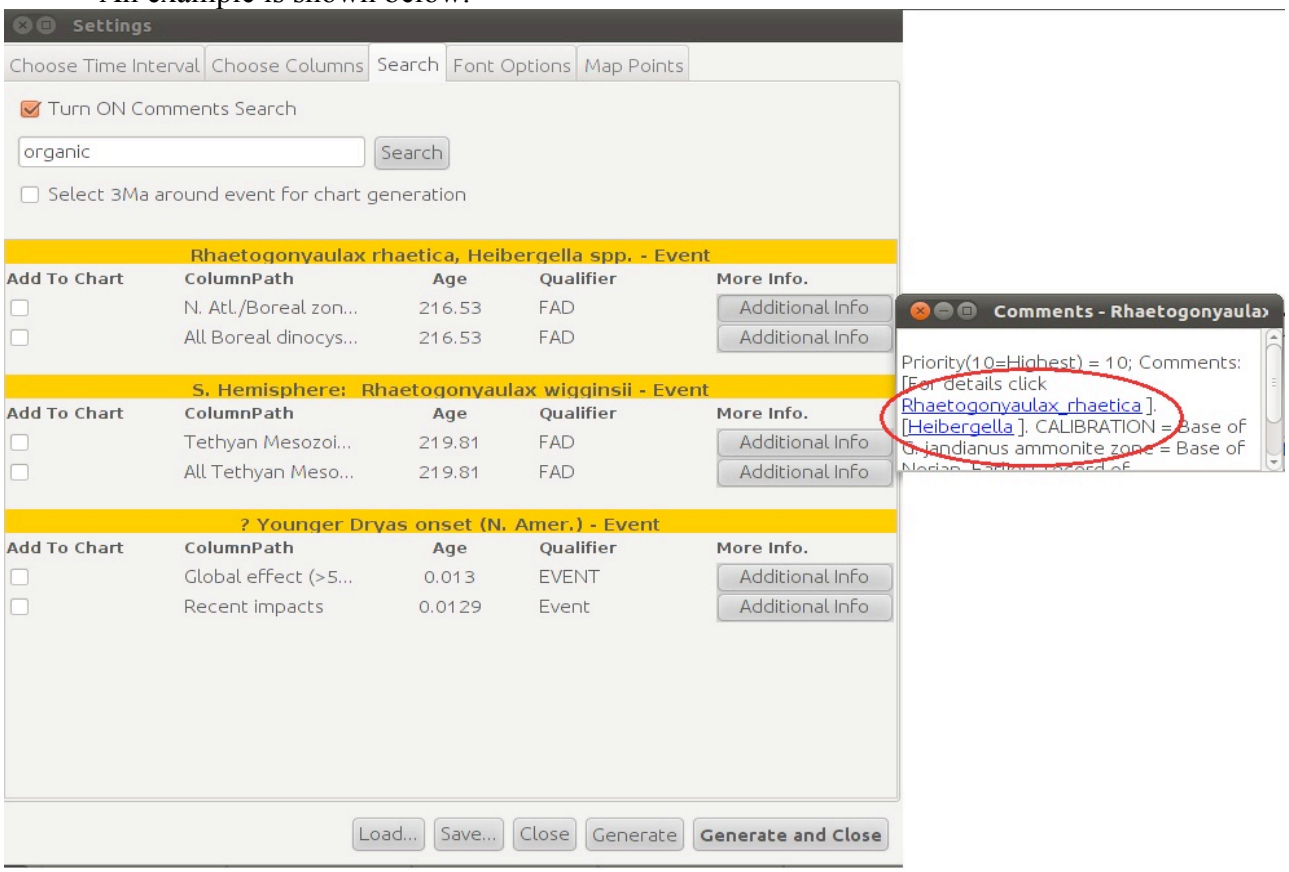
Process to generation of chart by selecting events from the search panel.

Other Features

1. Comments that contain embedded URLs.

If the datapack contains event-comment fields or zone-comment fields that contain links to URLs with external additional information (or to images in the datapack), then they can be accessed from the search results by clicking on the blue-underlined URL in the "Additional Info." popup.

An example is shown below.



URL in the results can be accessed with a 'click' on the link.

In this case, the **Dinoflaj** website will be activated to the page that contains details on *Rhaetogonyaulax rhaetica*.

2. *FUTURE ENHANCEMENTS:*

Synonym Search [*prototype under testing*]

The search functionality will be extended to searching for synonyms or searching with synonyms. This functionality will be added once the support for parsing the synonyms datapack is provided in the *TSCreator* software.

Such synonym datasets will be compiled by volunteering experts for each fossil group (beginning with different microfossil sets) and each region for lithostratigraphy. ***Please contact us if you are willing to contribute !!***

Time Panel and Columns ***Cumulative****-select and* ***Reset*** *[future]*

Presently, both of these panels are being reset for each search.

The option to reset the time panel and columns tree to their default values will be provided on the 'search' tab. This will enable the user to search several times and progressively add the

events (columns and/or age-span) to be included in the final chart. Upon executing 'generate', the cumulative selected results from all the searches are included in the chart.

The user can do a 'reset' to return the tree of columns to the default select states, and reset the time panel to the default values, before proceeding with the next set of searches.

****

USING MAP-PACKS (Geographic Interface)

MapPacks

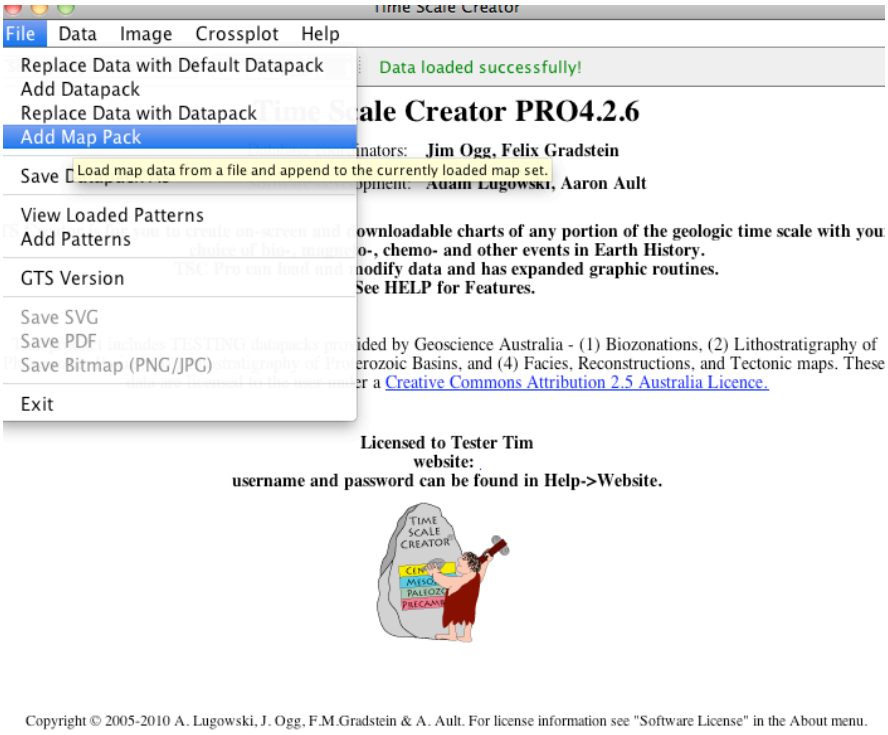
MapPacks are .map files that contain graphical information about datapacks loaded into TSCreator. Users can load MapPacks for a visual way to select and deselect data points.

For this demo, download the ***British mappack*** from the Public TimeScale Creator website.

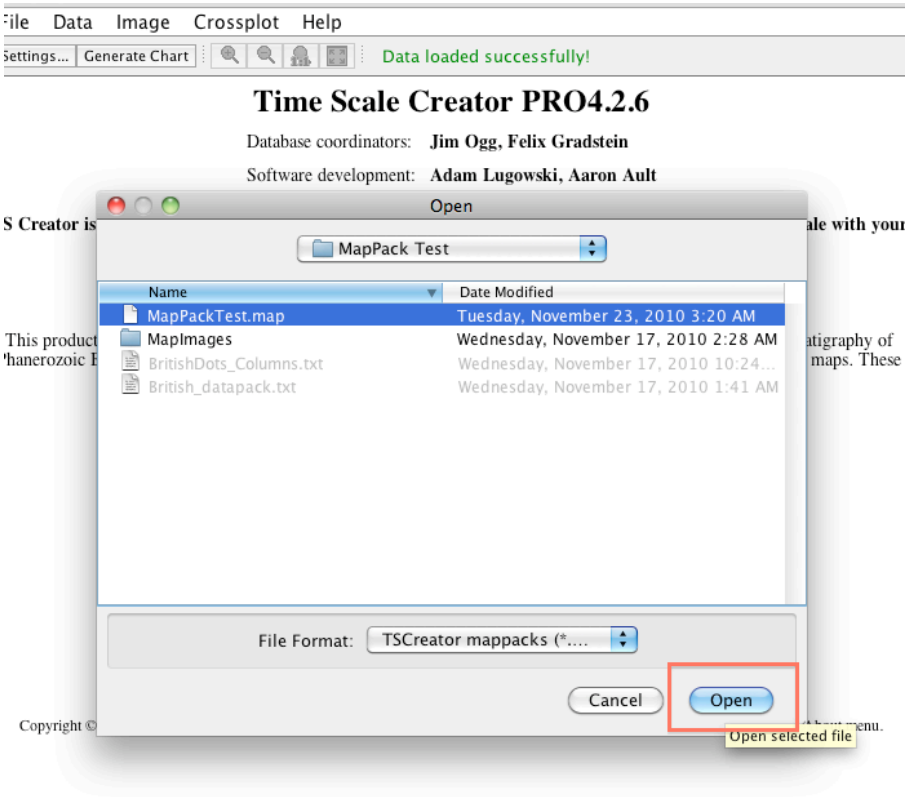
Importing MapPacks

MapPacks can be imported into TSCreator just like datapacks.

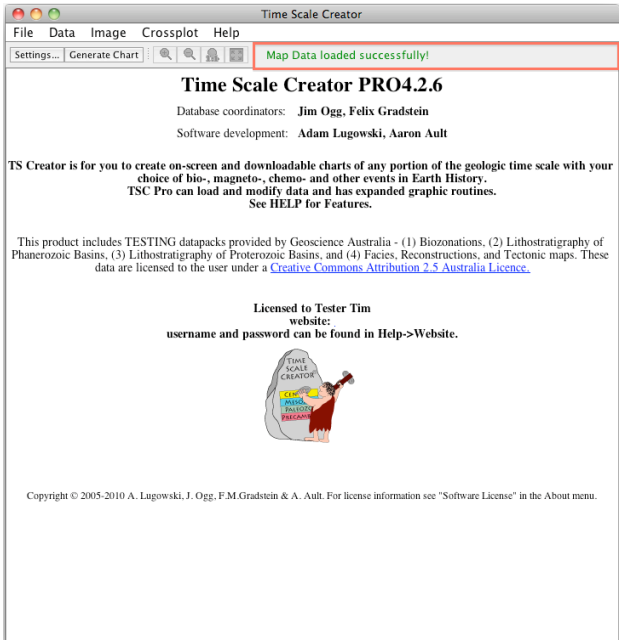
1. File -> Add MapPack.



2. Browse to the MapPack you wish to load and click **Open.**

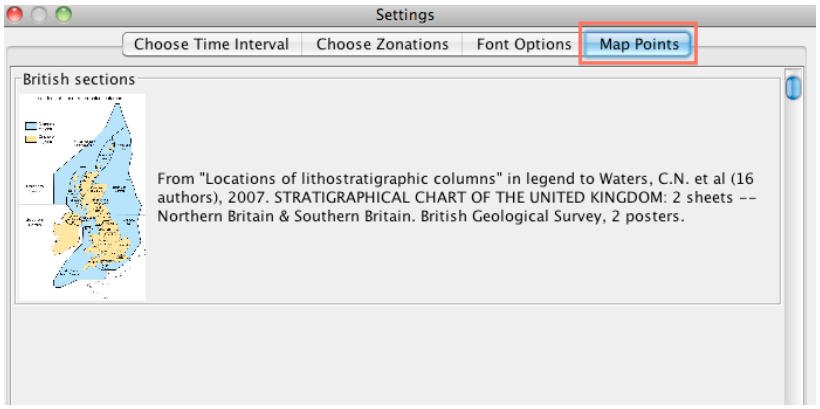


3. You will then see import status of your MapPack import. Finally, the MapPack will inform you when it has loaded successfully.



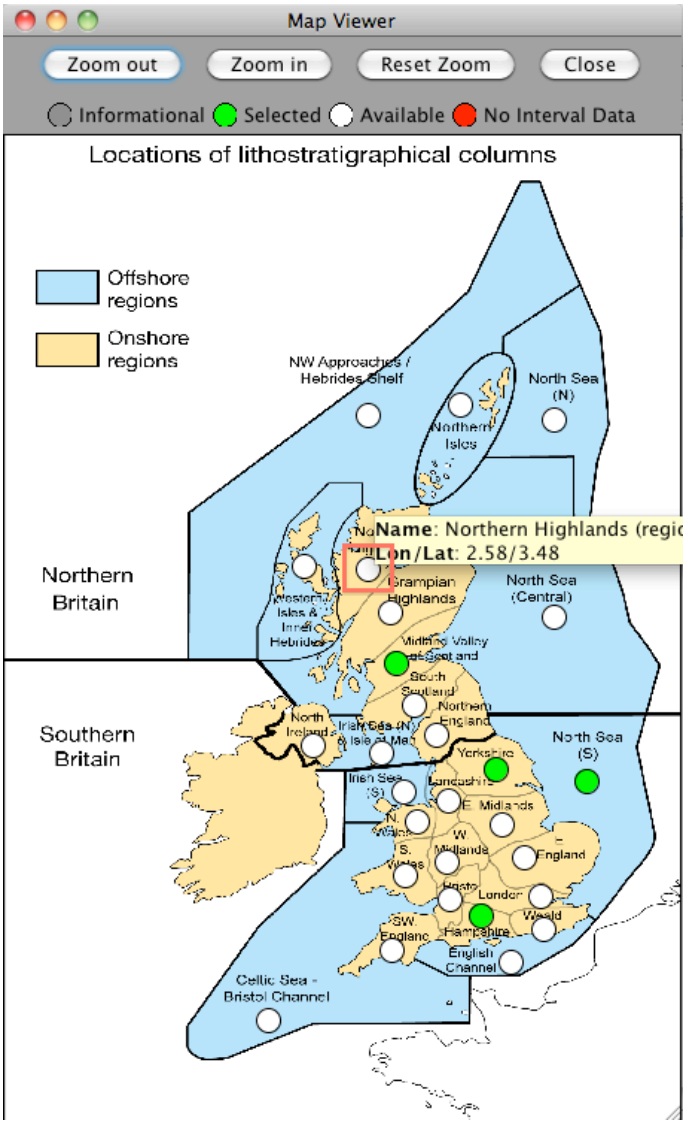
Navigating MapPacks

1. To view the list of MapPacks, click **Map Points** within the **Settings** tab.



2. Click a Map Listing to view the data for that map.

3. By clicking points on the maps you can select or deselect data columns in the **Zonations** tab, depending on the color of the point. If data columns do not exist for the map points, then they are read-only.



4. You can open multiple maps by clicking on them in the map list.

5. Submaps will open in a new window and display more detailed map information for that region.

- **Vertical perspective Map interface** -- TSC 5.0 had "rectangular" map (or any image-driven) user-interface with parallel Lat-Long lines. The "Google-Earth" type display from space onto our globe is now supported; in which one specifies the center-of-projection, height above Earth's surface of that projection, and central-scale. This will be used for most regional geology map packs; and we will mount several of these in the coming months.

Crossplot and Depth-to-Age Conversion

- *Bharath Kainkaryam (*bharath@purdue.edu*), Nag Varun Chunduru, James Ogg*

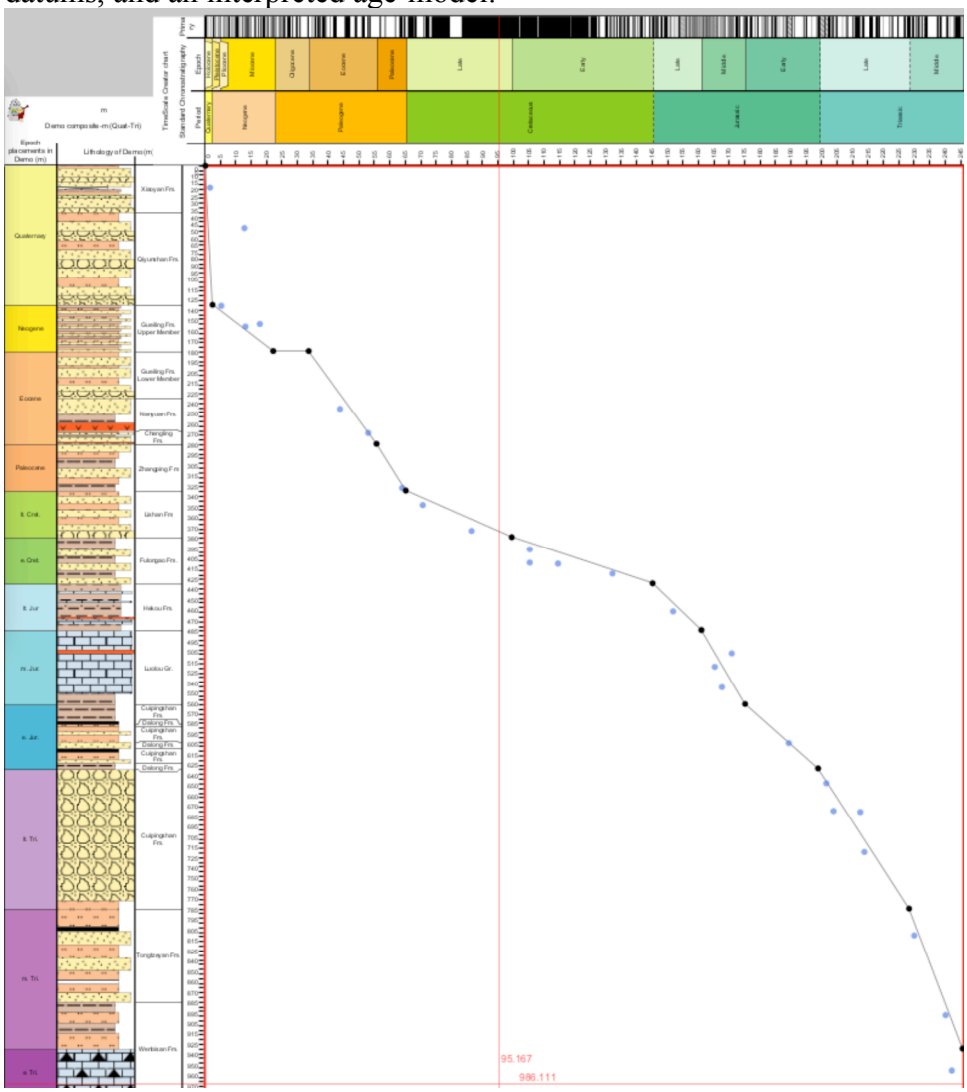
5 April, 2012

This manual summarizes the step-by-step process to convert a well log in "depth" to geologic age.

When an outcrop/well datapack (units in "feet" or "meters"; but not in "Ma") consisting of depth-varying information (biostratigraphy, petrophysical logs, lithological variations etc.) is added to the *TimeScale Creator*, the visualization software treats this as a separate display from the "Ma-age" information in its internal datasets. A suite of user interfaces allows mouse-click selection of corresponding datums and an interpreted age-model.

Dual sets of column/age-settings enable choice of which columns to display in each set.

A user interface has now been added to allow mouse-click selection of corresponding datums, and an interpreted age-model:



We will walk through this process in the following "Demo"; beginning with a brief overview here.

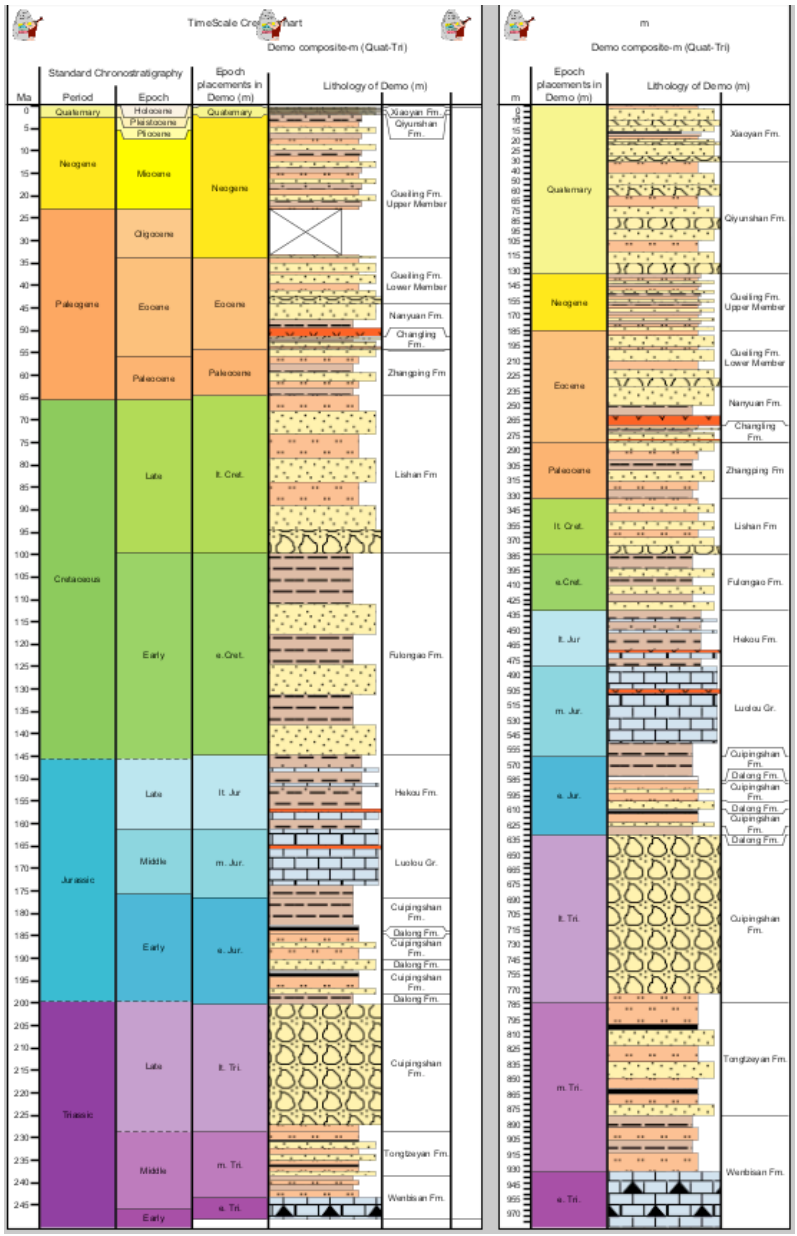
Specifying "age units", and "menu" (when making this datapack).

If one adds an outcrop datapack (***age units:*** is "**m**"); one can now designate a block column to come up in the age-selection menu ("interval columns"). In the following example, this menu set was a column called "Formations of Fujian"

format version:	1.4
date:	06/8/2010
age units:	m
interval column:	Formations of Fujian

Details will be given in the "Making Datapacks" section of this manual

One clicks "*convert*" to change the outcrop-in-meters to a corresponding outcrop-in-age-model (automatically saved). Clicking "Generate" now displays the converted file (age in Ma) adjacent to the internal dataset (**LEFT**); on the **RIGHT** was our **original** (with scale in meters).

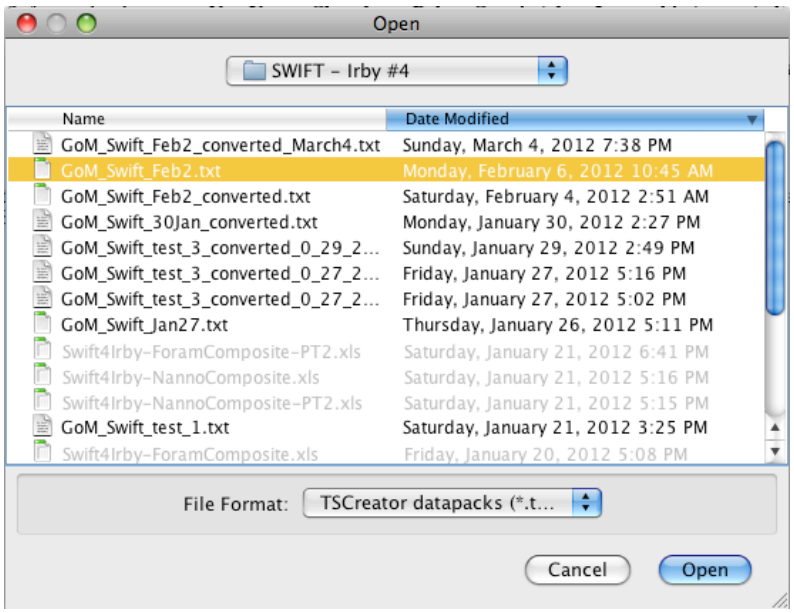


In this example, a Hiatus spans the Oligocene; but we didn't precisely adjust the "epoch boundaries" by clicking points on the depth-to-age model. This can be done by editing the depth-age file within TSCreator or externally (see detailed *Depth-Age and Crossplot manual* on website).

Crossplot and Depth-to-Age Conversion – Step-by-Step Demo

Step-1: Add "Depth" and any additional "Age" datapacks

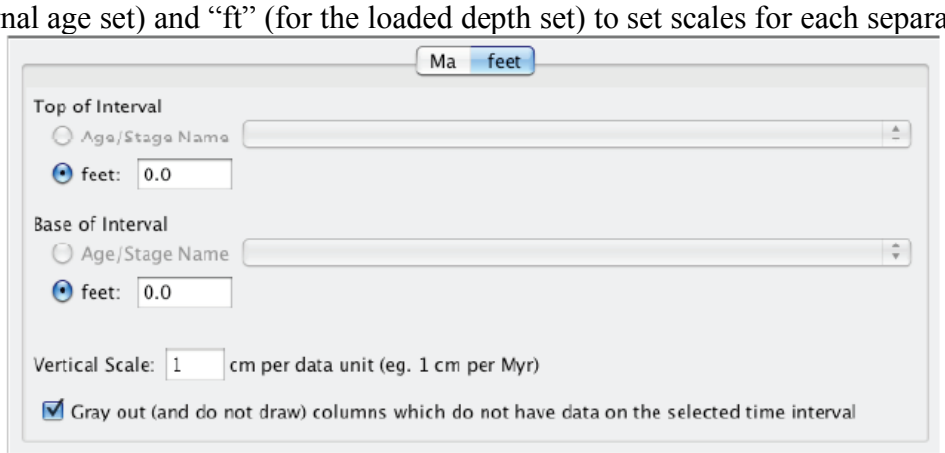
Under "File" menu, select "*Add Datapack*" and select the appropriate depth file. As a demonstration, the depth file for the facies and biostratigraphy of an onshore "*GoM Swift*" well (provided by PaleoData) is opened.



Selecting a depth file

To load additional "age" datapacks (e.g., we will use a compilation of Gulf of Mexico biostratigraphy scales and generalized regional stratigraphy), select "ADD" additional "age" datapacks.

A separate column menu for that outcrop/well (in "feet" in our example) appears in the age-selection menu ("interval columns"). The corresponding interval-selection menu in *TSCreator* appears as below. Our "Swift" well had units of "feet", therefore we a choice of "Ma" (for the internal age set) and "ft" (for the loaded depth set) to set scales for each separate plot.

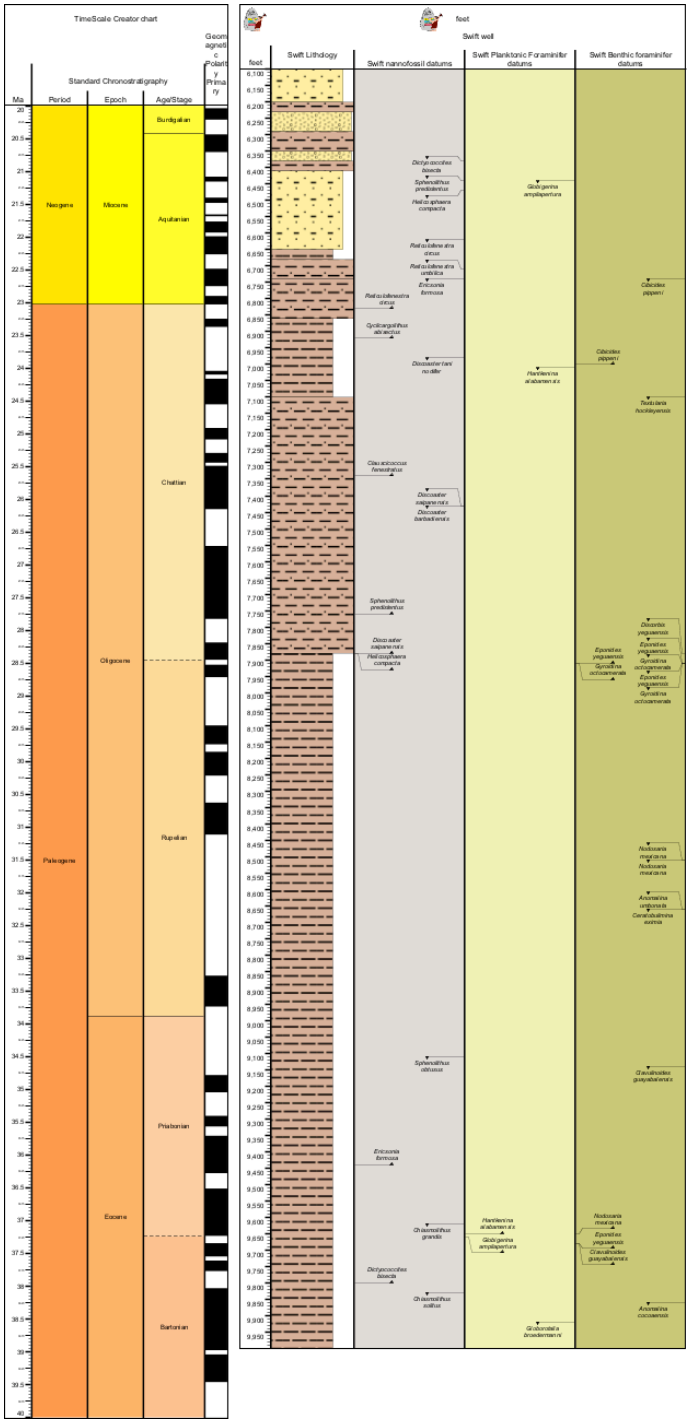


Dual-column display mode for depth and age

Dual-column display:

A non-crossplot, dual-column display is generated from the regular settings. For this initial view, we will select an Age interval of early Miocene (20 Ma) to middle Paleocene (60 Ma) for our Gulf of Mexico datapack. The Swift well has a depth range from 6140 ft to 12000 ft. Choose an appropriate scaling for the depth axis (e.g., 0.02 cm per ft).

The dual-column display that is generated is shown below. On the left is our internal "age" dataset spanning Lower Miocene to Early Paleogene. On the right is a visualization of the stratigraphy by depth in Swift well.



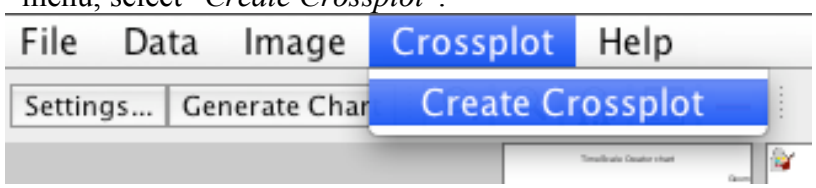
Dual-column display for the demo well file

The Swift-display (right-hand columns) shows the different kinds of lithology that appear in the well (claystone, sandstone, etc.) and the various microfossils that appear – in this view, the recorded first appearance datums (FAD) and the last appearance datums (LAD) of calcareous nannofossils, benthic foraminifers and planktonic foraminifers are shown.

Our task is now to convert the depths of the Swift well "feet" into a corresponding age in "Ma". To do this, we will compare the microfossils in the Swift well with reference microfossil-scales in the Gulf of Mexico datapack. Therefore, we wish to use a cross-plot to pick a series of corresponding depths-in-Swift-well to ages-of-events in the Gulf of Mexico datapack.

Step-2: Open the Crossplot window

Under "*Crossplot*" menu, select "*Create Crossplot*".

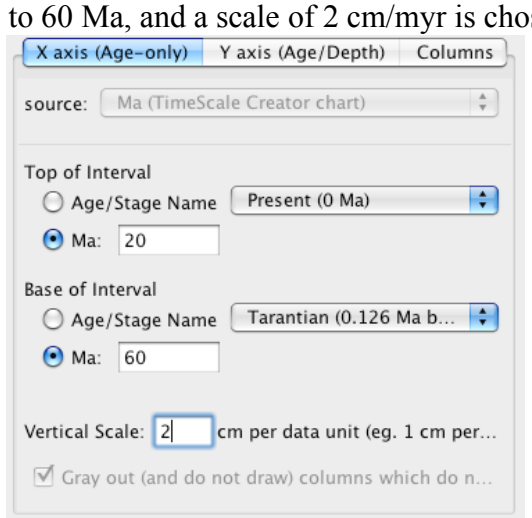


Crossplot window

The crossplot menu appears in a new window.

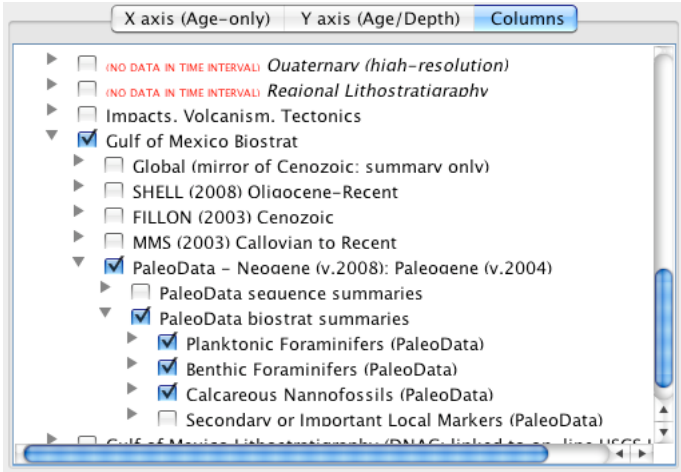
Step 3: X-axis is the age axis.

Select an appropriate "Age" interval on the age axis and a scale for the "age" axis. In the Figure 5 below, the interval from 20 to 60 Ma, and a scale of 2 cm/myr is chosen.



Choosing the top and base of the time interval

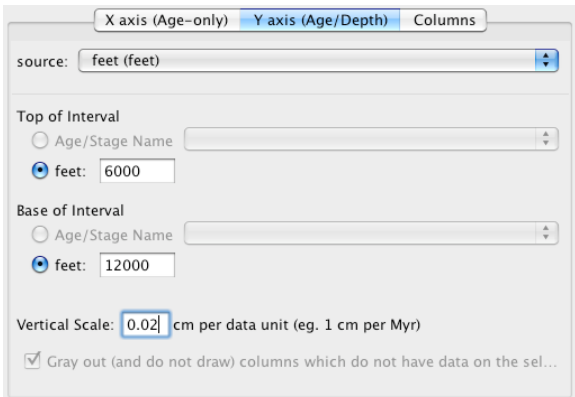
Then, under the *Columns* tab, we select the reference stratigraphic scales to be cross-plotted. In this demo example, microfossils from the PaleoData Inc's biostratigraphy datapack for the Gulf of Mexico are selected:



Selecting stratigraphic columns for cross-plotting on the age-axis

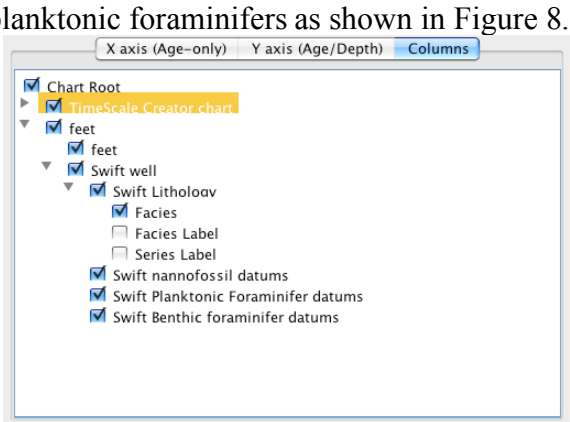
<u>Step-4: Y-axis is the depth</u>

Select an appropriate depth interval for the depth axis to be displayed and a corresponding scale. For the Swift well, we set the top and bottom to be 6000 ft and 12000 ft, respectively; then choose a scale of 0.02 cm/ft.



Choosing the top and maximum depth of interest for the well

Under "*Columns*", choose the appropriate columns for the depth axis to be crossplotted. For this Swift well, choose the facies and the different microfossil columns – calcareous nannofossils, benthic and planktonic foraminifers as shown in Figure 8.

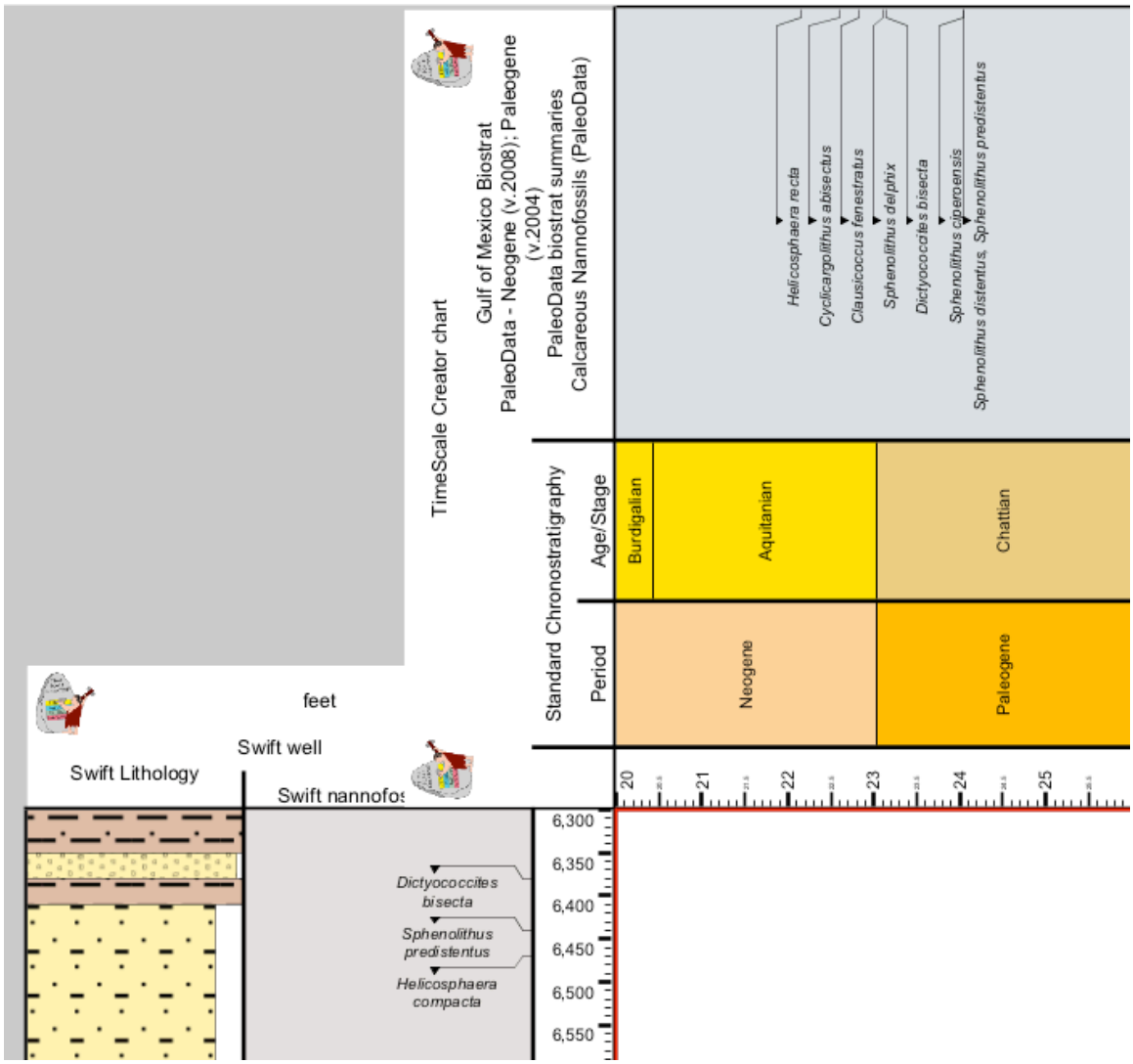


Choosing the stratigraphic columns for the depth axis

Step 5: Generate the crossplot

The crossplot display is generated by clicking on the '*Generate'* button is at the bottom of the crossplot window. The crossplot window has an Age-scale as the X-axis and Depth-scale as the Y-axis of the crossplot. A screenshot for a part of the crossplot window is shown below.

NOTE: At any time, you can reset any interval within the Age or Depth sets with a higher-magnification ("vertical scale") to see and correlate details. The placement of reference-correlation or age-model points are retained when zooming in/out, or when selecting a sub-interval for either depth or age.



Crossplot window for the demo Swift well

In the subset shown in the Figure, the X-axis has the Swift-well lithology and the various appearances/disappearances of calcareous nannofossils and the Y-axis has the geologic stages and the calcareous nannofossil biostratigraphy for Gulf of Mexico (part of PaleoData sets in that datapack).

Crossplot tools:

There is a menu of the main tools at the top of the crossplot window; and a set of keyboard shortcuts:

Crossplot Tools

(in addition to the standard zoom in/out)

	→ Select model point coordinates
	→ Select depth-age model coordinates
	→ Show/hide depth-age cross-hair lines
	→ Show/hide coordinate popups

Crossplot Keyboard shortcuts

(also listed at bottom of left-menu)

"X"	→ Pressing key **"X"** fixes age (X-axis) on the crossplot cross-hairs
"Y"	→ Pressing key **"Y"** fixes depth (Y-axis) on the crossplot cross-hairs
"O"	→ Pressing key **"O"** toggles between reference/model
"H"	→ Pressing key **"H"** shows or hides cross-hairs
"P"	→ Pressing key **"P"** shows/hides popups on the points

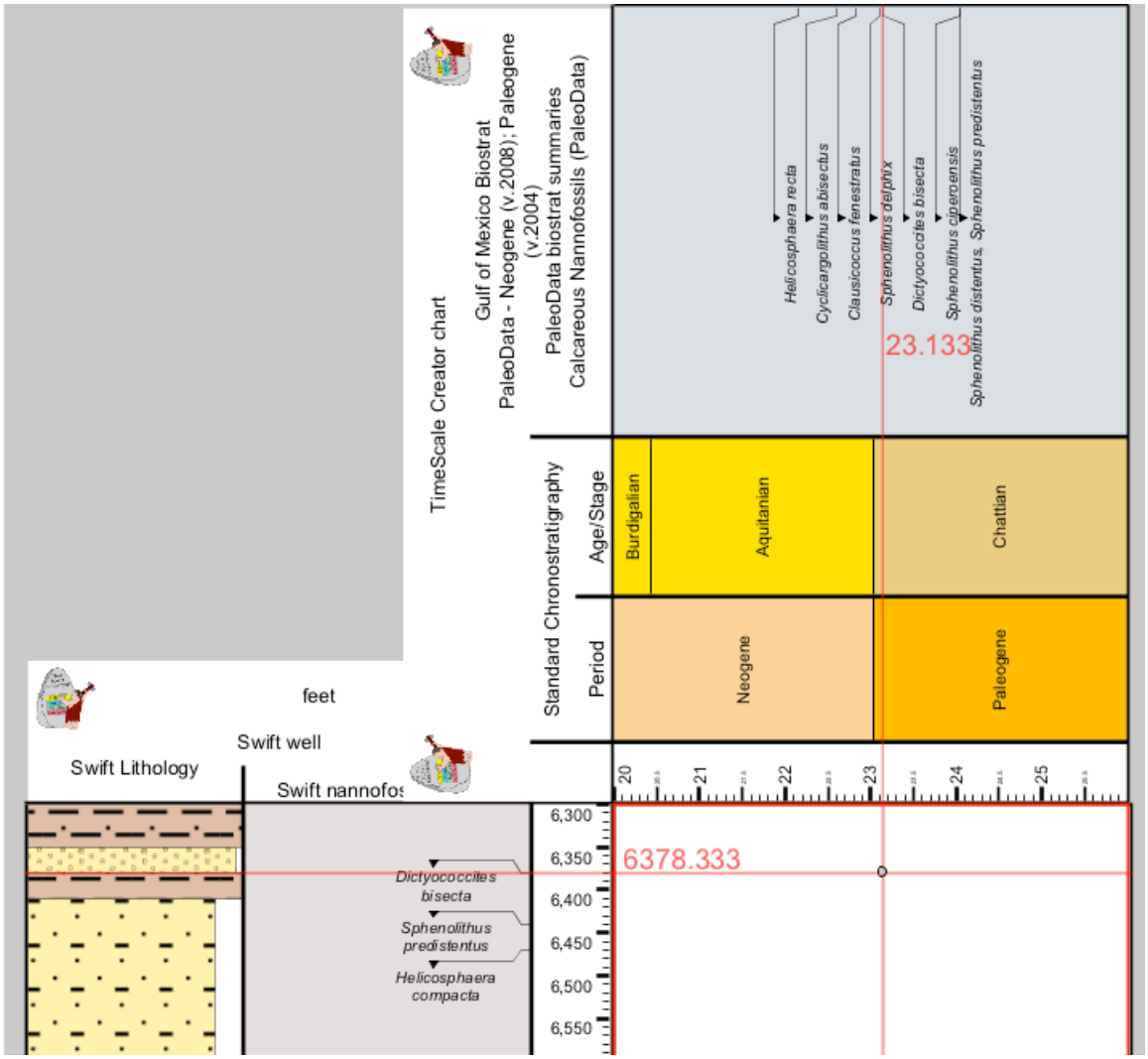
- The cross-hairs give precision when aligning events that are on both the Depth and Age axes.
- The ability to **fix** either depth or age on the cross-hairs is useful when zooming in/out to retain positions, or to force a hiatus (no change in depth, but a jump in age).

There are two types of markers – those "Model points" used for a visual display of all correlations, and the "Depth-Age model" points that fix our conversion. Typically, one first identifies all the various "Model points", then uses a subset of these or a subjective "curve fit" (a series of linear segments and perhaps interpreted hiatuses) for the "Depth-Age model".

Step 6: Choosing and editing depth-age points in the crossplot window

To choose points (markers) that will guide the depth-age model, we identify the same events that appear both on the age and the depth axis, then place a marker at the corresponding depth and age intersection. For our Swift well, our depth-age model is obtained by correlating the microfossils. Thus, we locate those microfossils that are found on both the depth and the age axes.

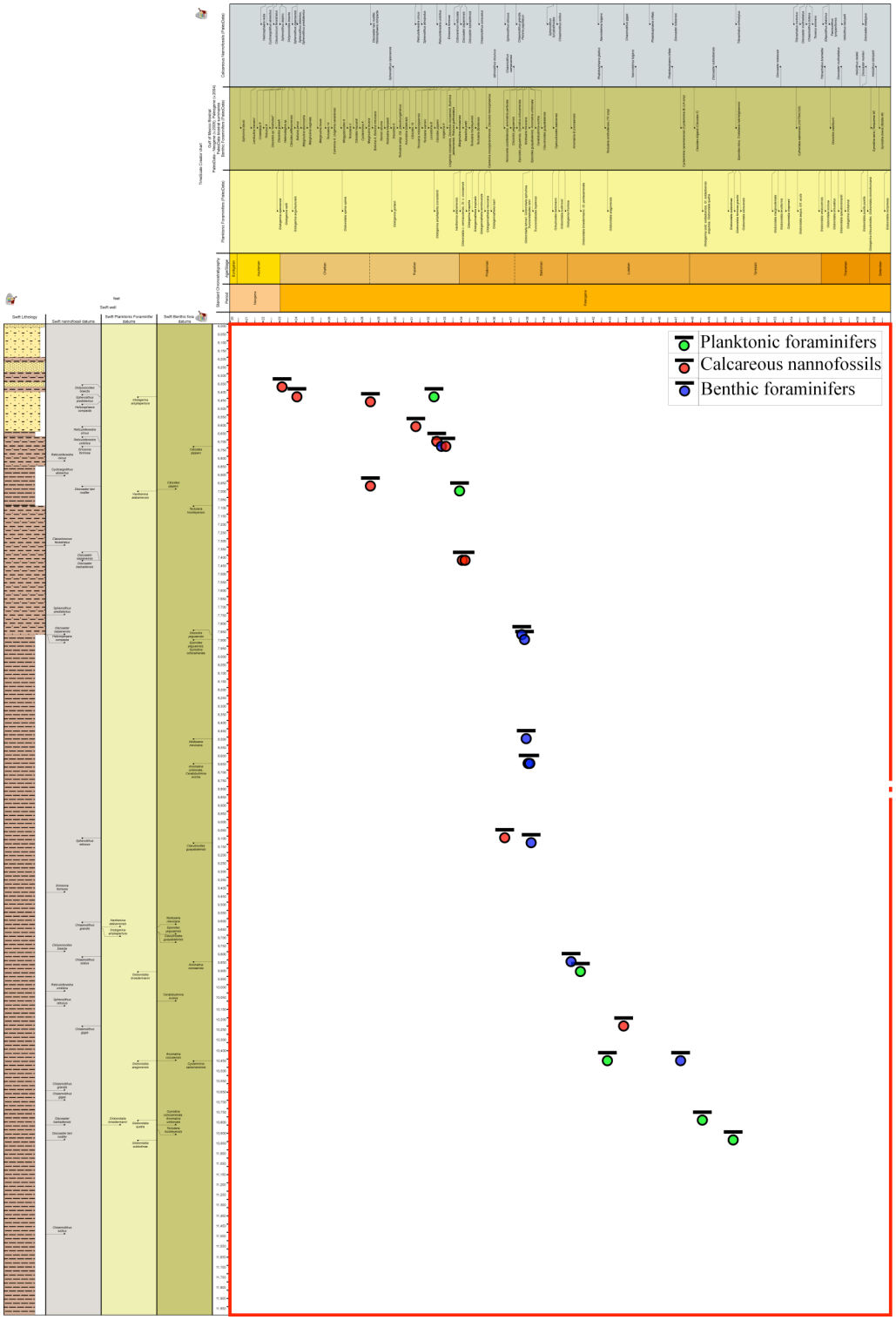
There are two ways: (1) the manual comparison of events on the depth and the age axes, and (2) an automated matching of items that have the same names in those two suites (either by selecting which columns in each to correlate, or a totally auto-match of all events found in any column). But, the automated routines function ONLY if the names in both the depth and the age sets are identical (although in later versions we will try to add synonym usage). We will summarize the manual comparison first, then the options for automated matching.



Correlating a nannofossil *Dictyococcites bisecta*

To fix the age coordinate of the event once the cross-hair is on it, press the shortcut 'X' to lock that age-crosshair. Similarly, the level of depth of the same event once the cross-hair is on it can be fixed by pressing the shortcut 'Y' to lock that cross-hair. Once this pair of age and the depth coordinates are fixed, a marker-point can be placed by double-clicking. and the point will automatically be on the intersection of the cross-hairs. *[A single-click on a previous marker-point will remove it.]*

In order to distinguish between different kinds of microfossils, different colors can be assigned to their markers. Also, to differentiate between FADs and LADs of different events, different symbols are given to the FADs and LADs. This is done by pull-down options in the Marker menu (lower-left of the cross-plot window).



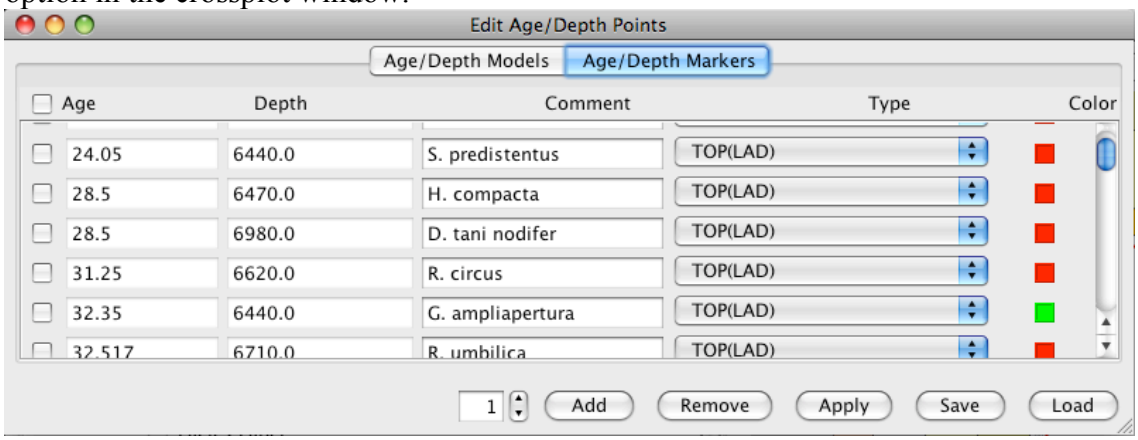
Crossplot with reference points for the Swift demo well

In the above figure, the calcareous nannofossils have been correlated with red circles, the benthic foraminifers with blue circles, planktonic foraminifers with green circles. LADs of events have a bar at the top of the circle. Similarly, FADs of events have a bar at the bottom of the circle.

The ability to distinguish between different events makes it convenient to choose "priority" points while choosing a depth-age model.

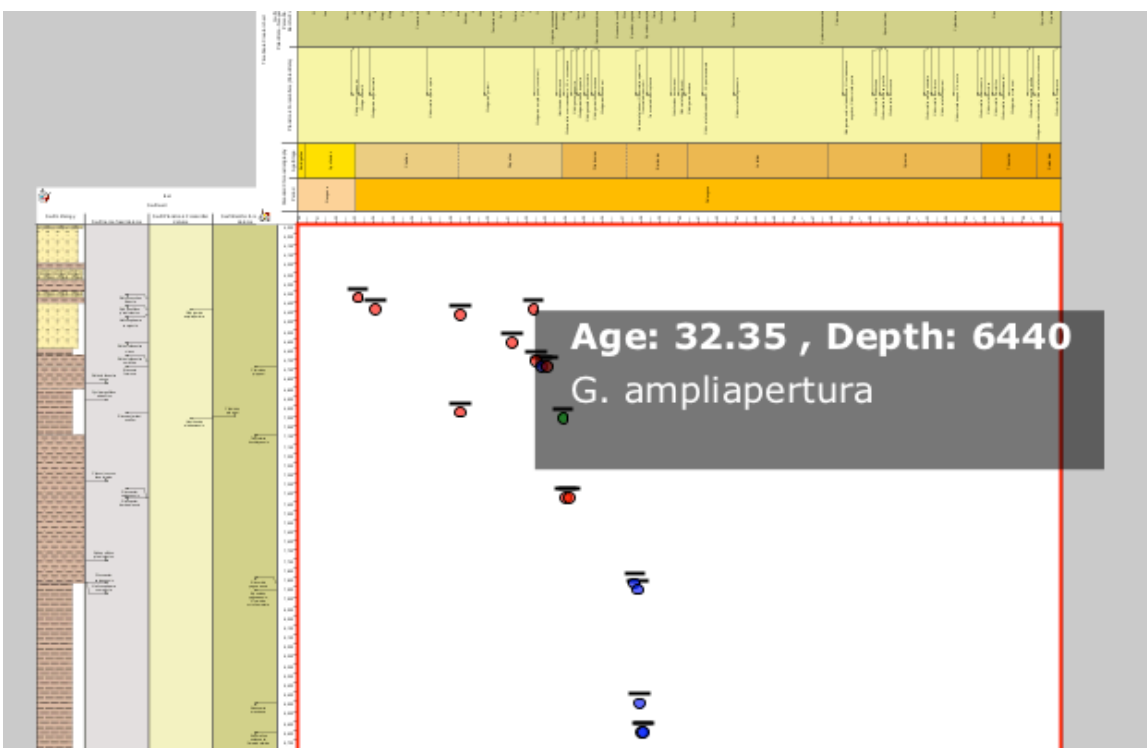
Editing points in the crossplot window:

The points chosen in the crossplot window can be edited by choosing the 'Edit Age/Depth points' option in the crossplot window.



Editing the points

- The age and depth **coordinates** for the chosen points can be changed or made more precise (e.g., type in an exact age for a nannofossil FAD).
- Points can be **added** or **removed** from the crossplot.
- A **comment** (such as the name of the fossil) can be attached to the chosen point, and this will appear in the popup as shown in Figure 13.
- A different **symbol** can be attached to the chosen point by specifying whether the chosen point is an FAD or an LAD or neither.
- Different **colored** symbols can be assigned to the chosen points – in Figure 12, clicking on the color in the edit window allows choosing a color from the color palette.
- ***NOTE: Upon making any changes, one must click "Apply", then move the mouse-pointer onto the Cross-plot display to see those changes.***

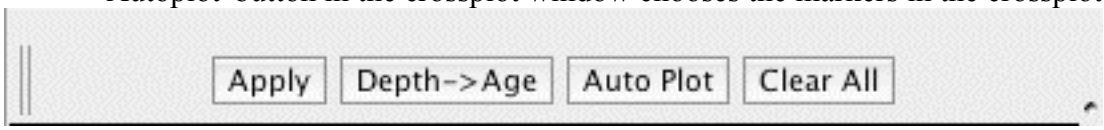


Popup associated with a point

SPECIAL: Automatch/autoplot features:

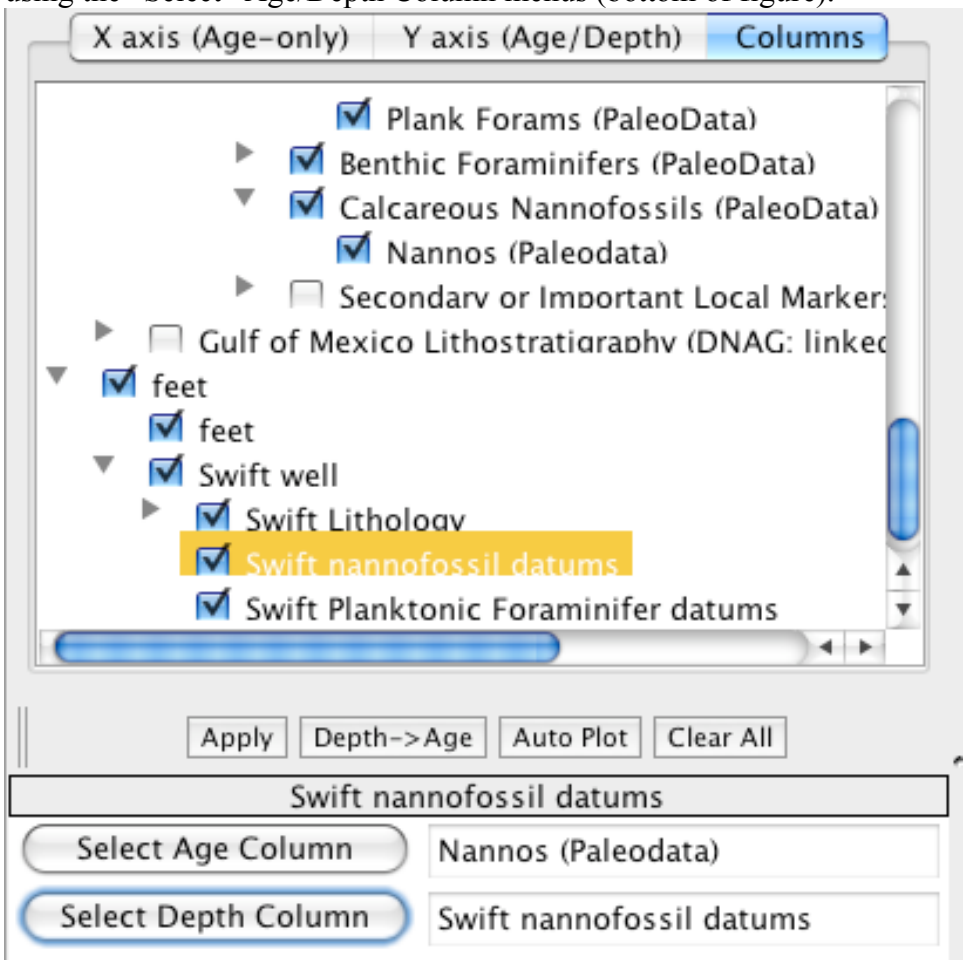
The marker points in the crossplot window can be also generated by using the Autoplot option instead of manually choosing the marker points. This matches similar names in the selected Depth and in the Age columns.

'Autoplot' button in the crossplot window chooses the markers in the crossplot window.



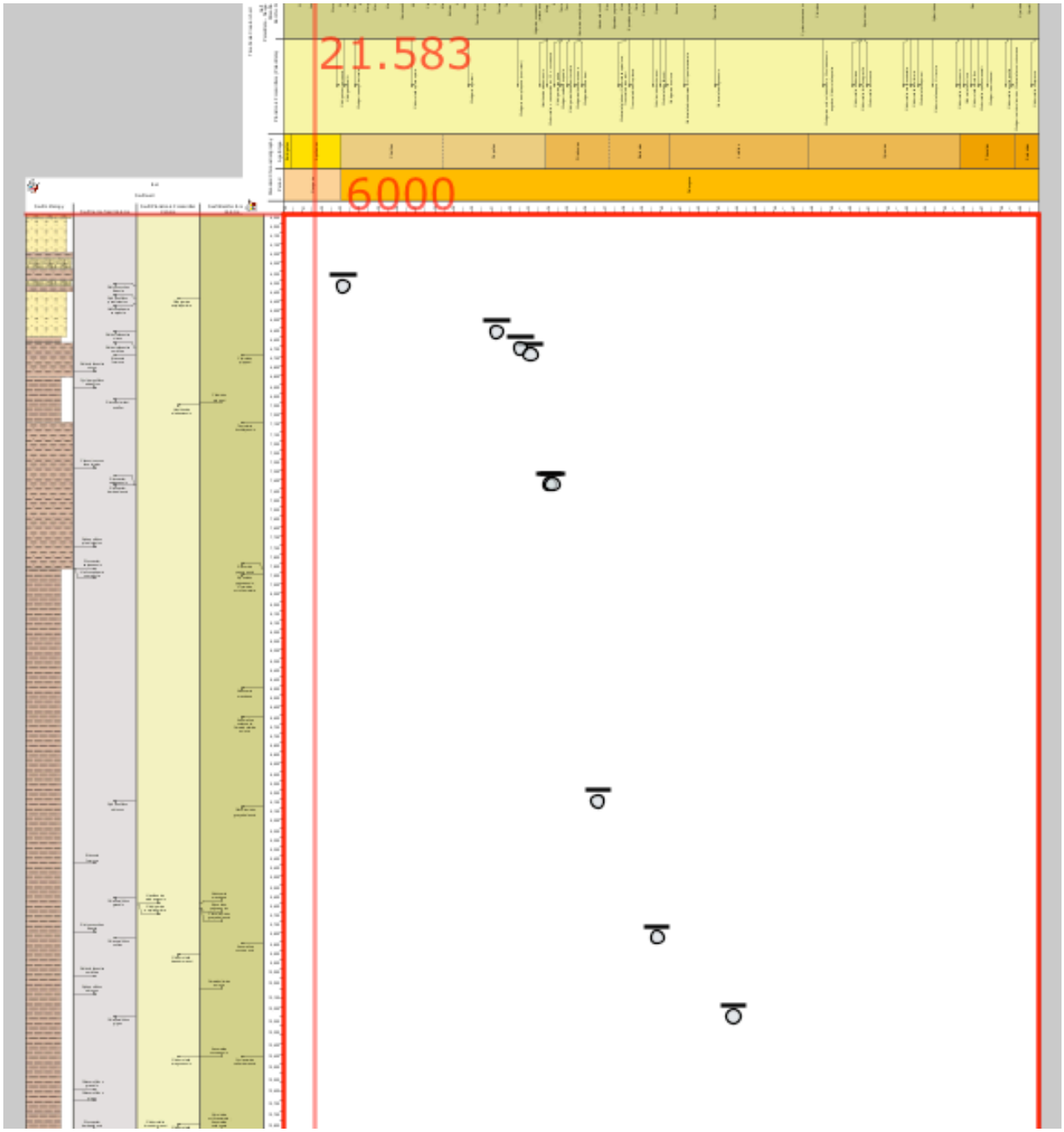
Autoplot button for crossplot

For autoplotting marker points, the columns that need to be crossplotted can be chosen using the "Select" Age/Depth Column menus (bottom of figure):



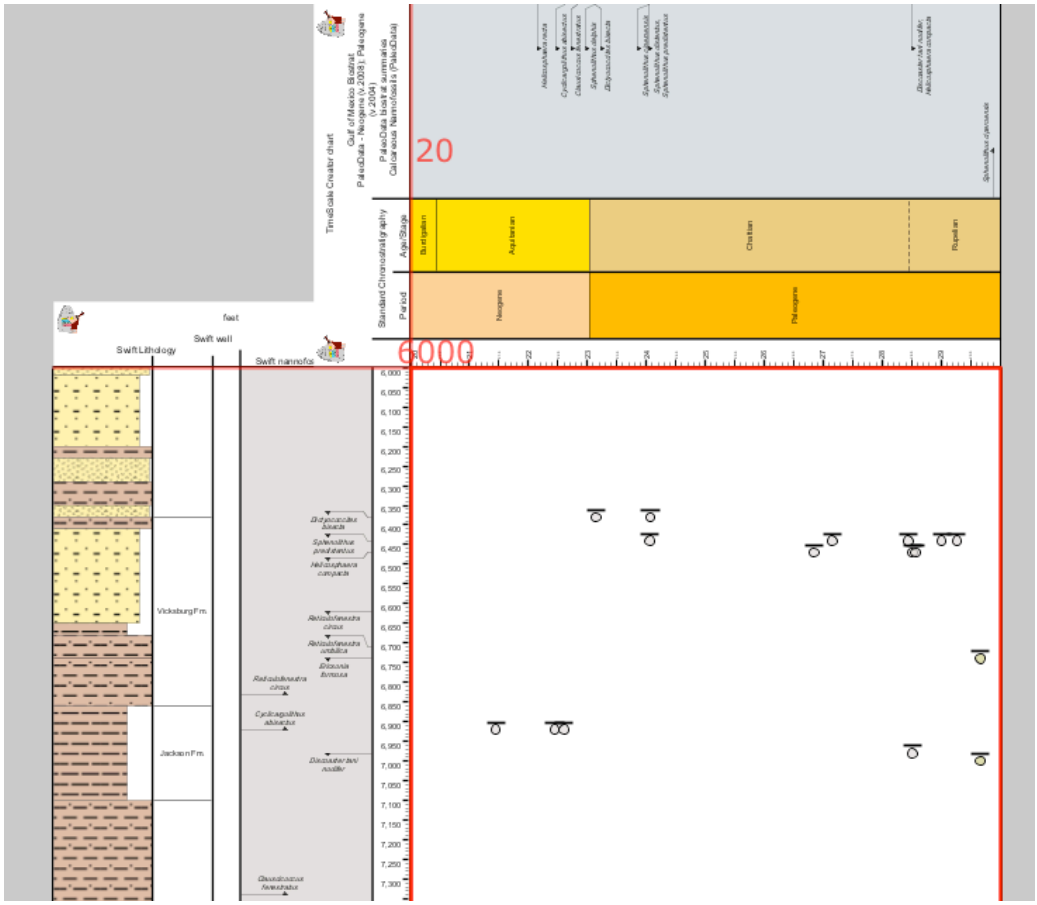
Selecting columns for autoplotting

After choosing the age and depth columns for crossplotting, the "Auto Plot" button generates matching marker points in the crossplot window.



Marker points for nannofossils (*Swift-well and PaleoData Nannos*) using autoplot

The autoplot option can be also used <u>without</u> choosing individual age and individual depth columns. If one clicks "AutoPlot" without choosing the age and depth columns, the autoplot feature plots all the points that match any within the entire suite of columns in the loaded and/or internal age-datapacks. For our Swift well, if we select "Autoplot" with this "use all" default, then these will be matched to PaleoData, Shell, global sets, BOEM, etc. – each of which had slightly different calibrations for some of these markers. Therefore, one gets an array for each of the taxa-matchs:



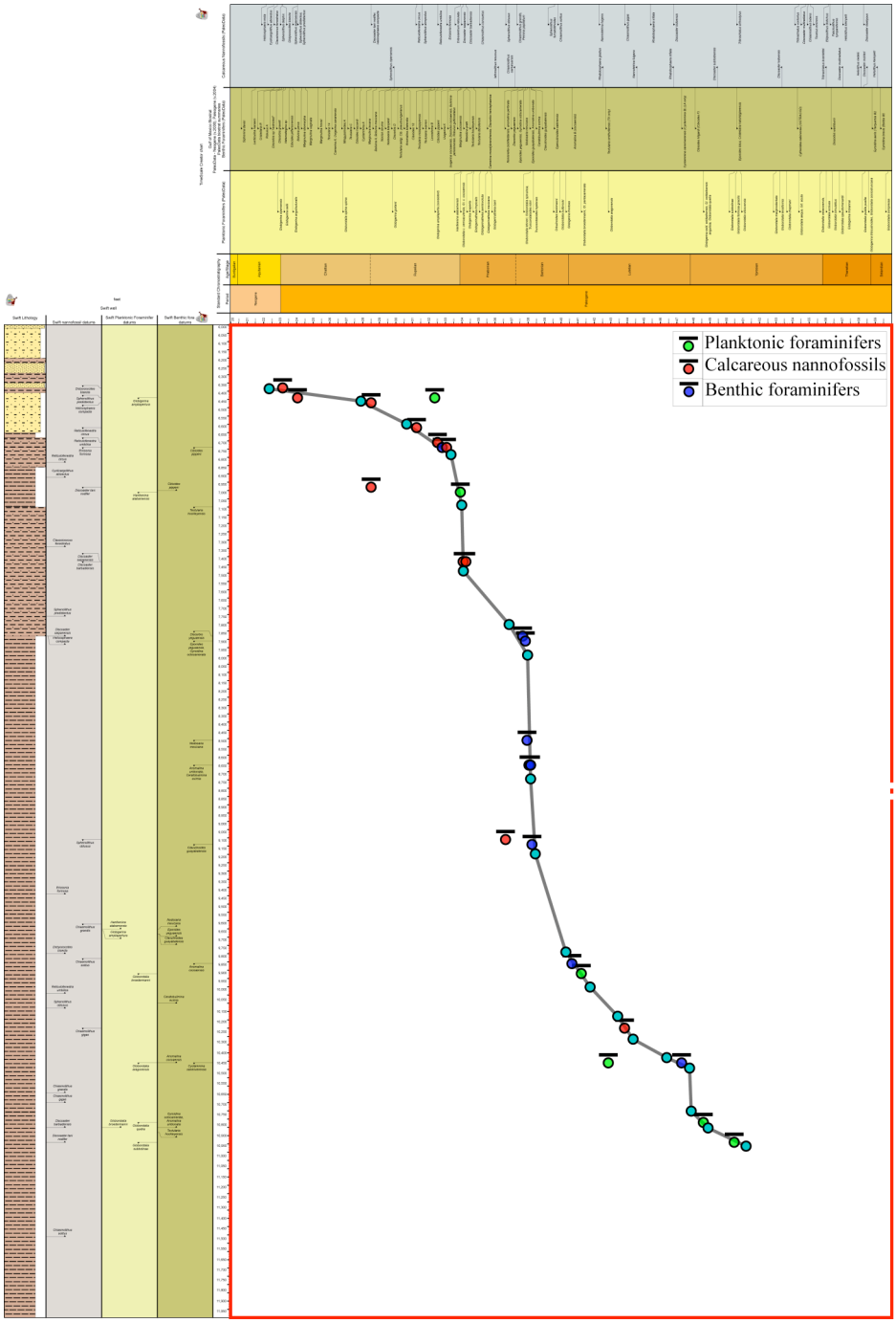
Autoplot without choosing the columns

<u>Step-7: Creating a depth-age model</u>

Now, we add control-points (with line segments) for a "Depth-Age Model":

→ Select depth-age model coordinates

A depth-to-age conversion model can be created either by joining the selected "model" markers or by using them as guidelines to select new points and joining them by a piecewise linear curve. Crossplot capability forces the slope of the depth-age curve to be positive – the geologic history is not allowed to be upside-down.



Choosing a depth-age conversion model

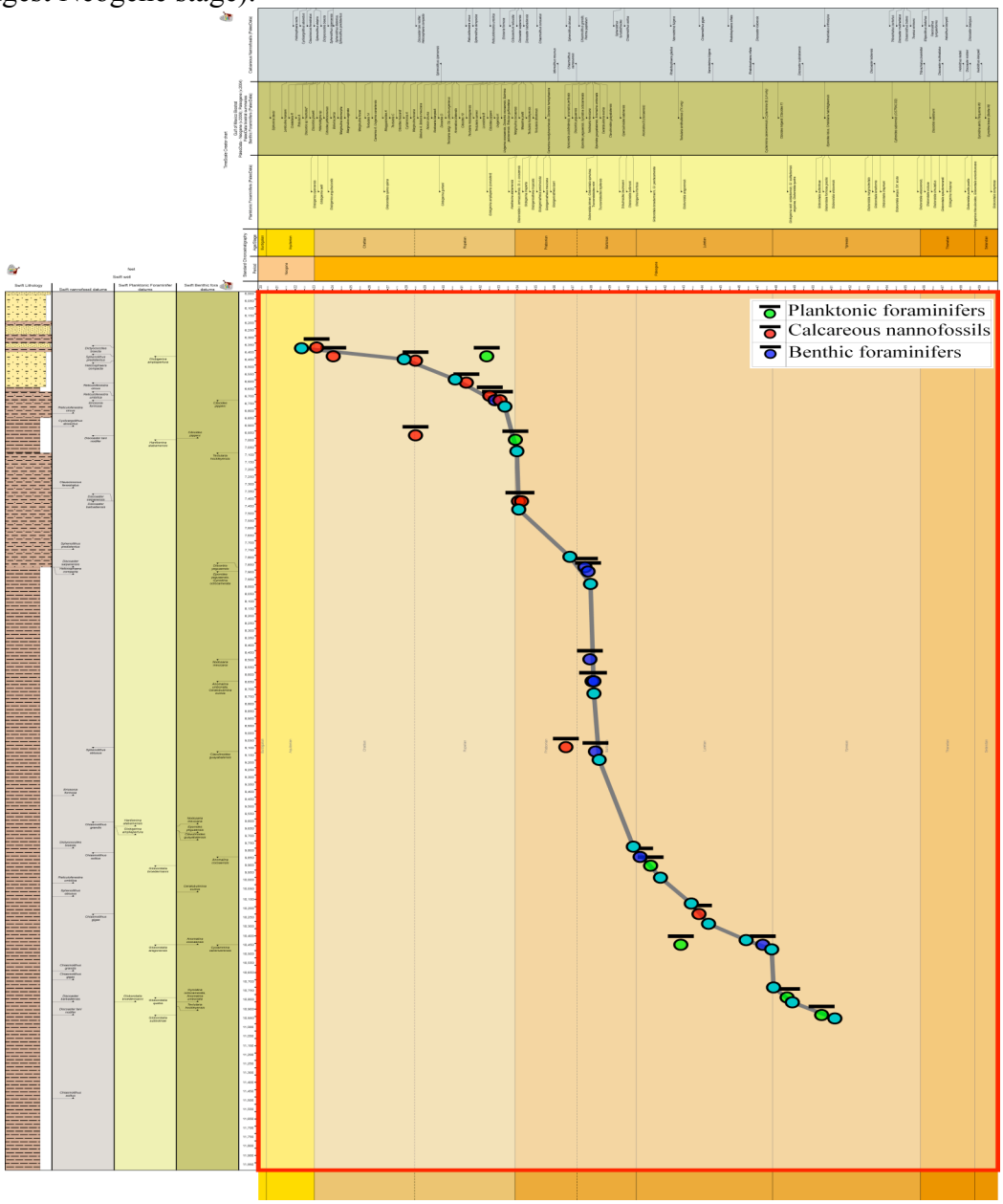
Double-clicking plots a new point, and single-clicking removes the point from the depth to age model.

To create a Hiatus (a time interval with no preserved rock record), one LOCKS the Depth-crosshair at the level where there is an unconformity; then double-clicks to add Age-points at the Beginning and Ending of that time-gap. Then, release that Depth-lock to enter Depth-Age controls at higher levels.

<u>Enabling the stage background:</u>

Clicking on *'Enable Stage Background'* adds the background colors for geologic stages according to their position on the X-axis reference Age columns. Figure 16 shows the depth-age conversion

model with the enabled stage background (shades of brown for Paleogene stages, and a yellow for the youngest Neogene stage).



Crossplot with stage background

<u>Loading and saving reference points and models:</u>

The points chosen in the crossplot window can be saved and later reloaded to the crossplot system. On clicking on the *'Edit Age/Depth points'* option in the crossplot window, *'Save'* option appears in the crossplot window.

This ability to re-load a previous Depth-Age model enables one to resume at a later time, or send to a colleague, or to modify one's earlier choices.

The Saved file format is a simple tab-delimited text-one (see next Figure) that can be also revised in Excel.

COMMENT	format version: 1.5				
COMMENT	date: Sun Mar 04 19:38:13 EST 2012				
COMMENT	AGE-DEPTH MODEL POINTS.				
CDTINFO	AGE	DEPTH	NOTE	COLOR	TYPE
MODEL	22.333	6385	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	27.883	6460	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	30.65	6598.3	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	33.333	6783.3	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	33.983	7088.3	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	34.083	7486.7	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	36.85	7810	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	37.967	7995	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	38.15	8743.3	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	38.433	9196.7	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	40.283	9790	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	41.75	10002	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	43.417	10178	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	44.35	10317	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	46.383	10428	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	47.767	10492	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	47.867	10752	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	48.883	10853	This is an "Age/Depth M	#00cccc	CIRCLE
MODEL	51.183	10963	This is an "Age/Depth M	#00cccc	CIRCLE

File of Saved Depth-Age model points

The contents for each column are described by the headers, which are part of the file. The first column "*CDTINFO*" indicates if the point is a control on the Depth-Age "Model" (as shown above) or a "Marker" display point. [In the above example, no fossil names were input as Note comments; therefore the default "This is an ..." comment was recorded.]

If the "Autoplot" option is used to choose the "marker" points, the name of the taxa being correlated becomes the default Note comments.

Conversion from depth to age:

Step 1: Create the conversion file

Clicking on the '*Depth-Age'* button in the crossplot window converts the Depth file to an Age file. The converted file is stored in the same folder as the depth "Swift" file, and automatically given a name based on that Depth file and the current date-time of creation. That Depth-Age conversion of the well data is also automatically loaded onto the TSCreator memory.

format version:	1.2	
date:	1/18/2012	
age units:	ma	
AgeConverterA	ageconvert-interpolate	
	6385	22.333
	6460	27.883
	6598.333	30.65
	6783.333	33.333
	7088.333	33.983
	7486.667	34.083
	7810	36.85
	7995	37.967
	8743.333	38.15
	9196.667	38.433
	9790	40.283
	10001.667	41.75
	10178.333	43.417
	10316.667	44.35
	10428.333	46.383
	10491.667	47.767
	10751.667	47.867
	10853.333	48.883
	10963.333	51.183

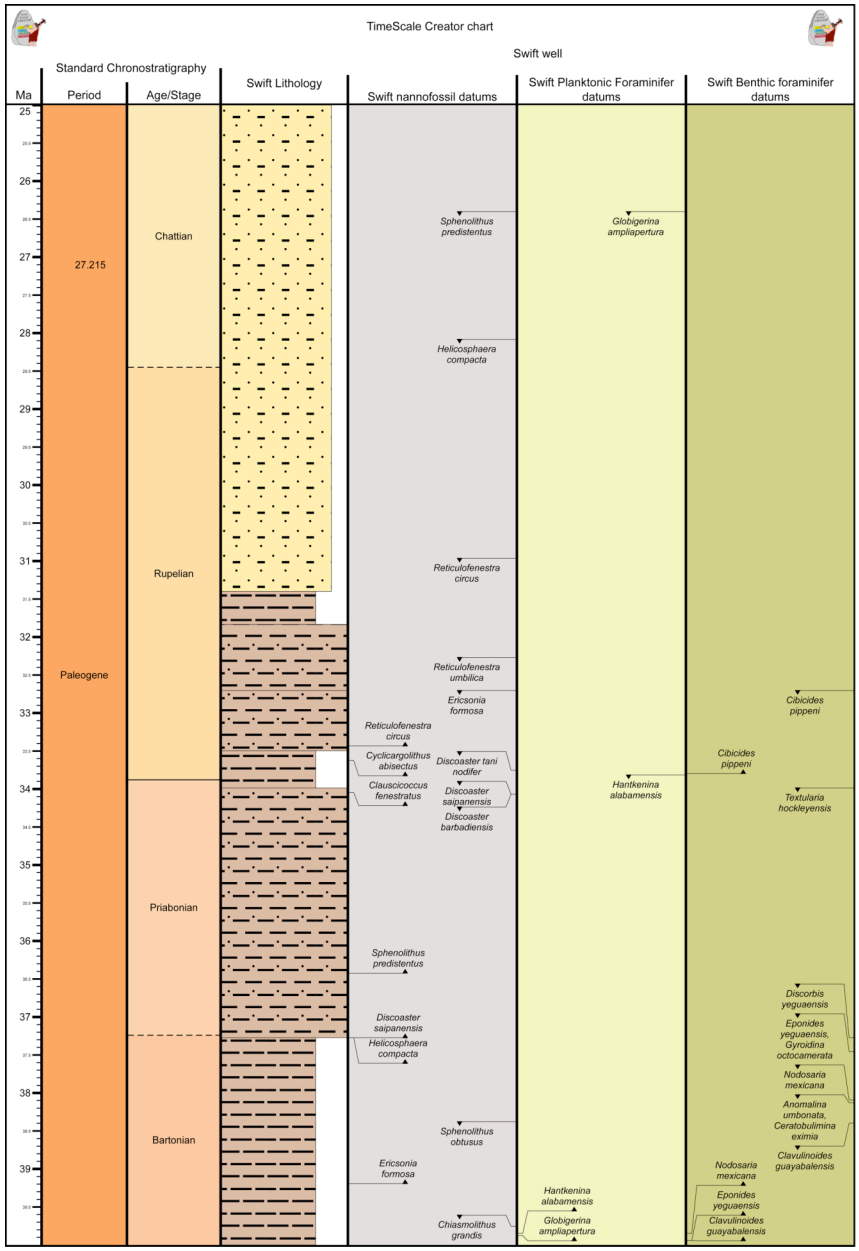
Depth-age conversion file that is generated

<u>Step 2: Visual display of the converted file</u>

The depth-to-age file is automatically loaded onto the main user interface.

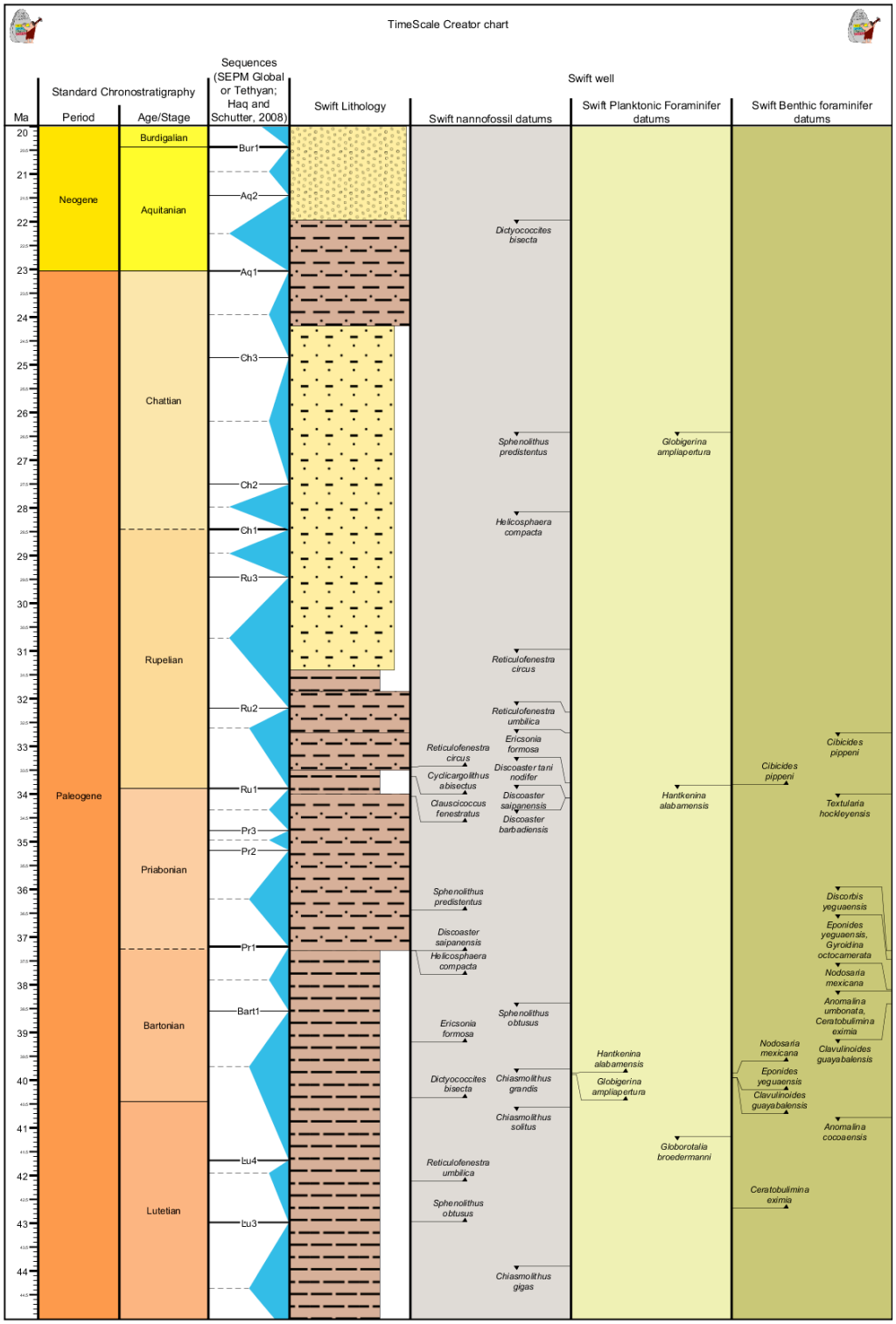
[NOTE: If one decides to apply a different depth-age model, then this suite is replaced with the new one; although the saved-output will be retained with its unique name-date-time stamp, in case one wishes to recover (or compare) earlier models.]

Return to the main TS-Creator window. In the '*Settings'* options for the "Ma" suite, under the 'Columns' tab, you will see that the depth-to-age converted file has appeared at the bottom of the column-menu. Click *Generate* to see the results against reference timescale columns.



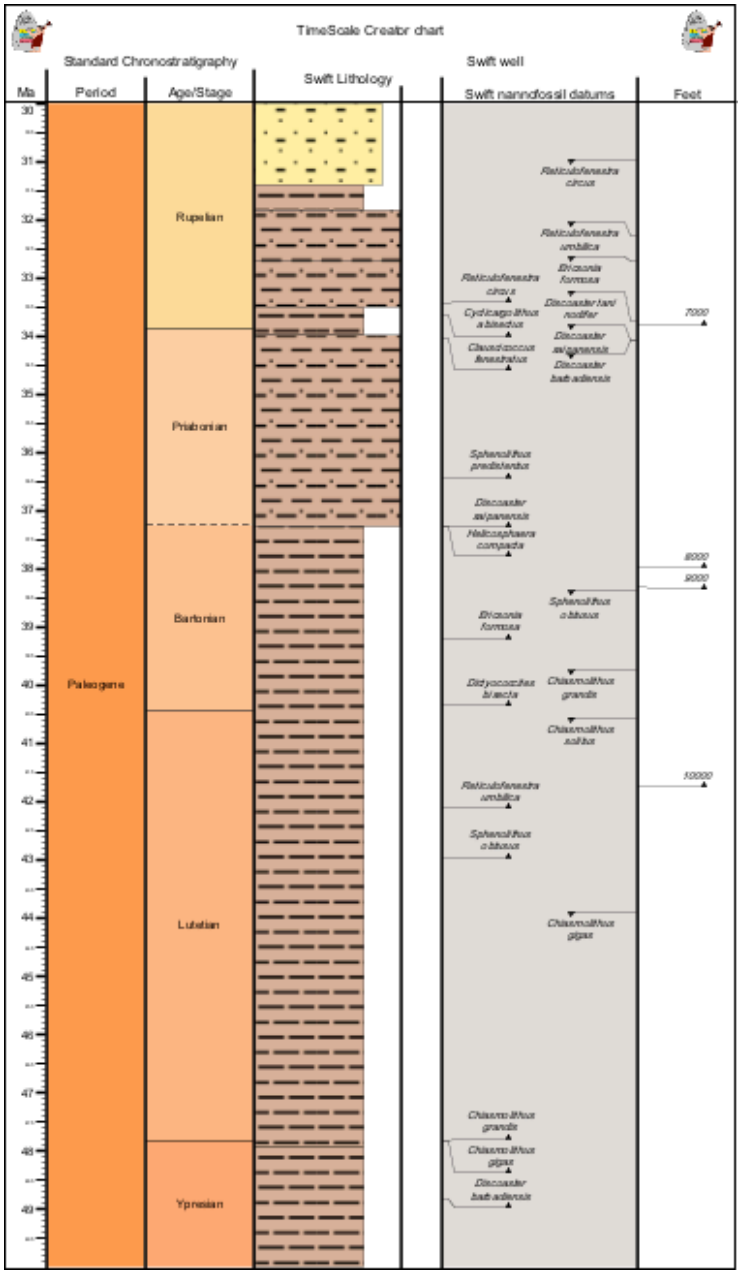
Depth-to-age converted demo well

The Swift well, as converted from depth to age, can be compared with any other stratigraphic data. For example, select the age models for global sea-level sequences to understand the link between facies trends and sea-level variations (next figure):



Comparison with global sequences of sea-level change

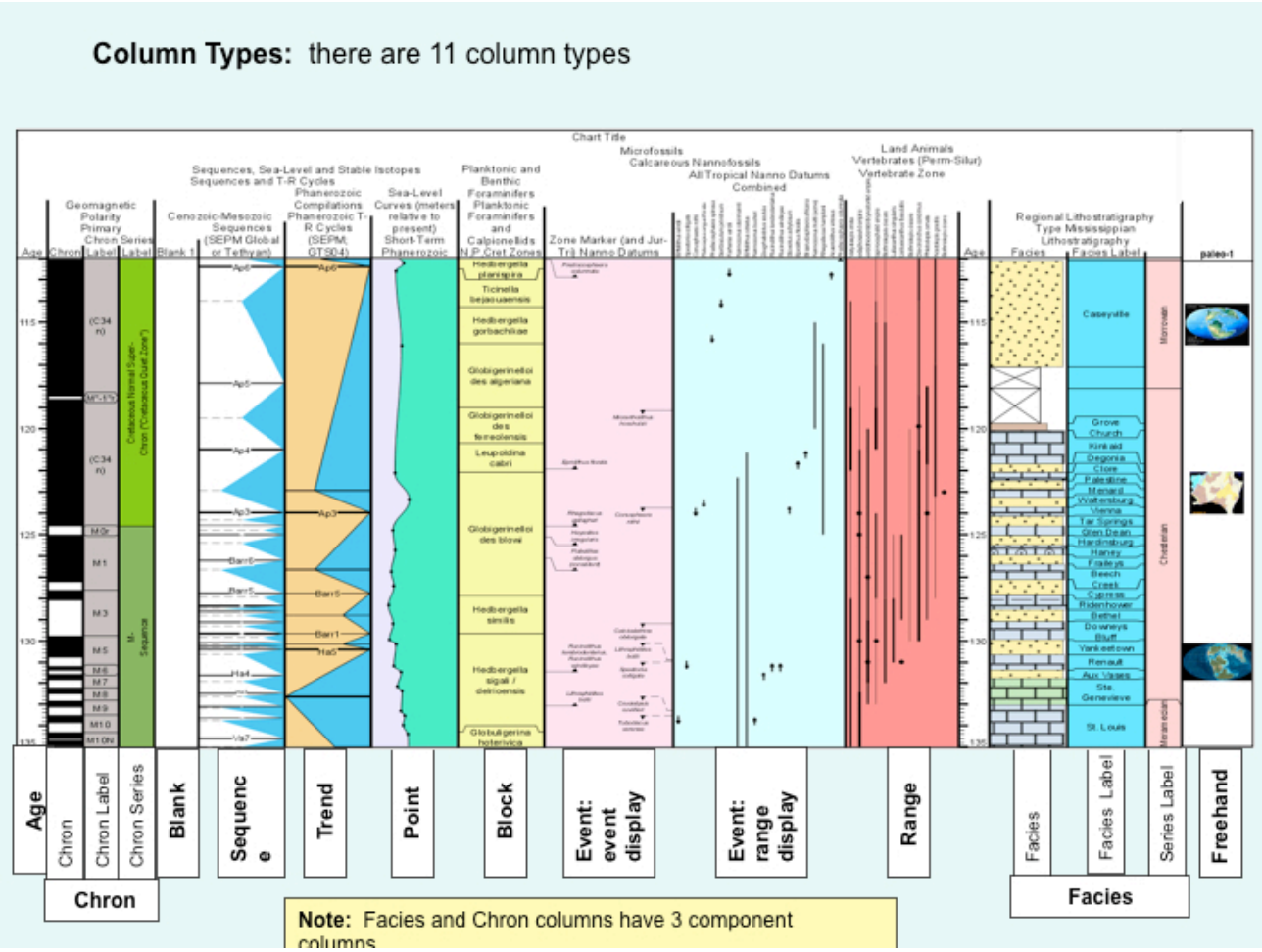
To see the variation of sediment-accumulation with time, an feet-scale column can be added to the depth file or to the depth-to-age converted file (using “event” style format – with “FAD” event named “1000” put at a depth of 1000, etc., at a regular spacing). Depth-labels that are close together after conversion-to-age extrapolation indicate Rapid pulses of accumulation, such as the ones below in late Burdigalian:



Depth-to-age converted file with depth scale added

Making Datapacks for TimeScale Creator

NOTE: The "picture" portions are from the "PowerPoint/Flash" manual compiled at ExxonMobil for TSCreator version 4.0 (2008). The "NOTE" after each picture indicates additional features that have been added, enhanced or revised.

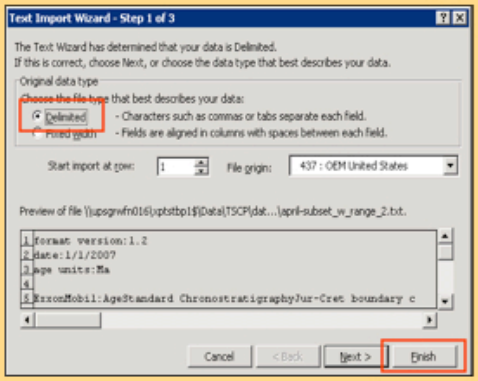


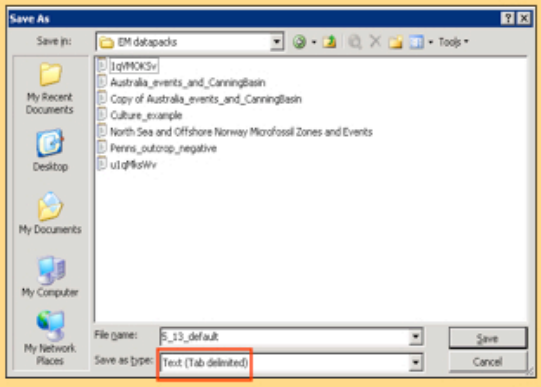
NOTE: We have also added "***transect***", plus enhanced "range" to include ***branching*** (evolution)

Datapack Format

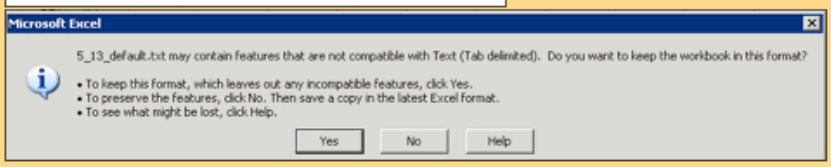
The TS Creator Pro data file, called a datapack, is structured as a **tab-delimited text file**. The tabs are used to separate cells, each cell containing some data. This structure means that the data files can be opened directly in a spreadsheet program like **Excel**. In Excel the cells will be neatly aligned, and it is the preferred method of editing data outside of TS Creator Pro.

- When entering Excel, select 'Delimited' for original data type (then click 'Finish').
- When exiting Excel, save the file as a tab-delimited text file.





If this warning appears while saving, select Yes.



NOTE: A less time-consuming method (and safer to avoid accidentally saving the entire Excel file as a .txt version that loses all equations, etc.) is to sweep/copy the "output-formatted" page in the Excel workbook, then paste directly into an empty TextEdit document or similar "dumb" text-editing window. It seems that the default copy-paste from Excel into these "dumb" text-editors is as a tab-delimited format.

Master header for ANY datapack *(uppermost lines; followed by a blank line)*:

format version: 1.4
date: 15/08/2012
default chronostrat: UNESCO
age units: m
interval column: Lithostrat formations in Demo (m)
chart title: Egypt regional stratigraphy

NOTE: "format version:" and "date:" are **required**.
"*default chronostrat*:" is a flag to use Color-tables for named geologic units (epoch, stage, etc.) according to official "*UNESCO*" (Comm. Geol. Map of World) or the "*USGS*" standards.
"*age units*:" has "Ma" as default. If another type is used and loaded as "*Add Datapack*", then TSCreator will assume it is potentially for **cross-plots** (see Crossplot manual below). If another "age unit:" type is loaded as "*Replace with Datapack*", then those units are used.
"*interval column*:" can be used to designate which block-style column should be used for the pull-down menu to select "age" intervals. The default is the column labeled "Age/Stage" (as in internal datapack)
"*chart title*:" can set a different default-title. The Internal datapack has "*TimeScale Creator chart*" as the default.

IMPORTANT: A **colon** (**:**) is REQUIRED after each item (and a Tab after the colon; but NOT before)

BASIC COLUMN HEADER:

Datapack: File Header Definition

Every column type begins with a one-line **header row**, followed by the data rows. (Some columns have additional, optional headers, ex. Series) One or more blank lines signals the end of a column.

Header Row:

<TITLE>	<type>	<width>	<color>	notitle	on or off	<popup>

Cell definitions:

- **<TITLE>** is the name of the column
- **<type>** is the column type
- **<width>** is the width of the column in SVG units.
- **<color>** is the background color of the column, specified in RGB values
- '**notitle**' will turn the title off when the column is displayed. Default is normally a blank cell (meaning title will be on).
- **'on' or 'off'** turns on or off the default display of the column (puts checkmarks in Settings/Choose Zonations list of columns)
- **<popup>** is the text that will appear in **MouseOver info**. MouseOver is activated in the 'Choose Time Interval' tab of Settings.

Note: In the following slides with column descriptions, 'notitle', 'on or off' and <popup> cells will be omitted for simplicity, although they exist on every column's header row.

GROUPING COLUMNS:

Group Column: creates column suites

Columns can be grouped together by column suites under one heading using a **grouping column**.

Format:

<Title>	:	<sub-column1>	<sub-column2>	< sub-column3>	...more sub-columns

Required fields:

- A **Title** (Example: Standard Chronostratigraphy)
- A **colon** in cell two
- Cells after the colon contain **sub-column** names (**at least one is required**) (Example: Italian marine stage)

Datapack:

Quaternary Regional Stages	:	sub-column1: Italian marine stage	sub-column2: Italian marine substage
Italian marine stage	block	100	211/217/206
	TOP	0.018	
	Tarantian	0.126	solid
	Ionian	0.96	solid
	Calabrian	1.81	solid
	Gelasian	2.588	solid
Italian marine substage	block	80	211/217/206
	TOP	0.09	
	Tyrrhenian	0.126	solid
	TOP	0.96	
	Sicilian	1.24	solid
	Emilian	1.5	solid
	Santernian	1.81	solid

Inside TS Creator Pro Settings:

- ☑ Quaternary (high-resolution)
  - ☑ Quaternary Regional Stages
    - ☑ Italian marine stage
    - ☑ Italian marine substage

EXAMPLE of Column-Groupings and Column-Headers:

Planetary Time Scale **:** Moon Mars Venus Mercury _TITLE_OFF
[*POP-UP AFTER 2 TABS:* Tanaka, K.L. and Hartman, W.K. (2008)]

Moon **:** Period (Lunar) Epoch (Lunar) Events (Lunar) _METACOLUMN_OFF

Period (Lunar) **block** 100 232/163/193 notitle on by Tanaka, K.L. and Hartman
TOP 0
Copernican 1725 dashed Fresh bright Copernicus crater ejecta 192/123/153
Eratosthenian 3200 dashed Dark ejecta of Eratosthenes crater. 192/86/136

Epoch (Lunar) **block** 100 232/163/193 notitle by Tanaka and Hartman
TOP 3200 dashed Dark ejecta of Eratosthenes crater. 204/204/204
Late Imbrian 3750 Mare basalts post-dating Orientale basin. 145/120/158
Early Imbrian 3800 Imbrum basin. 113/100/168
…

Events (Lunar) **event** 232/163/193 notitle by Tanaka, K.L. and Hartman.
EVENT
crater Tycho formed by meteorite impact 100 dashed
crater Copernicus formed by meteorite impact 800 dashed
preservation of bright-rayed craters 1000 dashed
…

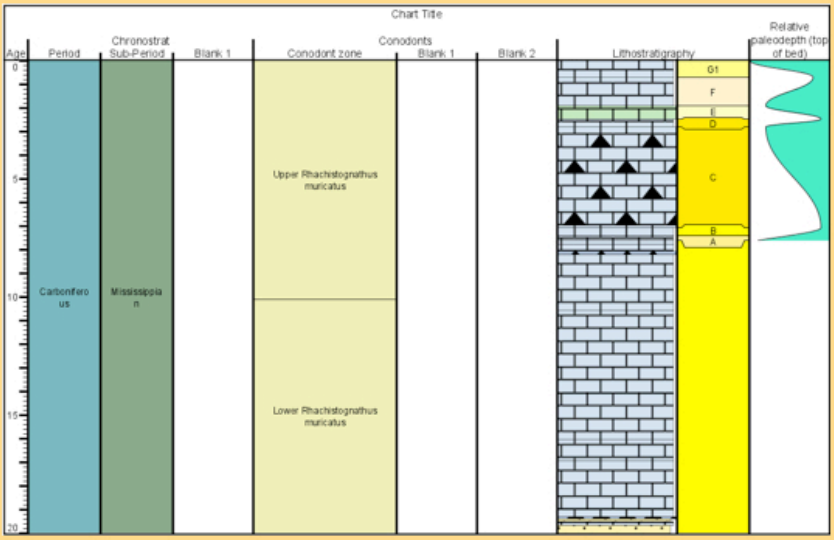
NOTE: "**_METACOLUMN_OFF**" sets default to NOT display this group unless turned on.

"**_TITLE_OFF**" will not display this Column-grouping title above its component columns/sub-groupings.

Special "Blank" type

Blank Column: leaves space which can be filled in with custom drafting

The Blank Column can be inserted multiple times, in any location.



Format:

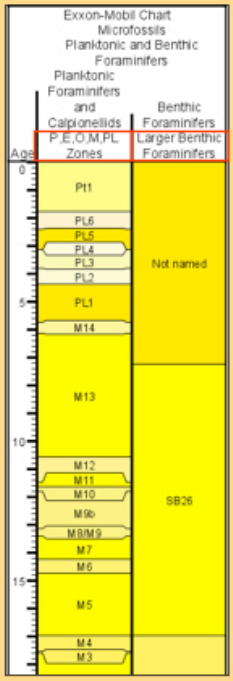
<Title>	**blank**	<width>

Required fields:
- A **Title**
- the word '**blank**' in the second cell
- width is optional

Note: blank columns can be added in Settings and in the Editor, but cannot be saved to the datapack. They can be saved to a settings file which will recreate them upon loading. The only way to add a blank column to a datapack is to manually insert this format line.

Block (zone), Event and other main types

Block Column: displays data over an interval



Block columns display data in blocks over an interval. The top of the interval is the base of the previous interval. The top of the topmost interval begins with the name TOP followed by an age value.

P,E,O,M,PL Zones	block	50	247/249/153
	TOP	0	
	Pt1	1.77	solid
	PL6	2.39	solid
	PL5	3.13	solid
	PL4	3.14	solid
	PL3	3.81	solid
	PL2	4.37	solid
	PL1	5.72	solid
	M14	6.14	solid
	M13	10.57	solid
	M12	11.47	solid
	M11	11.63	solid

Larger Benthic Foraminifers	:	Larger Benthic Foram Zone	Larger Benthic Foram M
Larger Benthic Foram Zone	block	100	204/204/92
	TOP	0	
	Not named	7.25	solid
	SB26	16.97	solid
	SB25	20.43	solid
	SB24	23.03	solid
	SB23	26.83	solid
	SB22b	28.45	solid
	SB22a	30.42	solid
	SB21	33.88	solid
	SB20	35.04	solid
	SB19	37.24	solid
	SB18	37.99	solid

Block Column Format:

Header row:

<Title>	**block**	<width>

Required fields:

- a **Title** (Example: Italian marine stage)
- the word '**block**'

Data rows:

<blank>	**<label>**	**<age>**	<linestyle>

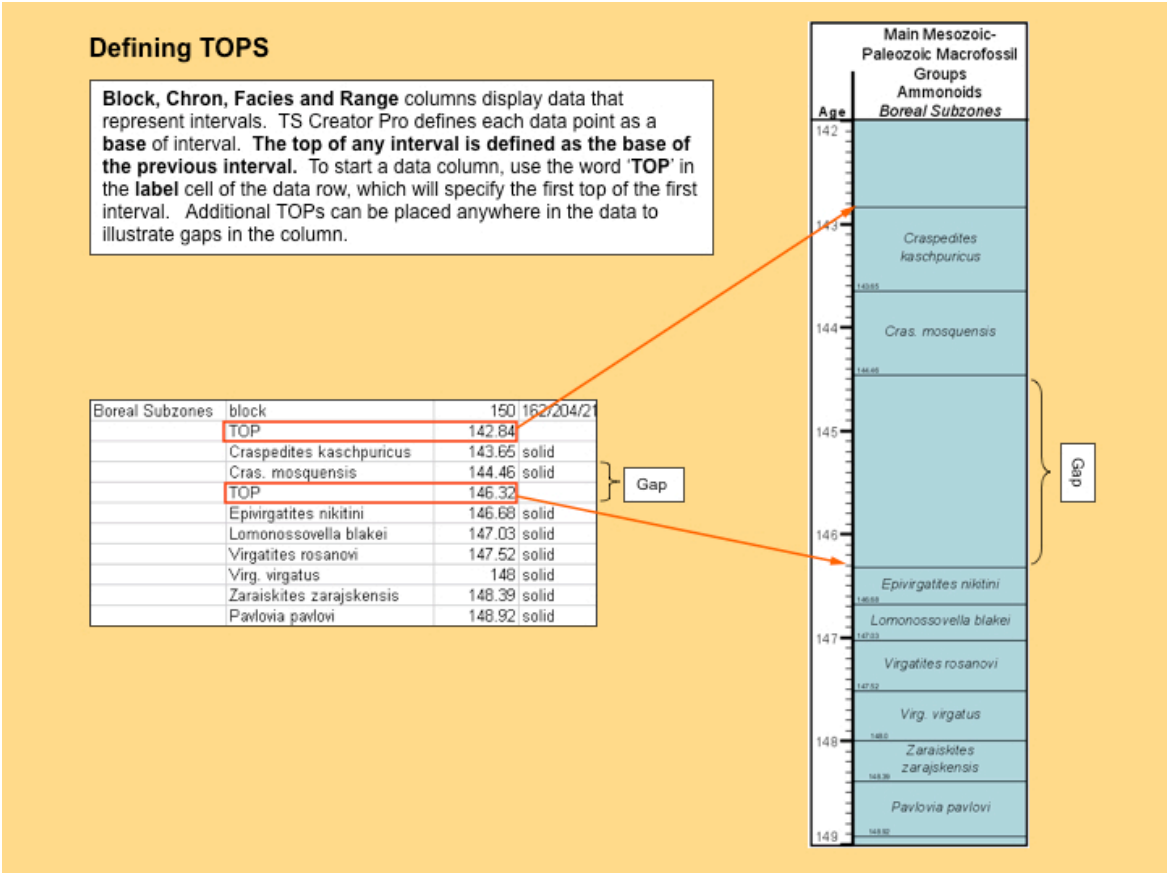
Required fields:

- a **blank** first cell
- the name **label** (Example: Ionian)
- the **age**.
- Linestyle can be solid, dashed or dotted. (optional)

The first data row in a block column should specify the TOP of the first block.

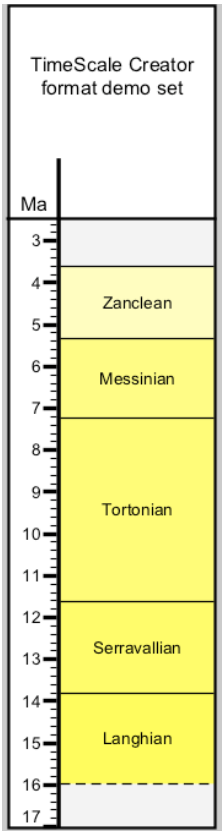
Datapack:

Italian marine stage	block	100	211/217/206	← Header row
	TOP	0.018		Data rows
	Tarantian	0.126	solid	
	Ionian	0.96	solid	
	Calabrian	1.81	solid	
	Gelasian	2.588	solid	



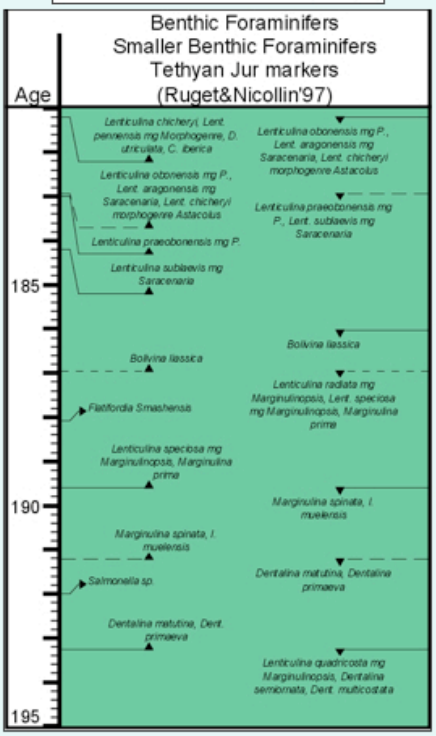
Example (showing tabs between entries) and Output:

```
Mid-Lt Miocene Stages → block→110 → 240/240/240→notitle → on¶
  → TOP → 3.6 → → Zanclean/Piacenzian boundary¶
  → Zanclean → 5.333→ → Base Pliocene → 255/255/179¶
  → Messinian → 7.246→ → Chron C3Br.1r → 255/255/115¶
  → Tortonian → 11.608 → → → 255/255/102¶
  → Serravallian → 13.82→ → Mi-3b cooling. → 255/255/89¶
  → Langhian → 15.97→dashed → Chron C5Br→255/255/77¶
```



Event Column: shows first appearance date (FAD), last appearance date (LAD), or an event

Event column with Event Display



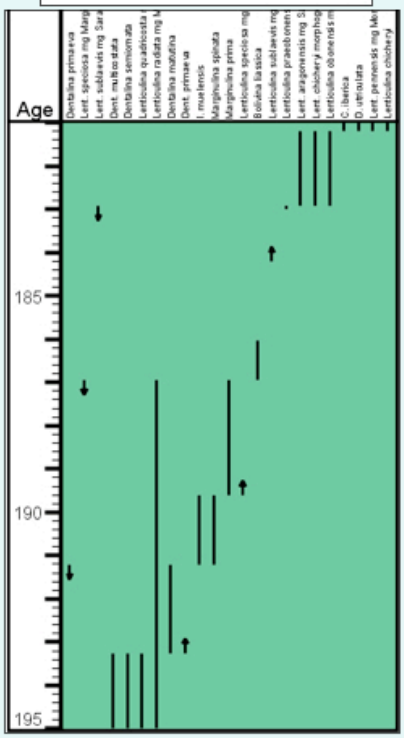
Up arrows show FAD.

Down arrows show LAD.

Side arrows show an EVENT.

Vertical bars (in Range display) show extent of one fossil from FAD to LAD.

Event column with Range Display

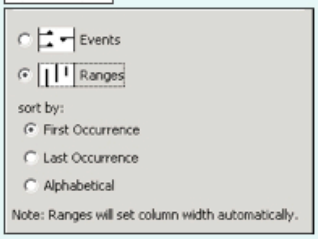


Event Column Display Types:

Inside TS Creator Pro Settings there are two display types for an Event column: **Event display** or **Range display**. (these display types cannot be set inside the datapack)

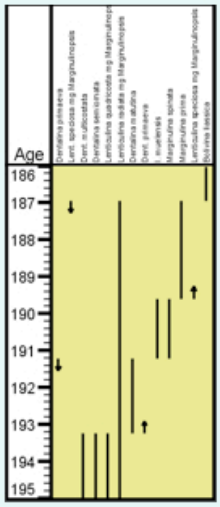
For Range display, you can sort by First or Last Occurrence or Alphabetical display.

Settings:

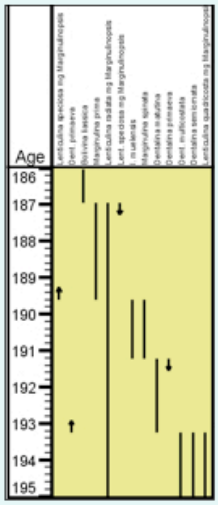


Range display sort options:

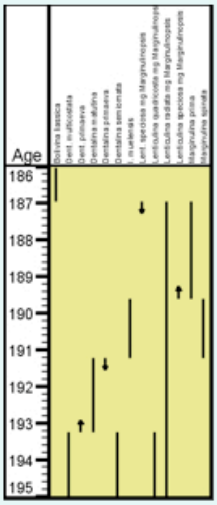
First Occurrence



Last Occurrence



Alphabetical

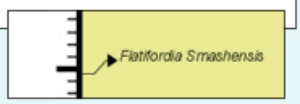


Range displays only: will connect a line between FAD and LAD of same name. Cannot vary line type – use Range column for more detailed display.

Range displays only: do not show EVENT Type data.

Event displays only: can show solid, dashed or dotted line type.

Event displays only: show EVENT Type data: a single event with arrow pointing to the side.

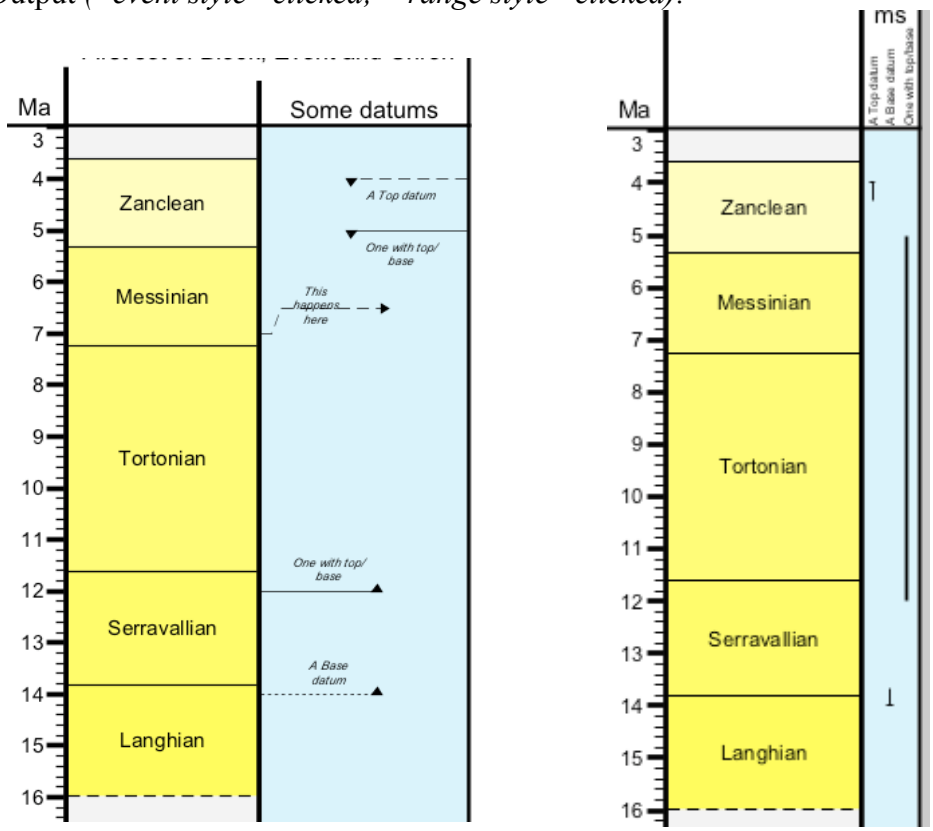


Example dataset for Event column:

```
Some datums → event → 120 → 210/240/250 → → on
FAD
  → A Base datum → 14 → dotted
  → One with top/base → 12 → → For a Range
LAD
  → A Top datum → 4 → dashed
  → One with top/base → 5 → → Top of range
EVENT
  → This happens here → 7 → dashed → An event

```

Output *("event style" clicked; "range style" clicked):*



Special Event Column: Standard Chronostratigraphy - GSSP Column

GSSP stands for Global Stratotype Section and Points and marks type section for Chronostratigraphic Stages. The base of each unit of the geologic time scale is defined at these specific locations and points (described in the popup text).

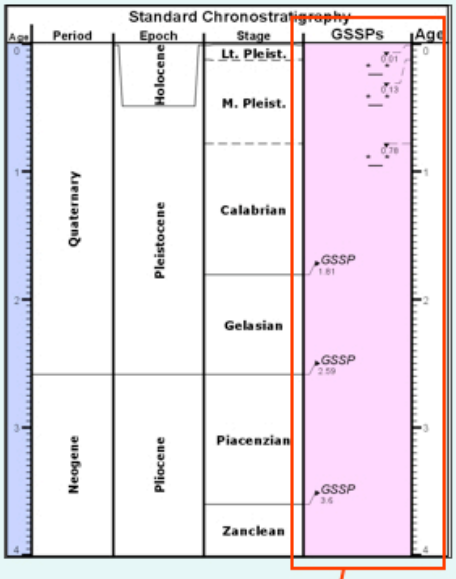
There are two event **types** in the GSSPs column:

- ***Ratified*** events (type: **EVENT**)
- Events that ***have not been Ratified*** (type: **LAD**) Note that the popup uses the word 'Potential..' to describe non-ratified events.

Datapack:

GSSPs	event	80	USGS		off	The base of each unit
LAD						
	—	0.0117	dashed	Potential	Holocene GSSP may coincide with	
	—	0.126	dashed	Potential	Upper Pleistocene subseries GSS	
	—	0.781	dashed	Potential	Middle Pleistocene subseries GSS	
	—	15.97	dashed	Potential	Langhian GSSP may coincide with	
	—	20.43	dashed	Potential	Burdigalian GSSP may coincide w	
	—	28.4	dashed	Potential	Chattian GSSP may coincide with	
	—	37.2	dashed	Potential	Priabonian GSSP may coincide wi	
	—	40.4	dashed	Potential	Bartonian GSSP may coincide wit	
	—	48.6	dashed	Potential	Lutetian GSSP may coincide with	
	—	58.7	dashed	Potential	Thanetian GSSP may coincide wit	

EVENT				
	GSSP	1.806	solid	The base of the Calabrian Stage of Pleistocene Series [
	GSSP	2.588	solid	The base of the Gelasian Stage, base of the Quaternary
	GSSP	3.6	solid	The base of the Piacenzian Stage [click <a href="http:/
	GSSP	5.333	solid	The base of the Pliocene Series and the Zanclean Stage
	GSSP	7.248	solid	The base of the Messinian stage [click <a href="http://w
	GSSP	11.608	solid	The base of the Tortonian Stage [click <a href="http://w
	GSSP	13.82	solid	Serravallian GSSP (submitted Fall 2006) coincides with
	GSSP	23.03	solid	The base of the Neogene System, Miocene Series and
	GSSP	33.9	solid	The base of the Oligocene Series and Rupelian Stage [c
	GSSP	55.8	solid	The base of the Eocene Series and Ypresian Stage [clic
	GSSP	65.5	solid	The base of the Cenozoic Era, Paleogene System, Pale
	GSSP	70.6	solid	The base of the Maastrichtian Stage [click <a href="htt



Ratified events are labelled **GSSP** and display on the left side of the column.

Not yet ratified events are marked with ***---*** and display on the right side of the column.

How to Display Multiple Items Per Age Date

In Block and Event columns, when two or more data items occur at the same time, they can be written in the same Excel cell separated by ' – ' (a dash), a **comma** or any separator.
Chart display will show the line exactly as written in the datapack.

B. bulloides	28.45	solid
Nummulites retiatus, Discocyclina spp., Orbitoclypeus spp., Asterocyclina spp.	33.88	solid
R. efunicus, R. vanderoeghentti, S. granulosus, H. reticulata, A. alpina, A. gomezi	33.88	solid

Nummulites retiatus, Discocyclina spp., Orbitoclypeus spp., Asterocyclina spp.

B. bulloides	28.45	solid
Nummulites retiatus - Discocyclina spp. - Orbitoclypeus spp. - Asterocyclina spp.	33.88	solid
Nummulites fabianii	35.04	solid

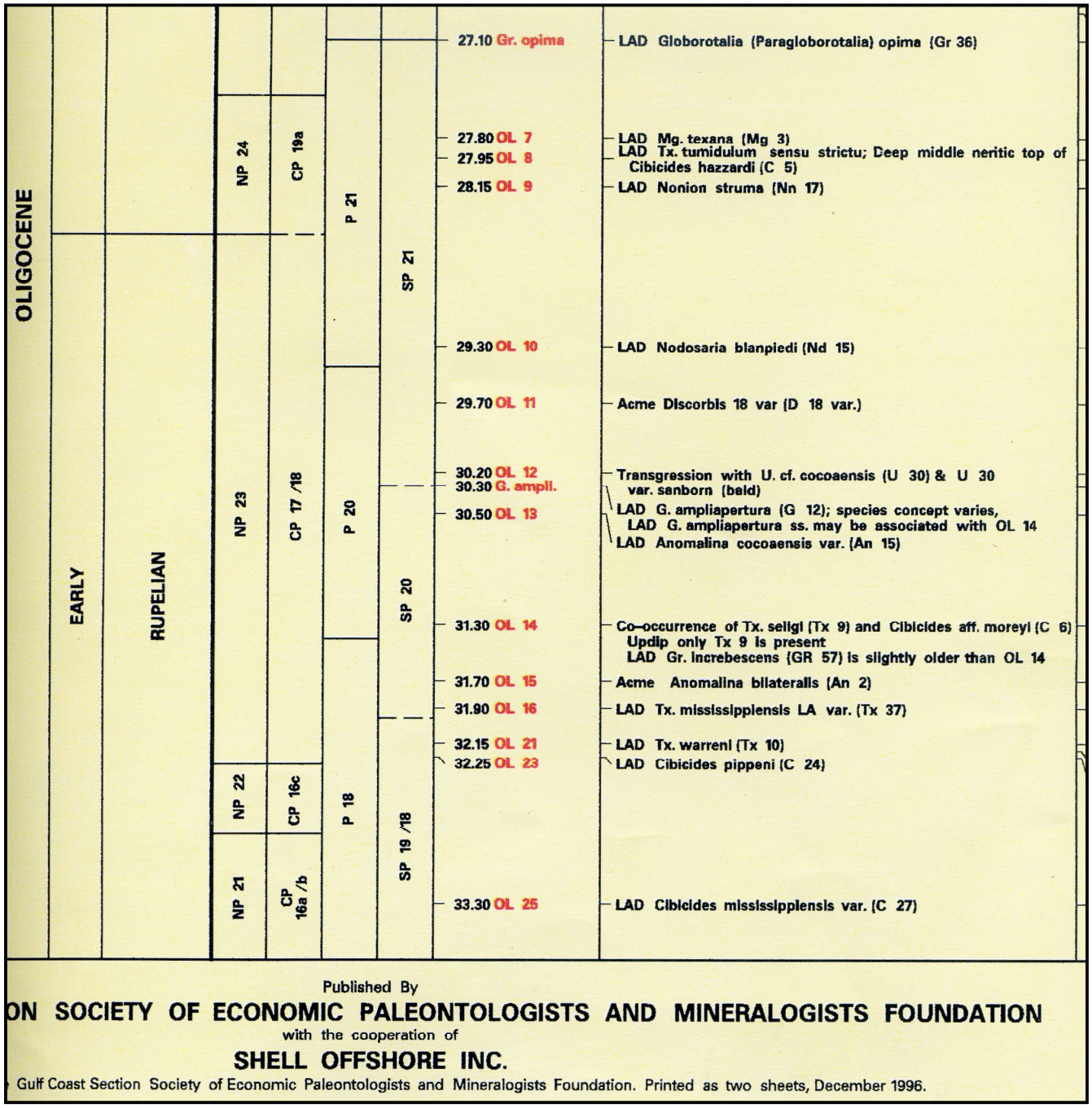
Nummulites retiatus - Discocyclina spp. - Orbitoclypeus spp. - Asterocyclina spp.

****

EXERCISE – Making your own datapack of Zones and Events

(1) **Gulf of Mexico, Rupelian**

We will use the Foraminifera markers of Shell Offshore Inc. (Michael Styzen, published by Gulf Coast Section of SEPM in 1996). On the next page is a scan of just the Rupelian portion of that chart. We will make a datapack for (1) the SP "standard zones" of Shell, and (2) Shell's "OL" foraminifer markers, which are a combination of benthic and planktonic taxa.



(2) **Set-up**

You will need to open EXCEL. We will be saving the file as a tab-delimited text file. Alternatively, one can use Word, and save the file as text, but this can be more tricky to easily see the tab-columns.

We will make 3 data columns: ***Shell SP zones***, ***Shell Foram markers***, ***Shell Foram details***.

The format for data is quite simple.

A header that gives the column type (*and optional settings for color, width, etc.*)

A set of items with their ages (*and optional dashed boundaries, pop-up comments, etc.*)

The column sets are separated by a blank row.

(3) **Block (zones)**

We will enter the three SP zones with the age of their bases.

Prepare the following [*NOTE: you can probably just copy-paste each set into Excel.*]

format version:	1.3					
date:	03/12/2009					
Shell SP zones	block	50	255/255/0			SEPM chart by Mike Styzen (1996)
	TOP	27.1				
	SP 21	30.3		NOTE: LAD of G. ampli.		
	SP 20	32.0	dashed	NOTE: definition uncertain	222/255/0	
	SP 19 /18	33.8				

The first two lines are needed to notify the program what Format is being used (1.3 allows use of separate colors for each zone, if desired)

Then, a ***blank*** row.

The "Shell SP zones" are a block-type format. Let's use a default width of 50; and give it the bright-yellow color of Shell's logo (RGB is 255/255/0). The seventh column (column G) can have a pop-up comment for the column title.

Each zone is entered, then its Age (as given on this SEPM chart). Notice that the lower boundary of SP21 and SP20 are dashed on the chart – but, to see how this option works, just put "dashed" after the SP20 (which has no indicated foraminifer marker). The next column (E) is for pop-up comments. For fun, let's give zone SP 20 a light-green color (the RGB code in column F).

(4) **Datums**

Next, let us enter the OL "markers" as EVENTS. The column type is "event" (small letters), and the options for sets of markers are "LAD", "FAD" and "EVENT". We will call of these "EVENT" for now.

After a blank-row (IMPORTANT!), then enter:

Shell Foram markers	event	60	255/255/0		on	SEPM chart by Mike Styzen (1996)
EVENT						
	OL 10	29.3				
	OL 11	29.7				
	OL 12	30.2				
	G. ampli.	30.3				
	OL 13	30.5				
	OL 14	31.3				
	OL 15	31.7				
	OL 16	31.9				
	OL 21	32.15				
	OL 23	32.25				
	OL 25	33.3				

The column-header above used a slightly wider width (60). Because the data-heavy event-type columns have a default of "off" to avoid accidental overcrowding of screen displays, then we've inserted an override of "**on**" in column F of the header.

Similarly, let's compile the details of these events. There are two types used by Shell – LADs of markers, and a set of EVENTS of acme's, co-occurrences, and transgression.

After a blank-row (*IMPORTANT to have to separate each new header*!), then enter:

Shell Foram details	event	200	255/255/0		on	SEPM chart by Mike Styzen (1996)
LAD						
	Nodosaria blanpiedi	29.3				
	G. ampliapertura	30.3	dotted	species concept varies		
	Anomalina cocosensis var.	30.5				
	Tx. mississippiensis LA var.	31.9				
	Tx. warreni	32.15				
	Cibicides pipeni	32.25				

	Cibicides mississippiensis var.	33.3				
EVENT						
	Acme Discorbis 18	29.7				
	Trans. with U. cf. cocoaensis	30.2				
	Tx. sellgi and Cibicides aff. moreyi	31.3				
	Acme Anomalina bilateralis	31.7				

We have long taxa names, therefore a generous width of 200 units is used (column header line). The LAD of *G. ampliapertura* is apparently vague, therefore its marker will be dotted, and a pop-up comment is added to explain this. Note that any pop-up comments for either datums or blocks must be in column E.

Now, SAVE this Excel sheet as "TEXT (**tab-delimited**)" format. Use a name such as "Shell_Rupelian_Forams.txt".

(5) **Insert into *TS_Creator***

Let us re-set the *TS-Creator* to clear the previous datapack.

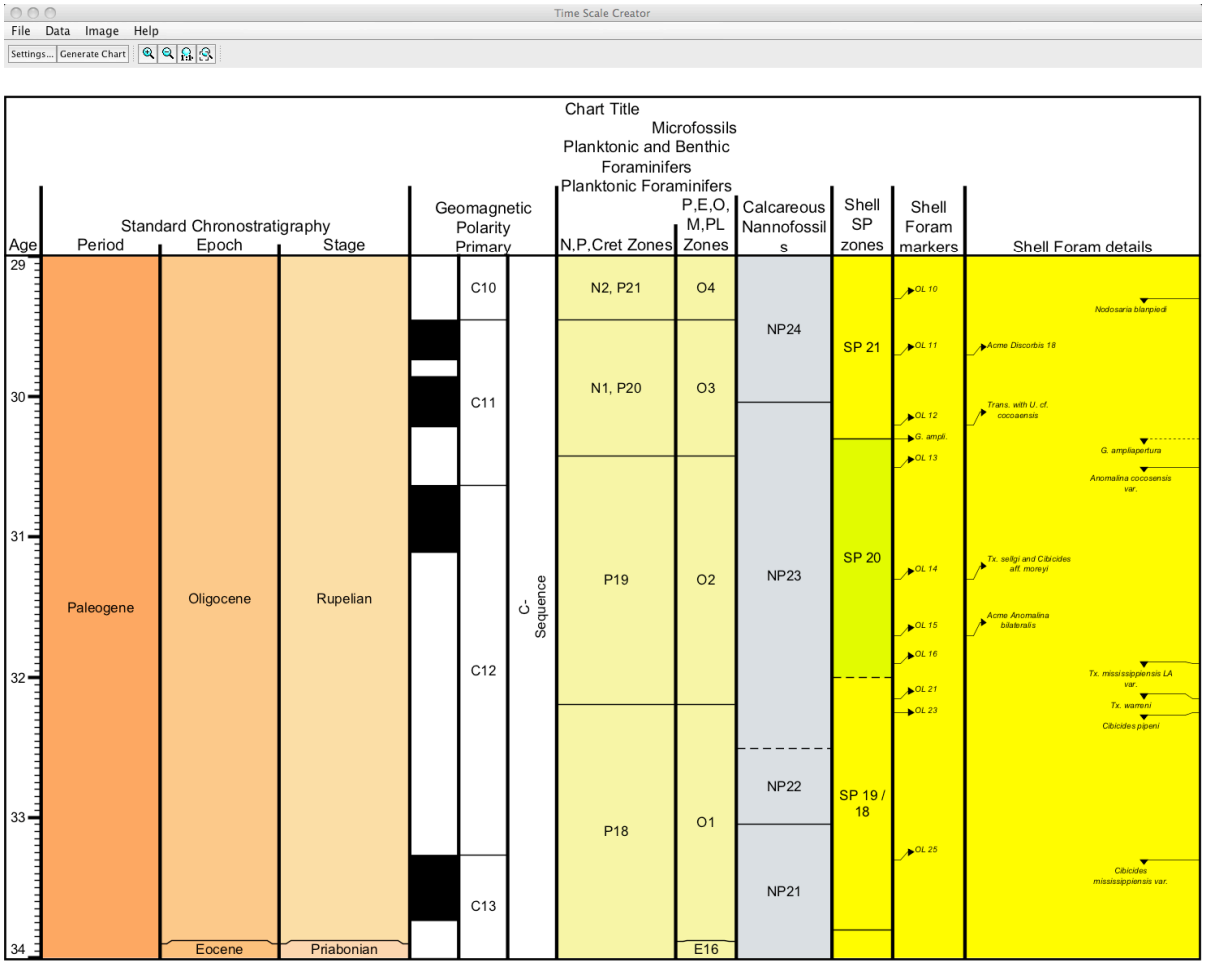
Under "File", click "*Replace Data with Default Datapack*".

Now, let us load the new Shell one that you've made – Under File, click *Add datapack*.

For the chart, we have a dense set of data. Therefore, under Settings (Time Interval), use Top of 29 Ma, Base of 34 Ma; and a Vertical scale of 4.

Click **Generate**.

Voila !! It should look like the diagram below:



We hope this is what you get, because it should work the first time. If not, then you may see an error message indicating a problem with a certain line. This is the same line as in the Excel file, and you can open that Excel file again to see what format might be wrong. Don't panic; just look at the instructions again, or ask us!

Setting Priorities for Zones and Events (see using "Crowding-avoidance and Priority setting" for examples)

(1) Zones/Blocks

This merging-control is immediately after the block-color flag in the input data:

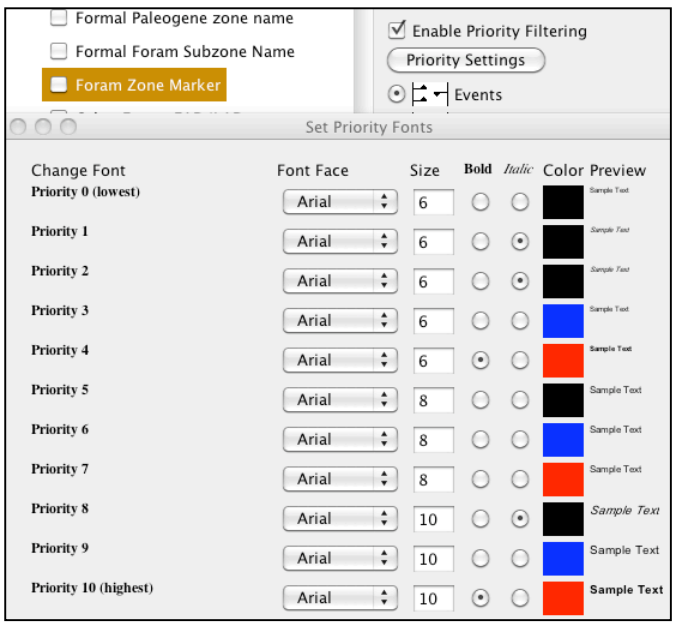
"zone 1 65.4 dashed Comment for popup RGB color ***Merge-control****"*

(2) Events

All Foram Datums	event		241/244/181		on	
LAD						
	Globorotalia flexuosa	0.07		~C1n.913 = Same chron-age c	1	
	Globoquadrina pseudofoliat	0.22		C1n.715 = Same chron-age ca	10	
	Globorotalia tosaensis	0.61		Base Pt1b (Top Pt1a). Astron	3	
	Globoturborotalita obliquus	1.3		Astronomically tuned from OD	1	
	Pulleniatina finalis	1.39		Same chron-age calibration as	4	
	Neogloboquadrina acostaen	1.58		Astronomically tuned from OD	5	
	Globoturborotalita apertura	1.64		Astronomically tuned from OD	6	
→ → → → → → → → → →						**Priority Values**

This event priority-setting is immediately after the Comment-field in the input data:

This event-priority option can also be used to color-code datums in a mixed taxa column. When highlighting that column, the options include "priority settings" where one can select a font-color and font-type.



Range Column: shows variation in abundance of a lifeform over time

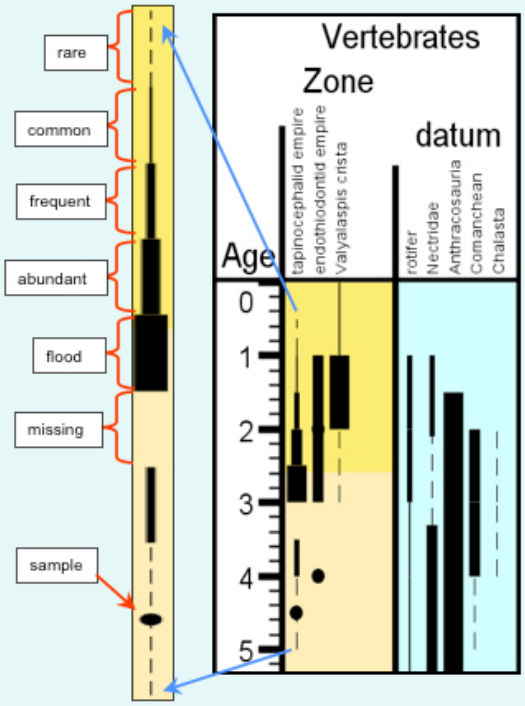
Abundance line thicknesses:

Datapack:

Vertebrates	:	Zone	datum
Zone	range	1000	USGS
	tapinocephalid empire	0.5	TOP
	tapinocephalid empire	1	rare
	tapinocephalid empire	1.5	common
	tapinocephalid empire	2	frequent
	tapinocephalid empire	2.5	abundant
	tapinocephalid empire	3	flood
	tapinocephalid empire	3.5	missing
	tapinocephalid empire	4	frequent
	tapinocephalid empire	4.5	sample
	tapinocephalid empire	5	rare

Abundance column

Range columns can be sorted for display by First Occurrence, Last Occurrence or Alphabetically.



Range Column Format:

Header Row:

<Title>	**range**	<width>

Required fields are:
- the **Title** (Example: Zone)
- the word '**range**'.
- width is optional

Data rows:

<blank>	**<label>**	**<age>**	<abundance>

Required fields are:
- a **blank** first cell
- a **label** (Example: tapinocephalid empire)
- **age**. (base age or age of a sample)
- abundance is optional. (Abundance specifies the **thickness of the line** that will be used to draw the range.)

Ranges are intervals of time. The age of each data row specifies the base of the range, so a Top must be specified first. This can be done using the word TOP in the abundance cell. If no TOP exists, then the topmost range point is used as a TOP.

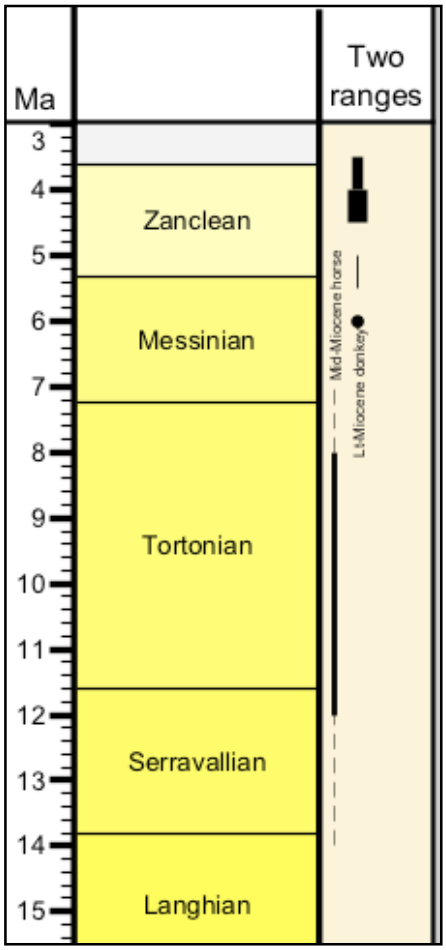
Abundance options:

- **TOP** - specifies the top of a range..default. Can also use LAD (last appearance date)
- **missing** - no line will be drawn
- **rare** - thinnest line: dashed
- **common** - thicker than rare
- **frequent** - thicker than common
- **abundant** - thicker than frequent
- **flood** - thickest line (warning: will hide sample symbol)
- **sample** - a filled circle is drawn at the age date; sample does not contribute to a range.

Example dataset for Range column:

```
Two ranges → range → 100 → 250/240/210 → → on
  → Mid-Miocene horse → 7 → TOP
  → Mid-Miocene horse → 8 → rare
  → Mid-Miocene horse → 12 → frequent
  → Mid-Miocene horse → 14 → rare
  → Lt-Miocene donkey → 3.5 → → "blank" = TOP
  → Lt-Miocene donkey → 4 → abundant
  → Lt-Miocene donkey → 4.5 → flood
  → Lt-Miocene donkey → 5 → missing
  → Lt-Miocene donkey → 5.5 → common
  → Lt-Miocene donkey → 6 → sample
```

Output:



****

Creating Evolution (Phylogeny) Datapacks

Data format – An addition to "Range" format *(described previously)*

A branch from a "Parent" to a "Child" has the following format and options. These "branch" flags are addition to the regular "range". The → "arrows" represent **Tabs** between entries:

Parent-name → Age (Ma) → ("branch") → to(Child-name) → on/off → Node-Label → dashed/dotted → Pop-up → Color → Priority

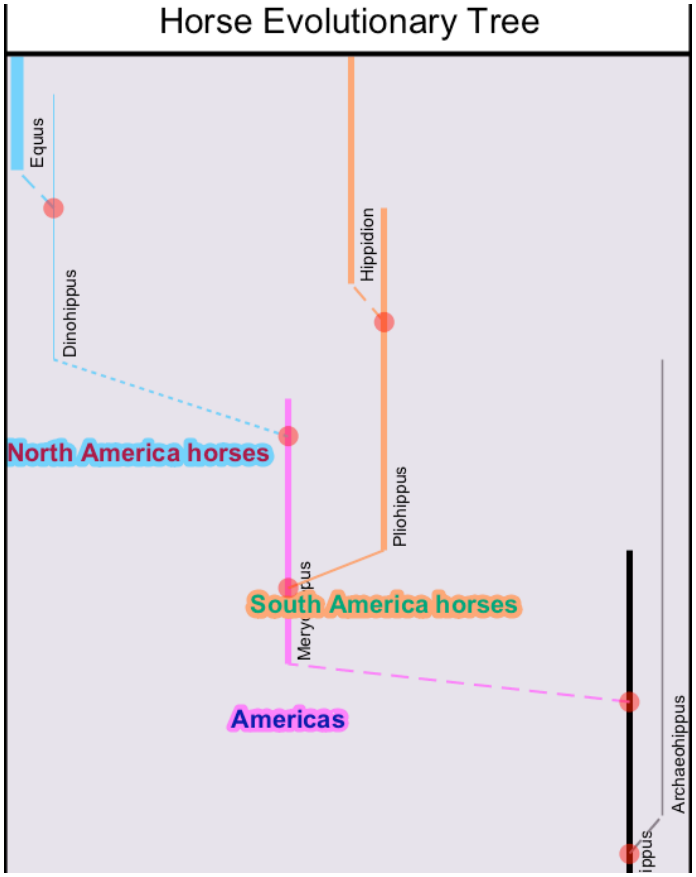
The first 4 items (Parent-name, Age, "branch" flag, and Child-name) are REQUIRED. The other items are options on how to display the branch or connector.

1) **Parent-name** – The "Parent-name" is identical to the name used for the range of the ancestor. *NOTE: In our evolution projects which involve name-plus-image, such as the Paleogene Foraminifera set or the Vertebrates Evolution datasets, we used the CONCATENATE function of Excel to attach an image to the name of this organism at the top/bottom of its range; but one can simply use the "name" only for the branch "Parent-name*".
2) **Age** –The branch-age must be within the age-range of the "Parent" (e.g., between or at the top/bottom); and can not be older than the base of the "Child".
3) "***branch***" – This is a flag to TS-Creator that the statement is instructions for an evolutionary branch.

4) **To Child-name** – This must be identical to the range-name of the Child (*but can omit an image-call, if such was used for a name-plus-image for that Child's rang*e).
5) **on/off** (optional; default is "*on*") – This is an option for setting a branch to be default-off to avoid overcrowding displays.
6) **Node-Label** – This option puts a horizontal-label centered below the displayed extent of the branch from that node. For example, a branch-node labeled "Carnivores" from early mammals would center the name "Carnivores" below all descendent cats, dogs, etc. For user-convenience, the background-color to this label is the same as that used for the branch-color (see #9 below).
7) **dashed/dotted** – The default style of the branch is a thin-line; but these options give other styles.
8) **Pop-up** – Text, image-calls, URLs, etc. in this string will be displayed upon a right-click of the mouse on the "red-node".
9) **Color** (*for branch*) – An optional assigned color will be "inherited" by all the "children," unless another color is given later at a node for "grand children". Colors are in RGB.
10) **Priority** (*for branch; default = 10*) – The priority determines what branches/ranges are displayed. Our practice is to assign high priority to selected "important" organisms, especially those that evolve into other major groups; and progressively lesser priority to meager branches or isolated "twigs".
11)

Example of an Evolutionary suite (*subset of Miocene-Pliocene horses in America*)

			Abundance	Pop-up						
	Fossil Name	**Age**	**Range Type**	**BranchTo (child)**	**On/Off**	**Node Name**	**Dashed/ Dotted**	**Node popup**	**Branch Color**	**Priority**
Horse Evolutionary Tree	**range**		**226/220/230**							
	Parahippus	15		Parahippus: <img align=' middle' src=' none'> CALIBRATION OF TOP=mB-Mbcene						
	Parahippus	19	**branch**	**Merychippus**		**Americas**	**dashed**	Branch to Merychippus dashed late-Early Mbcene. REFERENCE = MacFadden (2005) Science	250/100/250	10
	Parahippus	23	**branch**	**Archaeohippus**			**dashed**	Branch to Archaeohippus dashed mB-Early Mbcene. REFERENCE = MacFadden (2005) Science	120/110/120	7
	Parahippus	25	frequent	CALIBRATION OF BASE= latest Olgocene. REFERENCE= MacFadden (2005) Science						
	Archaeohippus	10		Archaeohippus: <img align=' middle' src=' none'> CALIBRATION OF TOP=mB-Late Mbcene						
	Archaeohippus	22	common	CALIBRATION OF BASE= mB-Early Mbcene. REFERENCE= MacFadden (2005) Science						
	Merychippus	11		Merychippus: <img align=' middle' src=' Merychippus.png'> CALIBRATION OF TOP=early-Late Mbcene						
	Merychippus	12	**branch**	**Dinohippus**		**North America horses**	**dotted**	Branch to Dinohippus dotted . REFERENCE = MacFadden (2005) Science	100/200/250	10
	Merychippus	16	**branch**	**Pliohippus**		**South America horses**		Branch to Pliohippus . REFERENCE = MacFadden (2005) Science	250/150/100	7
	Merychippus	18	frequent	CALIBRATION OF BASE= late-Early Mbcene. REFERENCE= MacFadden (2005) Science						
	Dinohippus	3		Dinohippus: <img align=' middle' src=' none'> CALIBRATION OF TOP=mB-Plbcene						
	Dinohippus	6	**branch**	**Equus**			**dashed**	Branch to Equus dashed mB-Late Mbcene. REFERENCE = MacFadden (2005) Science		10
	Dinohippus	10	rare	CALIBRATION OF BASE= early-Late Mbcene. REFERENCE= MacFadden (2005) Science						
	Pliohippus	6		Pliohippus: <img align=' middle' src=' none'> CALIBRATION OF TOP=latest Mbcene						
	Pliohippus	9	**branch**	**Hippidion**			**dashed**	Branch to Hippidion dashed mB-Late Mbcene. REFERENCE = MacFadden (2005) Science		7
	Pliohippus	15		CALIBRATION OF BASE= mB-Mbcene. REFERENCE= MacFadden (2005) Science						
	Equus	0.01		Equus: <img align=' middle' src=' Equus.png'> CALIBRATION OF TOP=Eaten by early Indians at ca. 12,000 ?						
	Equus	5	abundant	CALIBRATION OF BASE= Base of Mbcene. REFERENCE= MacFadden (2005) Science						
	Hippidion	1		Hippidion: <img align=' middle' src=' none'> CALIBRATION OF TOP=mB-Quaternary						
	Hippidion	8	frequent	CALIBRATION OF BASE= mB-Late Mbcene. REFERENCE= MacFadden (2005) Science						



Creating Evolution-branches with Range Output in Excel

We typically use three sheets in Excel. The first is a Master Chronostratigraphy (time scale of stages and/or zones). The second is a multi-column data compilation for the base/tops of ranges and the branches to "child" ranges. The third is a mirror of a portion of the second sheet that is in the format required for insertion into TS-Creator.

This multi-sheet system enables linking of range base/branch/top ages to a master time scale, so that if that master time scale is later revised, then all computed ages for ranges/branches are also updated.

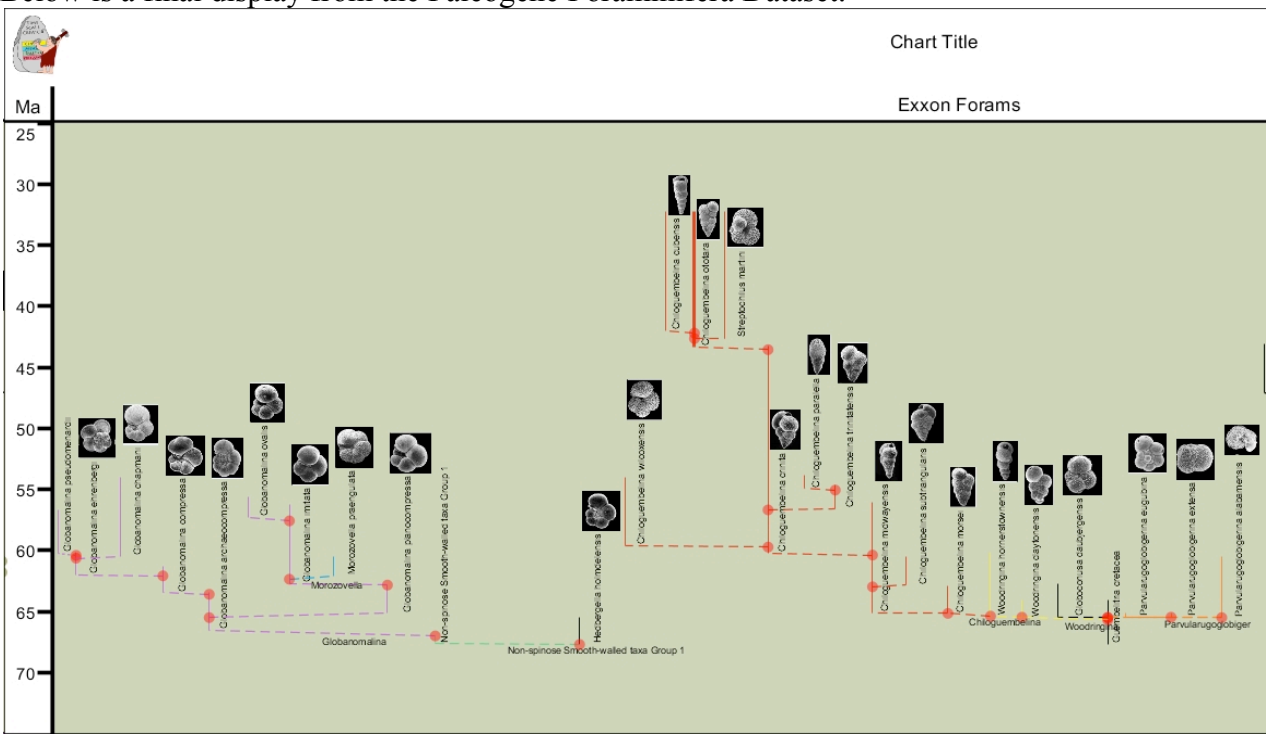
The multi-column second sheet enables us to have different columns for image-names, descriptions, age-calibration details, external URLs, and other features that are merged via a CONCATENATE statement into a single pop-up. The output will not contain all of the information from that second page, but will only mirror the required columns. In addition, separate output-columns are made for the range-only display and the evolution-range version; so that a user can select which type is desired.

Displayed below is a branch from *C. midwayensis* to *C. crinita*, the range for *C. crinita*, and a branch FROM *C. crinita*. Included are the "name with images," the age, range type, popup, dashed/dotted, node popup (in this case the calibration), and the "priority," which is represented by a number from 1-10. This is the "branch" output. The range output will be identical, except that it WILL NOT include the branches. Those lines will simply be omitted.

format version:	1.1									
date:	1/28/2012									
Exxon Forams	range		198/207/174							
	Chiloguembelina midwayensis	60.37	branch	Chiloguembelina crinita			dashed	70% up in P3b		7
	Chiloguembelina crinita <img align="middle" src="crinita90.jpg" width="30">	43.22		Chiloguembelina crinita: <img align="middle" src="crinita.png"> CALIBRATION= 15% up in E9 [Click crinita for details. Original 'crinita ' genus/species = Chiloguembelina].						
	Chiloguembelina crinita <img align="middle" src="crinita90.jpg" width="30">	60.19	common							
	Chiloguembelina crinita	59.72	branch	Chiloguembelina wilcoxensis			dashed	10% up in P4b		3

From this point, we are ready to test our outputs. To do this, one must have the Excel file open to their output page and then click File → Save As and then chose "Text – Tab Delimited" from the dropdown options. Excel will think this is a mistake and question you twice. Simply agree to the two popup windows and then CLOSE the excel WITHOUT SAVING again. No changes can be made to the "Text – tab delimited file" but must be made to the previous excel that was saved.

Once you have saved out your first branch/range output, you are ready to follow the "clean up" procedures listed in the TimeScale Creator Manual and then load the file into TSCreator. Below is a final display from the Paleogene Foraminifera Dataset.



Common Problems or Errors

There are a number of errors that can occur, after the cleanup of your text file that can cause problems in displaying your new output. Often, TSCreator can be very helpful in letting you know the specific line of the error and, hopefully, what is causing the trouble. There are, however, circumstances in which this does not occur and will require the user to understand the program's thinking.

Generally, the errors spotted tend to be things like missing or unneeded tabs and returns. Often, TSCreator will be looking for tabs in a line and discover that you have misplaced a column of data. It will, in this circumstance, return an error stating the line and what it expected to find. There are a few scenarios that are more complex, specifically when dealing with the branching/range type output as we are doing now.

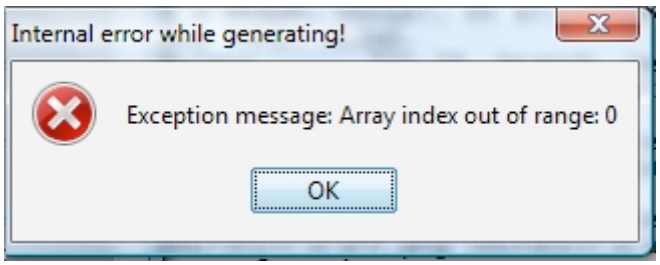
(1) Improper age of child or parent, backwards branch:

One error that can occur is directly related to "impossible evolution situations". TSCreator knows that a branch must be made from WITHIN the range of a Parent (or at its limits) and connect AT A LATER TIME to the BEGINNING of the Child's range. If one accidentally inputs an age for a branch is younger than that of the Child, TSCreator will tell you there is an error. The same will occur if a Parent has a branch to Child that doesn't exist (often because of mistyping the name), or if the branch-age falls outside the age-range of the Parent. In most cases, TS-Creator will try to tell you which Parent or which Child are the offenders.

A quick suggestion for locating such errors is to sort your output by AGE and look for places where the branch age is younger than the child's age, where there are missing ages, improperly defined units, or places where you are missing an individual that you have stated is the child of another group.

(2) Array Index Out of Range:

The following screenshot is of a common error that can occur when one is using the concatenate function to create ranges with images. The error is as follows:



This error is mainly caused by a name-plus-image or a popup-with-image calling for an image when no name for that image is given. In the output, the offending item is: src="", where there is no image-name within the double-quotes. Merely insert the missing image-name, or remove the image-call portion.

****

Sequence and Trend Columns: show T-R sea level cycle curves

Sequence and Trend columns both show transgressive/regressive sea level cycles and are represented by a horizontal set of peaks.

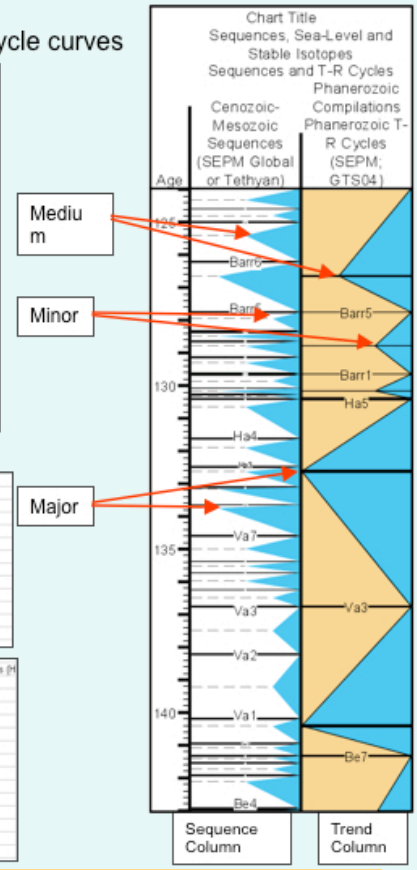
They differ by:

- Sequence columns show **high frequency** events. Trend columns show **low frequency** events (broader scope).
- default **background color** (Background color of a Sequence column is white, and a Trend column is orange. Background colors are editable.).
- peak **severities** (major, medium, and minor peaks.) Example: a major peak in a Sequence column is only 75% of the width of the column while in a Trend column, major is 100% of the width.
- the Trend column's peaks are **outlined in black** while the Sequence column's peaks are not outlined.

Datapacks:

Cenozoic-Mesozoic		Sequences (SEPM Global or Tethyan)	Boreal Jurassic Sequence	Boreal T-R Cycles
Sequences (SEPM Global or Tethyan)	sequence		100 255/255/255	
		MFS		0 Major
	LGM	SB		0.02 Major
		MSF		0.13 Major
	MIS 6	SB		0.14 Major
		MFS		0.24 Medium
	MIS 8	SB		0.27 Medium
		MFS		0.42 Medium
	MIS 12	SB		0.44 Major
		MFS		0.62 Medium
	MIS 16	SB		0.64 Major

Phanerozoic Compilations		Phanerozoic T-R Cycles (SEPM, GTS04)	Major Mesozoic-Cenozoic	Major Paleozoic Sequences (H
Phanerozoic T-R Cycles (SEPM, GTS04)	trend		100 245/204/131	
		MSF		0 Major
	LGM	SB		0.02 Major
		MFS		2.92 Medium
	Me 2	SB		5.77 Medium
		MFS		10.51 Major
	Ser 4/Tor 1	SB		11.8 Major
		MSF		15.71 Medium
	Ch 4/Aq 1	SB		23.03 Medium
		MSF		27.97 Major
	Ch 1/Ru 4	SB		28.45 Major
		MSF		30.72 Medium
	Lu 4	SB		41.67 Medium



Sequence and Trend Column Format:

Header Row:

<Title>	**sequence or trend**	<width>

Required fields are:
- the **Title** (Example: Boreal T-R Cycles)
- the word '**sequence**' or '**trend**' in the second cell.
- width is optional

Data Rows:

<blank>	<label>	**SB or MFS**	**age**	**severity**

Required fields are:
- a **blank** in the first cell
- the letters '**SB**' (Sequence Boundary) or '**MFS**' (maximum flooding surface)
- **age**
- **severity** (Options are Major, Medium or Minor)
- The label field is optional.

Datapack:

Cenozoic-Mesozoic		Sequences (SEPM Global or Tethyan)	Boreal Jurassic Sequence	Boreal T-R Cycles
Sequences (SEPM Global or Tethyan)	sequence		100 255/255/255	
		MFS		0 Major
	LGM	SB		0.02 Major
		MSF		0.13 Major
	MIS 6	SB		0.14 Major
		MFS		0.24 Medium
	MIS 8	SB		0.27 Medium
		MFS		0.42 Medium
	MIS 12	SB		0.44 Major
		MFS		0.62 Medium
	MIS 16	SB		0.64 Major

Header row

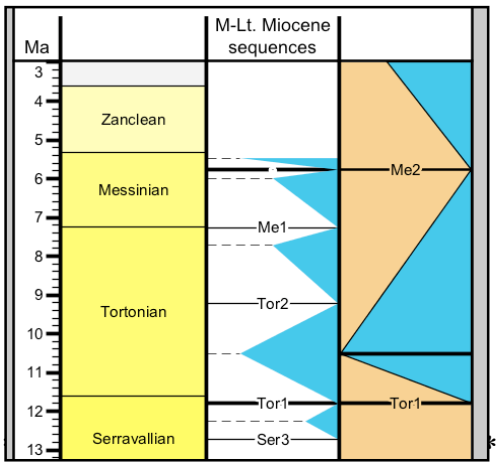
Data rows

Example dataset for Sequence-Trend columns:

```
M-Lt. Miocene sequences → sequence →    →    →    →    →  SEPM set
  →    →  MFS → 5.47 → Major  →  Nanno CN10a
  →  Me2 → SB → 5.77 → Major  →  Middle Nanno CN9d
  →    →  MFS → 5.99 → Medium →
  →  Me1 → SB → 7.26 → Minor  →  Middle Nanno CN9b
  →    →  MFS → 7.72 → Medium →  in CN9a
  →  Tor2 → SB → 9.22 → Minor  →  in CN8
  →    →  MFS → 10.51  →  Major  →
  →  Tor1 → SB → 11.8 → Major  →  Base Nanno CN5b
  →    →  MFS → 12.26  →  Minor  →
  →  Ser3 → SB → 12.72  →  Minor  →  Middle Nanno CN5a

M-Lt. Miocene T-R Cycles → trend  →    →    →  notitle →    →  SEPM
  →    →  MFS → 2.92 → Medium →  Pliocene transgression
  →  Me2 → SB → 5.77 → Medium →  Lt. Miocene regression maximum
  →    →  MFS → 10.51  →  Major  →  Flooding event
  →  Tor1 → SB → 11.8 → Major  →  Max mid-Miocene regression
```

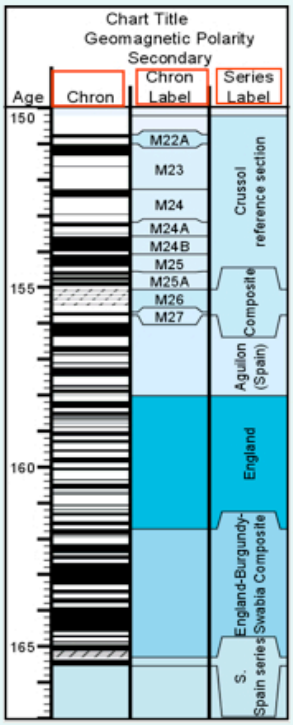
Output:



********** **********

Chron Column: shows Polarity

Chron columns contain three component columns: **Chron (polarity), Chron Label and Series Label.**



Column Type

Series Label

Datapack

Geomagnetic Polarity	:	Primary	Secondary
Secondary	chron	100	nocolor
Crussol reference section			
	TOP		150.21
	R		150.729
	N	M22A	150.844
	R	M22A	151.006
	N	M23	151.336
	R	M23	151.616
	N	M23	151.642
	R	M23	152.261
	N	M24	152.498
	R	M24	152.956
	N	M24	152.981
	R	M24	153.185
	N	M24A	153.312
	R	M24A	153.483
	N	M24A	153.509
	R	M24A	153.575
	N	M24B	154.007
	R	M24B	154.084
	N	M25	154.432
	R	M25	154.55
	N	M25A	154.669
	R	M25A	154.698
	N	M25A	154.805
	R	M25A	154.834
	N	M25A	154.969
	R	M25A	155.049
Composite			
	U	M26	155.128
	R	M26	155.185

polarity

Chron Label

Polarity choices include:

- **N** (Normal)
- **R** (Reverse)
- **U** (Unknown) or **No Data**
- **TOP**.

Chron Column Format:

Header Row:

<Title>	**chron**	<width>

Required fields are:

- **Title** (Example: Primary)
- the word '**chron**' in the second cell.
- width is optional

Series Row:

<Series name>	**<blank>**	**<width>**

Required field is:

- **Series name**. (Example: Austrian series)
- If width is to be specified, a **blank cell** is required in the second cell.

Data Rows:

<blank>	**<polarity>**	<label>	**< age>**

Required fields are:

- a **blank** first cell
- **polarity** (Examples: N, R)
- label is optional (cell can remain blank). Label will display in the Chron Label sub-column.
- **age** (the base age)

Polarity values:

TOP	
N (normal)	black
R (reverse)	white
No Data	grey
U (unknown)	grey

Datapack:

Primary	chron	124	nocolor
Austrian series			
	TOP		190
	N	Basalt	192
	R	E4	194
	No Data	No Data	196
	N	E2	198
	U	Gap?	200

Header Row

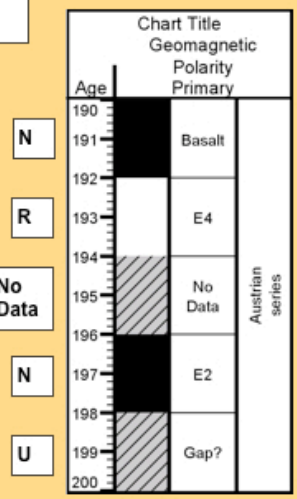
Series Row

Data Rows

Polarity column

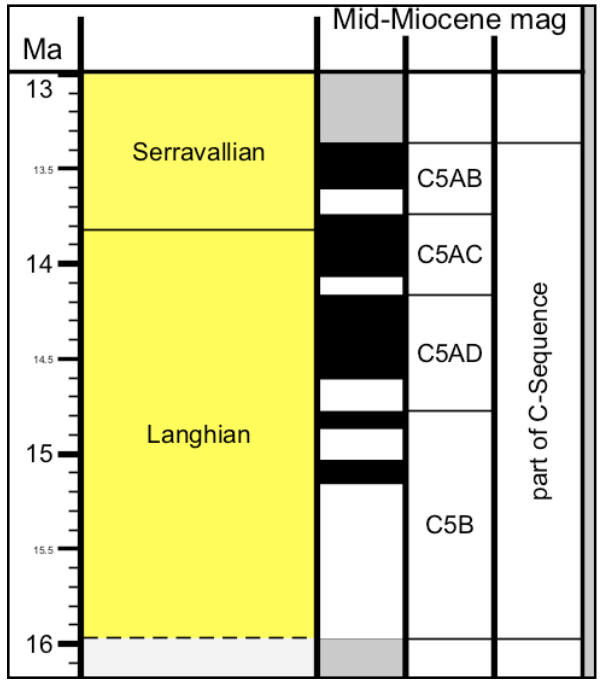
Label column

Age column



Example dataset for Chrons:

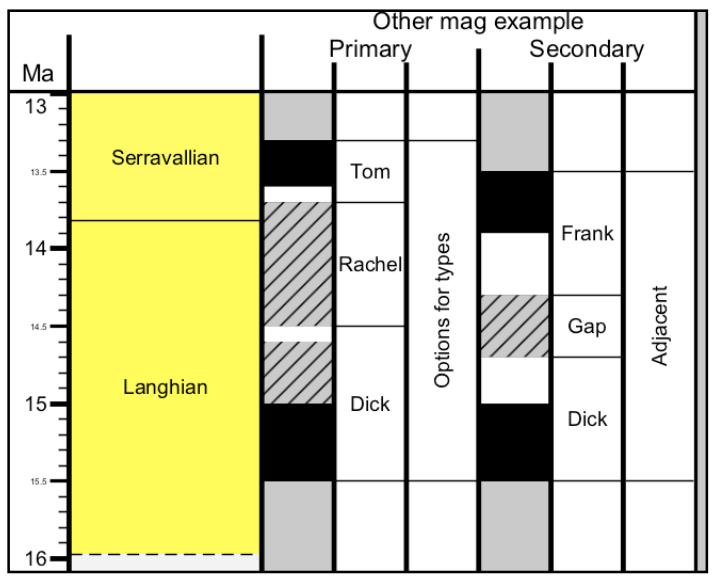
```
Mid-Miocene mag  →  chron
part of C-Sequence → Primary → 220/220/220
  →  TOP →   →  13.363
  →  N  →  C5AB→13.608  →  C5ABn
  →  R  →  C5AB→13.739  →  C5ABr
  →  N  →  C5AC→14.07   →  C5ACn
  →  R  →  C5AC→14.163  →  C5ACr
  →  N  →  C5AD→14.609  →  C5ADn
  →  R  →  C5AD→14.775  →  C5ADr
  →  N  →  C5B → 14.87   →  C5Bn.1n
  →  R  →  C5B → 15.032  →  C5Bn.1r
  →  N  →  C5B → 15.16   →  C5Bn.2n
  →  R  →  C5B → 15.974  →  C5Br
```



"U" or "No Data" can be used in place of N/R
"Primary" indicates to use and center the adjacent label until another Primary is encountered.
One always needs some character (or a Space) for the name associated with "Primary" label.
"Secondary" implies that the following suite will be Adjacent to the Primary set

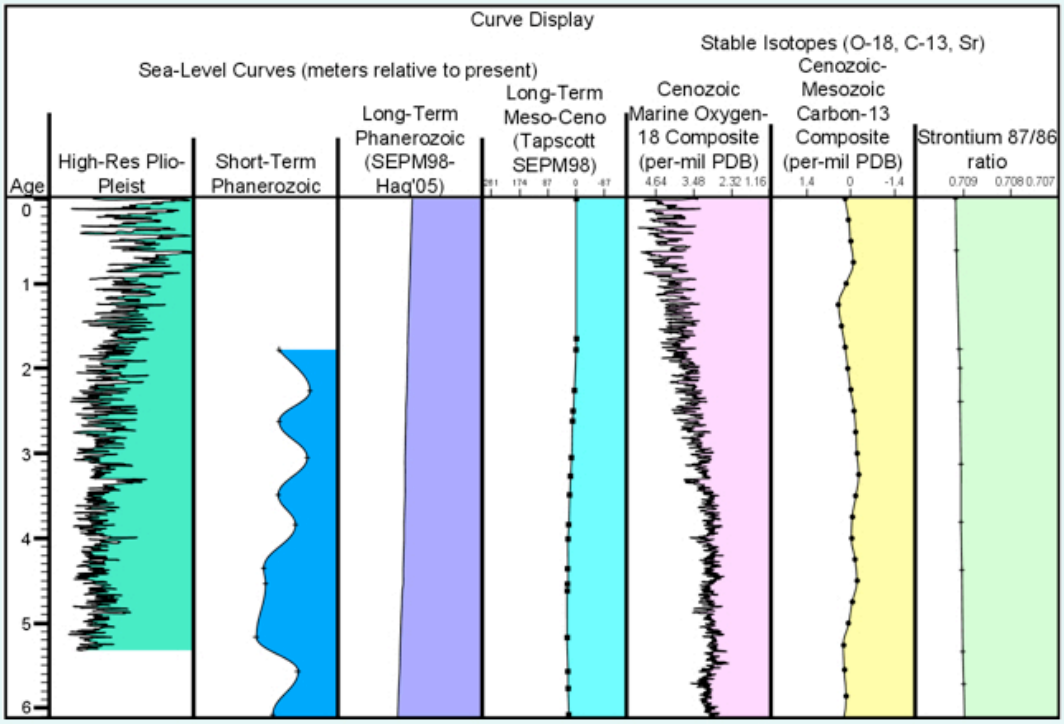
Example of options:

```
Other mag example → chron → 50  →  250/250/250
Options for types  →  Primary
  →  TOP →   →  13.3
  →  N  →  Tom → 13.6
  →  R  →  Tom → 13.7
  →  No Data →  Rachel  →  14.5
  →  R  →  Dick→14.6
  →  U  →  Dick→15.0
  →  N  →  Dick→15.5
Adjacent → Secondary
  →  TOP →   →  13.5
  →  N  →  Frank  →  13.9
  →  R  →  Frank  →  14.3
  →  U  →  Gap → 14.7
  →  R  →  Dick→15.0
  →  N  →  Dick→15.5
```



****

Point Column: draws an X vs Age plot curve.



Point Column Format:

Header row:

<Title>	**point**	<width>	<color>

Required fields are:

- **Title**
- the word **'point'**
- width and color are optional. (Color is the background color.)

Style row (optional):

<Point type>	line or no line	< fill color>	<range low>	<range high>	smoothed

Style row is **optional**. If used, **Point type** is required.

Optional fields include:

- the word 'line' will connect points. 'no line' will eliminate the line.
- *fill color* is specified in R/G/B format or as 'nofill'. Fill puts color under the curve.
- *range low* and *range high* specify the range of the curve in the X dimension. If omitted, TS Creator will fit all points inside the column.
- the word 'smoothed' determines whether or not to smooth the line connecting points. The smoothed curve (Bezier) passes through every point.

Point type choices:

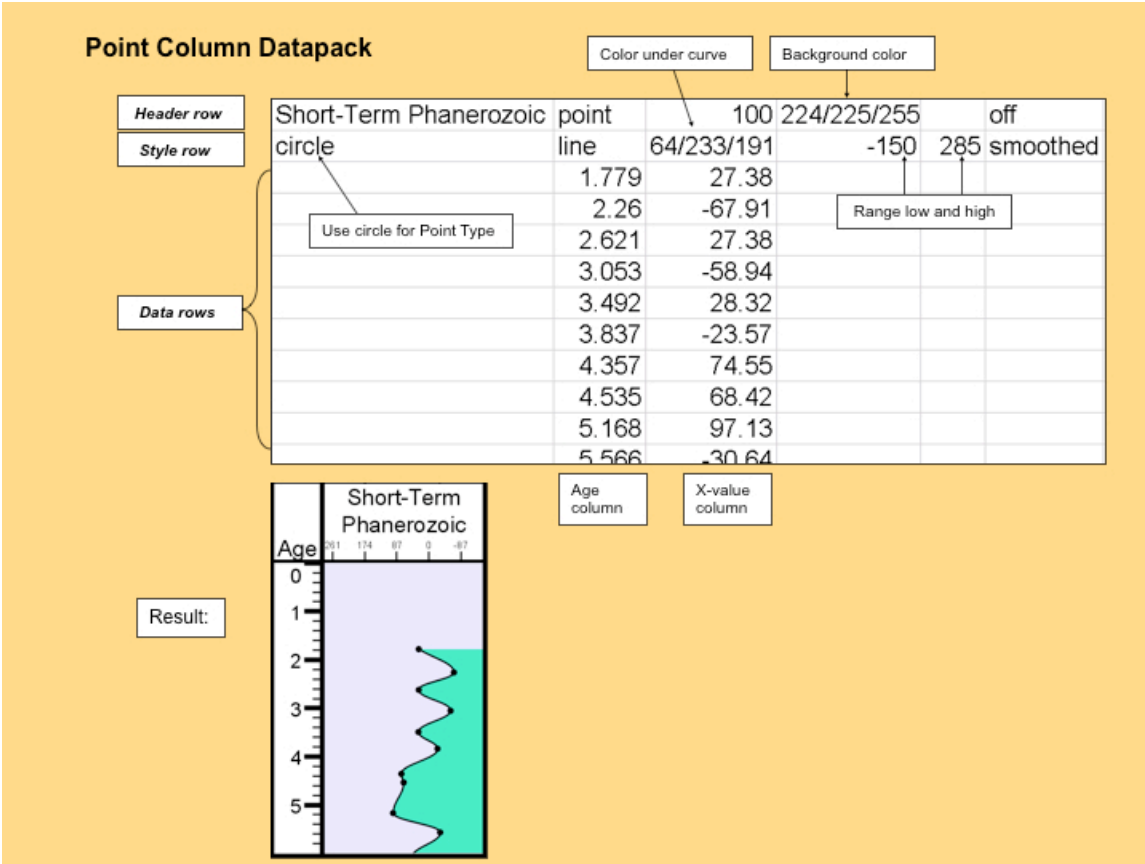
- **nopoints** - points will not be drawn on the curve
- **rect** - each point is a square
- **circle** - each point is a filled circle
- **cross** - each point is a '+'

Data rows:

<blank>	**<age>**	**<X value>**

Required fields are:

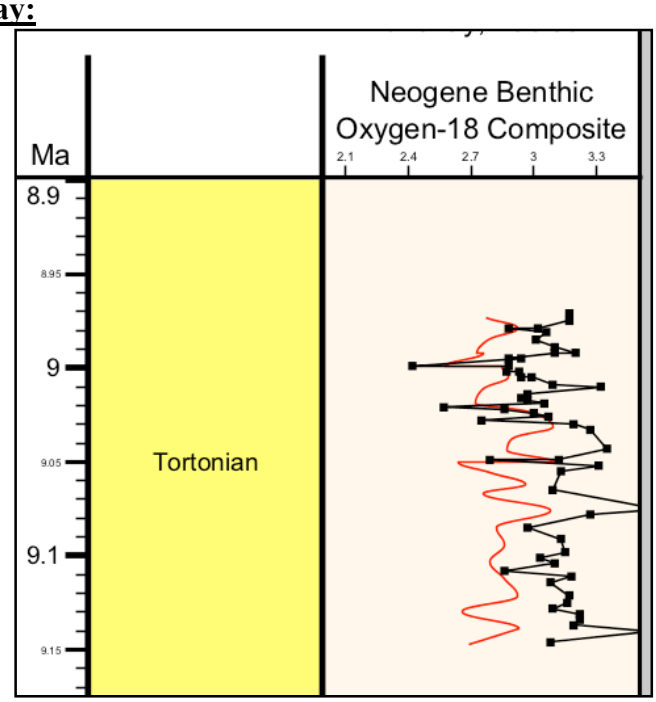
- an **empty first cell**
- **age** (age is the Y coordinate of the line – vertical position)
- **X value**. (horizontal position of the line)



Example datasets for Point columns – with Overlay:

```
Neogene Benthic Oxygen-18 Composite → point → 150 → 255/245/230
  →  →  → Data provided by I. Raffi (RED and SMOOTHED = data
of Shackleton & Hall (1997); 9 to 10 Ma)
nopoints → 255/0/0 → nofill → 2 → 3.5 → smoothed
  → 8.973 → 2.77
  → 8.979 → 2.92
  → 8.986 → 2.77
  → 8.992 → 2.73
  → 8.992 → 2.76
  → 8.999 → 2.58
  → 8.999 → 2.85
  → 9.005 → 2.88
  → 9.012 → 2.75
  → 9.019 → 2.72
  → 9.025 → 3.02
  → 9.031 → 3.09
  → 9.038 → 2.89
  → 9.044 → 2.87
  → 9.050 → 3.10
  → 9.050 → 2.64
  → 9.056 → 2.79
  → 9.062 → 2.96
  → 9.067 → 2.76
  → 9.076 → 3.08
  → 9.085 → 2.82
  → 9.094 → 2.86
  → 9.103 → 2.79
  → 9.112 → 2.86
  → 9.121 → 2.92
  → 9.130 → 2.66
  → 9.139 → 2.93
  → 9.147 → 2.69

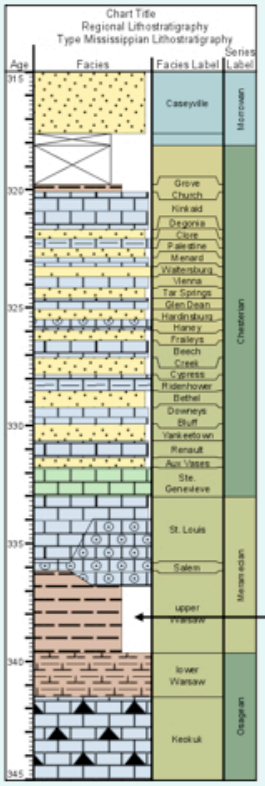
Westerhold 2005 (black) → point-overlay → 150 → 255/245/230 →  →
  → BLACK = Site 1085 d18O
points → 0/0/0 → nofill → 2 → 3.5 → notsmoothed
  → 8.971 → 3.17
  → 8.975 → 3.17
  → 8.979 → 3.02
  → 8.979 → 2.88
  → 8.981 → 3.06
  → 8.985 → 3.01
  → 8.989 → 3.10
  → 8.992 → 3.20
  → 8.992 → 3.10
  → 8.995 → 2.88
  → 8.995 → 2.94
  → 8.999 → 2.42
  → 8.999 → 2.88
  → 9.002 → 2.87
```



NOTE: Output uses "30 cm/Ma", with "Show scale" (*the assigned default was 2 to 3.5*)

****

Facies Column: draws lithofacies units



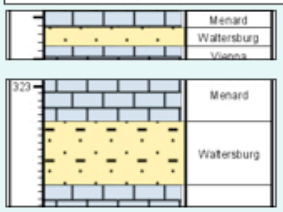
The Facies Column draws lithostratigraphic facies patterns and names.

There are **3 component columns** in a Facies column format (similar to the Chron column format):

- **Facies** - shows facies patterns. These patterns are editable using Adobe Illustrator. 50 patterns are included in TS Creator Pro. New ones can be created and added to the standard set.
- **Facies Label** – shows facies names next to facies patterns.
- **Series Label** – shows Chronostratigraphic Stage.

Automatic indentation mimics the look of strat column charts by making rock types with smaller grain sizes horizontally smaller, as they tend to erode faster. Indentations can be controlled using the **patternwidth** format.

Hint: If a unit is not thick enough to reproduce the entire pattern, increase the vertical scale in Settings.



Scale: 1.5

Scale: 5.0

Facies Column Format:

Header row:

<Title>	**facies**	<width>

Required fields:

- **Title** (Example: Type Mississippian Lithostrat)
- the word '**facies**'
- width is inactive (can be set inside TS Creator Pro)

Series row:

<Series label>	**<blank>**	<width>

Required fields:

- **Series label** (Example: Morrowan)
- a **blank** second cell
- width is optional

Data rows:

<blank>	**<facies>**	<label>	**<age>**

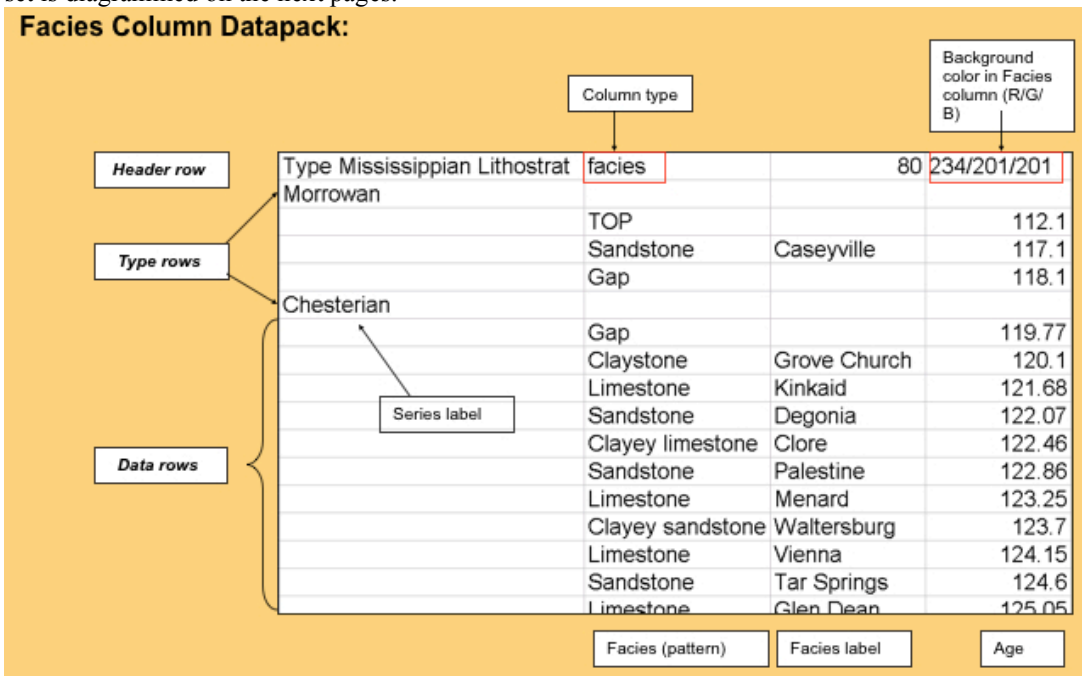
The 'facies' field value in a data row is either 'TOP' or a facies pattern.

Required fields:

- a **blank** first cell
- **facies** (a pattern, Example: Sandstone)
- label (name of facies, Example: Caseyville) –optional. Label will display in the Facies Label sub-column.
- **age**

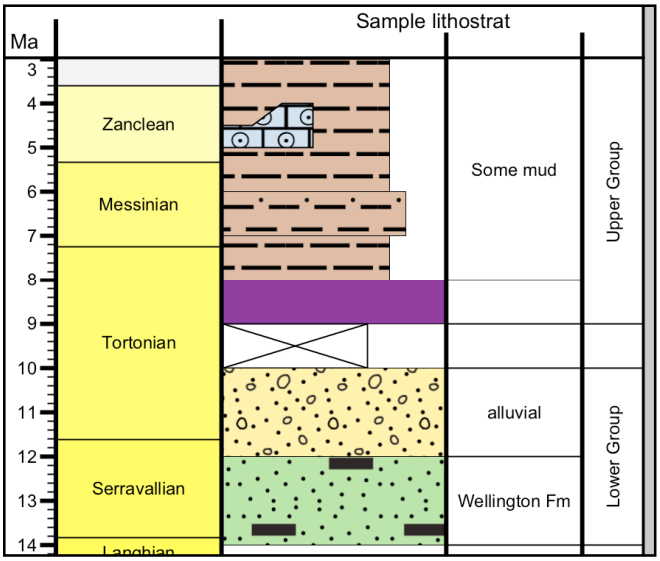
One calls each pattern according to its name (***case-sensitive*** – the name must exactly match the pattern name, *except an underscore can be a space*). Please realize that it is only the "name" for a suitable *pattern*, not an official rock type (e.g., the "*Sandy claystone*" pattern is usually fine for showing a mudstone).

TSCreator 5.0 had a merged USGS-ODP-GeoArabia set of colored facies patterns (about 60). Beginning with version 5.3, we included a set of colors (about 50), New Zealand facies set, Australian facies set, standard offshore-Norway facies set and others. One hopes that the 248 patterns/colors will now satisfy most needs. The full set is diagrammed on the next pages.



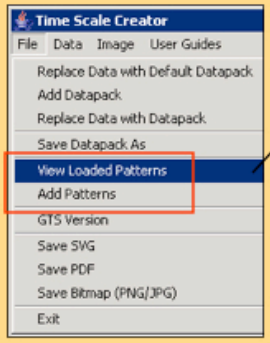
Example dataset for Facies column (including a lithology overlay)

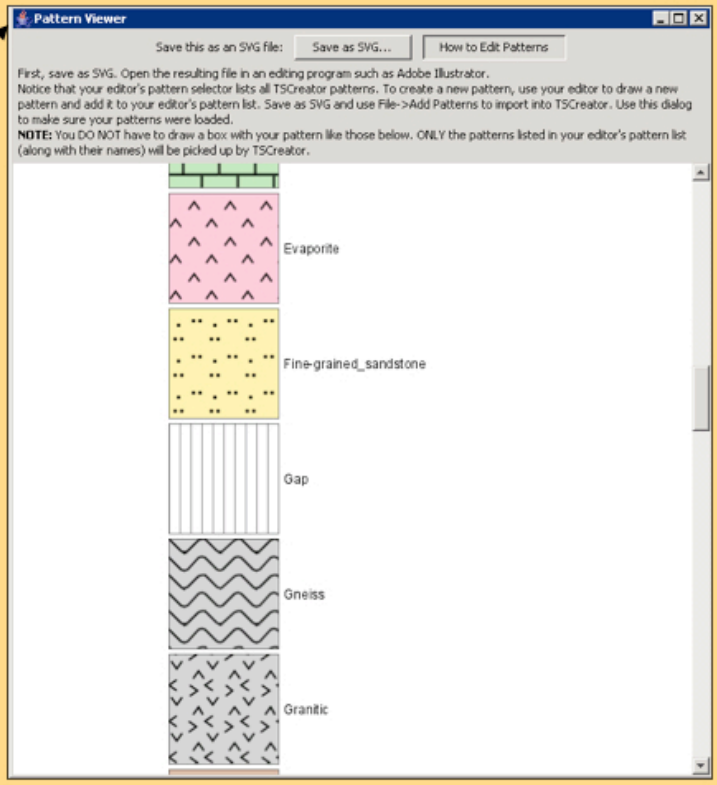
Sample lithostrat	facies	150		
Upper Group	Primary			
	TOP		3	
	Claystone	Some mud	6	
	Sandy claystone	Some mud	7	
	Claystone	Some mud	8	Name spans set
	CS dark purple		9	Popup = color for "odd"
	Primary			[NOTE: Space in first column]
	Gap		10	
Lower Group	Primary			
	NZ Conglomerate	alluvial	12	
	NZ Coal sandstone	Wellington Fm	14	
Lms wedge	freehand-overlay	150		
POLYGON	closed		Oolitic limestone	
	61	4		
	40	4		
	20	4.5		
	-1	4.5		
	-1	5		
	20	5		
	40	5		
	61	5		



****

Viewing, Creating or Editing Lithology Patterns





To see the 50 default lithology patterns, click on *File/View Loaded Patterns* to bring up the Pattern Viewer.

To add new patterns, click on *Save as SVG* button to save the 50 default patterns. Bring the file into **Adobe Illustrator** and add new patterns as desired. Then click on File→*Add Patterns* to import the new file into TS Creator Pro.

Facies Pattern Width Format: pattern indentations

Facies columns show grain size by **varying the width** of the box containing the pattern. The patterns built into the software already have widths associated with them. These widths can be altered by specifying them inside the datapack using the **patternwidths format.**

Important: **The patternwidths parameters are independent of the Facies column (do not include within the Facies column data in the datapack).**

Header row:

patternwidths	**patternwidths**

Required fields:

- the word **'patternwidths'** in the first and second cells.

Data rows:

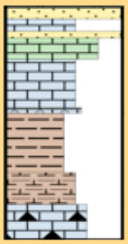
<blank>	**<pattern name>**	**<pattern width>**

Required fields:

- a **blank** first cell
- **pattern name** (a pattern, Example: Sandstone)
- **pattern width** – width of column block in percent. (low percentages may make the pattern unreadable: suggest using 50 to 100% range for readability)

Datapack

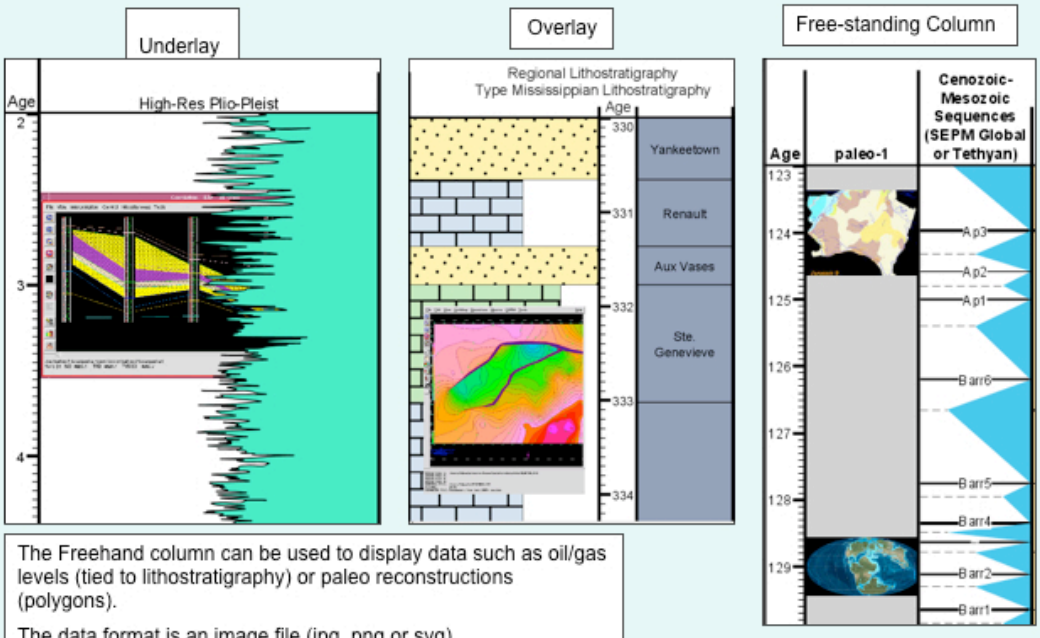
patternwidths	patternwidths	
	Limestone	60
	Claystone	50
	Siliceous limestone	70
	Continental marl	60
	Oolitic limestone	65
	Sandstone	100
	Dolomitic limestone	80
	Clayey limestone	75



Note: pattern widths are global: changing them inside the Editor for one set of facies columns will change them for all sets of facies columns loaded.

Freehand Column

Freehand columns allow import of image files to be displayed on top of (overlay) or underneath (underlay) the column listed above in the datapack. It can also be displayed as a separate, free-standing column.



The Freehand column can be used to display data such as oil/gas levels (tied to lithostratigraphy) or paleo reconstructions (polygons).

The data format is an image file (jpg, png or svg).

Freehand Column: allows loading of image files

<Title>	<coltype>	< width>	<color>

Freehand columns can be drawn as a separate column, or overlaid or underlaid on the column listed above it in the datapack. Note: Under or overlay will not work on Block, Range or Event columns. Chron overlay will work but not underlay.

Required fields:

- **Title** (Example: Scotese Paleomap)
- **<coltype>** is the word '**freehand**' (creates a separate column), '**freehand-overlay**' or '**freehand-underlay**' (image appears in column listed above it in datapack)
- width and color are not required. 'Color' is background color.

image	<filename>	< top age>	<base age>

Required fields:

- the word **image**
- the **filename** (including path) of the image file. Supported formats are **JPG, PNG** or **SVG**.
- 'top age' and 'base age' are not required, but if specified, the image will be placed centered both horizontally and vertically between them, maintaining the aspect ratio.

For **additional control** of image placement use the following (optional) format lines:

agetype	<type>	< top age>	<base age>
xtype	<type>		

<type> choices:

- **Fit** – stretch image to fit disregarding original aspect ratio.
- **Center** – center image
- **Start** – place image toward the top age for agetype or the left for xtype.
- **End** – place image toward the base age for agetype or the right for xtype.

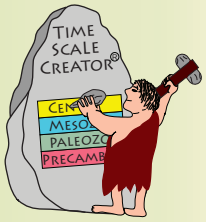
Note: the xtype row is optional: center is the default horizontal placement choice.

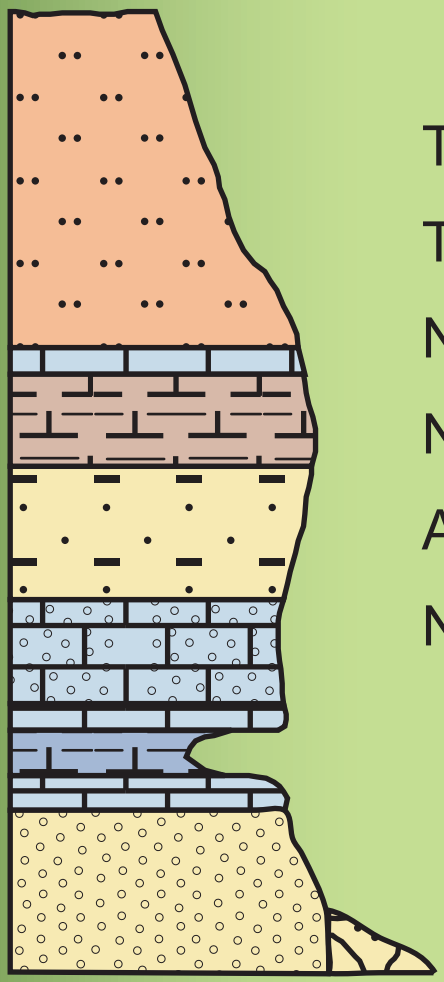
Required fields:

- the word '**agetype**' in the first row, first cell
- **type:** where to place the image **vertically**
- 'top age' and 'base age' are not required fields

- the word '**xtype**' in the second row, first cell
- **type:** where to place the image **horizontally**

Available Pattern Fills for TimeScale Creator Graphics





TSC Color Patterns

TSC Lithostraigraphic Patterns

Norwegian Lithostratigraphic Patterns

Neftex Lithostratigraphic Patterns

Australian Lithostratigraphic Patterns

New Zealand Patterns

April 2012

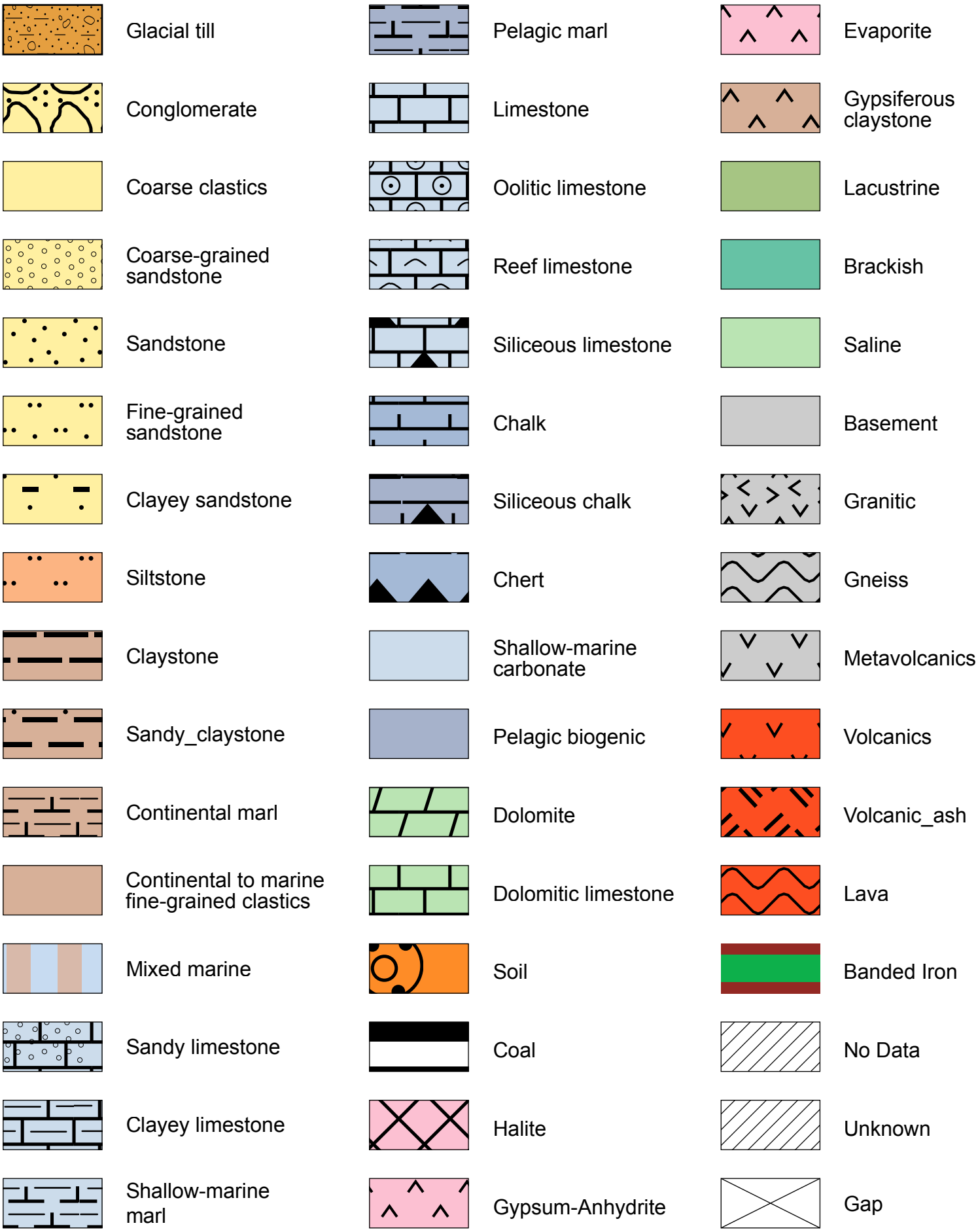
TSC Color Patterns

CS_light_yellow
CS_medium_yellow
CS_dark_yellow
CS_light_beige
CS_medium_beige
CS_dark_beige
CS_light_green
CS_medium_green
CS_dark_green
CS_light_olive_green
CS_medium_olive_green
CS_dark_olive_green
CS_light_seagreen
CS_medium_seagreen
CS_dark_seagreen
CS_light_blue
CS_medium_blue

CS_dark_blue
CS_light_navy
CS_medium_navy
CS_dark_navy
CS_light_purple
CS_medium_purple
CS_dark_purple
CS_light_brown
CS_medium_brown
CS_dark_brown
CS_light_red
CS_medium_red
CS_dark_red
CS_light_orange
CS_medium_orange
CS_dark_orange
CS_light_magenta

CS_medium_magenta
CS_dark_magenta
CS_light_pink
CS_medium_pink
CS_dark_pink
CS_light_gray
CS_medium_gray
CS_dark_gray
two_tone_beige
two_tone_olive_green
two_tone_blue
two_tone_red
two_tone_gray
two_tone_red_green

TS-Creator Lithostratigraphic Patterns



Norwegian Lithostratigraphic Patterns

5.1 Rock Types

5.1.1 Clastic rocks

- NOR Conglomerate
- NOR Sedimentary breccia
- NOR Sandstone
- NOR Siltstone
- NOR Mudstone
- NOR Claystone
- NOR Fissile siltstone
- NOR Fissile mudstone
- NOR Shale

5.1.2 Carbonate rocks

- NOR Limestone
- NOR Dolomitic limestone
- NOR Dolostone
- NOR Calcareous dolostone
- NOR Chalk
- NOR Marl

5.1.3 Evaporites

- NOR Gypsum
- NOR Anhydrite
- NOR Gypsum/Anhydrite
- NOR Halite
- NOR Salt in general

5.1.4 Coal

- NW Coal
- NW Brown coal

5.1.5 Magmatic rocks

- NOR Intrusive rock in general
- NOR Silicic plutonic rocks
- NOR Mafic plutonic rocks
- NOR Dykes and sills

5.1.6 Metamorphic rocks

- NOR Metamorphic rocks

5.1.7 Combined symbols

- NOR Tuffaceous
- NOR Bituminous

NOR Skraraster

Neftex lithostratgraphic patterns

NF_Lacustrine shale

NF_Continental sandstone

NF_Shallow sandstone

NF_Deep-water sandstone

NF_Shallow-marine shale

NF_Deep-marine shale

NF_Clastic source rock

NF_Shallow carbonate

NF_Deep carbonate

NF_Carbonate source rock

NF_Anhydrite

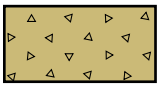
NF_Salt

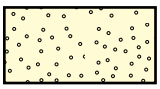
NF_Basement and volcanics

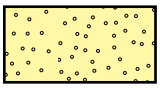
NF_Oceanic crust

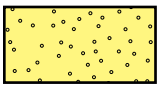
Australian Lithostratigraphic Patterns

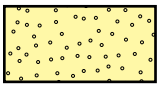

Aus Conglomerate

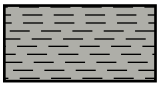

Aus Breccia

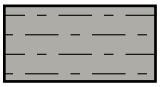

Aus Sandstone very fine

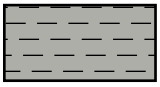

Aus Sandstone fine-grained

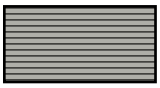

Aus Sandstone medium-grained

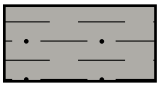

Aus Sandstone coarse-grained

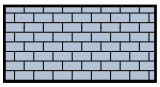

Aus Silty mudstone

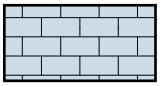

Aus Muddy siltstone

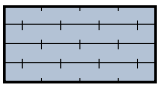

Aus Siltstone

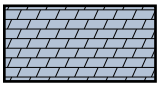

Aus Mudstone

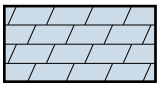

Aus Sandy siltstone

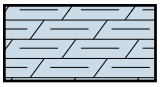

Aus Limestone

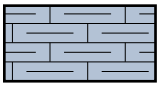

Aus Massive limestone

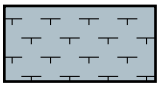

Aus Chalk

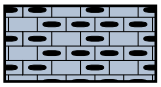

Aus Dolomite

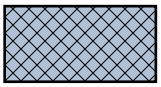

Aus Massive dolomite

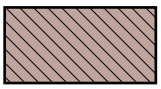

Aus Silty dolomite

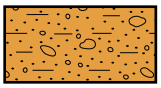

Aus Silty limestone

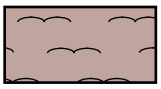

Aus Calcareous siltstone


Aus Limestone with chert

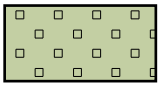

Aus Calc-silicate rock

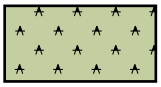

Aus Chert

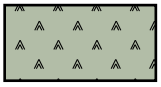

Aus Glacial till

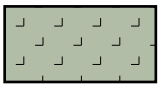

Aus Alluvium

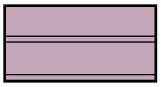

Aus Coal

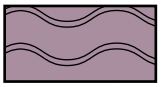

Aus Halite

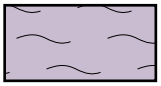

Aus Anhydrite

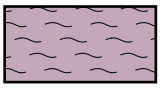

Aus Gypsum

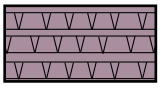

Aus Evaporites

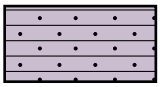

Aus Slate

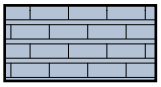

Aus Phyllite

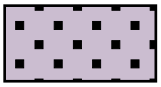

Aus Schist

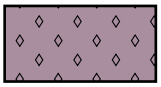

Aus Gneiss

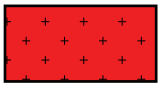

Aus Amphibolite

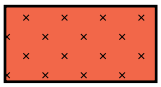

Aus Quartzite


Aus Marble

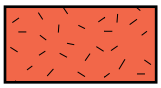

Aus Hornfels

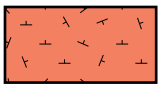

Aus Granulite

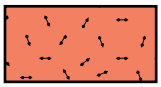

Aus Granite

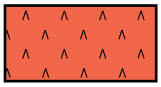

Aus Syenite

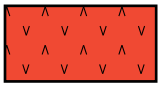

Aus Dolerite

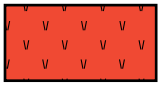

Aus Intrusive

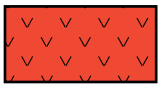

Aus Peridotite

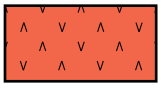

Aus Pegmatite

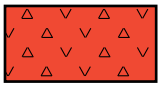

Aus Rhyolite

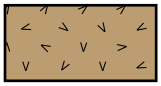

Aus Dacite


Aus Basalt


Aus Volcanics


Aus Andesite


Aus Volcanic breccia


Aus Tuff


Aus Ignimbrite

New Zealand Pattern fills - Folio 1

NZ_Coal_claystone
NZ_Coal_silty_claystone
NZ_Coal_clayey_sandstone
NZ_Coal_conglomerate
NZ_Coal_sandstone
NZ_Coal_siltstone
NZ_Coal_pebbly_sandstone
NZ_Pebbly_sandstone
NZ_Conglomerate

NZ_Sandy_siltstone
NZ_Sandy_mudstone
NZ_Silty_claystone
NZ_Muddy_sandstone
NZ_Tuff
NZ_Tuffaceous_claystone
NZ_Tuffaceous_conglomerate
NZ_Tuffaceous_siltstone
NZ_Tuffaceous_sandstone

NZ_Silty_marl
NZ_Clayey_marl
NZ_Marl_limestone
NZ_Chert_nodule_limestone
NZ_Marl
NZ_Flysch
NZ_Conglomerate_flysch
Red

NZ Pattern fills -Taranaki Chronostrat

NZ_Fan_sands
NZ_Mid_bathyal_carbonate
NZ_Mid_bathyal_clastic_marl
NZ_Mid_bathyal_marl
NZ_Mid_bathyal_mud

NZ_Shelf_mud
NZ_Shelf_sand_mud
NZ_Shelf_silt
NZ_Shoreface_gravel
NZ_Shoreface_sand

NZ_Shoreface_sand_mud
NZ_Terrestrial_coal
NZ_Upper_bathyal_clastic_marl
NZ_Upper_bathyal_marl
NZ_Upper_bathyal_mud

TSC default pattern overwrites

NZ_Clayey_sandstone
NZ_Sandy_claystone
NZ_Claystone
NZ_Fine-grained_sandstone
NZ_Sandstone

NZ_Limestone
NZ_Clayey_limestone
NZ_Volcanics
NZ_Siltstone
NZ_Chalk

NZ_Sandy_limestone
NZ_ Chert
NZ_Siliceous_chalk
NZ_Siliceous_limestone

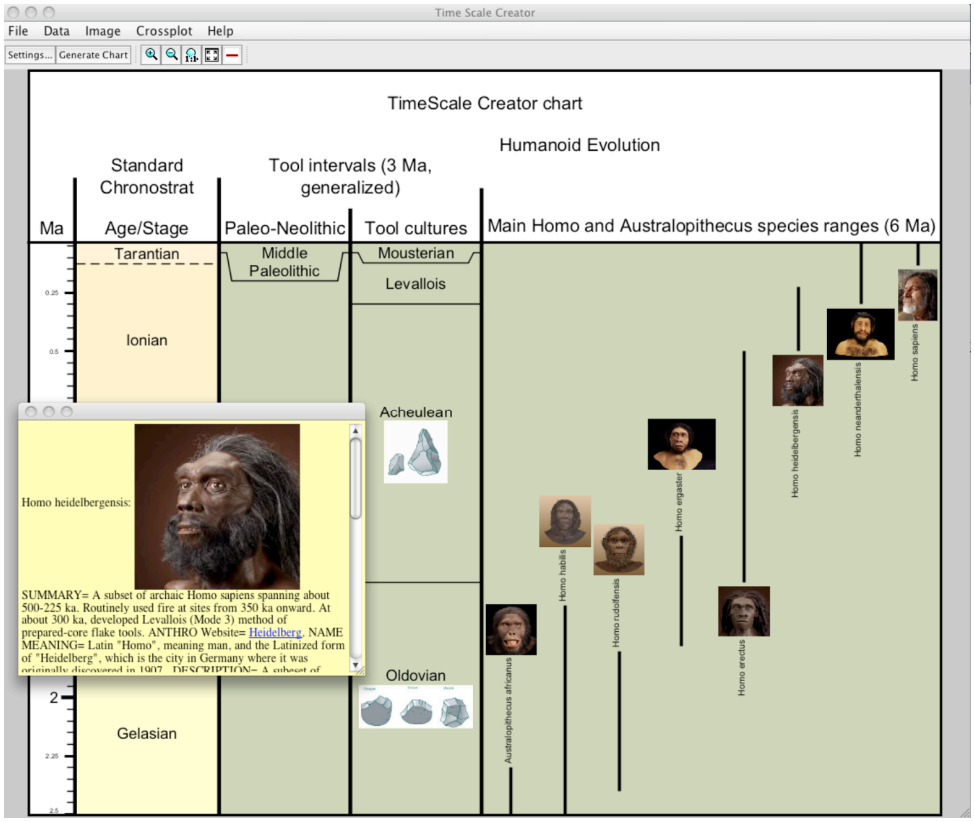
For how to use Images, see NEXT PAGE

Additional Options

- Super-titles on columns turned off using “ _TITLE_OFF” in headers.
- Zip-packaged datapacks can contain comments that have links to HTML files that are stored in the same Zip archive (e.g., one can essentially load a website of lots of image/data sub-pages, with each one called from the master TS-Creator on-screen pop-up windows system. This function is intended for more comprehensive special education and research datapacks developed by other users.
- External datapacks with other scales (e.g., “m”, “ft”, “ka”) can now be loaded. Therefore, a full set of outcrop information (lithology, strat units, fossils, geochem, paleomag, etc.) can utilize TS-Creator for quick plotting using the “Replace Data with Datapack” option. If one of its block-format columns is named “Stage” or “Age/Stage”, then this set will be used for the pull-down menu (e.g., duplicate the block-list of Formation names in a meter-scaled section and call it “Age/Stage”).
- External datapacks with other scales can be loaded using the “Add Datapack” option, then cross-plotted against the internal time-scale data suites. This enables a comparative age-versus-depth diagram for discussing possible sediment-history models.

Attaching Images to Events, Zones, etc. using the **<img>** tag

- Images can be included "attached to text" within on-screen data-labels, zone-labels, pop-ups, etc. Essentially, the attachment of HTML-style images (with top/vertical-bottom position options) are permitted in nearly every text location. If not an internal TS-Creator set (e.g., oil-gas symbols, impacts, etc.), the referenced images need to be within the directory containing the datapack. Download "***Humanoid evolution***" datapack from the Public TS-Creator website for an example:



<u>Summary</u>

This works just like in HTML: <img src="*image.png*">

Supported attributes are **src**, **width**, **height**, and **align**. The **src** attribute is mandatory.

The tag can appear anywhere where text is supported. This includes popups, labels inside columns, and even column titles. Hold off on using it in column titles, we may want to have a more restricted "icon" system.

ATTRIBUTES:

In HTML, a tag can be modified by attributes. Attributes are key/value pairs, and look like this: key="value". Multiple attributes are separated by a space: key1="value1" key2="value2". The order of the attributes doesn't matter.

For example, the <a> tag supports the *href* attribute. A web browser will support much more than just *href*, but the rule in HTML is that unsupported tags and attributes are silently ignored. That's what TSC will do, it will ignore all attributes except *href*.

The **<img>** tag supports several attributes:

src="image.png" - the image file. See next sections for file location, supported file formats, and built-in images. NOTE: The image-name can NOT have a "comma" (e.g. NOT "*jim**,**jack and jill.png*), but can contain spaces (although underlines are preferable).

width="10" **height**="20" - Optional to include one, or the other.
These are the same "units" as in the column width. So width="100" would produce a image that is as wide as a default column. If only width is specified then the height is scaled proportionally and vice versa. If both are specified then the image is stretched to that size.

align - Optional. Controls the vertical alignment of the image with the line of text it appears on. Can be one of "**bottom**", "**middle**", "**top**". ***The default is bottom***, and aligns the image with the text's baseline. The baseline is the bottom of the regular letters, ignoring descending ones like y, g, p, etc. So the baseline of abcde_ is the underscore.

Example: **default** <img src="*testimage.png*">
 bottom <img align="*bottom*" src="*testimage.png*">
 middle <img align="*middle*" src="*testimage.png*">
 top <img align="*top*" src="*testimage.png*">

OTHER HTML TAGS

The link tag (**<a>**) is also supported anywhere, not just popups.

The line break tag, **
** is also supported.
example: "This is text on one line
This is on another" will appear as:

This is text on one line This is on another

FILE LOCATION:

The **search order** for the image file is:

1. **In the datapack.** The path is **relative to the .txt file**.
   If the datafile is /Users/guest/Desktop/cretaceous.txt and the image is <img src="*t-rex.png*">, then the image has to be /Users/guest/Desktop/*t-rex.png*. If it was <img src="***dino**/t-rex.png*"> then it would have to be in /Users/guest/Desktop**/dino/**t-rex.png
2. **Built-in images.** These include the Blakey reconstructions, oil/gas symbols and "other". A listing of the current ones with their directories is at the end of this section.

The images in the freehand column follow these rules as well. So if something works in the freehand column it will work in the <img> tag too.

SUPPORTED FILE FORMATS: PNG or JPEG

SVG - Note that at the moment svg images **should NOT be used** in **popups** or **column** names. That's because popups and column names are sometimes rendered by Java's HTML renderer (in Settings or the popup window), which doesn't support SVG images. This can be worked around, but for now avoid this situation.

BUILT-IN IMAGES SUPPORTED IN TSCreator 4.5 and above:

Note that you do NOT need include the extension (.jpg/.png) of these images, especially for the oil/gas ones. TSC will find correct extension, and this way we can later switch the low-quality

bitmaps for high-quality .svg versions. This applies ONLY to the built-in images, i.e. the ones listed below.
So, for example, use this: <img src="*Oil_Gas/CO2_discovery*"> instead of this <img src="Oil_Gas/CO2_discovery.png">

Global_reconstructions_Blakey/105moll.jpg
Global_reconstructions_Blakey/120moll.jpg
Global_reconstructions_Blakey/150moll.jpg
Global_reconstructions_Blakey/170moll.jpg
Global_reconstructions_Blakey/200moll.jpg
Global_reconstructions_Blakey/20moll.jpg
Global_reconstructions_Blakey/220moll.jpg
Global_reconstructions_Blakey/240moll.jpg
Global_reconstructions_Blakey/260moll.jpg
Global_reconstructions_Blakey/280moll.jpg
Global_reconstructions_Blakey/300moll.jpg
Global_reconstructions_Blakey/340moll.jpg
Global_reconstructions_Blakey/35moll.jpg
Global_reconstructions_Blakey/370moll.jpg
Global_reconstructions_Blakey/400moll.jpg
Global_reconstructions_Blakey/430moll.jpg
Global_reconstructions_Blakey/450moll.jpg
Global_reconstructions_Blakey/470moll.jpg
Global_reconstructions_Blakey/500moll.jpg
Global_reconstructions_Blakey/50moll.jpg
Global_reconstructions_Blakey/540moll.jpg
Global_reconstructions_Blakey/560moll.jpg
Global_reconstructions_Blakey/600moll.jpg
Global_reconstructions_Blakey/65moll.jpg
Global_reconstructions_Blakey/90moll.jpg
Global_reconstructions_Blakey/Pleistmoll.jpg
Global_reconstructions_Blakey/presentmoll.jpg

Oil_Gas/oilrig.jpg

Oil_Gas/Oil_and_Gas_discovery.png
Oil_Gas/Oil_and_Gas_indication.png
Oil_Gas/Oil_and_Gas_show.png
Oil_Gas/Oil_discovery.png
Oil_Gas/Oil_discovery_Gas_indication.png
Oil_Gas/Oil_discovery_Gas_show.png
Oil_Gas/Oil_indication.png
Oil_Gas/Oil_show.png
Oil_Gas/Oil_show_Gas_indication.png

Oil_Gas/CO2_discovery.png
Oil_Gas/CO2_discovery_Oil_show.png

Oil_Gas/Gas_discovery.png
Oil_Gas/Gas_discovery_Oil_indication.png
Oil_Gas/Gas_discovery_Oil_show.png
Oil_Gas/Gas_indication.png
Oil_Gas/Gas_show.png
Oil_Gas/Gas_show_Oil_indication.png

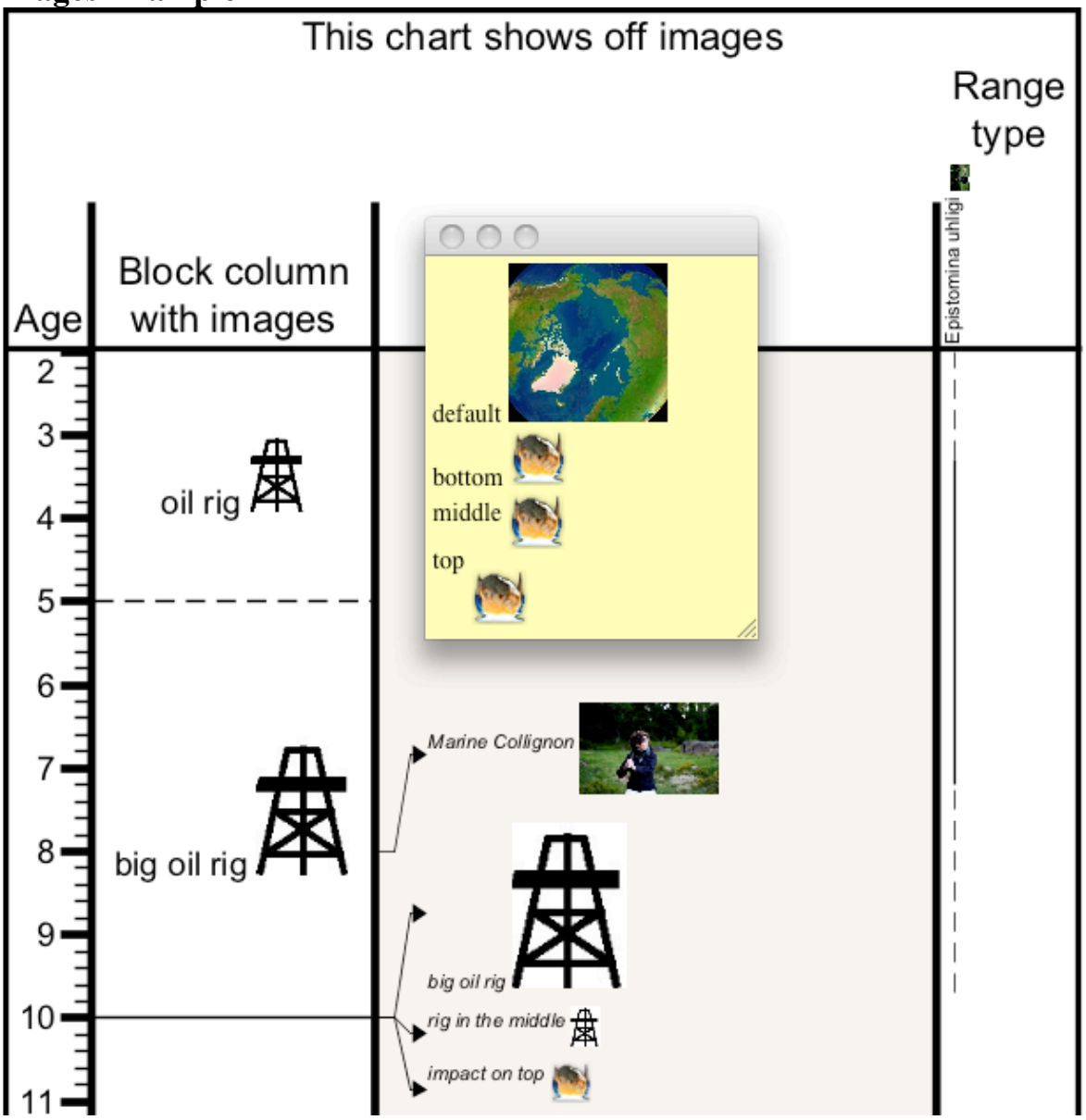
Oil_Gas/PetroExpl_dry_hole.png
Oil_Gas/PetroExpl_not_classified.png

Oil_Gas/SourceRock_Gas.svg
Oil_Gas/SourceRock_Oil.svg
Oil_Gas/SourceRock_Oil_and_Gas.svg
Oil_Gas/SourceRock_Possible.svg

Oil_Gas/Mine.png

Other/ge_impact_icon.png
Other/Lava1.png

Images Example



format version: 1.4
date: 1/5/2005
chart title: This chart shows off images

Block column with images block 100
TOP 0
oil rig <img src="Oil_Gas/oilrig" width="20"> 5 dashed **default <img src="Other/ge_impact_icon">
bottom <img align="bottom" src="Other/ge_impact_icon">
 middle <img align="middle" src="Other/ge_impact_icon">
 top <img align="top"** src="Other/ge_impact_icon">
big oil rig <img src="Oil_Gas/oilrig" height="50">> 10

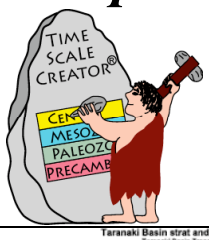
Event column with images event 200 245/240/235 notitle on
EVENT
small oil rig <img src="Oil_Gas/oilrig" width="12">> 2 dashed default <img src="Other/ge_impact_icon">
bottom <img align="bottom" src="Other/ge_impact_icon">

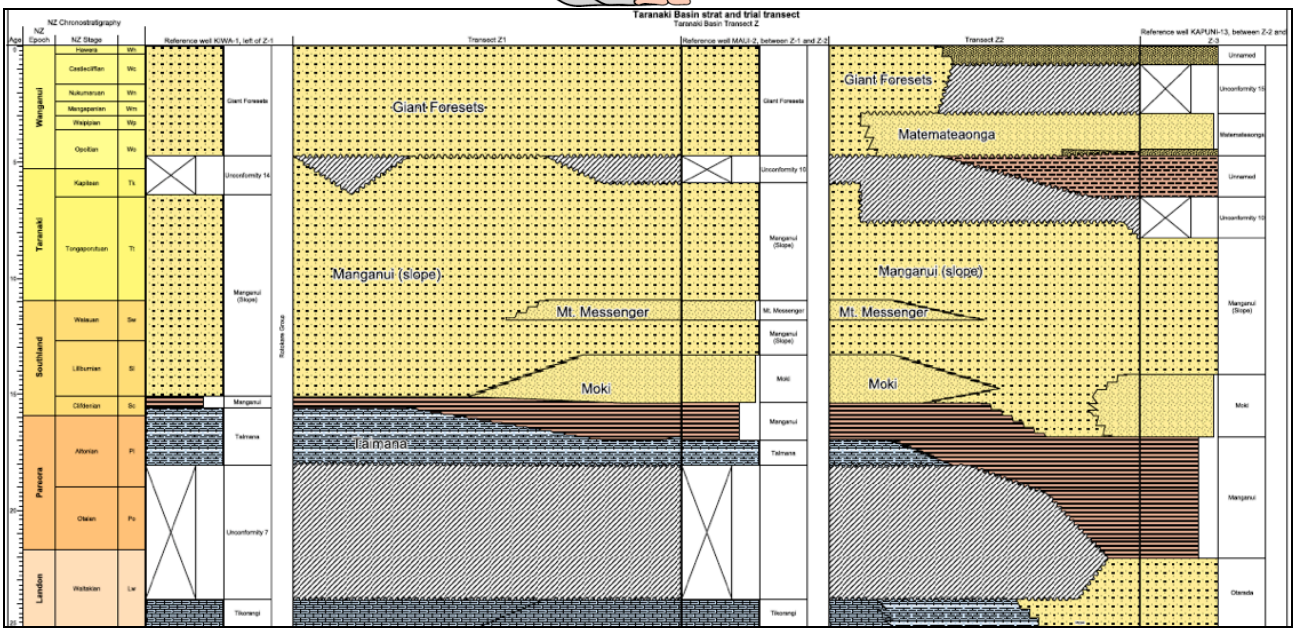
```
middle <img align="middle" src="Other/ge_impact_icon"><br> top <img align="top"
src="Other/ge_impact_icon">
        Marine Collignon <img align="middle" src="Marine_base ball.jpg" width="50">      8
        big oil rig <img src="Oil_Gas/oilrig" height="60">      10
        rig in the middle <img src="Oil_Gas/oilrig" align="middle" height="15">      10
        impact on top <img src="Other/ge_impact_icon" align="top" height="15">  10

Range type     range
        Epistomina uhligi <img align="middle" src="Marine_base ball.jpg" width="10">      1.8
        TOP
        Epistomina uhligi <img align="middle" src="Marine_base ball.jpg" width="10">      3.3
        rare
        Epistomina uhligi <img align="middle" src="Marine_base ball.jpg" width="10">      7.2
        common
        Epistomina uhligi <img align="middle" src="Marine_base ball.jpg" width="10">      9.7
        rare     <img align="middle" src="Marine_base ball.jpg" width="150">
```

NOTE: Substitute your own image for "Marine_base ball.jpg" in this example. Called-images are searched FIRST in the directory that contains the datapack.txt file; and keeping datasets and images together is easier to use and avoids accidentally calling similar-name items from elsewhere.] The oil/gas and impact images are within the Internal TS-Creator.

Inserting Reference Holes and Transects into *TimeScale Creator:* *Key Steps for Experienced Users*





Part A -- Graphics and Excel Setup for reference wells and transect

Create A Template

1) Open TS Creator
2) Chose **Data** -> **Save Transect Template**
3) Revise Top Age and Bottom Age appropriately
4) Save file to a desired location with an appropriate name that includes "template"
5) **IMPORTANT**: While Adobe Illustrator is **<u>not</u>** open, double-click the SVG template file to auto-open Illustrator – This procedure is **required** to properly load the swatches (lithologic patterns) into Illustrator.
6) Move the template text and line-styles above the "red box" for later use

Layer Set Up

1) "**Save-As**" <u>Illustrator</u>-format with the title *Transect_XXX_date.ai*
   a. NOTE: The SVG format will NOT preserve layers
2) Create Layers
   a. If the "Layers" window is not present, turn it on in the "Windows" menu

b. Rename Layer 1 “Transect XXX polygons” and change the layer to an appropriately easy to read color (Red/Green)
c. Use the “Create New Layer” function in the Layer window’s drop down menu, and create additional layers as needed.
d. Drag the “Transect XXX Polygons” layer to the middle, being sure to place it above the layer of the scan, which you also must create.
e. Label the lowest layer as the Scan layer and the top layer for guides/rulers, leaving the polygon layer(s) to be inserted in the middle as needed.
f. Insert the Transect Scan (from PDF) into the BOTTOM layer
g. Chose the appropriate sizing and resolution for the scan, LOCKING the layer afterwards.
h. Next, create the 10-line ruler (or copy it from a previous source) and add it to the “Guides/Ruler” layer.

Creating Layers for Reference Wells

1) Select the desired reference well location (these will be the boundaries of the “red-boxes”)
2) Duplicate “Transect XXX polygons” sheets according to the number of panels between chosen reference holes.
3) SAVE THE FILE – Begin each session with a new “Save-As,” remembering to add the most recent date to the AI file name. This enables one to recall an earlier file in case of major errors.

Microsoft Excel Spreadsheet Set-Up

Create a Work Book that includes Sheets for:

a. The Master Chronostrat Reference Scale
b. Table for Reference Wells and Transect Age linking
c. TSCreator Formatted Output

Set-up for the Well-Transect Sheet in Excel

Transect panels between 2 reference wells: Reference Well #1 – Transect Panel A – Reference Well #2 (this permits cross-linking to these wells).

Transect panels will, ideally, share a reference hole with the next panel (9 columns per well, 8 per panel)

1) The Reference-well includes columns for:
   a) The item or name
   b) A “Book-keeping” note on calibration
   c) Original SVG-conversion age
   d) “Real” age as derived from the reference wells

Hampshire Basin								
Group	Lithology (TSC pattern name)	Formation name	Base of BASE	Combined Comments (pop-up)	Lithology	Calibration & Comments	BGS Lexicon URL	Reference
Purbeck Gp.	Primary			LITHOLOGY = Interbedded mudstones, limestones and evaporites of brackish and marine origin (For details click >a href="http://www.bgs.ac.uk/lexicon/lex.cfm?pub=DU&RNY=PB">)	Interbedded mudstones, limestones and evaporites of brackish and marine origin		PB	UK strat chart; Brit. lexicon
	Continental marl	Durlston Fm.	143.35	LITHOLOGY = Interbedded, shelly limestones and dark mudstones (For details click >a href="http://www.bgs.ac.uk/lexicon/lex.cfm?pub=DU&RNY=DURN">). CALIBRATION = 40% up in Berriasian	Interbedded, shelly limestones and dark mudstones	40% up in Berriasian	DURN	UK strat chart; Brit. lexicon

2) The transect set between Reference wells includes these columns:

Great South Basin; southeast transect 27 (one panel)							
Item	Age control	Polygon original	Polygon ages relative to Reference Wells	Text item	Text age control	Text original age	Text relative to formations
Top of Penrod Group	<-- Left	0	0.00	Penrod Gp	50% up in full extent of Penrod Group	7.68	7.34
Base of Penrod in Right-center	Middle of Wc	1.5	0.99				

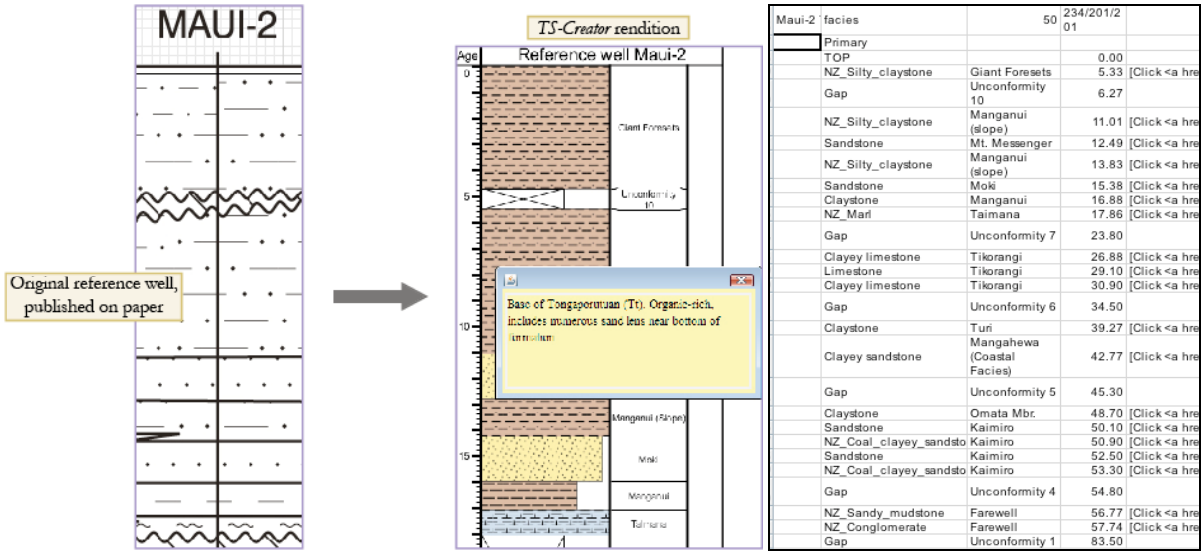
The Data Output sheet of the Excel file will mirror the well/transect/well in sequential order

****

Part B. Reference well scaling to Master Chronostratigraphy

Recording and Age Calibration of Lithologic Units

1) "***Snap-to-Grid***" must be **OFF**
2) Use the Ruler overlay to acquire proportional placement of each facies change.



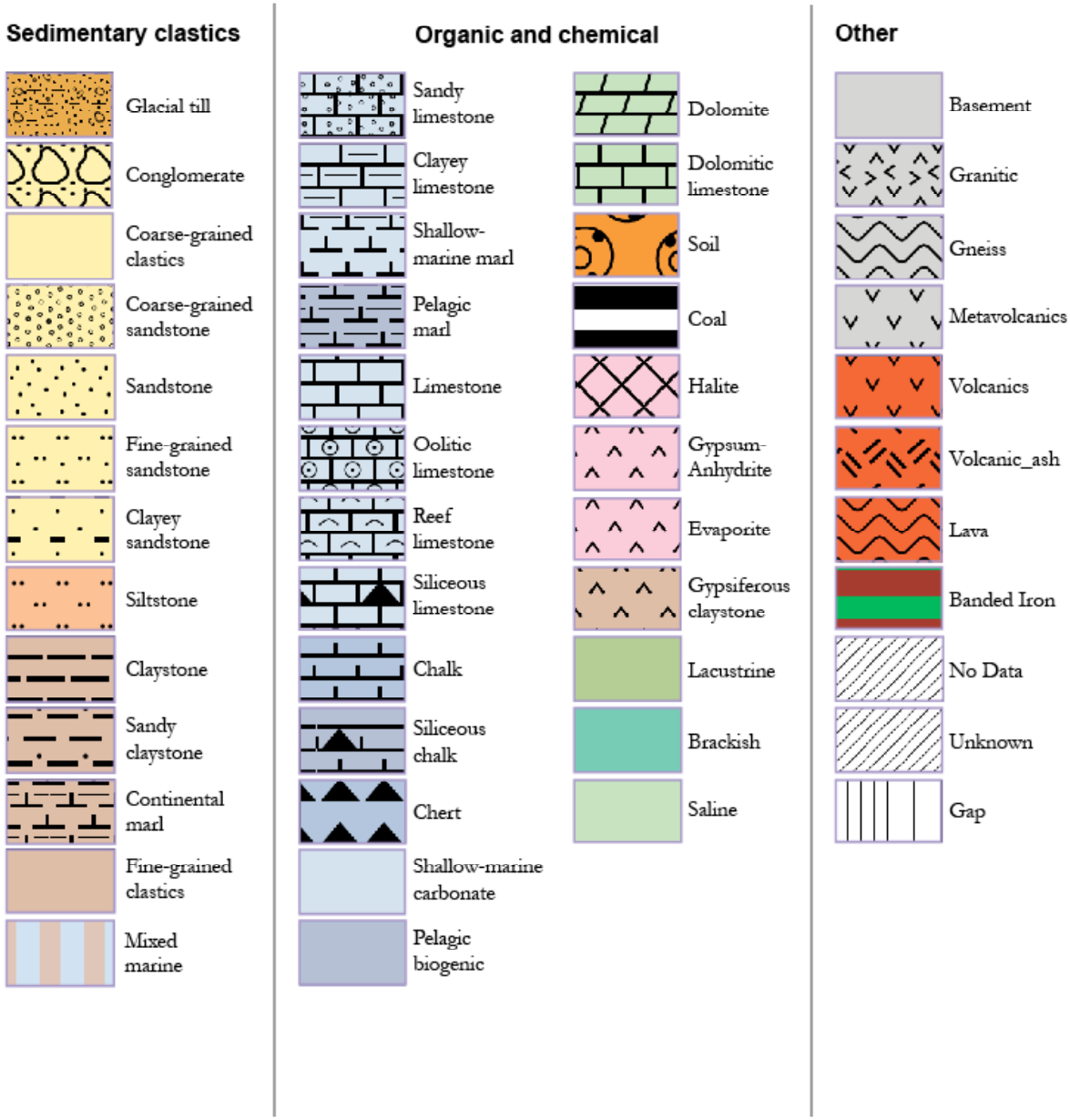
3) Pop-ups include lithologic summary, calibration to Geologic stages, URLs for lexicons (if available), and references.

Pointers on Lithology

1) "**TOP**" with an age entered will terminate the overlying lithology pattern
2) "**Gap**" performs the same function but is used for a hiatus less than 10 myr in length
3) "**Primary**" flag (white box to the left of "Primary" (the group column) **must have** a SPACE or it will not be read by the program.

Time Scale Creator lithostratigraphic patterns

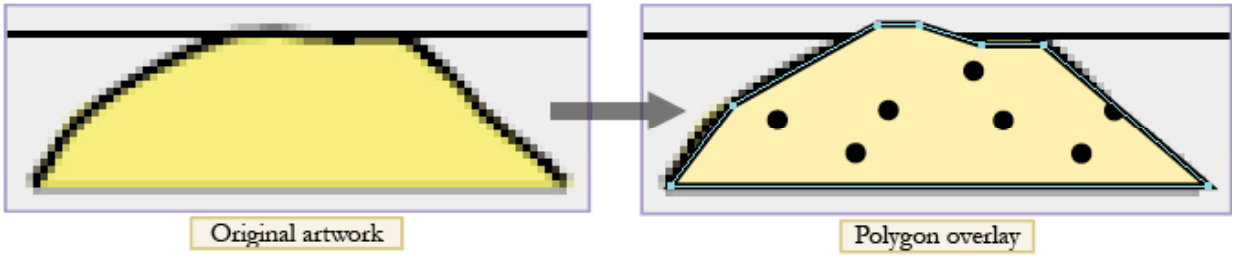
TS-Creator is case-sensitive. If it does not recognize the lithological label, it will draw a blank formation without generating a an error message.



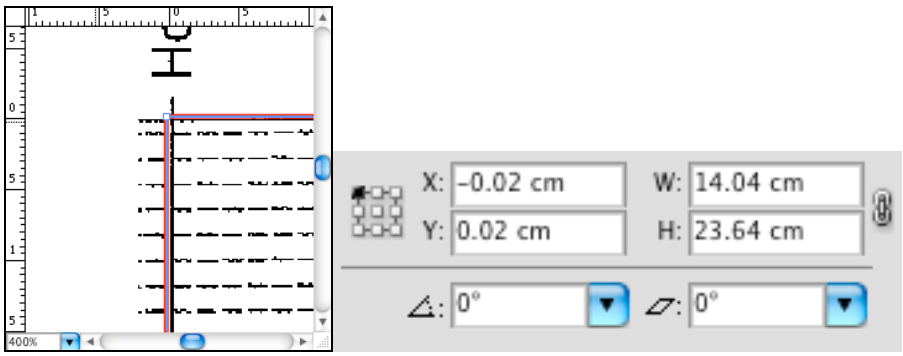
<u>CAUTION</u>: *TS-Creator* is **case-sensitive**. If it does not recognize the lithological label, it will draw a blank formation without generating an error message. Writing "*Clayey Sandstone*" instead of "Clayey sandstone" (a named-pattern) is a common mistake.

****

Part C. Transect panel digitization and conversion



1) Setting up "*Snap-to-Grid*"
    a. Preferences -> Guides and Grids -> set Grid Spacing to 10
    b. Turn ON "Snap-to-Grid" (Under View in AI)
    c. Turn ON desired Transect layer (lock others)
    d. Adjust sizing the "Red-Box" outline relative to grid to encompass the panel between reference holes
    e. Revise Top Age and Base Age, as appropriate
    f. To ensure that all plotted points fit within the "Red Box", adjust the dimensions of the box by 0.02 cm in all directions. (Transform menu) – see detailed Manual for details, if needed.



Tracing Polygons -- Set-up:

1) The original scan is on the bottom layer (locked)
2) Ruler layer is OFF and locked
3) Red rectangle is on the overlying layer with any polygons that you draw (only unlocked layer)

Using the Pen tool in AI  , begin drawing polygons over the original lithologies. Remember to select the correct fill from the "Swatches" menu.

POINTERS for Polygon digitization:

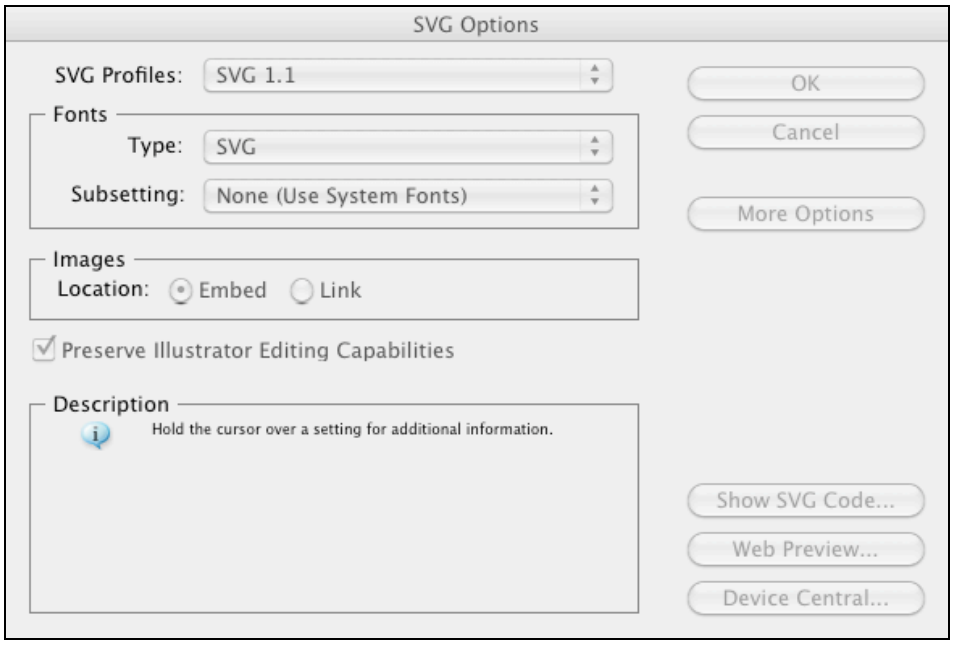
1) All points must create closed line segments
2) All shared lines must share the exact same points
3) All points must lie within the "red-box"
4) In order to later calibrate the correct ages, the polygons that cross multiple scans should be on the same level. (Y)

5) Simplify shapes by using the fewest points possible, thus saving a great deal of extra work in later stages
6) Reducing the transparency of polygons for easier legibility is a good idea
7) After drawing all polygons, insert text titles (Arial 10) in the best, easiest to read locations on the layer
8) Insert popups (format popup: Formation Name), being sure to place the lower left point of the pop-up within the appropriate polygon.
9) As a final step in the drawing process, insert the wavy and interfingering line patterns on appropriate boundaries.

IMPORTANT: Polygons cannot overlap, unless one polygon lies entirely within another.
REMEMBER TO SAVE ILLUSTRATOR FILE (as .ai format; plus date)

Export the Transect Panel as SVG

1) **Only After** saving the Illustrator file, do a Save-As, saving the file, this time, as an SVG.
2) When the "SVG Options" window opens, use the drop down menu to change the "Type" to SVG and select the box for "Preserve Illustrator Editing Capabilities" before clicking "Ok."



Open the SVG panel in TS Creator

Open TS -> **Data** -> **Load Transect Column from Template**

Assuming no errors, the column will be displayed. Do the following:

1) Check that the **Top Age** and **Base Age** are correct
2) Adjust zoom or column width to check for errors more easily
3) Check to see that popups are functional (correct if necessary)
4) Adjust "*Point-Merge Distance*," "*Snap-X-to-Grid*," and "*Snap Y to Grid*" to get the best looking polygons.
5) Save-As text file, remembering to include the above values in the name for other users

****

Part D. Inter-Linking Transect panels to Reference wells

Paste converted Transect-SVG into Excel "output" sheet

1) Open the text file (saved in TSC from the SVG) in word
2) Copy and paste all data into the output file of the tab delimited text file (don't transfer format and date)
3) Change font to Arial 10

Mirrored-Age Set up

1) With the Well-Transect-Well sheet opened, copy the Age-set for the X-Y grid into "Polygon Original Ages" for the transect panel (3rd column)
2) Copy the same into "Polygon ages relative to reference wells"
3) Replace the Age-set in the TS text file with a LINK to "polygon agers relative to reference wells"
4) Perform the same mirroring for the labels, creating a LINK between Text and Ages

Linking to Reference Wells

A) A DIRECT link ties a cell to another reference hole using a cell from that reference hole for the age in the panel
B) ART scaling uses the ruler to measure ages relative to a provided geologic timescale OR using the lithologies whose upper and lower limits are known.

The format should be:

RED TEXT: ART - % up in Formation XXX

Label Linking

Follow the same processes as above to link in the locations of text in the panel

As a final note, changes can be made in the output text file and, because of back linking, the changes will trickle down.

Output, editing

Only AFTER you've Saved your Excel work, go under "*Save As*", select "***Text Tab-delimited***". Save this as a .txt file.

Clean the Excel output – Open the .txt in WORD

Delete excess tabs at ends of lines:

Using WORD special-character option, Replace all "Tab-Paragraph" with "Paragraph"

To remove extra quote marks, do the following In Order (and, only a single time each) –

Replace "Paragraph"-quote with "Paragraph"
quote-"Paragraph" with "Paragraph"
"Tab"-quote with "Tab"
quote-"Tab" with "Tab"
quote-quote with quote (this removed double-sets of quotes)

Save the "cleaned" file as .txt. Load into TS-Creator to review work.

See detailed manual for editing and revision advice.

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Part F. Advanced Graphic-interface

Add a map interface for the transects and reference wells -- See below for details.

CREATING MAP-PACKS (Geographic Interface)

What are MapPacks?

MapPacks are .map files that contain graphical information about datapacks loaded into TSCreator. Users can load MapPacks for a visual way to select and deselect data points.

MapPack Contents

MapPacks contain at least 2 files: 1) the MapPack Data file and 2) the map images.

1. MapPack data files are tab-delimited files that contain information about the following:

   - Basic map information: **Name**, **Description**, and **Image Name**. The image name is the file name of the image, which is located in the MapImages folder. You do **not** need to append the folder name, just the file name itself.

HEADER-MAP INFO	MAP NAME	IMAGE	NOTE				
MAP INFO	Belgium	BelgiumGeoISites_16May11.png	*Unknown projection; overlay by us of locations onto regional provinces*				

   - Map parent information: **Parent Name**, **Parent Coordinate Type**, and **Parent Coordinate Information.** The **parent map** is a world map on which a "submap" of your chosen area can be overlain. In this manual, we will be using Belgium as an example. The area we would like to choose as a submap on our world map is designated by the latitude and longitude coordinates indicated in the last four columns here. Currently, the only **coordinate type** supported by TimeScale Creator is rectangular, meaning that each point on the map is assigned an x and y coordinate and the curvature of the earth is essentially ignored.

HEADER-PARENT MAP	PARENT NAME	COORDINATE TYPE	UPPER LEFT LON	UPPER LEFT LAT	LOWER RIGHT LON	LOWER RIGHT LAT
PARENT MAP	World Map	RECTANGULAR	1.70	51.55	6.47	49.42

   - Map coordinate information: **Coordinate Type**, and **Coordinate Information.** The coordinate information is where the corners of our map are in latitude and longitude format, just as we used before. However, it is important to be as accurate as possible with these corners, as all of the coordinate data for the columns will be overlain on this map relative to the corners you choose. If your corners are off by a half a degree, all of your column locations will also be off by a half a degree on the map.

Format for "Rectangular" (parallel Lat and parallel Long lines), *or simple X-Y coordinate system*

-

HEADER-COORD	COORDINATE TYPE	UPPER LEFT LON	UPPER LEFT LAT	LOWER RIGHT LON	LOWER RIGHT LAT
COORD	RECTANGULAR	1.70	51.55	6.47	49.42

- Data column coordinates: **Name**, **Coordinate Information**, and **Description**

COMMENT	DataColumns			
HEADER-DATACOL	NAME	LAT	LON	NOTE
DATACOL	Oostende anc	51.22	3.07	

Important: Latitude and longitude coordinates must be in decimal degrees, not degree-minute-second form. To convert, simply use the formula: degree + minutes/60 + seconds/36000.

Making the Image and Input format for "Vertical Perspective" (Google-Earth or other "from space" view):

Step 1: Select the area in Google Earth for the map.

Step 2: Make sure map is aligned properly with the north.

Step 3: Mark the center using the Pin. Make sure the Latitude and Longitude are in decimal-degree. If not, go to preferences and change them to decimal-degrees. Make sure the values for the Scale and height are in KM's. If not change them in Preferences.

Step 4: Hide the pin if necessary before taking the snapshot of the map.

Step 5: Select the appropriate elevation.

Step 6: Once again make sure that the map is aligned north wards.

Step 7: Use command + shift + 4 in case of make to bring the snapshot tool.(Or use the appropriate snapshot tool in case of other OS.). Select the entire area of the map as snap shot.

Step 8: User Scale and Eye Alt and Pin Values for the SCALE , HEIGHT and CENTER LAT LON values in the map pack. Make sure the values for the Scale and height are in KM's. If not, change them in Preferences.

Step 9: Rename the screen Shot to the name you like.

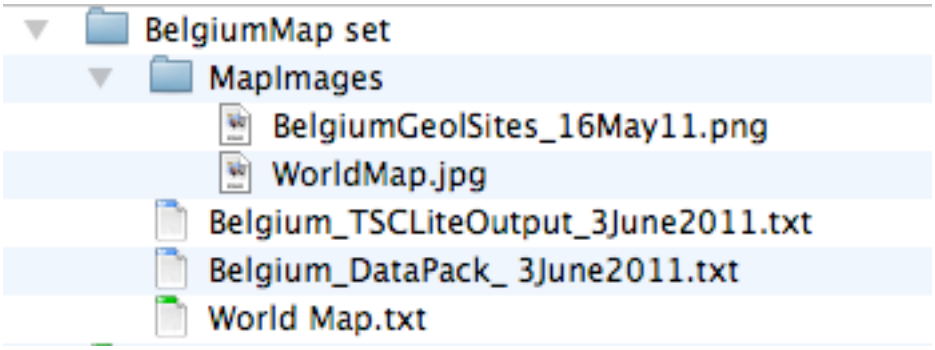
Step 10: Add the values to the corresponding fields in the map pack.

For e.g. In this example (Google Earth of entire USA; USAMap.png): HEIGHT (Eye alt) = 3671.83 (km), SCALE = 1285 (km), CENTER LAT = 37.42 , CENTER LON = -100.38 *(it is West of Greenwich)*

MAP-VERSION	1				
HEADER-MAP INFO	MAP NAME	IMAGE	NOTE		
MAP INFO	USA	USAMap.png	World Wind Image		
HEADER-COORD	COORDINATE TYPE	CENTER LAT	CENTER LON	HEIGHT	SCALE
COORD	VERTICAL PERSPECTIVE	37.42	-100.38	3671.83	1285

MapImages and sub-images

2. MapPacks also contain the images for the map data files. Inside MapPacks should be the MapImages folder. Images should be placed inside this folder. Again, Image Names referenced in MapPacks should not append the MapImages folder, but instead it should only contain the name of the file.



Building MapPacks

MapPacks are tab-delimited files with the map contents described above. They can be built in a spreadsheet application (like Microsoft Excel) for a more user-friendly and cleaner interface. The contents (or sections) must be displayed in the file in the following order:

Map Information > Coordinate System > Parent Map Information > Data Columns > Information Points > Transects

The first column of a MapPack has information about the row type. Row types include:

- Comments – used for displaying purposes and informational notes only.
- Header – used for indicating a new section. The rest of the row contains header information (and the order) for items underneath the header.
- Information Items – items that follow specific details for a particular header.
- Transect information: **Name**, **Start Location** (Name of Data column), **End Location** (Name of Data column), **Description.** Unfortunately, Belgium does not currently have any transect data. However, if one were to want to set a transect up, a similar format is used. Although this transect does not exist, this is the general format for transect information:

Header-Transects	Name	Startloc	Endloc	Note
Transect	Woensdrecht-Kallo	Kallo	Woensdrect	Reference...

To create your own:

1. If you are still unsure about what data belongs in each section rows, use this as a template. Copy this template and update it with your own information.

MAP-VERSION	1.0						
COMMENT	**Map Information**						
HEADER-MAP INFO	MAP NAME	IMAGE	NOTE				
MAP INFO	World Map	WorldMap.jpg	This map pack was created by Bradley Van Dyk for testing purposes				
COMMENT	**Coordinate System**						
HEADER-COORD	COORDINATE TYPE	UPPER LEFT LON	UPPER LEFT LAT	LOWER RIGHT LON	LOWER RIGHT LAT		
COORD	RECTANGULAR	-180	90	180	-90		
COMMENT	**Parent Map Information**						
HEADER-PARENT MAP	PARENT NAME	COORDINATE TYPE	UPPER LEFT LON	UPPER LEFT LAT	LOWER RIGHT LON	LOWER RIGHT LAT	
PARENT MAP	World Map	RECTANGULAR	171.5712	-37.4913	175.4356	-41.789	
COMMENT	**DataColumns**						
HEADER-DATACOL	NAME	LAT	LON	NOTE			
DATACOL	Purdue Airport	40.41194444	-86.93361111	Purdue's small airport			
DATACOL	Toronto	43.64402585	-79.40917969	Toronto city in Canada			
DATACOL	China	34.30714386	103.7109375	China			
COMMENT	**Information Points**						
HEADER-INFORMATION POINTS	NAME	LAT	LON	NOTE			
INFOPT	South of Purdue Airport	20.41194444	-86.93361111	Purdue's small airport			
INFOPT	CENTER	0	0	Center of the earth			
COMMENT	**Transects**						
HEADER-TRANSECTS	NAME	STARTLOC	ENDLOC	NOTE			
TRANSECT	Taranaki general transect (low-resolutio	West side of Taranaki r	East side of Taranaki regio	Reference = King et al (1999) with later review by GNS working groups			

2. Once you are satisfied with your map data, save the file using Save As…

3. For **Format** or **Save as Type**, select Tab Delimited Text or Text (Tab delimited) depending on your version of Microsoft Office.

4. You should now have a valid map file. You can combine these with Datapacks to create a MapPack file following the instructions below.

****

MapPacks and Datapacks

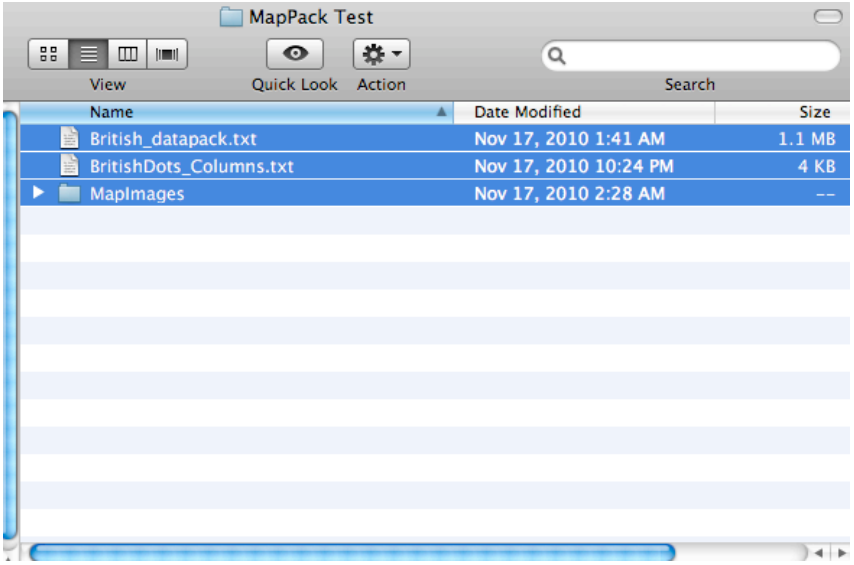
MapPacks can contain regular TSCreator datapacks. When a MapPack contains a TSCreator datapack, that datapack is loaded into TSCreator just as it would normally, but after it is successfully loaded, the MapPack information is loaded.

This is particularly useful since MapPacks are directly related to datapacks. MapPacks allow users to easily modify data points that are loaded by datapacks. Inserting datapacks into MapPacks eliminates the extra step of importing datapacks.,

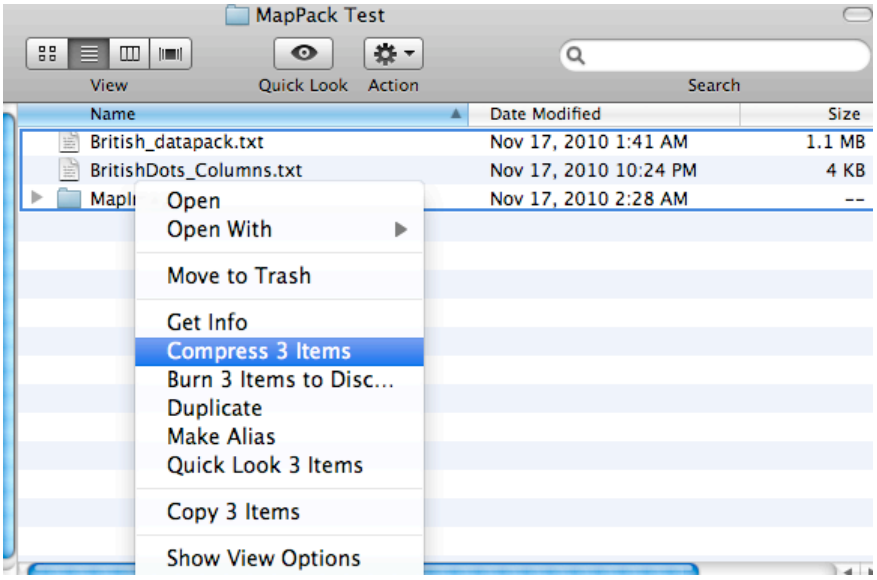
Creating the .Map File *in Mac OS X*

MapPack files are created as .zip files and then properly renamed to .map files. Once the Map Pack data files and images are correctly created, zip the files by performing the following:

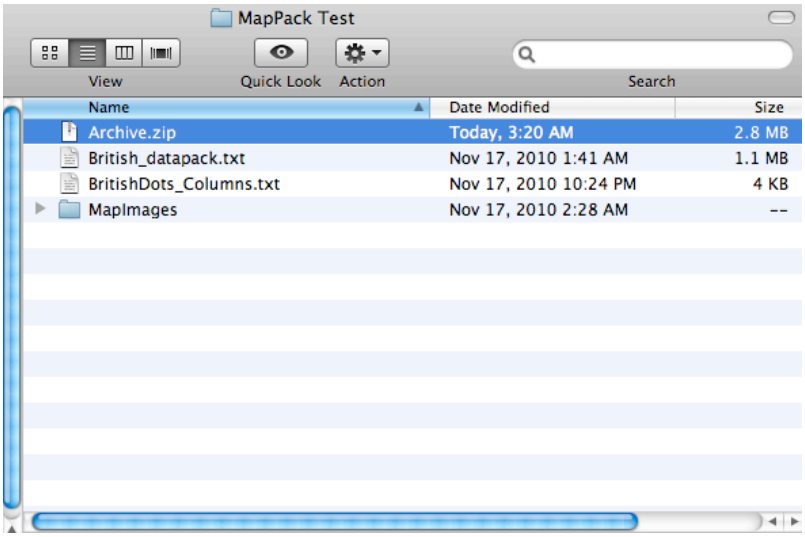
1. Select the necessary files and datapacks if available (see previous section MapPacks and Datapacks)



2. Right click and select "Compress x Items" where x is the number of files to be added to the Map Pack.



3. A new “Archive.zip” file should have been created.

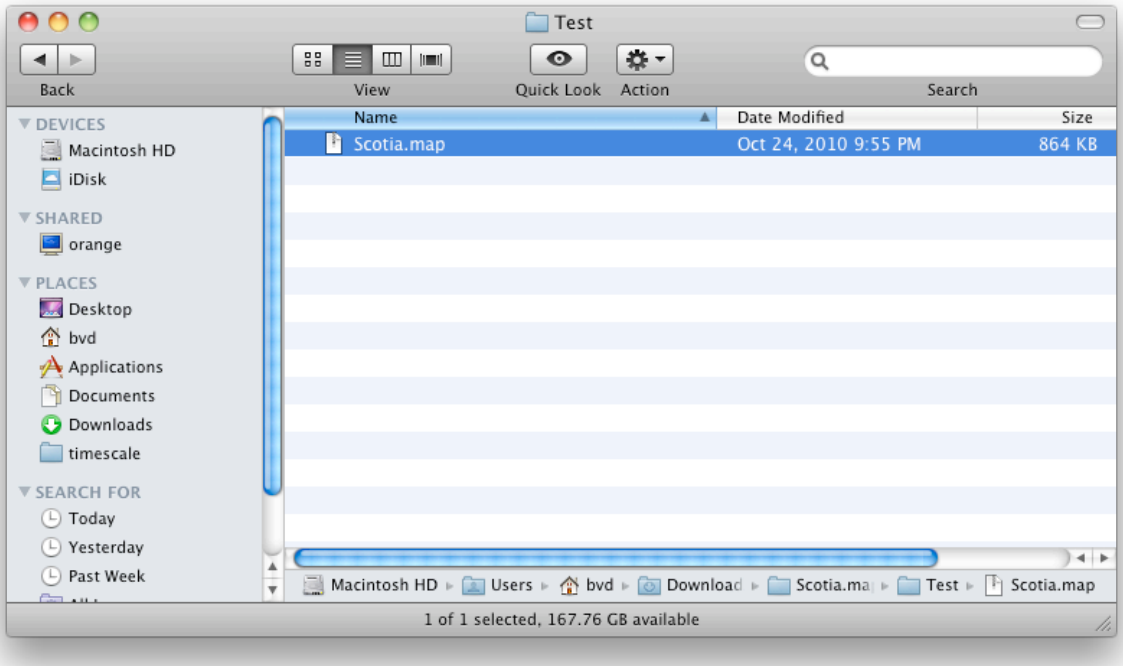


4. Rename the MapPack to .map by following the instructions in the “Rename MapPacks Mac OS X” section.

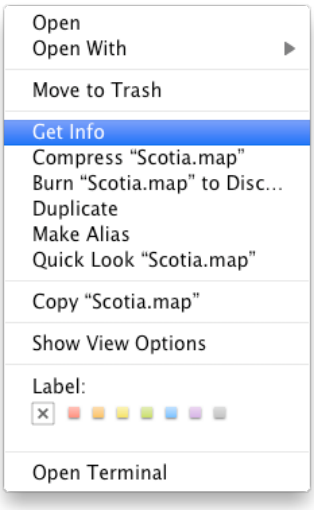
   While not recommended, you are able to leave the MapPack in its original .zip format and still import it into TSCreator.

Renaming MapPacks *in OS X*

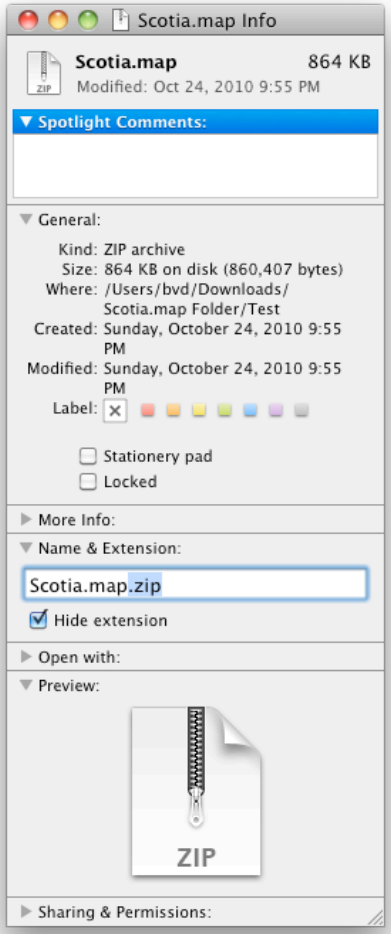
Sometimes a MapPack looks like it is renamed to .map if extensions are hidden by default.

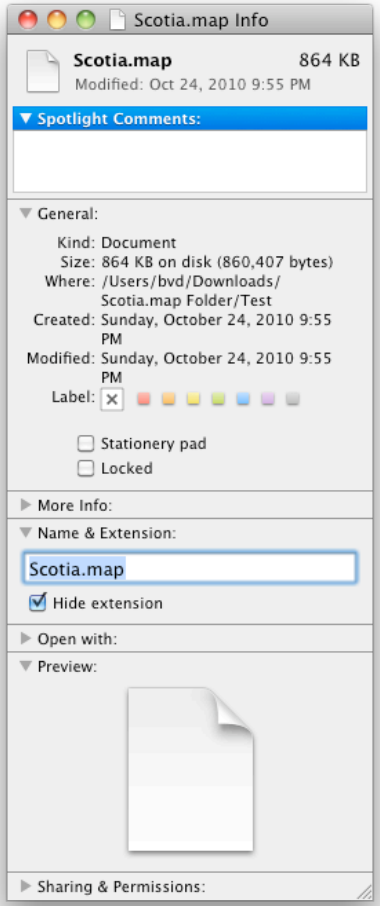


1. To rename the file to a MapPack, first right click the file and click “Get Info”.

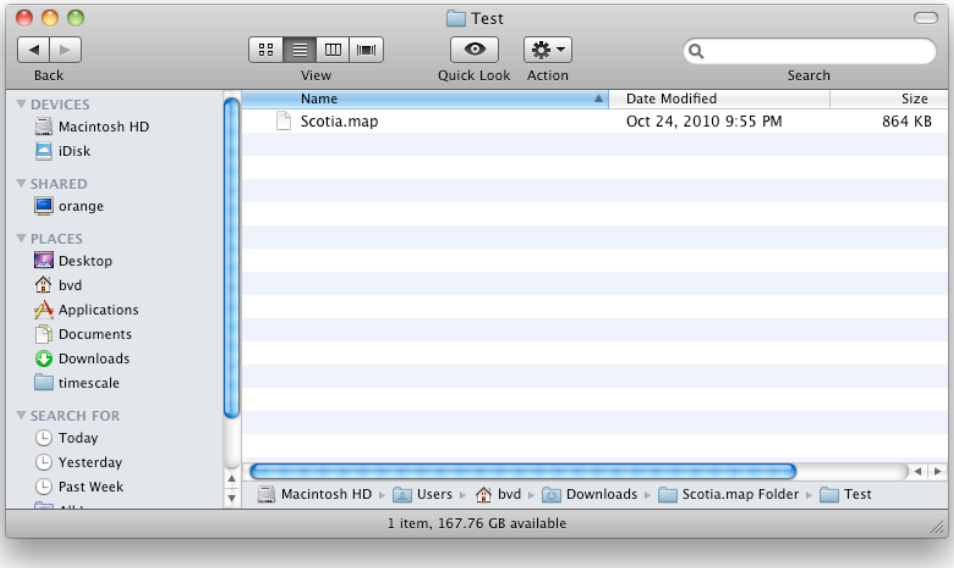


2. In the properties window, remove the ending “.zip” in the “Name & Extensions” section. Ensure that the file name now ends in “.map”.





The MapPack looks the same as it did in the beginning, but following these steps ensures it is in the correct format.

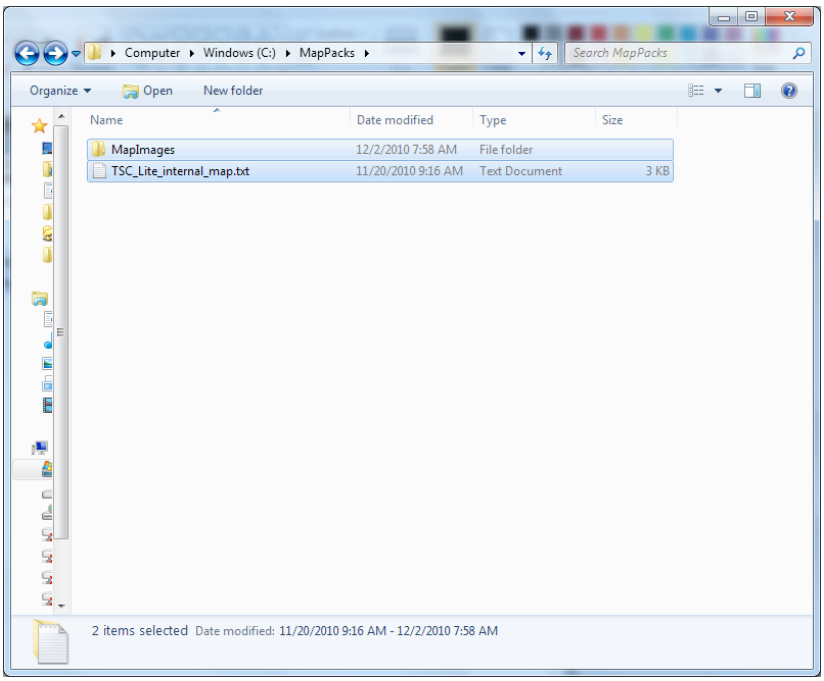


****

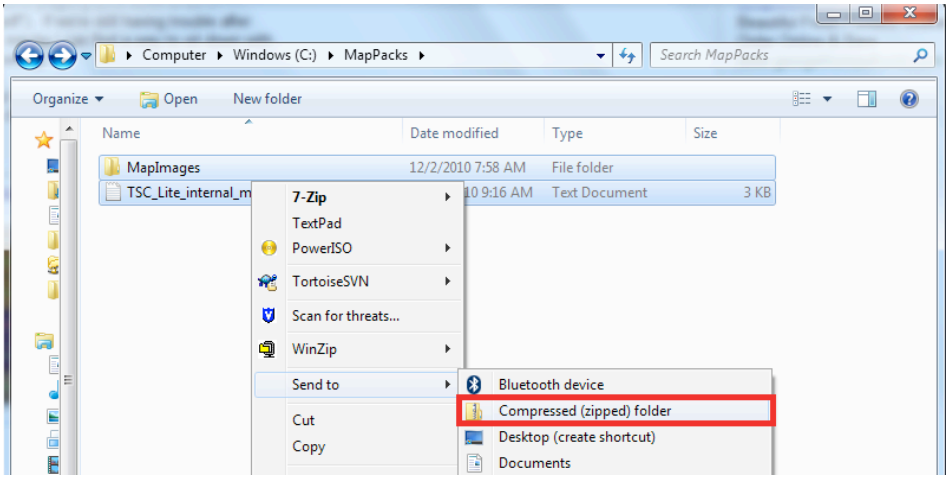
Creating the .Map File *in Windows*

MapPack files are created as .zip files and then properly renamed to .map files. Once the Map Pack data files and images are correctly created, zip the files by performing the following:

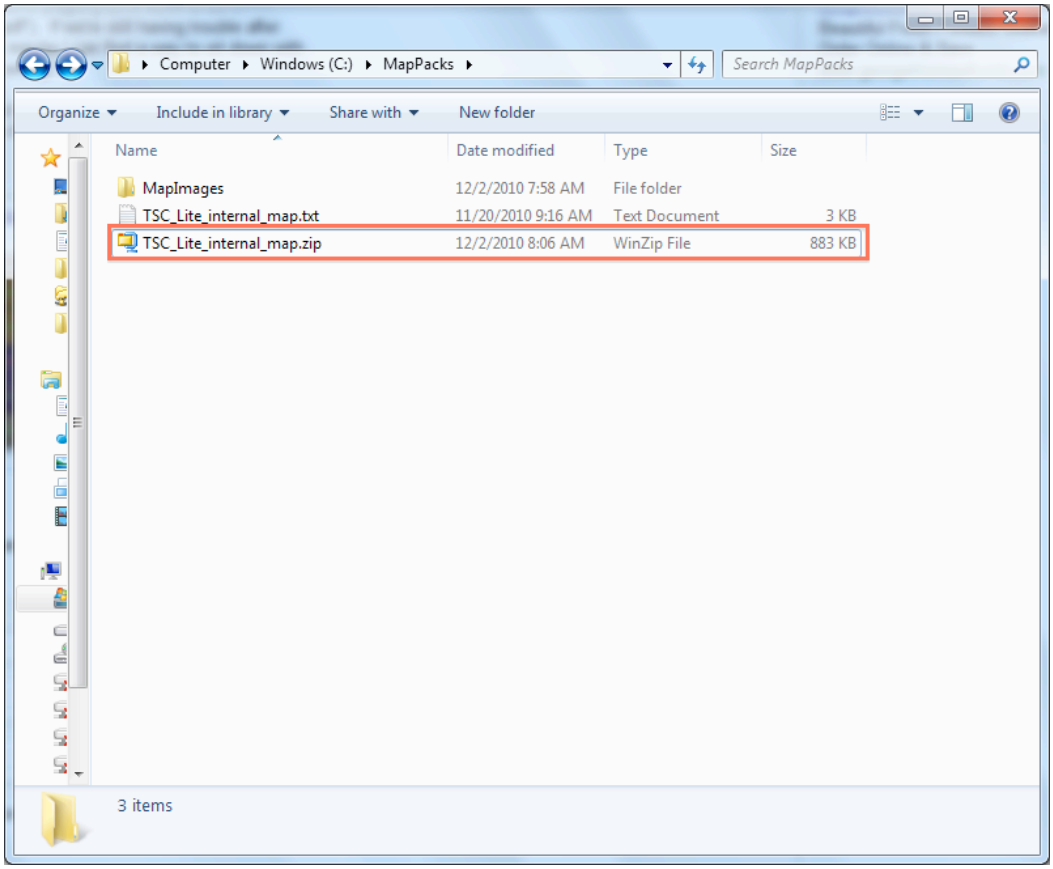
1. Select all of the necessary files



2. Right click and select “Send to” -> “Compressed (zipped) folder”.



5. You should now have a zipped folder with the contents of the files



6. Rename the MapPack to .map by following the instructions in the “Rename MapPacks Windows” section.

   While not recommended, you are able to leave the MapPack in its original .zip format and still import it into TSCreator.

Renaming MapPacks *in Windows*

MapPacks need to have a .map extension. To do this in Windows perform the following:

1. Right click and select "Rename"

Remove the .zip ending and add to .map to the end of the file name.

****

FAQs – Common Questions for MAP-PACKS (Geographic Interface)

What if my coordinates aren't showing up where I want them?

Check to make sure that your coordinates are correct. Ensure that your latitude and longitude coordinates are in the correct order corresponding to the header information.

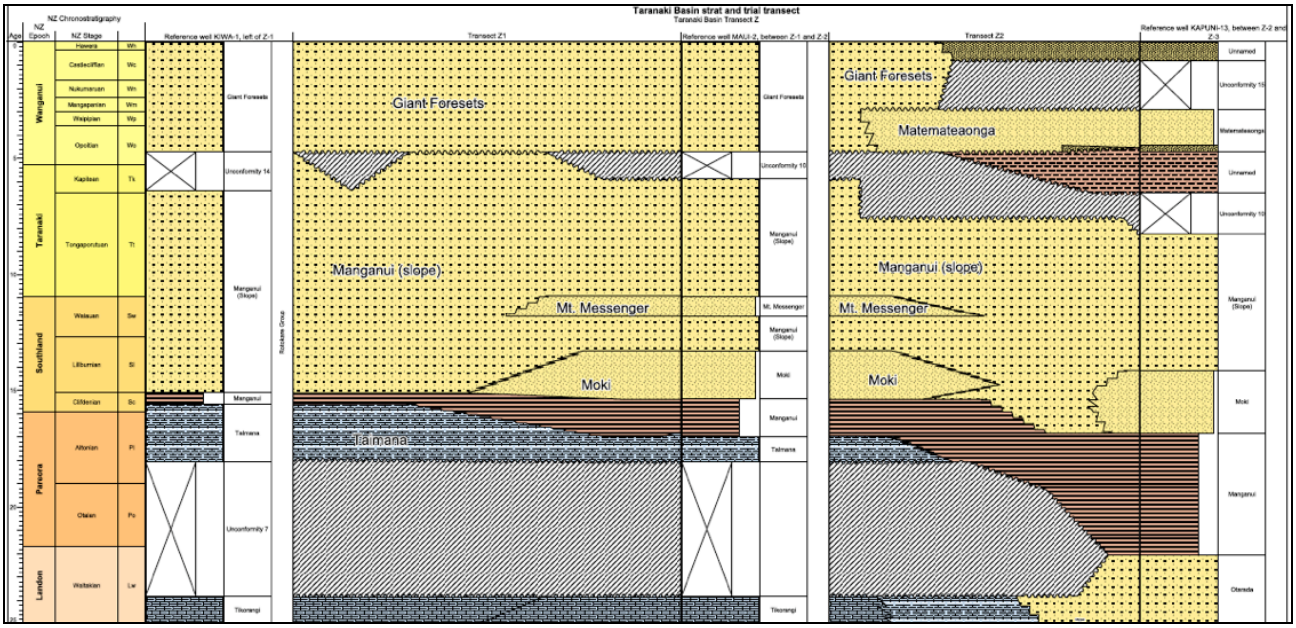
What if my MapPacks aren't loading properly?

Check to make sure that they were created following the instructions in this file under the "Creating MapPacks" section. You need to zip the files for your MapPack and **not** the files inside of a folder.

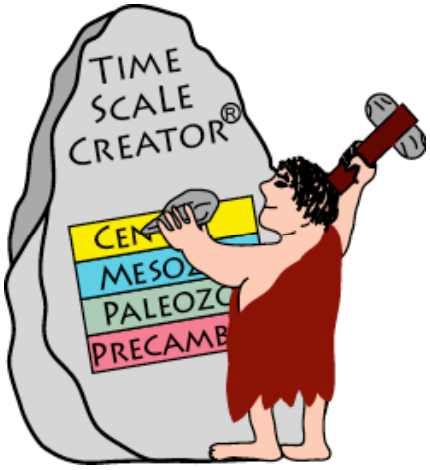
What if my MapPack is failing for the map's image?

Make sure the image name in your .txt file is a valid map name. If the map is called "WorldMap.png", make sure the image name is "WorldMap.png". It must be placed in the MapImages folder location and it should **not** contain the MapImages folder name.

Inserting Reference Holes and Transects into *TimeScale Creator*



This Manual has 2 versions – a FULL explanation for first-time users; and a STREAMLINED check-list for experienced users (which was inserted above, before MapPacks).



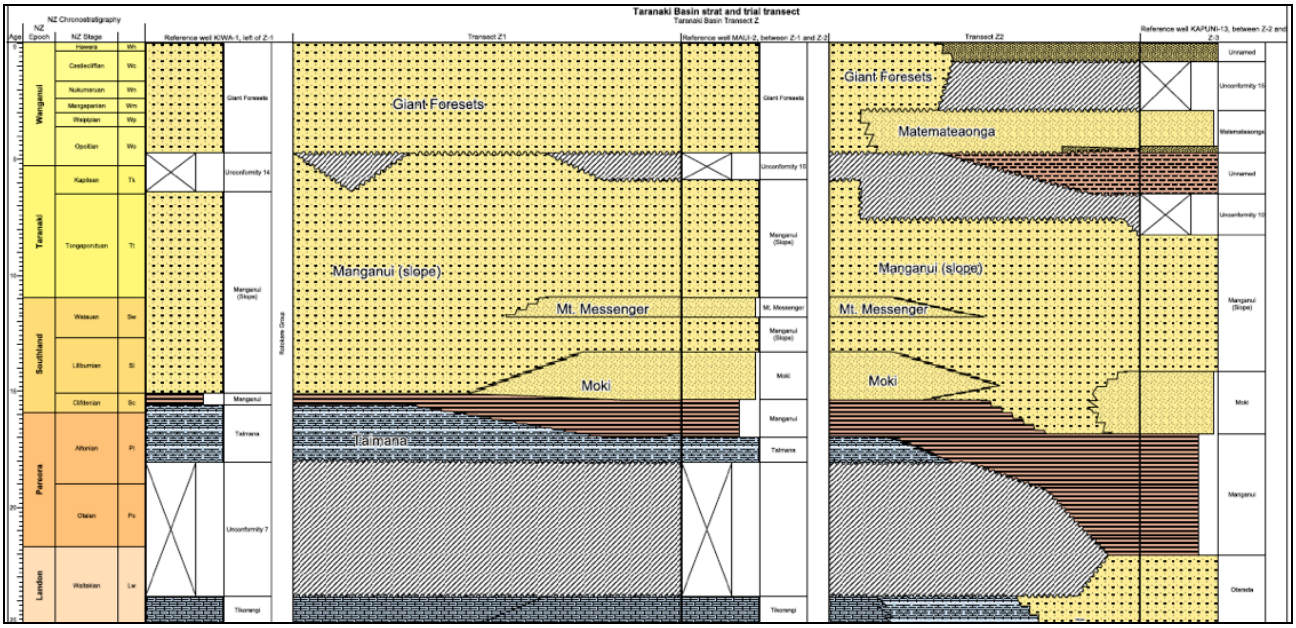
Software developed by Adam Lugowski (Univ. Calif., Santa Barbara) and James Ogg (Purdue University) with partial support from New Zealand's Geological and Nuclear Science. Manual compilations by Alex Huang (Univ. Georgia) and James Ogg, with revisions by Dane Dudley (Purdue University), Marine Collignon (Univ. Strasbourg) and other students at Purdue University. Manual formating by Gabi Ogg.
Contact jogg@purdue.edu for questions or suggested revisions.

Inserting Reference Holes and Transects
CONTENTS – Detailed Manual

INTRODUCTION

TimeScale Creator capabilities and advantages

TimeScale Creator can display lithologic sections and interpreted transects of facies between reference holes:



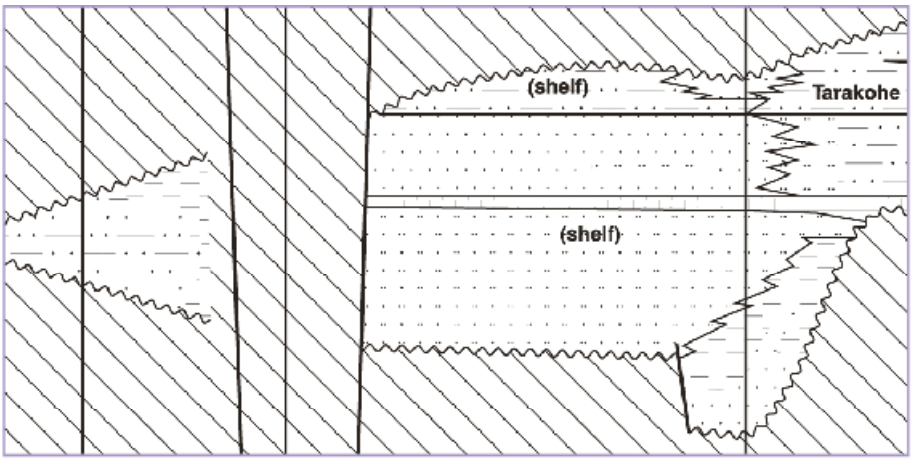
There are several advantages to the *TS-Creator* display system:

- **Chronostratigraphy**, biostratigraphy, sequence stratigraphy, regional stratigraphic summaries, or even basin transects from other parts of the world can be displayed at the **same scale** next to information from the selected basin sections and transect.
- **Focus-in** on any time interval; or change the vertical scale or horizontal scales – the stratigraphic column or transect will automatically replot.
- Embedded "**pop-ups**" within each facies block in the lithologic section and within the transect can be activated by a mouse-click. Pop-ups can include photos of outcrop characteristics or have embedded hot-links to external URLs (e.g., to a lexicon hosted on a geological survey website).
- Transects can be subdivided into **panels**, and users can select only the panels of interest, or compare to a panel of a transect from another portion of the basin.
- Each transect-panel and reference-hole can be turned **on/off** separately.
- One can load new or revised **lithologic pattern sets** into *TS-Creator*; and the displayed facies columns and transect artwork will also be converted.
- Charts in *TS-Creator* can be **output** as SVG (scalable vector graphics) format, hence allowing enhancement or revision of each individual element or text item within Adobe Illustrator or other graphics package.
- Geographic locations of reference wells and transects can be included for the convenient **geographic user-interface** of the *TS-Creator*.
- By including cross-calibrations of the reference wells to a master chronostratigraphy, and/or interlinking the transect facies to reference wells, then a change in a chronostratigraphic age or calibration of a lithologic formation will automatically revise the other sets and artwork within the transect. Our extensive use of specifying data relationships (e.g., proportional **calibration linking** to reference scales via Excel

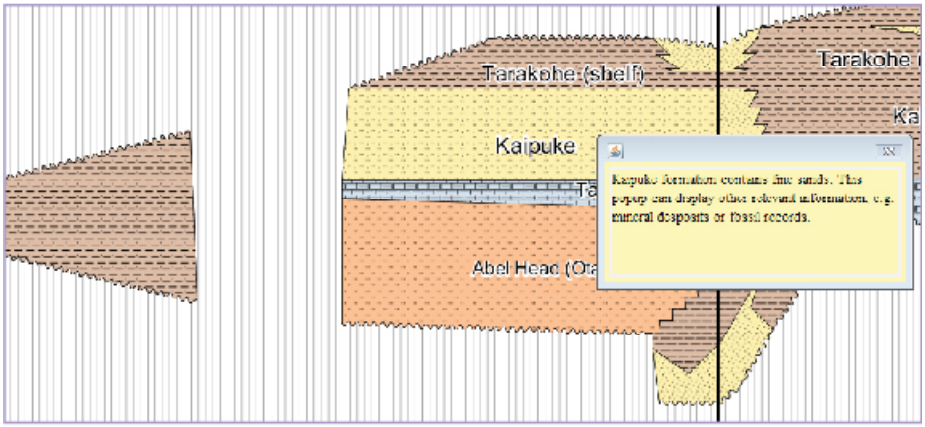
spreadsheets) solves this problem - simply tweaking a calibration or revising a reference scale age updates the entire transect. And this process encourages "transparency" – ideally, one indicates in the calibration-comment column why each level has an assigned placement relative to geologic stages (or, if it is only approximate); thereby making it easier for future stratigraphers to include new knowledge on calibrations for auto-updated transects.

- The **Search** function in *TS-Creator* (v.5; May 2011) enables finding which holes/transects have a desired formation name (and its assigned age span); and an appropriate chart can be generated.
- *TS-Creator* version 7 (under development for 2013) will enable a **geographic view** of the reference holes and transects in 3-D over an underlying map. Crossing-transects can be rotated; and a time-plan inserted for guiding correlations.

In addition to being more flexible and customizable, the transects rendered by *TS-Creator* are more standardized and can be aesthetically appealing.



Original transect, published on paper



TS-Creator rendition

Overview of capturing and linking information

This manual will concentrate on time-facies diagrams -- stratigraphic columns that have an approximate scale of geologic stages, and transects that have been interpreted as facies-versus-distance patterns on a common vertical scale of geologic stages (diagram as shown above).

Our goal is to transcribe the visual information from original diagrams into a format readable by *TimeScale Creator*, and to inter-calibrate that information to a master chronostratigraphy. Our method of stratigraphic-column and transect transcription promotes data integrity.

This manual will guide you through the process of digitizing a geologic transect and maintaining its integrity. You will need:

- *Time Scale Creator* 4.2.5 or later (requires Java Platform version 1.5 or later)
- *Microsoft Excel* or similar spreadsheet.
- *Adobe Illustrator* CS or later; or similar graphics program utilizing SVG. The specific instructions and screen shots in this manual are for version CS4; but all versions have a similar capability.

A complete transcription and inter-linking process consists of four distinct parts – Setup; Reference holes; Transect; and Inter-Calibration. Accordingly, this manual is split into four sections, each devoted to one part of the process.

Part A: **Graphics and Excel Setup** for digitizing reference wells scaling and transect. The graphics setup has 3 layers – an initial SVG template generated from TS-Creator (lithology patterns; bounding box; wavy/interfingering line designators); then insertion of a basal layer for the source diagram (e.g., scan of published transect); and an intermediate layer with a ruler to estimate proportional placement within geologic stages. The Excel setup has alternating column sets for recording reference holes and for transect-panel interlinking; and an output page for the composite tab-delimited text formatted for TS-Creator datapacks.

Part B: **Reference well** scaling to Master Chronostratigraphy. The reference holes bordering each selected transect panel are treated as standard outcrops – facies blocks (patterns) with bases assigned relative to geological stages/zones. These relationships, either from the original publication or according to scaling on the published diagram, are recorded as appropriate linking to the master chronostratigraphy (stage-age scale or zonal-age scale), plus pop-up text is created that may include links to lexicons. [*NOTE: This portion can be used separately as a guide for creating standard outcrop/well datasets without any transect*.]

Part C: **Transect panel** digitization and conversion. The main details of the published transect are captured as a suite of polygons with appropriate lithologic pattern fills, line-types and labels. Pop-ups are added to each polygon for later identification and linking to additional details on lithologies. A bounding "red box" over the panel includes assigned Top/Bottom ages for converting polygon placements to an approximate numerical age. This polygon set for each transect panel is saved as SVG; then TS-Creator has a special conversion routine to make a "paint-by-number" text-format grid that details placement and attributes of each polygon. [*NOTE: This converted transect text-file can be a stand-*

alone dataset for TS-Creator; but we advise Part D for insuring data accuracy and to enable later re-calibrations.]

Part D: **Inter-Linking Transect panels to Reference wells.** After inserting this file into our Excel sheet; the age-scales for the polygons and text-labels as estimated from that bounding "red box" are re-linked to the exact ages from our reference holes. The combined reference-hole and recalibrated-transect sets are output as a datapack for TS-Creator.

Stratigraphic columns and transects can utilize direct depth-facies diagrams. Conversion of a stratigraphic column from meters to numerical age via the depth-to-age conversion capability of TS-Creator is explained in a separate manual. Such a conversion is not possible for a transect directly via that TS-Creator routine, but can be accomplished if it is inter-linked to the reference wells (Part D above) and those "meter-scales" are converted to "age-scales" (with an allowance for hiatuses).

Part E: **Advanced Geographic-interface.** This last section has two parts. First, how to convert the default widths of a set of transects into relative real-world distances using the Lat-Long of the bordering reference wells (e.g., standardizing scale to 10 units per km-distance). Second, making a map datapack that specifies the Lat-Long of the reference holes, and which of these holes bound each transect panel. It is possible to have the map-interface show a dog-leg to a transect.

The last part of this manual has some selected trouble-shooting items. Needless to say, we can't anticipate all possible things that might go wrong. Therefore, contact **Jim Ogg** (*jogg@purdue.edu*; tel: 1-765-494-8681 (office); -494-0257 (lab; if I'm not there, then my students might also know the answer); -743-0400 (home) for assistance.

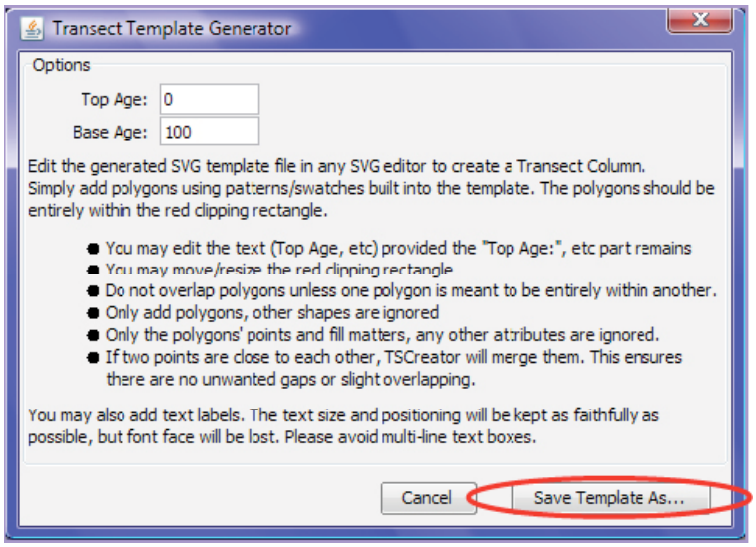
Part A. Graphics and Excel Setup for digitizing reference wells scaling and transect

1. Generate template and initialize *Adobe Illustrator*

TimeScale Creator produces a special **SVG** template that includes all necessary lithology patterns, bounding "red box" with Top/Bottom age qualifiers, and drag-and-drop designators for denoting contacts that should be wavy (e.g., hiatus) or interfingering. We use this template to open Adobe Illustrator, thereby installing all needed swatches, etc.

Open *TimeScale Creator*

We've cleverly hidden the Template generation: At the top of main screen, under "***Data***", you see "***Save Transect Template***". The following window will appear:



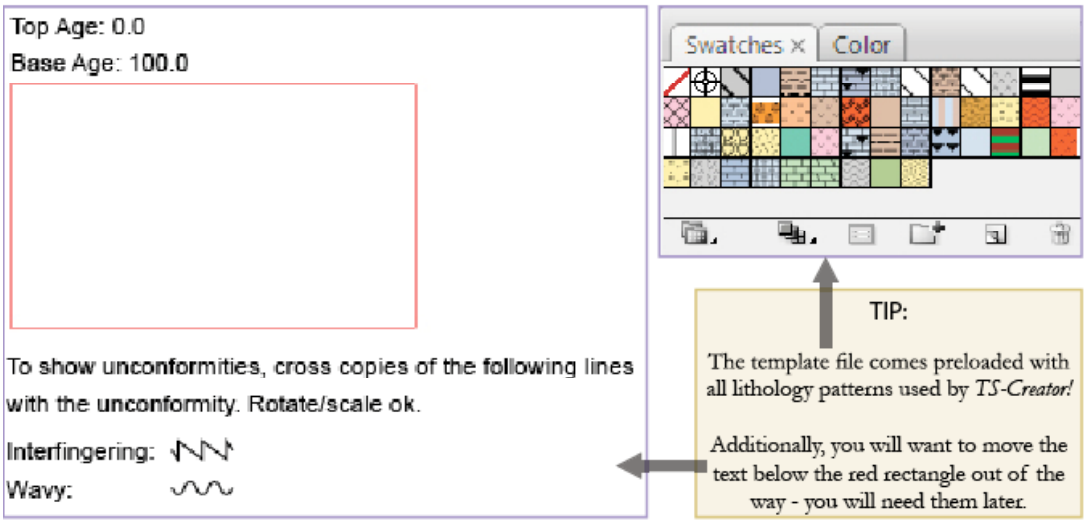
You can either revise the Top/Bottom age before saving; or, perhaps easier, do it after preparing the transect underlay.

After clicking "*Save Template As…*", Save the file with a desired name and **location**.

IMPORTANT: The next step is to Click on this SVG. **CAUTION: DO NOT HAVE ADOBE ILLUSTRATOR PROGRAM ALREADY OPEN! Otherwise, the lithology patterns will load incorrectly.**

Now, Double-Click on that Template SVG. It should automatically open Adobe Illustrator program; and install the lithology swatches.

Open your template file with Adobe Illustrator. You should see something similar to this:



Notice the following:
(1) **Red Box** – we will position this OVER the published transect (inserted BELOW as next step)
(2) **Interfingering** and **Wavy** line-type designators, which we will drag-and-drop copies onto appropriate segments later.
(3) **Top Age** and **Bottom Age**. These values can be later changed as appropriate to the captured interval of the transect digitization.
(4) **Swatch set** of all internal TS-Creator patterns.

If you wish to add additional swatch-patterns; then you will need to also insert the same set (saved as SVG pattern suite) into TS-Creator. We have such sets from Geoscience Australia and New Zealand's GNS (at *www.tscreator.org*; bottom of download page), but highly recommending using our set (hybrid of USGS, Ocean Drilling and GeoArabia) for simplicity. [Remember, these are just patterns with reference-names, not official lithologies. Your "calcareous claystone" might be represented by a pattern that is named "continental marl".]

2. Layer set-up

(a) Save in Illustrator format

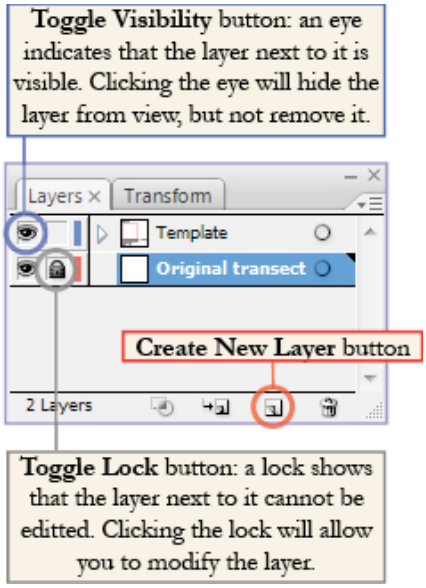
Use **SAVE-AS** (not "SAVE") for template-generated set-up as "***Transect_XXX_date.ai***" (where "XXX" is your desired name, and "date" is so you can save intermediate versions) using **"Adobe Illustrator" format**. This is important, because SVG will not preserve layers, etc.

(b) Make 3 Layers:

First, be sure that Layers are displayed on the right-hand Illustrator tool-menu set. If not, then in Illustrator under "Window", turn ON Layers.

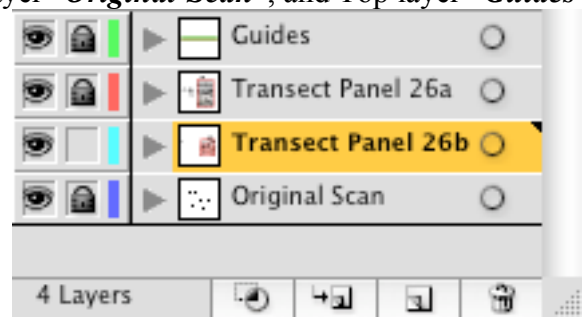
Double-click on the name "Layer 1". Change the name to "*Transect XXX polygons*"; and change the color to Red or Green (*shows up better against black borders*).

At bottom of Layer window, the far-right button (just before Trash-can) is "*Create New Layer*". Make 2 more layers.



By default, new Layers are placed above the original layer. Therefore, drag the "Transect XXX polygon" layer to the Middle.

Label the lowest layer "***Original-Scan***", and Top layer "***Guides***".



Lock the "***Transect XXX polygon***" layer; and turn OFF visibility. We will return to this polygon-digitization in Part C.

Insert Published Transect (PDF/Scan/Image) into <u>bottom</u> Layer

This base diagram is the source geologic-transect with placement of reference holes. Importing a published diagram with medium-resolution is best, but even a simple pencil sketch serves as an adequate guide when scanned as an image into Adobe Illustrator. Such a diagram should have a "left-hand" or "right-hand" chronostratigraphy scale (e.g., geologic stages, biozones, etc.).

Highlight the bottom "*Original-Scan*" layer in Layers. Use "Open" from Illustrator, select published transect image – by default, it opens in another window. You will need to "Copy" from that window, and "Paste" into the "Original scan" layer in our Transect file.

If needed, use the Rotate tool or "Object"->"Transform"->"Rotate" function to remove any tilting-distortion from the transect-scan (*ideally, your scan-image is already perfect*).

If the scan is larger than the template artboard (the white-background-area on the Illustrator screen), go to File > Document Setup > Edit Artboard and then drag the corners of the artboard to encompass the scan of the transect (plus some room at top for Top/Bottom Age). This will also enable the Navigator window to include the entire scan-image.

LOCK this Base layer.

Make a 10-line guide for estimating relative placement for the <u>middle</u> Layer

We wish to use the following grouped-object "ruler" for estimating relative-proportions of a boundary relative to stages or of an inflection point in facies relative to the formation boundaries:

Highlight the "*Guide*" layer.

Use the Pen tool of Illustrator  (*icon, 3rd from top, on Tools – if not visible; then be sure that Tools is ON (under Window menu)*]. Select Pen-tool; and click a SINGLE-TIME on the drawing screen on the left side. The Pen-tool works by Clicking on points; not dragging between them. Therefore, WITHOUT HOLDING DOWN THE MOUSE-Drag, ***<u>but</u> holding down SHIFT***, move the pointer to another spot on the right side, and CLICK. The SHIFT forces this line to be exactly horizontal. Now, release the Pen, by clicking on the Black-arrow on the Illustrator Tool-set. Repeat this process another 10 times to draw 10 parallel lines, or use "select-OPTION-drag" combination to duplicate the selected line. Don't worry about spacing yet. Change the color of the 1st, 5th and 11th parallel lines to be a dark-red; and the others to be a medium-green. [For novices to Illustrator, this is done by highlighting a line, then using the Color menu (turn ON in Windows) applied to the "box" icon.]

Now, a neat trick – highlight all 11 parallel lines. Use the Align menu (turn ON under Windows), and select "Distribute Objects" using the icon in the middle of the left-trio. This will automatically equal-space your 11 lines between the lowest and highest. Similarly, use "Align Objects" using icon in the middle of the left-trio; which will center all the 11 lines relative to each other. Now, Group the 11 selected lines (under "Object" menu at top of Illustrator).

You now have a ruler with 10-percent-divisions that can be stretched/squeezed/expanded as desired. One selects the ruler, drags it to a desired location, and uses the white-boxes on the edges to change its size. We will use this to estimate percentage-proportional placement of boundaries relative to stage-intervals on the reference scale.

NOTE FOR ILLUSTRATOR NOVICES – **<u>SELECT TOOLS</u>**: There are 2 "arrows" for selecting in Illustrator (Top of TOOL BAR). The **Black** one is the main one. The **White** arrow is a Special one – for selecting a point or item WITHIN a larger object (e.g., just one of the lines in our grouped-ruler, or just a single corner within a polygon). Be careful to use only the **Black** one, unless one wants to work within a grouped object.

For advanced Photoshop/Acrobat/Illustrator users, one can also "clip" a copy of the scanned diagram "chronostratigraphy column" portion, and insert onto the Guides layer. This can then be moved (carefully, to maintain exact horizontal relationship) to intermediate positions within the transect to obtain relative placements of facies changes relative to geologic stage intervals.

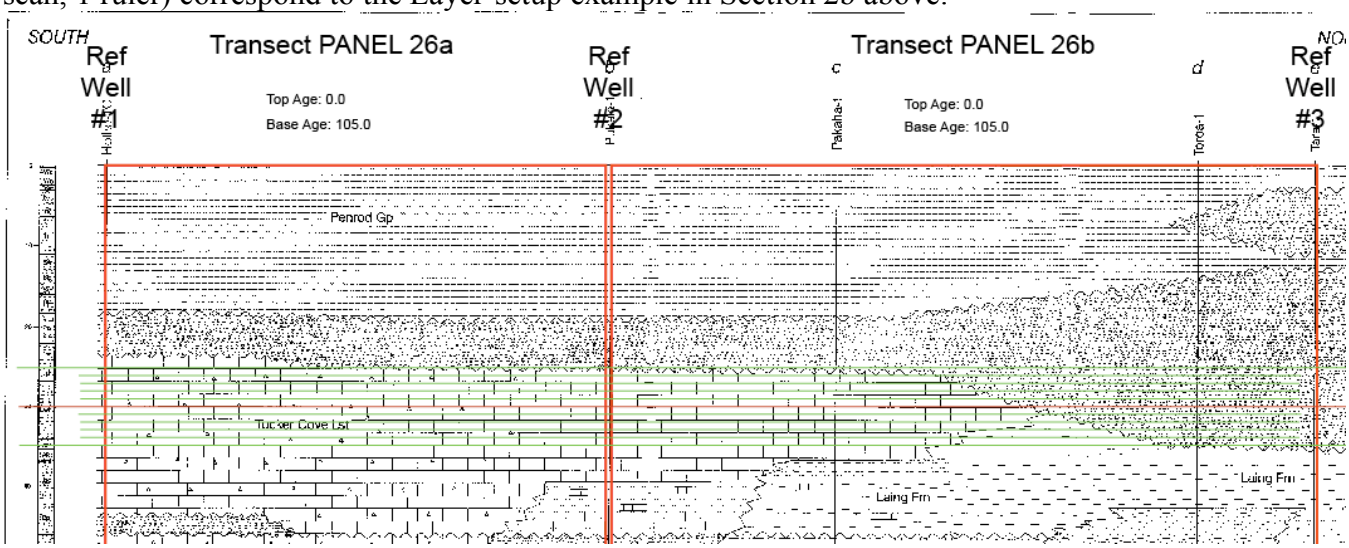
(c) Selecting reference wells and transect panels; making layers

Transects are usually interpretations based on several reference wells and stratigraphic outcrops, and perhaps including seismic stratigraphy. For TimeScale Creator transects, the goal is

usually a more simplified representation. Therefore, one must balance time-effort and geologic accuracy when deciding on conversion of a previously compiled transect array.

For a large transect, how many reference holes and intervening transect panels are desired for digitization to convey the main information and "ground truth" control? Each transect panel must be separately coded and separately inter-calibrated to the bounding reference wells.

Below is an example from New Zealand of **2 transect-panels**, bound by **3 reference wells**. The Red-Box outlines have already been adjusted (explained later). The 4 layers (2 transects, 1 scan, 1 ruler) correspond to the Layer-setup example in Section 2b above:



Our general philosophy has been to select reference wells at the limits of transects (also useful for Lat-Long control), at the junction of crossing transects, and whenever there are major changes in facies suites or age-transgressions. Typically, a short transect has two end-point reference holes – a single panel. A long transect (e.g., eastern coast of New Zealand's South Island) might be subdivided into up to a dozen transect panels (between sequential pairs of 13 reference holes).

Each transect panel will need a separate polygon-transect digitization for just that panel area. Therefore, after one decides upon the set of reference wells and associated transect panels, then the "*Transect XXX polygons*" layer is Duplicated accordingly (an option after highlighting this layer then clicking the upper-right arrow on the Layers panel). Each of these panel layers is given an "a,b,c" or geographic abbreviation for the Layer name to avoid confusion (*see examples in Section 2b-2c above*). One works with each layer separately; keeping the others Locked.

(d). Save your Illustrator file

Now that all layers are ready; save the file.

We advise beginning each working session by doing a new "Save As", thereby giving the new file a different date, just in case that previous work needs to be recovered from the old file.

3. Corresponding Excel spreadsheet set-up

Now it is time to prepare your spreadsheets. We need pages for Master Chronostratigraphy reference scale; for the Tables of Reference Well lithostratigraphy and Transect age-linking, and for Formatted-output.

Create a new workbook (i.e. a new file), in Microsoft Excel. Your workbook is created with three blank spreadsheets. Double-click on the spreadsheet tabs and rename them as “Master Chronostrat” (or similar), as “Wells and Transect” (or equivalent), and “Datapack Output” (or equivalent).

(a) Master Chronostratigraphy

This first spreadsheet will act as the “master” to the other sheets -- all numerical ages are computed relative to the values in the master sheet. Therefore, if you modify the master sheet, all other sheets will automatically adjust their values to reflect the change.

Insert a copy of the current international stages, any regional-stage scales that are used on your reference wells, and any biostratigraphic zones that are important constraints on lithostratigraphy. Below is an example of our typical International Stages (GTS04 version). If you require a ready-made, up-to-date copy of the standard international chronostrat, contact us. It is recommended that your regional and biostrat scales also have ages computed as relative proportions within each international stage.

	A	B	C	D	E	F	G	H	
1	INTERNATIONAL STAGES								
2	Eon	Era	Period	Sub-Period	Series	Stage	Sub-stage	Ma	Comments
56						Valanginian	E	140.18	
57							LL	142.3	
58			Cretaceous		Early	Berriasian	E.	145.40	
59							Lt.	147.10	
60						Tithonian	E	150.84	
61							LL	153.08	
62						Kimmeridgian	E.	155.65	
63							Lt	157.4	
64							M.	159.61	
65					Late	Oxfordian	E.	161.21	
66							Lt	162.52	
67							M.	163.2	
68						Callovian	E.	164.74	
69							Lt	165.72	
70							M.	166.89	
71						Bathonian	E.	167.68	
72							Lt	169.64	
73						Bajocian	E.	171.6	
74							Lt.	172.49	
75							M	174.71	
76					Middle	Aalenian	E.	175.6	
77							Lt.	180.5	
78							M	181.2	
79						Toarcian	E.	183	
80							Lt. - Domerian	186.95	
81						Pliensbachian	E Carixian	189.6	
82							LL	193.25	
83						Sinemurian	E.	196.5	
84			Jurassic		Early	Hettangian		199.6	No substages

An example of a master spreadsheet displaying part of a chronostrat.

(b) Reference Well columns; and Pop-up construction

Time Scale Creator reads data in a specific tab-delimited format, so the following columns must be included as the left columns of every reference well suite.

Hampshire Basin				
Group	Lithology (TSC pattern name)	Formation name	Base of BASE	Combined Comments (pop-up)
Purbeck Gp.	Primary			LITHOLOGY = Interbedded mudstones, limestones and evaporates of brackish and marine origin (For details click PB);
	Continental marl	Durlston Fm.	143.35	LITHOLOGY = Interbedded, shelly limestones and dark mudstones [For details click DURN]. CALIBRATION = 40% up in Berriasian
	Clayey limestone	Lulworth Fm.	146.00	LITHOLOGY = Lower calcareous/rich calcareous, Upper interbedded grey mudstones and white marles. Contains anhydrite and gypsum [For details click LULW]. CALIBRATION = 50% up in Tithonian

The "combined comments (pop-up)" is attached to the lithology-pattern block. We generally include information on actual lithology, calibration, link-to-Lexicon (if available) and references; using Excel's "concatenate" statement that combines information of several cells. Therefore, our usual Lithostrat column set is more extensive:

Hampshire Basin								
Group	Lithology (TSC pattern name)	Formation name	Base of BASE	Combined Comments (pop-up)	Lithology	Calibration & Comments	BGS Lexicon URL	Reference
Purbeck Gp.	Primary			LITHOLOGY = Interbedded mudstones, limestones and evaporates of brackish and marine origin (For details click PB);	Interbedded mudstones, limestones and evaporites of brackish and marine origin		PB	UK strat chart; Brit. lexicon
	Continental marl	Durlston Fm.	143.35	LITHOLOGY = Interbedded, shelly limestones and dark mudstones [For details click DURN]. CALIBRATION = 40% up in Berriasian	Interbedded, shelly limestones and dark mudstones	40% up in Berriasian	DURN	UK strat chart; Brit. lexicon

In this case, the "combined comments (pop-up)" cell for Durlston (Line AY) has the form: =CONCATENATE("LITHOLOGY = ",AX56," ",I1,AZ56,I2,AZ56,I3,"CALIBRATION = ",AY56,". REF= ",AZ56); where, I1, II$2, $1$3 refer to cells containing URL linking details for the British Lexicon:

```
[For details click <a
href="http://www.bgs.ac.uk/lexicon/lexicon.cfm?pub=

">

</a> ].
```

The final merged pop-up (text output) is thus: *LITHOLOGY = Interbedded, shelly limestones and dark mudstones [For details click DURN]. CALIBRATION = 40% up in Berriasian. REF= UK chart, British lexicon*

Do **not** place any hidden **line-feeds** into the pop-up text. [NOTE: A direct copy-paste of text from a PDF document often inserts such hidden line-feeds. One must delete these.]

(c) Transect columns

For the suite of facies-polygon and for the text-labels, one needs a set of 4 columns – the item or name, a book-keeping note on calibration, the original SVG-conversion age, and the "real" age as derived from the reference wells:

Great South Basin; southeast transect 27 (one panel)							
Item	Age control	Polygon original	Polygon ages relative to Reference Wells	Text item	Text age control	Text original age	Text relative to formations
Top of Penrod Group	<-- Left	0	0.00	Penrod Gp	50% up in full extent of Penrod Group	7.68	7.34
Base of Penrod in Right-center	Middle of Wc	1.5	0.99				

(d) Full set – Reference Well #1, Transect-panel A, Ref-Well #2, Panel B, Ref-Well #3

Each transect-panel is between two reference wells, and will be cross-linked to those wells. Generally, the next transect-panel shares a reference well with the first transect-panel. Therefore, the full Wells and Transect spreadsheet will be many columns wide – about 9 columns for each Well, 8 columns for each Panel, etc. (and a color-divider column between each set).

(e) DataOutput sheet

The output is a sequential mirror of the well/transect/well in sequential order. Below is an example of the "datapack header" for a multi-transect-panel set (NZ South Island). Except for the uppermost two lines (format, date); all information is a mirror of the Well-Transect Excel sheet; as will be explained in detail later.

NZ_transects_28a_Linking_22Mar11.xls:1

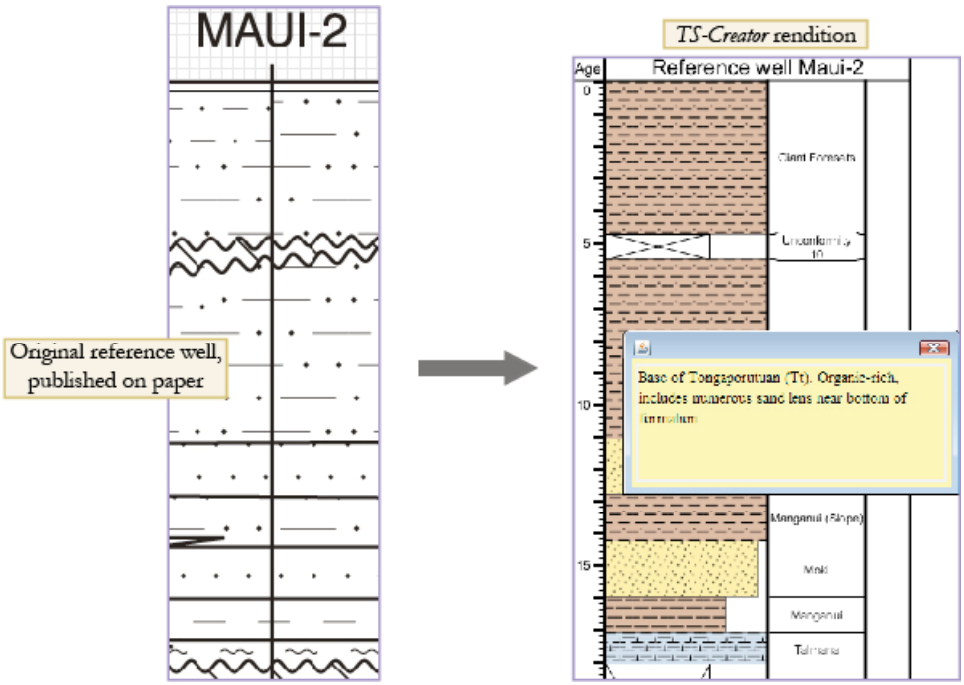
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	format version:	1.3											
2	date:	09/27/2010											
3													
4	Great South Basin and SE tip of South Island; southern transect 26-27-28	:	Hoiho-1C	Transect 26A	Pukaki-1	Transect 26B	Tara-1	Great South Basin; southeast transect 27 (one panel)	Takapu-1A	Great South Basin; southeast coast transect 28A	Shag Point composite	Great South Basin; southeast coast transect 28B	Oamaru Composite
5													
6	Hoiho-1C	facies	50	234/201/201		off							
7	Penrod Group	Primary											
8		TOP		0.00	LITHOLOGY = . CALIBRATION = Present surface. REFERENCE =								
9		Claystone		18.70	LITHOLOGY = Clay. CALIBRATION = Base of Pl (Altonian). REFERENCE = Diagram 26 of New Zealand								
10		Primary											
11		Gap		23.80	LITHOLOGY = . CALIBRATION = About 40% up in Lw (Waitakian); wavy-line. REFERENCE = Diagram 26								
12		Siliceous limestone	Tucker Cove Lst	43.91	LITHOLOGY = Cherty Limestone. CALIBRATION = About 55% up in Dp (Porangan); wavy-line. REFEREN								

Part B. Reference well scaling to Master Chronostratigraphy

1. Overview

Why are reference wells necessary?

- Reference wells hold "ground truth," meaning they are the result of physical drilling, precise measurement, and human observation. In contrast, transects are interpolations and interpretations of the underground structure between reference wells.
- The samples obtained from drill sites are meticulously analyzed to calibrate the formations to standardized nomenclature and to the geologic time scale. We document these calibrations and more detailed lithology descriptions with pop-up windows in *Time Scale Creator*. Thus, when the calibrations or numerical geologic time scale is revised, the assigned ages for calibrated formations are automatically updated as well.
- Because transects are based on reference wells, we use the wells to assign precise numerical ages to the transects. By scaling the transect illustrations to corresponding formations in the wells, we effectively "link" transects to their parent wells. Any change to the well automatically results in a change to the transect as well.



Method of Calibration as Proportion within a Geologic Stage

The facies succession in a reference hole (or outcrop) consists of a succession of lithologic patterns and temporal gaps (hiatuses, unknown, etc.). The calibration for the <u>base</u> of each lithologic pattern or gap is recorded as a relative assignment to a geologic age and/or biostratigraphic zone in the Master Chronostratigraphy (see above).

For example, in Part A-3, the base of a lithologic pattern named "*Continental marl*" is the entire Durlston Formation. The base of this lithologic pattern is *CALIBRATION = 40% up in Berriasian.* Therefore, the assigned age would be computed by the equation of "Base-Berriasian" – 40% (duration of Berriasian); where "duration of Berriasian" is "Base-Berriasian" – "Base-Valanginian". Those two values, "Base-Berriasian" and "Base-Valanginian" are obtained by

using Excel's equation-entry tying to the Master Chronostratigraphy cells containing "Berriasian" and "Valanginian" ages.

	F	G	H
1			
2	**Stage**	Sub-stage	Ma
57	Valanginian	E.	140.18
58		Lt.	142.3
59	Berriasian	E.	145.46
60		Lt.	147.16
61	Tithonian	E.	150.844

Therefore, in that "**Base Age**" cell for Durlston, one enters the following ties to the Master Chronostratigraphy using the *Base minus 40% of the Stage-duration* relationship:

Lithology (TSC)	Fm.	Base
Continental marl	Durlston Fm.	=Master_Chronostrat!H59-0.4*(Master_Chronostrat!H59-Master_Chronostrat!H57)

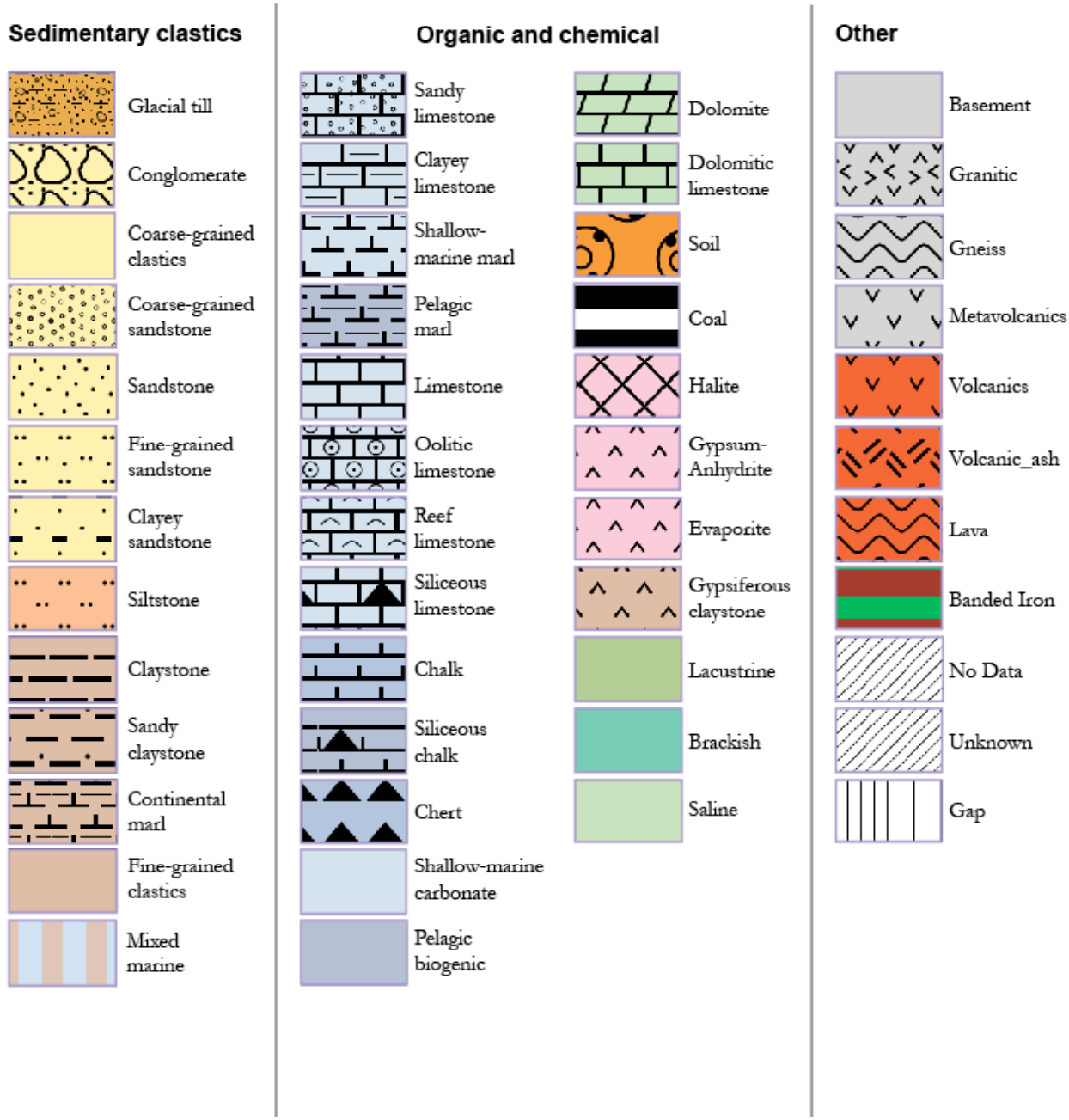
This is typically done during entry of the equation by clicking on those Master Chronostratigraphy cells; which are open in a separate Window -- A separate window into the Spreadsheet is under the WINDOW menu ("New Window").

TimeScale Creator lithology patterns

The following suite are some of the most-common used "built-in" pattern-names within *TS-Creator*. **A full set (248 facies/color patterns) begins on approximately page 92 of this manual.**

Time Scale Creator lithostratigraphic patterns

TS-Creator is case-sensitive. If it does not recognize the lithological label, it will draw a blank formation without generating a an error message.



CAUTION: *TS-Creator* is **case-sensitive**. If it does not recognize the lithologic-facies label, it will draw a blank formation without generating an error message. Writing "*Clayey Sandstone*" instead of "Clayey sandstone" (a named-pattern) is a common mistake.

Formations, TOPs and Groups

Multiple Lithologies in a Formation: Enter the formation name next to each pattern-name. In the example below, *TS-Creator* will automatically put a single "Reading Fm." label next to

a merged block containing a Claystone-pattern in the lower 2/3rds, and Soil-pattern in the upper-third. But, a mouse-click on either pattern will bring up a separate pop-up window with description and calibration.

Group	Lithology (TSC)	Fm.	Base	Lithology	Calibration & Comments
Thames and Lambeth Gp.	**Primary**			Silty clay/mudstone	
	Claystone	London Clay Fm.	52.20	Silty clay. Glauconitic at base	50% up in Ypresian
	Gap		53.28		35% up in Ypresian
	Soil	**Reading Fm.**	54.54	Major paleosol	Arbitrarily in upper third
	Claystone	**Reading Fm.**	55.80	Clay, mottled by pedogenetic processes in a humid environmen	Base of Ypresian
	Primary				
	TOP		70.60		Base of Maastrichtian
Chalk Gp.	Primary			Mainly chalk, with marl seams and flint layers in parts.	
	Chalk	Portsdown Chalk Fm.	73.83	White chalk with marl seams (particularly in the lower part) and flint bands; although less flinty than underlying Culver Chalk.	75% up in Campanian
	Siliceous chalk	Culver Chalk Fm.	79.00	Soft white chalk, relatively marl free with flint seams	35% up in Campanian

TOP: The word "*TOP*" with an age entered in the TSC-Lithology-pattern column will terminate the underlying lithology pattern; and a white space will be present until the next lithology-pattern is specified. Therefore, in the above example, the Chalk-pattern will end at 70.6 Ma; and no pattern will be drawn until the onset of Claystone-pattern at 55.8 Ma. NOTE: The uppermost lithologic unit in the stratigraphic section must be terminated with a TOP, or it will be drawn upward forever. Even if the unit goes to Present, it is a good practice to use "TOP" with an age of "0.0" as the uppermost entry.

Gap: The Gap-pattern is a cross-hatched designation. Deciding whether to indicate a "gap" versus a blank-space "TOP" depends on the user; but we normally use "TOP" if the hiatus is longer than about 10 myr.

<u>Group</u> column: The first column of *TS-Creator* lithologic output is for "group" names to place next to a set of formations or patterns. The term "Primary" in the TSC-Lithology pattern is a flag to the software that this is a Group name, rather than a new column. [*There is also "Secondary" for generating an adjacent lithology-pattern set for a composite strat-column, but usage of this advanced option is not detailed in this manual.*]

In the above example, "***Thames and Lambeth Gp***." will be written adjacent to the interval of Reading Fm. (base at 55.8 Ma) and London Clay Fm. (overlain at 48.6 Ma by

Wittering Fm., not shown). The term "Chalk Gp." is written from 70.6 Ma downward adjacent a set of eight chalk formation units.

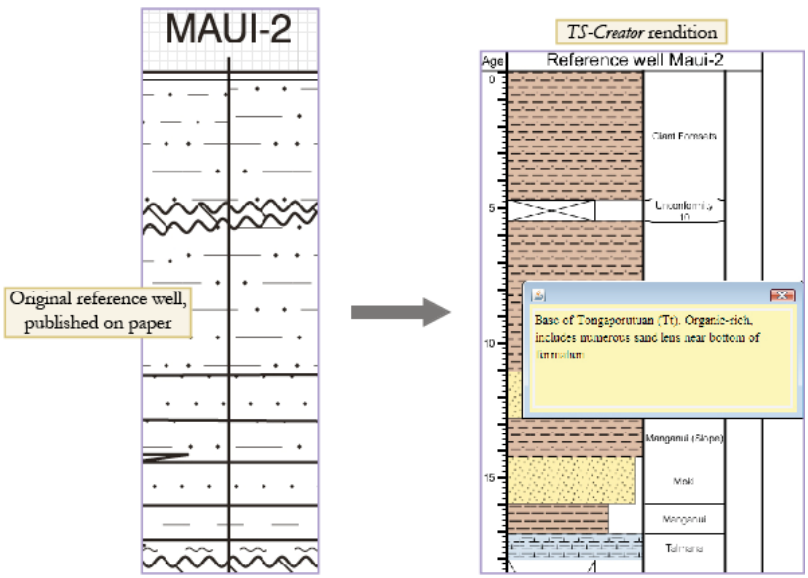
Base of Primary: There is a "Primary" with a red-box below the Claystone of Reading Fm. This is a flag that "***Thames and Lambeth Gp***." labeling ends at this level (base of Claystone), and should not be written adjacent to the blank space from "TOP" to "Claystone".

It is **IMPORTANT** that this "Primary" flag have at least one **SPACE** in the Group column, and NEVER to leave that cell EMPTY. This is because the software requires a text, even if just a space, as the name for each Group. [For clariity, we typically put a "box" around this "SPACE" Primary name, to know that a space is indeed present.]

Pop-ups for Group clusters: At present (TSC version 4.3), there are no active pop-ups for the Group column; but this will be changed in a future version. The TSC-format already supports these entries.

2. Recording and Age-calibration of Lithologic Units

Goal: Conversion of schematic reference well on Transect into a chronostrat-tied lithologic column dataset:



Maui-2	facies	50	234/201/201	
	Primary			
	TOP		0.00	
	NZ_Silty_claystone	Giant Foresets	5.33	[Click <a hre
	Gap	Unconformity 10	6.27	
	NZ_Silty_claystone	Manganui (slope)	11.01	[Click <a hre
	Sandstone	Mt. Messenger	12.49	[Click <a hre
	NZ_Silty_claystone	Manganui (slope)	13.83	[Click <a hre
	Sandstone	Moki	15.38	[Click <a hre
	Claystone	Manganui	16.88	[Click <a hre
	NZ_Marl	Taimana	17.86	[Click <a hre
	Gap	Unconformity 7	23.80	
	Clayey limestone	Tikorangi	26.88	[Click <a hre
	Limestone	Tikorangi	29.10	[Click <a hre
	Clayey limestone	Tikorangi	30.90	[Click <a hre
	Gap	Unconformity 6	34.50	
	Claystone	Turi	39.27	[Click <a hre
	Clayey sandstone	Mangahewa (Coastal Facies)	42.77	[Click <a hre
	Gap	Unconformity 5	45.30	
	Claystone	Omata Mbr.	48.70	[Click <a hre
	Sandstone	Kaimiro	50.10	[Click <a hre
	NZ_Coal_clayey_sandsto	Kaimiro	50.90	[Click <a hre
	Sandstone	Kaimiro	52.50	[Click <a hre
	NZ_Coal_clayey_sandsto	Kaimiro	53.30	[Click <a hre
	Gap	Unconformity 4	54.80	
	NZ_Sandy_mudstone	Farewell	56.77	[Click <a hre
	NZ_Conglomerate	Farewell	57.74	[Click <a hre
	Gap	Unconformity 1	83.50	

We will use the Ruler overlay on the Transect scan to acquire proportional-placement of each lithologic facies change; and tie these to the Master Chronostat in Excel, as explained above. [Alternatively, if the original reference well information is available, then this lithostrat column can be compiled from the raw data on biostratigraphy and facies variations.]

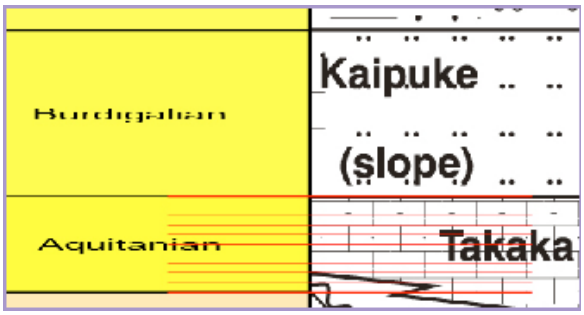
IMPORTANT – The "**Snap-to-Grid**" option in Adobe Illustrator must be **OFF** in order to get precision scalings using the Ruler. This is under "View" in Illustrator.

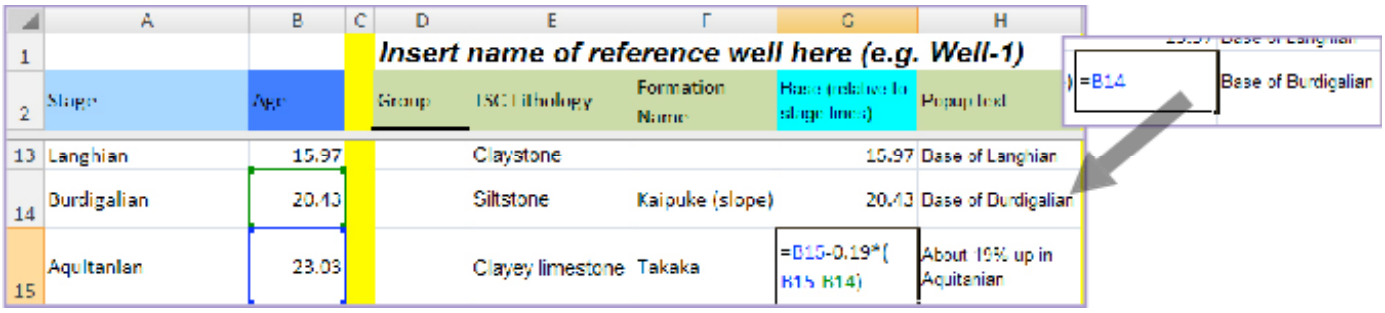
Start from the top of the reference well and enter information progressively into the Excel spreadsheet. At the minimum, the TSC Lithology-pattern and Base-age columns must be filled out for each lithology change. As noted above, the TSC Lithology-pattern is case-sensitive.

In the example below, a reference well (*set at the extreme Left-side of transect*) is shown as the original artwork and its Excel equivalent. Kaipuke formation's base is equivalent to the bottom of the Burdigalian, so its numerical age is linked directly to Master Chronostratigraphy c

ell B14. We used the Ruler (10-equal-spaced intervals, see Set-up above) to measure Takaka's **base** relative to the Aquitanian Stage (you can see it is about 19% up where it intersects the left-margin Reference-well) and entered a formula for its numerical age that is tied to the Master Chronostratigraphy. As explained above, the relational-age formula uses the Stage-base and Stage-duration:

(Basal-age of Stage) - %Up-in-Stage × (Basal-age of Stage – Basal-age of overlying-Stage)





Pop-ups for each lithologic block generally provide a lithologic summary, calibration to geologic stages, URL to detailed lexicon (if available), and reference – see examples above under Excel sheet Set-up. [*The New Zealand geological survey utilizes a master-reference-page of formation descriptions which are linked to each reference hole and transect. Therefore, if they revise a description or formation-name in this master description table, then it updates all description-popups for every well in New Zealand.*]

NOTE: In some cases, it is advantageous to have a dual-set of "base-ages" in the Excel table – one showing numerical ages in the published chart (e.g., if it used a 1960 time scale), and the other (which is our output-age) being converted to the GTS08 or other revised time scale. Such a dual-age set is useful for linking digital-extrapolated transect ages based on that published scale, then converting the transect to a revised scale. If you would like more information on this method, contact Jim Ogg (jogg@purdue.edu), who will send you an example well/transect set from offshore New Zealand.

3. Formatted output

On the composite output page, mirror the lithology-column suite (Group, pattern, formation-name, base-age, pop-up) for the reference well.

The column-type is "facies". The default size is

Data header: the first cell contains the column name, the second cell denotes the data type ("**facies**" for reference wells), and subsequent cells are optional parameters. The column name must match a group member's name (both cells are circled).

There must be **NO blank lines within** each reference-well set (the entire lithostrat succession); but at least one blank-line BETWEEN that set and the adjacent column-datasets.

6907			Fm.					
6908		Gap		522.36	CALIBRATION = 90% up in Stage 2. Dashed.			
6909		Sandstone	Hollybush Sandstone Fm.	533.92	LITHOLOGY = Micaceous sandstone with abundant chlorite and glaucor			
6910		Coarse-grained sandstone	Malvern Quartzite Fm.	536.82	LITHOLOGY = Quartz-cemented sandstones and interbedded conglome			
6911		Gap		555.95	CALIBRATION = 85% up in Ediacaran. Dashed.			
6912		Lava	Warren House Fm.	576.41	LITHOLOGY = Spilitic basalt lavas, altered intermediate lavas ('keratop			
6913								
6914								
6915								
6916	**Hampshire Basin (region S12)**	facies	100	234/201/201			Waters, C.N. et al (16 authors), 2007. Strat	
6917	Britannia Catchments Gp.	Primary			LITHOLOGY = Fluvial, lacustrine, mass movement, periglacial and aec			
6918		TOP		0.00	CALIBRATION = Today			
6919		Conglomerate		0.72	LITHOLOGY = Fluvial, lacustrine, mass movement, periglacial and aec			
6920	Residual Deposits Gp.	Primary			LITHOLOGY = Deposits formed by weathering and solifluction of origin			
6921		Soil	Clay-with-Flints Fm.	16.42	LITHOLOGY = Residual deposit of orange-brown and red-brown sandy (			
6922		Primary						
6923		Gap		23.03	CALIBRATION = Base of Aquitanian			
6924	Solent Gp.	Primary			LITHOLOGY = [For details click <a href="http://www.bgs.ac.uk/lexicon			
6925		Claystone	Bouldnor Fm.	32.25	LITHOLOGY = Not given [For details click <a href="http://www.bgs.ac.			
6926		Continental marl	Bembridge Limestone Fm.	35.22	LITHOLOGY = Not given [For details click <a href="http://www.bgs.ac.			
6927		Sandy claystone	Headon Hill Fm.	37.20	LITHOLOGY = Sandy claystone [For details click <a href="http://www.			
6928	Barton Gp.	Primary			LITHOLOGY = Yellow weathering, green-grey clay, with discrete fine-gr			
6929		Coarse-grained sandstone	Becton Sand Fm. and Chama Sand Fm.	38.80	LITHOLOGY = Not given [For details click <a href="http://www.bgs.ac.			
6930		Sandy claystone	Barton Clay Fm.	40.40	LITHOLOGY = Olive grey glauconitic sandy clays [For details click <a			
6931	Bracklesham Gp.	Primary			LITHOLOGY = Laminated silts and silty clays [For details click <a hre			
6932		Siltstone	Selsey Sand Fm.	42.04	LITHOLOGY = Silty sand to sandy clayey silt [For details click <a hre			
6933		Claystone	Marsh Farm Fm.	44.09	LITHOLOGY = Laminated clay an fine-grained glauconitic sand. [For d			
6934		Fine-grained sandstone	Earnley Sand Fm.	46.55	LITHOLOGY = Glauconitic silty sands and sandy silts [For details clic			
6935		Sandy claystone	Wittering Fm.	48.60	LITHOLOGY = Greyish brown laminated clay to fine-grained sparsely-g			
6936	Thames Gp.	Primary			LITHOLOGY = Silty clay/mudstone [For details click <a href="http://w			
6937		Claystone	London Clay Fm.	52.20	LITHOLOGY = Silty clay. Glauconitic at base [For details click <a href			
6938		Primary						
6939		Gap		53.28	CALIBRATION = 35% up in Ypresian			
6940	Lambeth Gp.	Primary			LITHOLOGY = Variable [For details click <a href="http://www.bgs.ac.uk			
6941		Soil	Reading Fm.	54.54	LITHOLOGY = Major paleosol [For details click <a href="http://www.bgs			
6942		Claystone	Reading Fm.	55.80	LITHOLOGY = Clay, mottled by pedogenetic processes in a humid env			
6943		Primary						
6944		TOP		70.60	CALIBRATION = Base of Maastrichtian			
6945	Chalk Gp.	Primary			LITHOLOGY = Mainly chalk, with marl seams and flint layers in parts.			
6946		Chalk	Portsdown Chalk Fm.	73.83	LITHOLOGY = White chalk with marl seams (particularly in the lower pa			
6947		Siliceous chalk	Culver Chalk Fm.	79.00	LITHOLOGY = Soft white chalk, relatively marl free with flint seams [			
6948		Siliceous chalk	Newhaven Chalk Fm.	84.69	LITHOLOGY = Smooth white chalks with numerous marl seams and flir			
6949		Siliceous chalk	Seaford Chalk Fm.	86.40	LITHOLOGY = Firm white chalk with conspicuous semi-continuous nodu			
6950		Chalk	Lewes Nodular Chalk Fm.	89.33	LITHOLOGY = Hard nodular chalks and hardgrounds [For details click			
6951		Chalk	New Pit Chalk Fm.	92.80	LITHOLOGY = Blocky, white firm chalk with numerous marls [For deta			
6952		Chalk	Holywell Nodular Chalk Fm.	94.16	LITHOLOGY = Hard nodular chalks with thin flaser marls and significan			
6953		Chalk	Zig-Zag Chalk Fm.	96.58	LITHOLOGY = Blocky, chalk, lower part has rhythmic alternations of m			

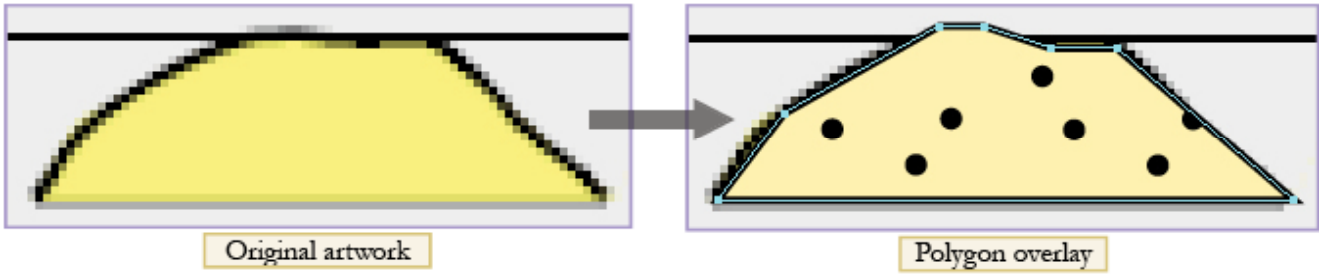
In this example, the Header indicates that the title of this "*facies*" type column is "*Hampshire Basin*", the default-width of the lithology-pattern column is *100* units (about 3 cm), the background RGB color is *234/201/201* (but, not really seen in most user-output), then 2 blank columns implying default "title" for the column title (if "notitle" is here, then it is not shown) and default "on" for it to show if the subdirectory is selected (if "off" is here, then one would need to display only via a click-on within TS-Creator zonation menu). The last cell is a pop-up that will appear when clicking on the Hampshire Basin title on the displayed chart.

The rest of the output is the Groups of lithology patterns with formation-names and pop-ups.

Part C. Transect panel digitization and conversion

1. Overview – how it works

This is the core of transect conversion. In order for *TimeScale Creator* to recognize and accurately reproduce a transect, we manually draw polygons over the original shapes, much like one would use tracing paper to reproduce a sketch or drawing. We capture these lithologic-areas within a "Red-box transect frame".



Note in the upper-right image, the polygon's outline comprises a series of dots (seven in total) connected by line segments. These dots are "anchor points", and every polygon consists of a series of anchor points connected by line segments - even shapes with curved, unconformity (wavy) or jagged lines. The Fill of this polygon is from the TS-Creator pattern template.

The placement of these "anchor points" relative to the edges of the "Red-Box" outline, as recorded in the SVG output from Adobe Illustrator, are interpreted by TS-Creator. Each anchor-point has a Horizontal-position (percentage across Red-Box) and a Vertical-position (percentage down in Red-Box). That Vertical-position is converted to Numerical Age based on the "Top Age" and "Bottom Age" that we've assigned to that Red-Box outline. TS-Creator creates an Age-versus-Horizontal-position grid-table as text output, where numbered "X93" markers indicate the named anchor-points for each polygon, and the polygon descriptions include pattern-fill-name designations. Polygons can have common boundaries.

Similarly, the placements of Labels (*formation names to be displayed onto the transect*) are relative to that Red-Box; and their word-lengths are assigned a scaling box by TS-Creator to enable auto-rescaling of font-size if the final diagram is compacted or expanded. Pop-ups associated with each polygon are denoted by typing "*popup: xxx*"; and TS-Creator recognizes the "popup:" as a flag; and assigns this as a characteristic to that polygon.

The transect-template also includes "wavy" and "interfingering" (or lapping) line-segments. When these line-segments are crossing Polygon boundaries; TS-Creator assigns the output-line-style to have this geometric pattern (another set of magic routines).

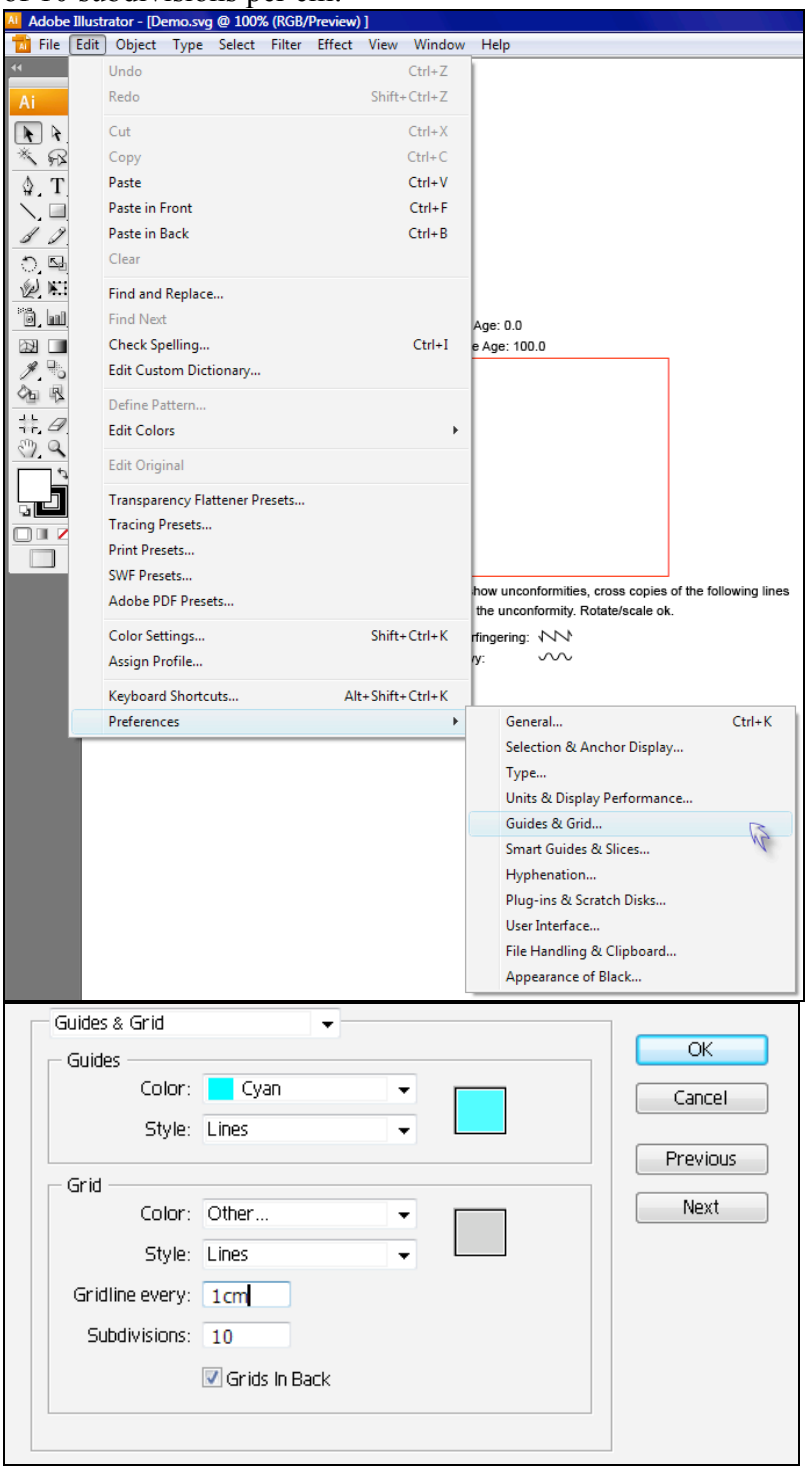
Therefore, the Vertical-position of the anchor points, as given interpolated ages by the TS-Creator conversion, can be assigned more precise ages by linking to facies-boundary-ages within Reference wells, or by other proportional relationships. The interpolated-ages for Labels are given a similar revised inter-linked age.

2. Digitization

(a) Setting up the "Snap to Grid"

In order that horizontal boundaries within the transect artwork are recorded as exactly horizontal "same-age" levels, it saves countless headaches by forcing all anchor-points to be on a fixed 1-mm grid.

In Illustrator's ***Preferences***, select the "***Guides & Grids***" sub-menu and set a grid spacing of 10 subdivisions per cm:

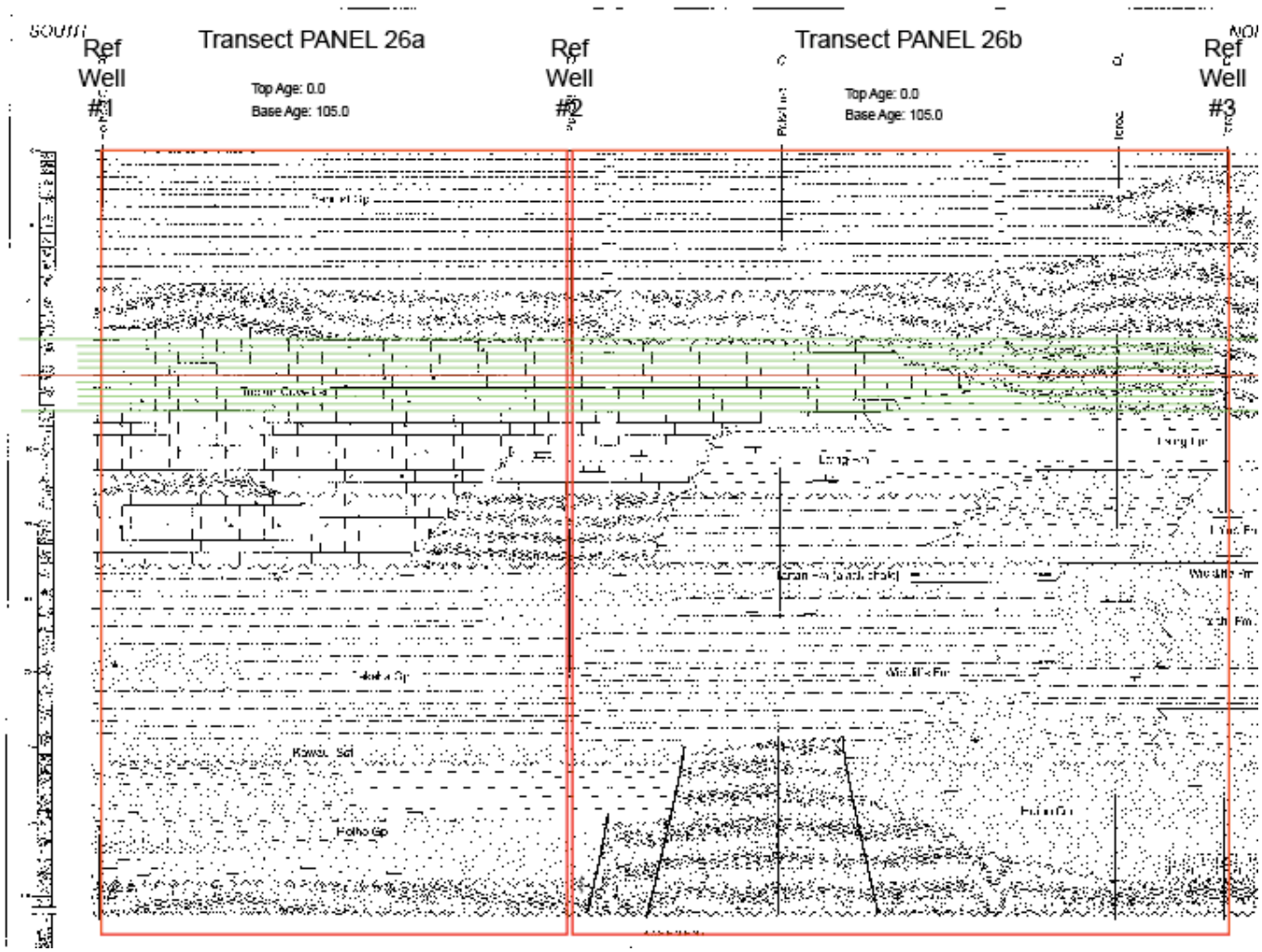


NOW, Turn **<u>ON</u>** "***Snap to Grid***" (under View in Adobe Illustrator).

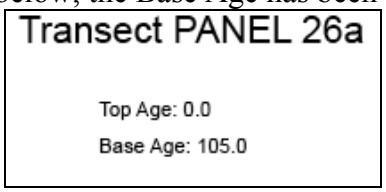
(b) Scaling "Red Box" and age-span

Turn ON the desired Transect Layer. For the moment, be sure that all other layers are locked, including the ruler-layer. Indeed, one can turn OFF the visibility of the ruler-layer for the polygon-creation process.

Move and expand/contract the Red-Box outline to encompass the Transect-panel between the Reference holes. This will be the area for digitizing the facies with polygons.

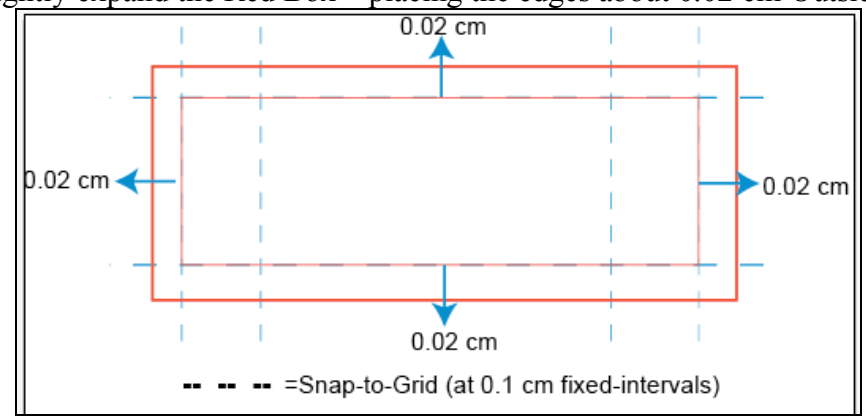


Based on the Transect-region to be digitized, revise the **Top Age** and **Base Age** for that Red-Box outline. In the example below, the Base Age has been set to 105 Ma:



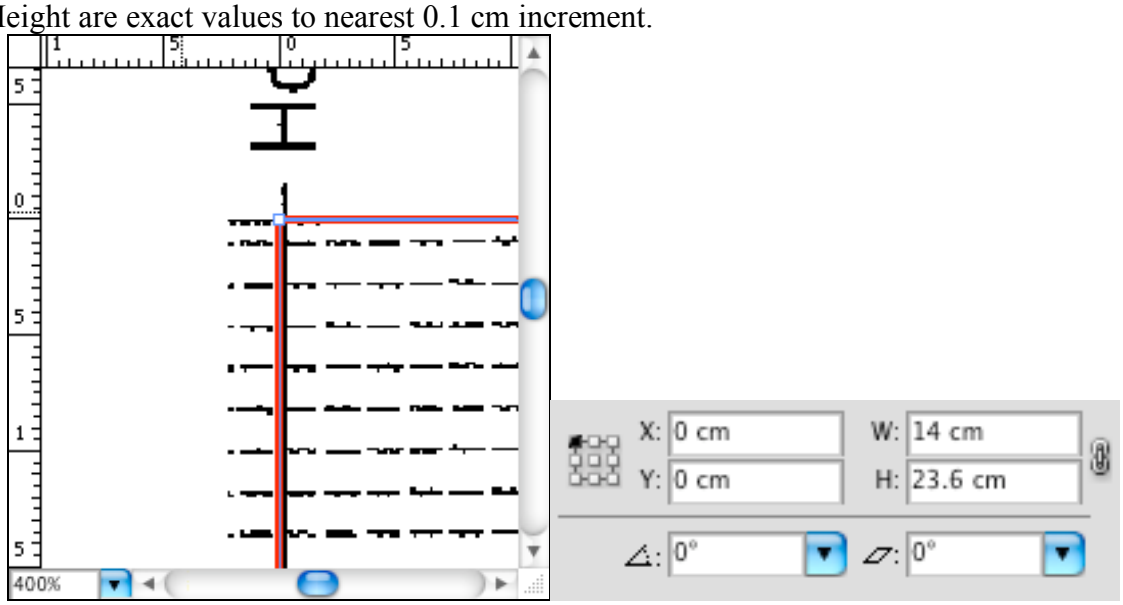
Applying a slight enlargement to the Red-Box outline

To avoid a potential mis-interpretation when an Anchor-point of a polygon is exactly on the Red-Box outline (hence might be ignored by TS-Creator conversion due to rounding errors), one needs to slightly expand the Red Box – placing the edges about 0.02 cm Outside of the Grid.

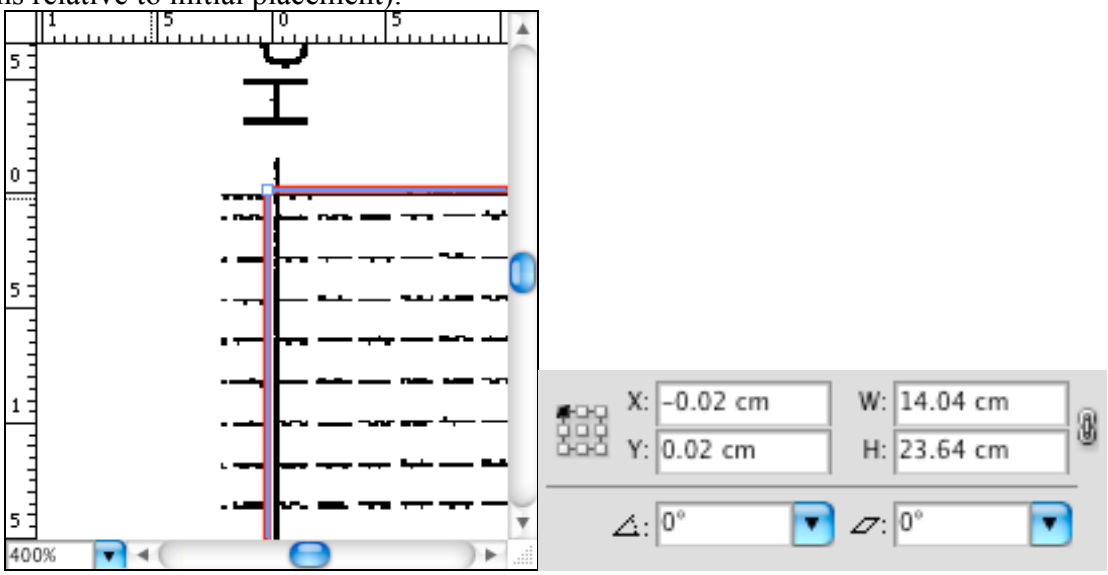


For convenience, first set the Grid "zero" at the upper-left corner of the Red-Box outline. Under "View" in Illustrator, chose "Show Rulers". The upper-left corner of the resulting Illustrator drawing area has the intersection of the horizontal and vertical rulers. Press the Mouse-pointer within the "blank" intersection cell, and drag the created cross-hairs to the upper-left corner of the Red-Box outline. This resets the Illustrator grid "0,0" at that point. It might be necessary to zoom-in (e.g., scale of 400 on Navigation) to be sure that this "0,0" coincides with the upper-left corner.

To adjust the Red-Box borders to be offset by 0.02 cm from the "*Snap-to-Grid*" assignment, use the Transform (activate under Illustrator "Window" menu). Click on the Red-Box outline to highlight it. In the Transform, click on the placement-selection (the set of dots on its left side) to have the active corner to be upper-left. One should see that the X and Y are both "0" (if the zero-reset was done) or an exact values to nearest 0.1-cm increment; and similarly the Width and Height are exact values to nearest 0.1 cm increment.



NOW, Subtract 0.02 from the "X" (to move that Red-Box border to the left); Add 0.02 to the "Y" (shifts it upward); and increase the W and H by 0.04 (which adds 0.02 to the other margins relative to initial placement).



(c) Tracing the polygons

The original-transect-scan should be on the bottom (locked) layer, the ruler-layer should be locked (and turned OFF), and the red rectangle should be on the overlying layer with any polygons you draw (the only "unlocked" layer).

The tracing of each lithology region in the original transect will have a corresponding polygon in our Traced-Transect layer WITHIN the Red-Box, or else TRUNCATED by that Red-Box. You must draw the anchor points of all polygons within the Red-Box outline for *TimeScale Creator* to recognize them. We outline the facies-boundaries using the Pen tool; and use the Template Swatches of lithology-patterns to add an appropriate Fill.

There are several rules when tracing the Polygons – mainly to insure that each polygon is closed; polygon boundaries do not overlap; and each anchor-point on one polygon has a matching anchor-point on the bordering polygon.

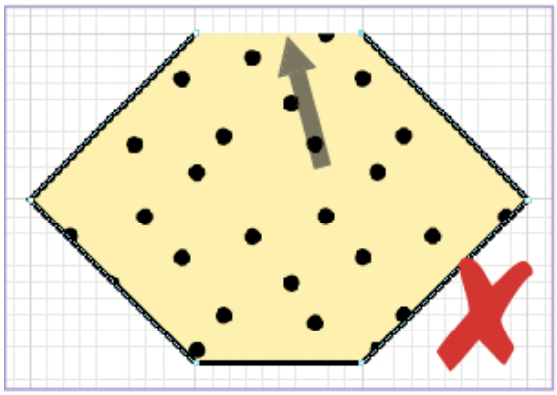
1. Close each Polygon as the last line-segment

Trace all polygons using the Pen Tool.  [*icon, 3rd from top, on Tools – if not visible; then be sure that Tools is ON (under Window menu)*]. The Pen-tool works by Clicking on points; not dragging between them.

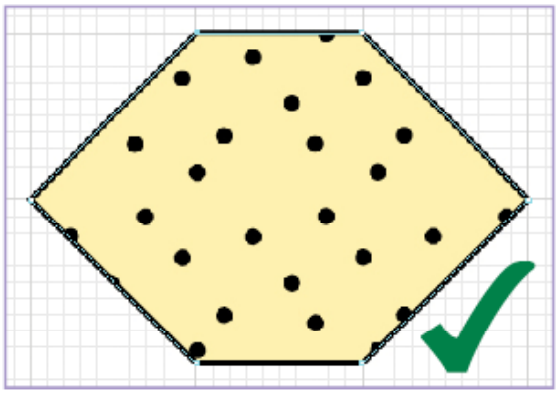
Select Pen-tool; and click a SINGLE-TIME on the drawing screen on the left side. Then, WITHOUT HOLDING DOWN THE MOUSE-drag, move the pointer to another spot on the right side, and CLICK to add a line-segment to the future polygon. If you wished to have an exactly horizontal or exactly vertical offset; then ***holding-down-SHIFT*** before clicking the Mouse forces this line segment to vertical or horizontal. Each successive Mouse-click adds another anchor point to the polygon.

Continue this process until the facies-area has been outlined completely by the polygon – NOTE that you <u>MUST</u> **RETURN TO THE FIRST ANCHOR-POINT AND CLICK IT** to **close the Polygon**. In essence, this draws a line from the last point to the first. In Illustrator

CS4/CS5; a "green-colored" "anchor" appears below the mouse-tip to indicate that this pen-click will close the polygon. See General Tips (about three pages below), for how to return to a un-closed Polygon to close it.



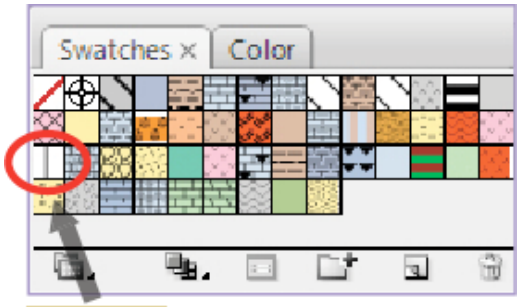
The top line segment is missing.



This polygon is complete.

THEN, select the Black-arrow on the Illustrator Tools to release the Pen. Otherwise, Illustrator will continue to draw more line segments.

Highlight the completed Polygon, and select the appropriate Fill from the lithology-pattern swatches. Note that Illustrator has separate selections for the line-color and the fill-color – we suggest keeping Lines as black (and width of 1 point).



Gap swatch

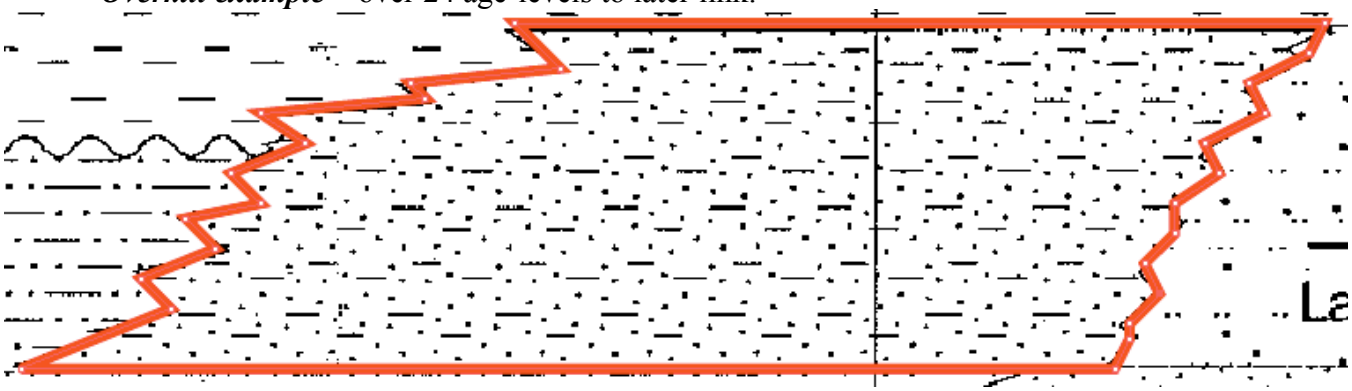
Every polygon has a stroke by default. You can make it thinner by lowering the weight (thickness) in the Stroke panel, or remove it by clicking the "None" box in the Color panel. Polygon stroke-width has no effect on *TimeScale Creator*, but may interfere with tracing.

Have at least one polygon corresponding to every lithologic change in the bordering reference well (as you created above); and be consistent in the assigned lithology-pattern.

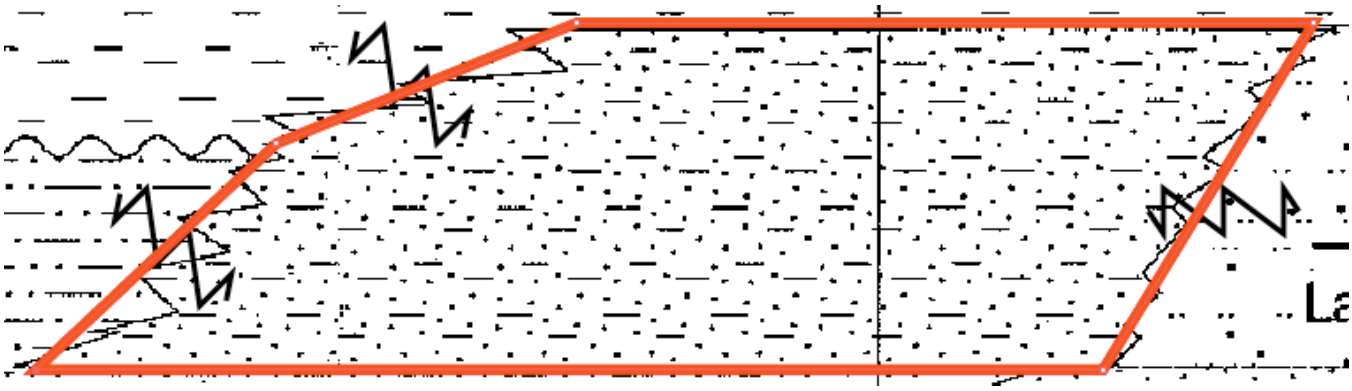
2. Try to Minimize the number of Anchor Points – Make it schematic

Keep in mind that you will need to Inter-Link EVERY age for anchor-points. Frankly, a large part of most transect is "artistic interpretation". We don't need to capture all that detail. Balance one's artistic flair with how many hours you have to spend in the later linking (*this advice will become quite apparent after having completed your first full transect with linking*!).

Overkill example – over 24 age-levels to later link:



Same example – only 3 age-levels to link, with "Interfingering-line designators:



Here are some suggestions:

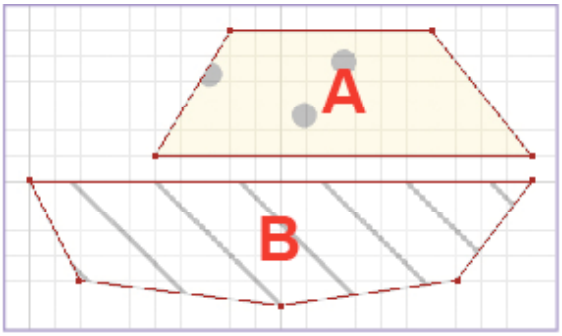
(a) We will utilize a "*Interfingering*" line-style for that type of contact. One usually does not need to draw a lot of *in-and-out* contacts of one polygon interfingering with another. The *TS-Creator* display default is such inter-fingering is displayed with 400-kyr saw-tooth oscillations.

(b) Strive to keep as many anchor-points as possible on a single age-level. We only need to constrain the age-assignments to the reference-wells.

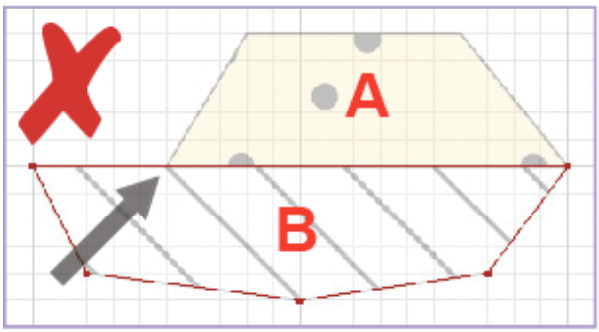
(c) If a contact is "curving", simplify to a few (*ideally not more than three intermediate anchor-points*) straight-line segments to convey the general trend. Detail is important for accurate tracings, but, after a certain point, adding additional anchor points only increases the trace fidelity by a negligible amount.

3. All Anchor-points must match between adjacent Polygons

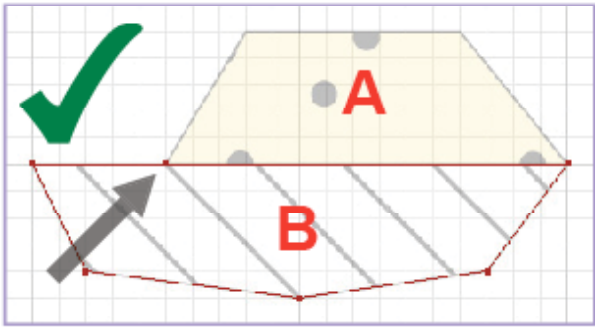
If polygon A has an anchor point that touches polygon B's border, then polygon B must have an anchor of its own at the point of contact to match polygon A's anchor.



Polygon A + Polygon B =



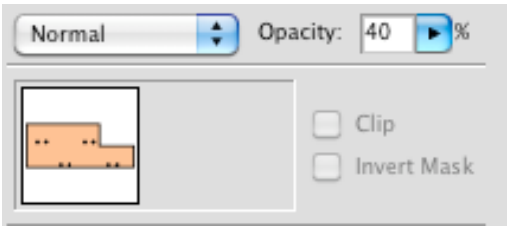
Polygon A has an anchor at the indicated spot, but polygon B does not.



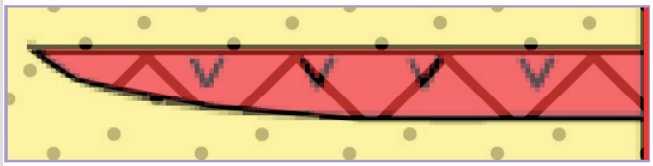
Both polygons A and B have an anchor point at the indicated spot.

4. Turn on Transparency of 40%

Highlight the Polygon, and use the Transparency (from Illustrator "*Window*" menu) to apply a transparency of 40%. This enables one to see the underlying original scan.

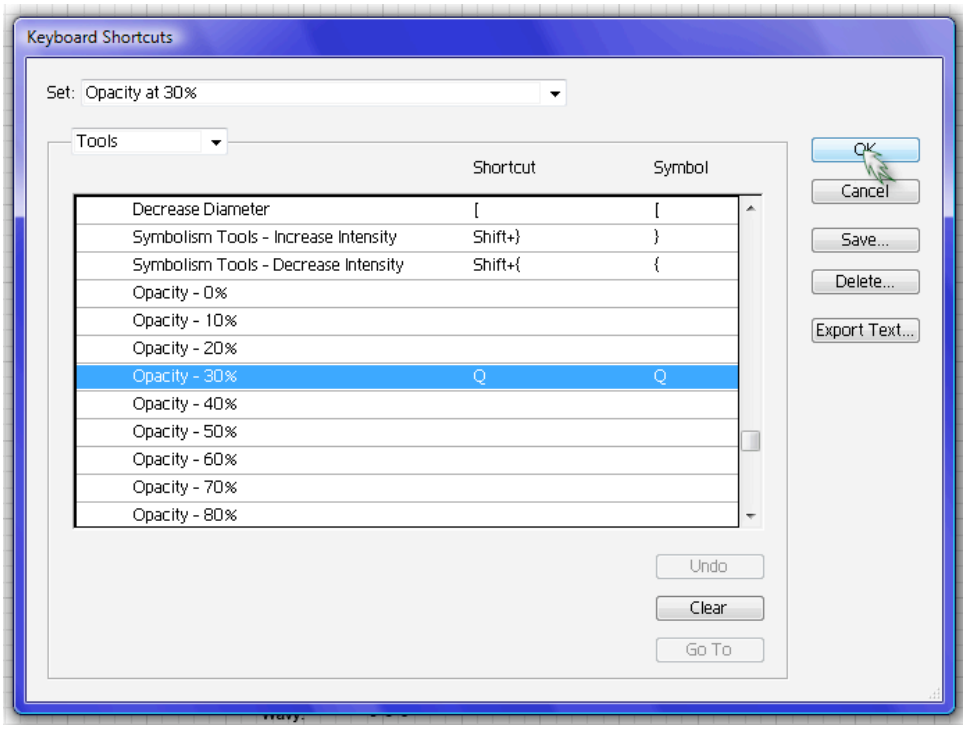


Original artwork without modifications



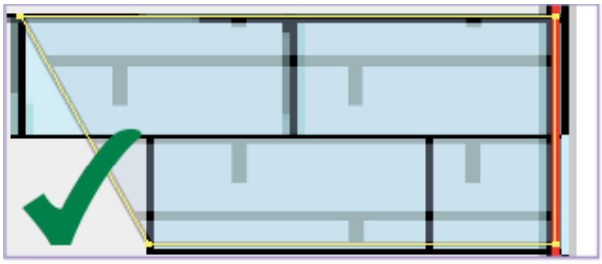
Original artwork overlain by semi-transparent polygons

HINT: Repeatedly using the transparency slider to adjust polygon opacity is troublesome, especially if you are in the middle of tracing a polygon. Assigning a keyboard shortcut to accomplish this allows you to adjust polygon transparency without moving the cursor away. You can find the keyboard shortcuts under the Edit menu.

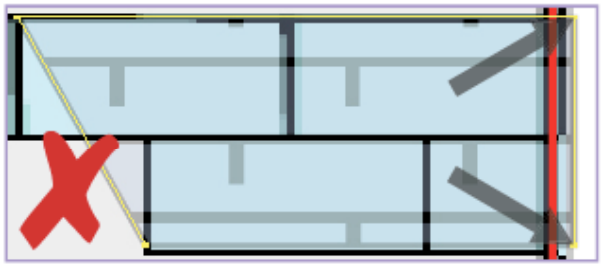


5. Keep all Polygons inside the Red-Box outline

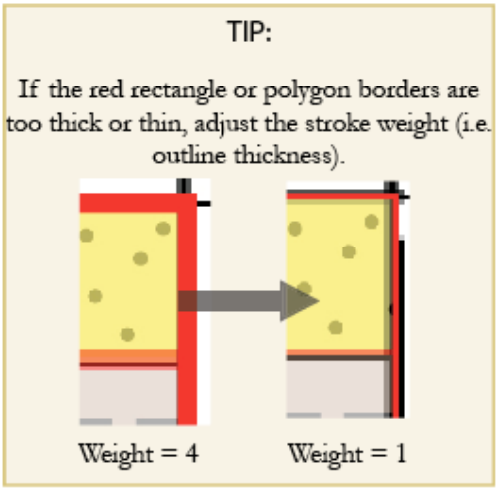
As noted above, by using "Snap-to-Grid", but adjusting the Red-Box outline to be offset by 0.02 cm from that 0.1-cm grid, it helps avoid this problem.



All four anchor points are inside or on the rectangle.

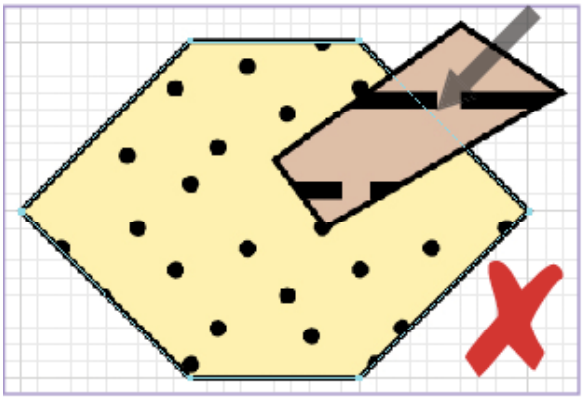


Two anchor points are outside the rectangle.

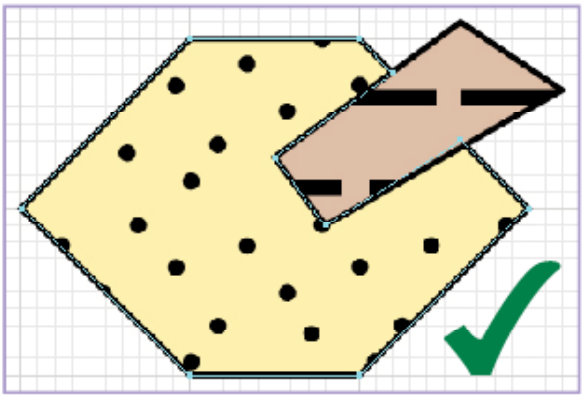


6. No overlapping Polygons

TimeScale Creator can not decode a situation when one polygon overlaps another, and will reject the upload. This is avoided by drawing each polygon around the intruder.



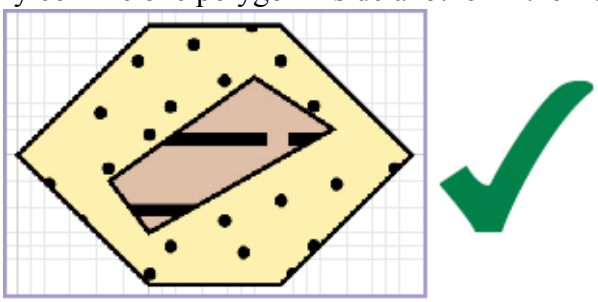
The teal line marks the border overlap.



The dotted polygon now has ten sides.

7. Enclosed Polygons are Okay

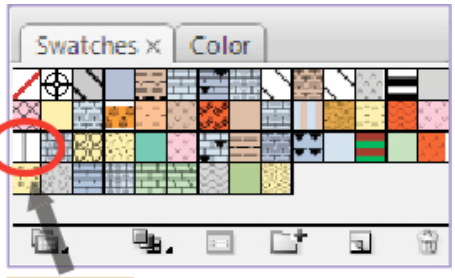
You may completely confine one polygon inside another if their borders do not touch.



8. Only FILL polygons with pre-loaded patterns

To apply a pattern, select a polygon and click on the appropriate pattern in the Swatches panel. Only use the default swatches provided by the template; Time Scale Creator will not recognize any other textures.

Note that sedimentary gaps (unconformities) must be drawn in as polygons filled with the "Gap" swatch; TS-Creator treats gaps like any other polygon, so leaving the area empty and using a general background fill does not work.



Gap swatch

9. Hiatuses (gaps) can be either "Gap-filled" polygons or left Blank

If there is a 20-myr regional hiatus, then it is easier to just leave that "age-facies" interval as a blank area, rather than add a "gap-filled" polygon. "Floating" polygons in a blank age-space region are okay.

10. After tracing all Polygons; and before adding Labels, etc. – Review it

(a) Using the "White-arrow" in the Illustrator tools, click a polygon to cause the anchor-points to be visible as white-boxes. Then, click the adjacent polygon to see if its anchor-points are coinciding, and that all anchor-points have a corresponding brother on the adjacent bordering polygon. One might turn OFF the basal original-scan-layer to see this better.

(b) After you have traced all the polygons, we strongly advise you to create a sample output file; doing so will uncover any tracing errors and to ensure that you are satisfied with the TimeScale Creator rendition before continuing. This is much easier before adding Labels, For instructions, refer to the following section on ***converting the transect into a text file***. **BUT, SAVE your current Illustrator file in Illustrator-FORMAT (.ai) before doing this!!** Otherwise, you will loose your day's work.

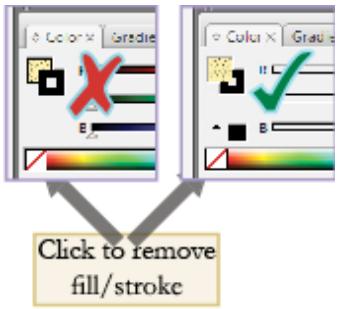
<u>GENERAL TIPS for Polygons; and Correcting problems</u>

(1) If I need to Move an Anchor-point:

Select the "***White-arrow***" of the Illustrator tools. Click on the Polygon to highlight the line-segments and anchor-points. Then, click directly on the anchor-point that needs adjusting. You will see this anchor point becomes a "filled-square", whereas all other anchor-points become open-squares. Then, either use the keyboard move-keys to shift this anchor by increments, or drag it with a mouse. When finished, you need to return to the ***Black-arrow*** of the Illustrator tools – the "White-arrow" is only used to modify existing objects (but, it is invaluable for this!).

(2) I clicked on a Lithology-swatch, but it doesn't do anything to the Polygon-fill:

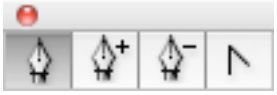
If you attempt to change a polygon's pattern and nothing seems to be happening, you are probably changing the polygon's stroke (outline) rather than its fill (interior). In the upper-left of the Color panel, click the solid square so that it overlaps the hollow box.



(3) If I forgot to have an Anchor-point where adjacent polygons intersected. Can I <u>add</u> one?

This is a very common mistake. Fortunately, Illustrator provides an easy solution – "Add Anchor Point" (in their non-existent manual).

Under the Tools, click the Pen Tool and hold-down-the-Mouse. In 2 seconds, a second menu appears – The Pen tool, an "Add Anchor Point" option, and a "Delete Anchor Point" option.



If you do many transects, these will become invaluable for quick trouble-shooting! Select "*Add Anchor Point*"; use the *Black-arrow-tool* to highlight the Polygon that needs an additional anchor; click on the "*Add Anchor Point" tool*; then click onto the Polygon-line-segment in the place that needs this additional anchor. If nothing happens, then you probably missed the grid; just try again.

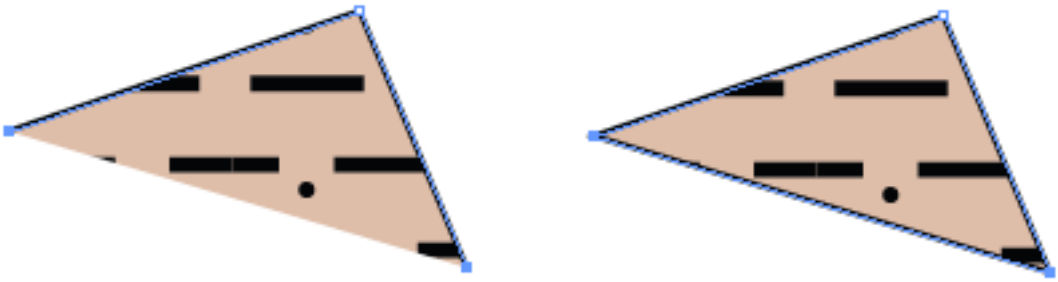
Similarly, the "Delete Anchor" can remove superfluous ones.

NOTE: You must re-activate the regular Pen tool to draw the next Polygon, etc.

(4) Unclosed Polygons – how to easily fix them

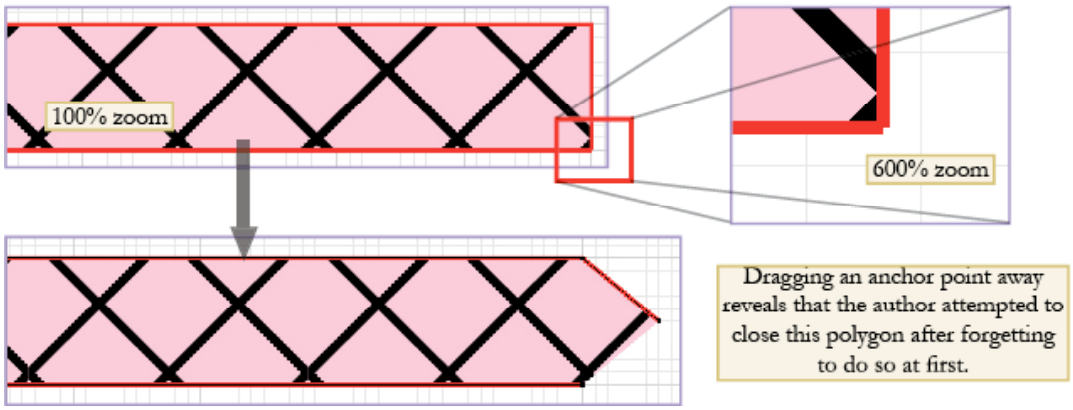
There are two ways. The First, obviously, is to delete the polygon and re-do it.

The Second is to use the "White-Arrow" in Illustrator tools to select ONLY the two end-anchors (hold-down *SHIFT* to enable selecting the second-one) that need to be joined (see below). Then after highlight-selecting those two anchors, **Right-Click** the Mouse to bring up a menu, and choose "***Join***" – this will draw a connecting line-segment between those two end-points.



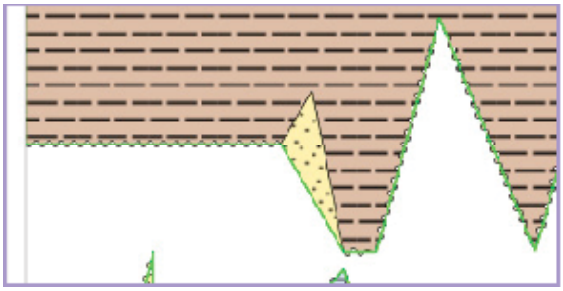
But, this can sometimes be tricky if there is an adjacent bordering polygon with its line-segments. Therefore, one often needs to use the Black-arrow to select the polygon; move it intact away from its neighbors, do the join-the-end-anchor procedure, then with the Black-arrow again move it back into place. Fortunately, with the "Snap-to-Grid", this can be accomplished with precision.

NOTE: Placing two endpoints at *almost* the same place does NOT close the polygon. In fact, doing so will make an open polygon appear closed to your eye, when in fact it technically is not (and TS-Creator will treat it like it is not). This halite block looks properly drawn...until you zoom in.



Detecting Unclosed Polygons:

Unfortunately, Adobe Illustator allows filled-shapes to be open (i.e., there are two distinct endpoints in a series of anchor points) or closed. For our purposes, we only use closed shapes and Time Scale Creator will not recognize open polygons; and will have a "Blank-area".

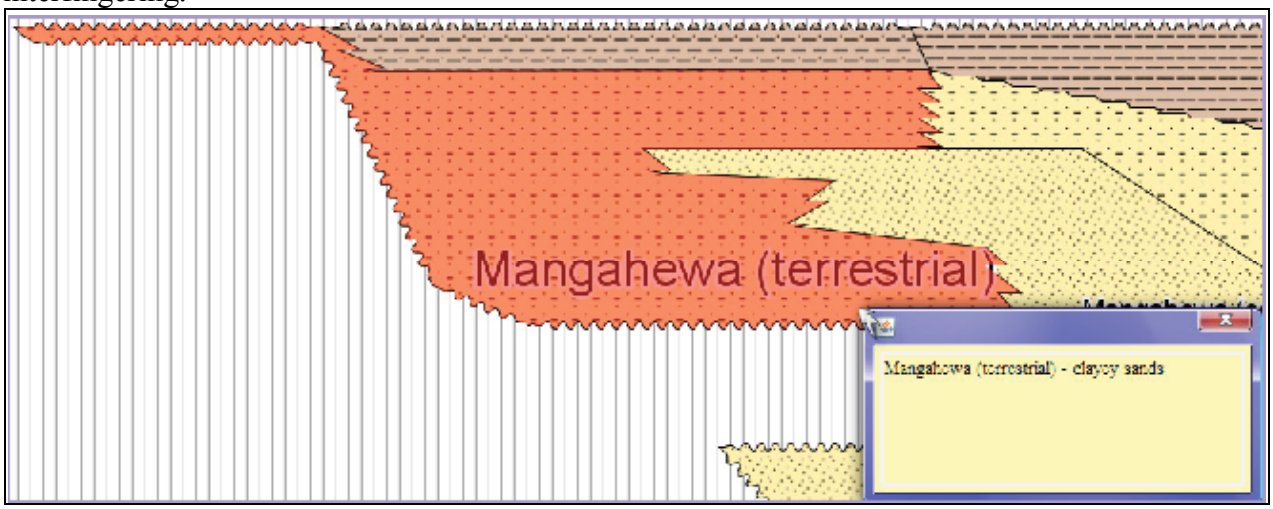


This is a preview from the Transect Template Loader. As you can see, unrecognized open polygons are simply omitted from the transect.

Unclosed polygons blend in easily when you are tracing because neighboring shapes and underlying artwork can hide the mistake. However, once you load your traced SVG into *TimeScale Creator*, the unclosed polygon becomes immediately obvious (as seen above). Within Illustrator, one way to spot open polygons are to isolate the polygon against a white background (e.g., hide the underlying Original-Scan-Layer), then use the White-arrow to select polygons to have the line-segments highlighted (or show as non-existent). This is one reason to have the Transect-layer "*select color*" to be Red or other distinctive color against the black-bordered polygons – See Part A, Section 2-b on how to do this.

(d) Labels and Pop-ups

In three separate passes – to avoid visual confusion – we will add text-labels (which appear as overlays on the TS-Creator visualization), followed by pop-ups (which appear using "Mouse-over" in TS-Creator visualization), and finally designating line-types to appear as wavy or interfingering.



Use **Arial** for the font. One can either reset Illustrator permanently (unless you love their Myriad Pro default font); or use the CS4/CS5 menus for each transect diagram.

To permanently change the default font for Illustrator CS4 (quoted from Adobe Website)

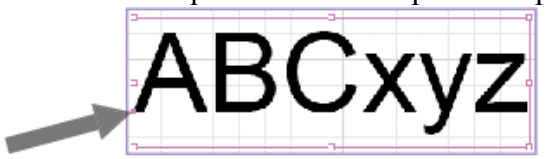
Choose *File > Open* and go to *Documents and Settings/User/Application Data/Adobe/Adobe Illustrator CS4 Settings/New Document Profiles* (**Windows**) or to *Users/**YourUserName**/Library/Application Support/Adobe/Adobe Illustrator CS4/en_US/New Document Profiles* (**Mac OS**).

Open one of the default document profile template files (Basic CMYK, Basic RGB, Mobile and Devices, Print, Video and Film, or Web, depending on which type of document you intend to use). – usually CMKY is your default-open.
Choose *Window > Type > Character Styles*.
Select the *Normal Character Style* and choose *Character Style Options* from the palette menu (by clicking on small-arrow at upper-right of that pallet window).
Select *Basic Character Formats* from Left menu and choose the desired font from the *Font Family* menu.
Click OK, and then choose *File > Save* and close the file. Choose *File > New* and select the desired default document profile.

For **CS5**, it is nearly as obscurely difficult – see extended instruction set at:
http://forums.adobe.com/message/2977073

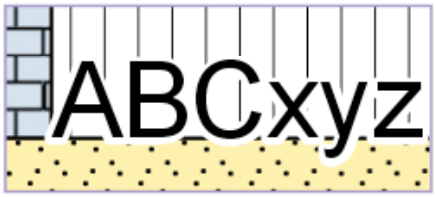
1. Add Labels (use Arial font)

To create a label for each formation or other item, enter the desired text using the Type Tool [the "**T**" on tool bar.]. *TS-Creator* will automatically detect the font and character size, and apply those settings when it generates transects. We recommend the Arial font sizes 10, 12 or 14; as appropriate to fit onto the polygons or nearby. NOTE: The TS-Creator display has a white-outline for the Labels, therefore these are quite visible on top of dark patterns; don't worry.



Use the indicated point to align the label.

Illustrator setup



TS-Creator result

IMPORTANT – Each label must be a SINGLE LINE. No line-feeds or other features. If a 2-line label is desired, then enter two **separate** text-objects.

The "lower-left" corner of the Illustrator text object is used for the Age and horizontal-position relative to the Red-Box outline.

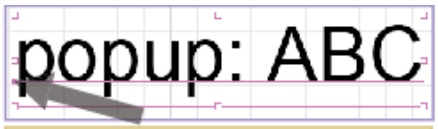
When you complete all Labels, turn OFF the Original-Scan layer to see the resulting display. Adjust as desired – this is what will appear on the final TS-Creator transects.

2. Add Pop-ups (use tiny Arial font)

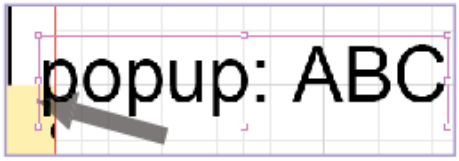
To create a popup, begin with the flag: **popup:** (with a **space after the colon**), followed by the desired text using the Type Tool . The font and character size does not matter, but

to avoid clutter, choose a neat font in the smallest practical size. Indeed, the font can be Arial 4 or smaller – TS-Creator only needs the text-wording after the "popup: " flag in the SVG file.

The lower-left corner of the pop-up text-object must be WITHIN the Polygon associated with that pop-up. However, unlike Labels, the right-side of the pop-ups may extend outside of the red-box outline.



The indicated point must rest inside the boundary of the desired polygon.



Once the point is aligned, the rest of the text can overlap anything with no issues.

TS-Creator result

We recommend a UNIQUE pop-up for each and every polygon – these are useful for locating the polygons after SVG conversion in case a lithology-pattern needs to be changed or another modification, plus enables linking to more extensive popups (such as full lithology details, URL links to lexicons, etc.). Therefore, as long as you've clearly marked each polygon's popup, it is not necessary to insert all the lithologic details at this point into such pop-ups; it can be done later in the Excel-output sheet.

NOTE: In case you forget a pop-up, you will have a last chance to enter missing ones by highlighting the polygon during the SVG conversion process within TSCreator.

(e) Adding line-styles – wavy and interfingering

By default, the edges of all polygons are straight-line segments. However, *TimeScale Creator* supports two borders illustrations commonly used in geological diagrams: Unconformity (**wavy**) interfaces, and **Interfingering** (lapping, jagged) interfaces: These Wavy and Interfingering (lapping) styles are line-segment modifiers. A template for each type were included in the transect template file generated by TS-Creator. One merely has a copy of these CROSS the appropriate line-segment, and TS-Creator does the conversion and coding upon SVG upload – magic!

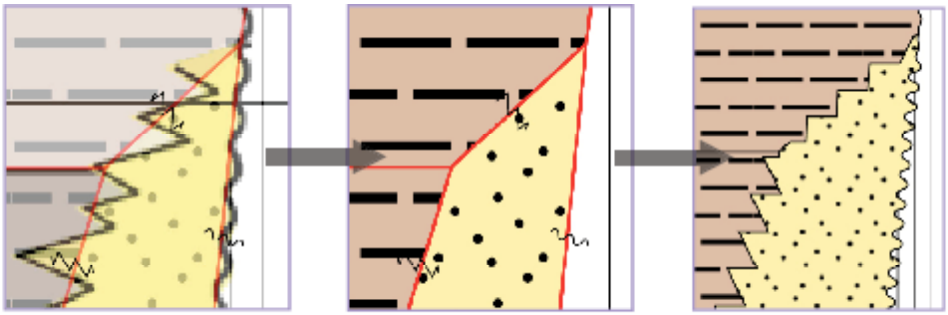
First, bring the line-segment modifiers to the front (Select to highlight, right-click, Arrange menu - *Bring to Front*). Therefore, they will appear on TOP of the Polygons you've drawn.

To implement a wavy or jagged border, drag a copy of the desired line-segment-modifier to the appropriate polygon line-segment. This line-segment can be a common boundary-segment

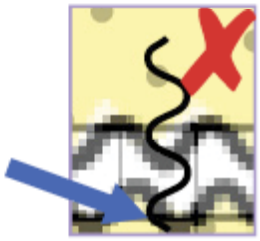
between adjacent polygons, or a segment adjacent to a blank "hiatus" zone. [*To make a Copy, using "Option-drag" with Mac is easiest*.]

Rotate the modifier so that it is ***more-or-less*** **perpendicular** to and crosses the appropriate line segment – it merely must cross at a steep angle. [*To rotate items in Illustrator, mouse over the exterior middle section of an item until a rotate-icon appears at the tip of the curser. Click and drag in a circular motion to rotate. Move the cursor farther from the center to fine-tune*.] [To rescale while maintaining proportions (i.e. change overall size while maintaining horizontal to vertical ratios) items in Illustrator, highlight an object. Hold Shift, then click an open-square at the corner, and drag diagonally toward or away from the center to rescale.]

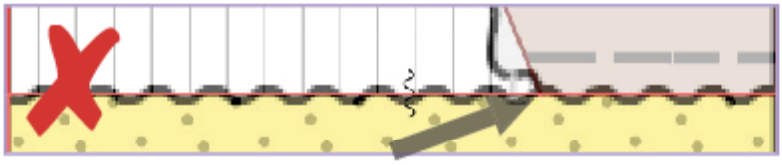
Line-segment modifiers may only intersect a **single** polygon interface. You must have a crossing-modifier for each appropriate line segment (each interval between pairs of anchor points). TS-Creator recognizes border modifiers of any size, as long as they retain the original proportions.



Artwork, 30% opacity | Artwork, 100% opacity | *TS-Creator* rendition

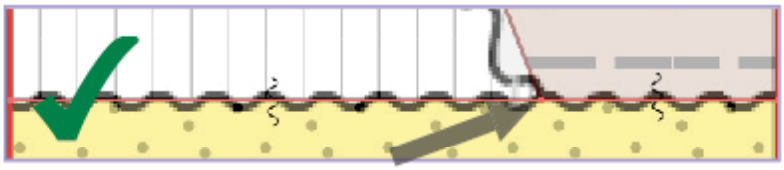


This wavy modifier is so large it covers two borders.



As explained in Anchor points must match, the top edge of the dotted polygon is made of two line segments separated by the indicated anchor point. Each line segment must have its own border modifier, so in this case only the left two-thirds of the polygon will have a wavy border, while the remaining one-third on the right will not.

Properly rescaled modifier



The line segments on either side of the indicated anchor point have their own modifiers, so both segments will be wavy in the *TS-Creator* rendition.

NOTE: The example of "Interfingering" shown above (from TSC ver. 4.2.1) has a much improved display-output in TS-Creator v. 4.3 and above.

Turn OFF the underlying Original-Scan, and review your set of labels, pop-ups and line-modifiers. It is easiest to make corrections at this stage.

(f) SAVE Illustrator diagram !!

Then, just in case, do a "***Save As***" with a slightly different name-date.

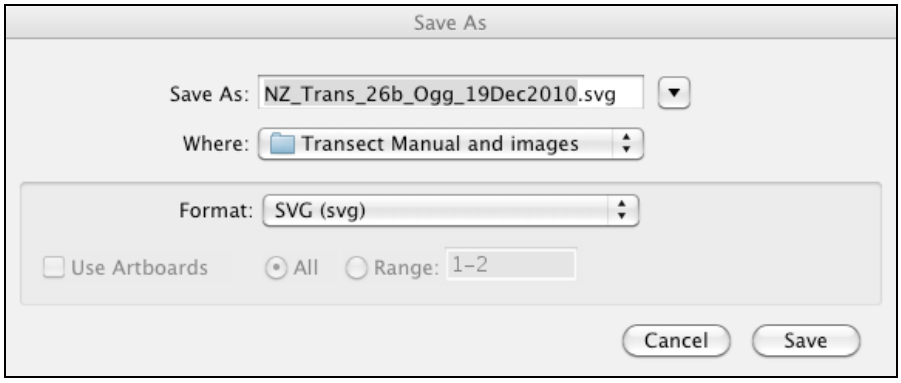
Our work from this point forward involves permanently removing data, so you must have a copy of your complete work in Illustrator Format on hand for future modifications.

Our next step will delete several layers, and one would not want to accidentally overwrite the original!

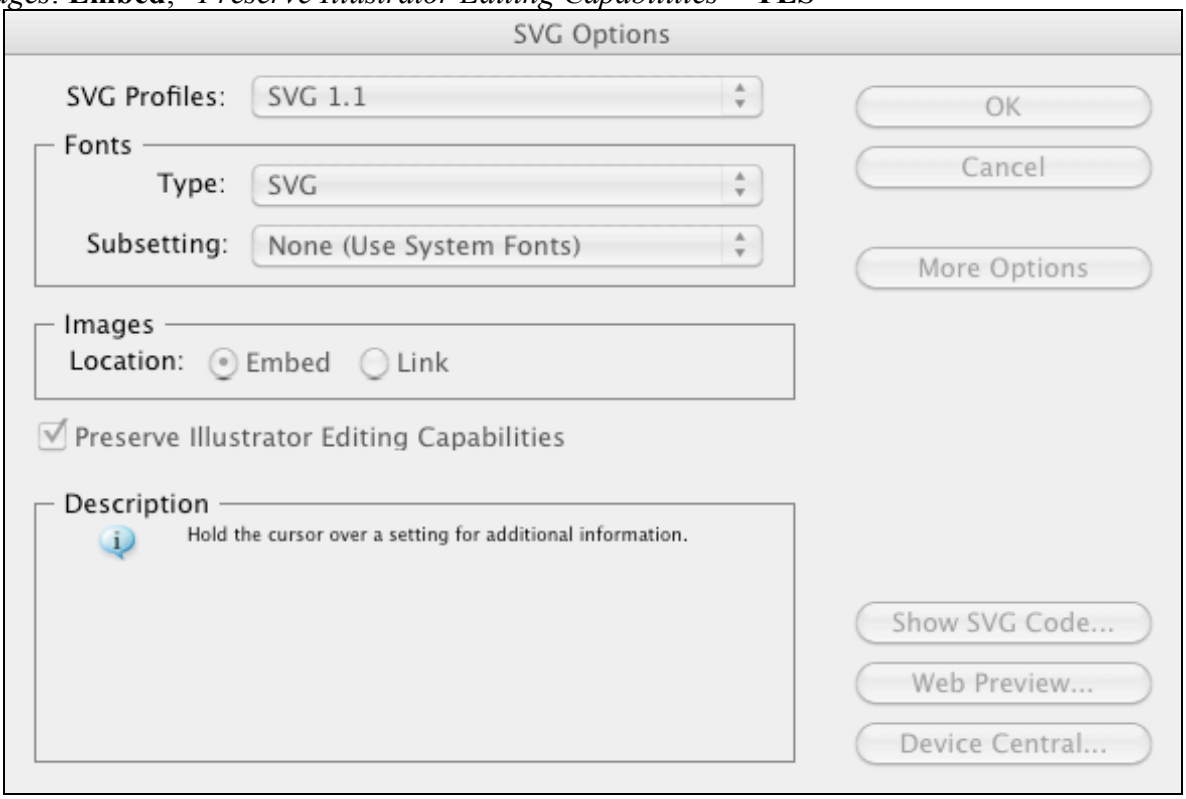
(g) Export the Transect Panel as SVG

Select "Save" first, then select "Save as..." using "***TransectPanel_XXXa***" to create your SVG file (extension .svg) – where "*XXXa*" is the name for just this panel of the transect. By doing this, you will end up with one .ai file and one .svg file. Remember to never remove the underlying art from the .ai file! Your .svg file is expendable, but the .ai file is not.

Now, Save as SVG:



Use these options when saving your SVG – *SVG Profile* = **SVG 1.1**; *Type*: **SVG**; *Images*: **Embed**; *Preserve Illustrator Editing Capabilities* = **YES**



NOTE: In some versions of Illustrator, saving an SVG file brings up the warning message "*Transforms are expanded*." To date, this has not caused any known problems.

After clicking "*OK*," Illustrator should automatically close the .ai file and leave you with an SVG file looking exactly like the original. You can check this by looking at the top of the Illustrator window. To finish the graphics editing, complete the following:

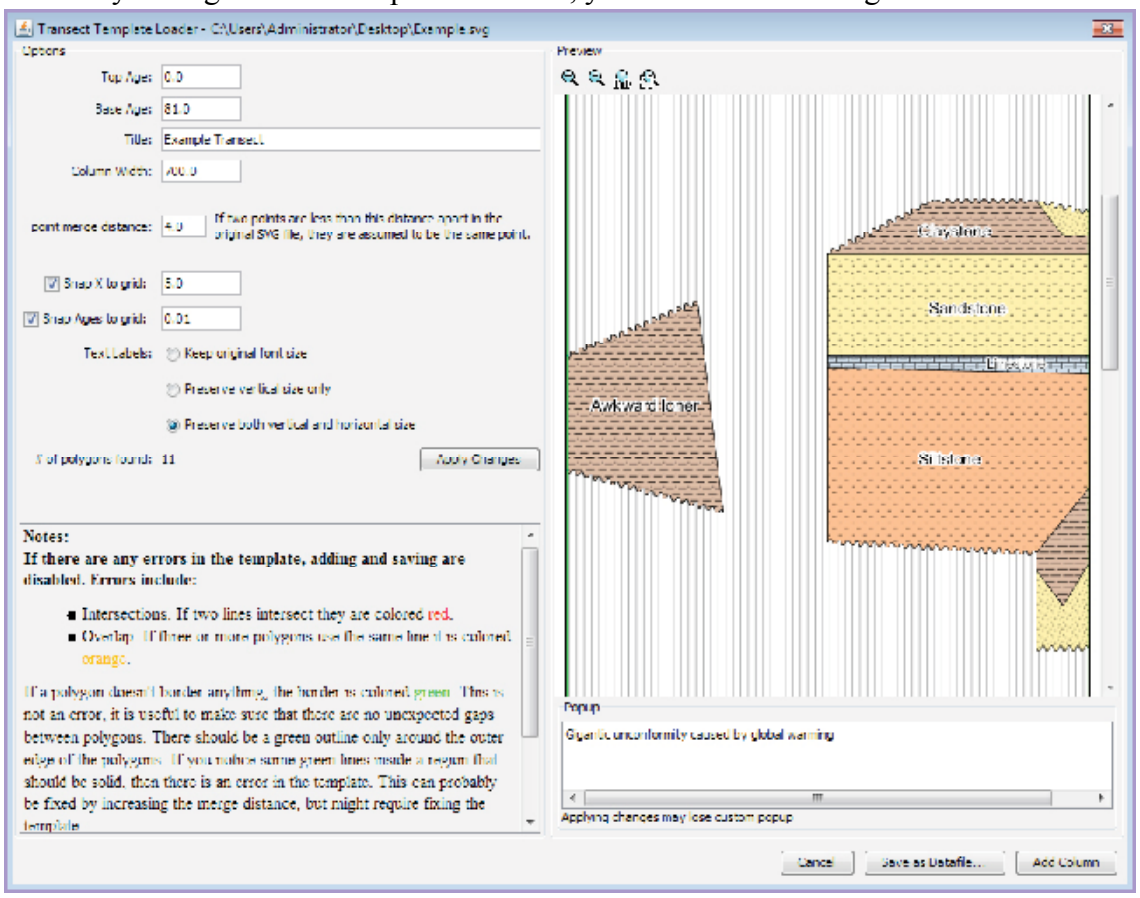
- **Delete** the layers containing Original-Scan, the Ruler, and any transect-panels other than the one you have completed.
- Select all (Control+A for Windows, Command+A for Mac) and set the **opacity** to 100%.
- Bring the Red-Box outline to the **front** (Select to highlight, right-click, Arrange menu - *Bring to Front*). This seems to avoid some anomalous problems in SVG conversion later.

Your tracing is complete! Save this single-layer file.

3. Converting Transect-panel into a TS-Creator dataset

Load the SVG file into TS-Creator: In the Top menu bar, click "Data", then "Load Transect Column from Template …"

Let's assume your digitization was perfect. Then, you will see something similar to below:



The **options** allow you to fine-tune *TimeScale Creator's* interpretation and reconstruction of your transect for both accuracy and aesthetic purposes. Here are their functions:

- **Top/Base Age**: These should match the values in the SVG; but you can also modify them at this stage.
- **Title**: The preferred name for the transect, and will appear as such at the top of the column. The default is "transect" – Change this to the TransectPanel name to avoid ambiguity.
- **Column Width**: This is the width of the final transect display. The default is "300", which would be about 10-cm wide on full-scale *TS-Creator* chart production. A value of

"1000" is more useful at this point -- a higher value will stretch the image horizontally while a lower value will compress it.

- **Point merge distance:** If two points are less than this distance apart, then TS-Creator assumes they are the same point and merges them. A lower value is often necessary if one has fine-scale "art" or narrow-span polygons in age or horizontal extent.

TS-Creator measures horizontal distances (X) in percentage of the total column width and vertical distances (Y) as interpolated to millions of years from the Red-Box Top/Base ages. The options **Snap X** and **Snap Ages** determine the horizontal and vertical resolutions, respectively. This strives to make the resulting transect easier to manipulate, and removes irregularities. The defaults were set for "normal" low-resolution transects according to our experiences. But, Lower values are **often** necessary if one has fine-scale "art", if the gridded-version doesn't capture features that one wishes to emphasize (e.g., a slightly slanting boundary), or to preserver narrow-span polygons in horizontal or in age extent.

- **Snap X to grid:** The default of "5" shifts all points to the nearest 5%. If two points are less than this distance apart, then *TS-Creator* assumes they are the same point and merges them.
- **Snap Y to grid:** The default of "0.2" shifts all points to the nearest 0.2 myr value. If two points are less than this distance apart, then *TS-Creator* assumes they are the same point and merges them. This aids in recovering "horizontal boundaries" from rounding errors or a misplaced anchor-point-level in the Illustrator diagram. It is rare that this default needs to be changed (e.g., few transects have layers less than 0.2 myr in thickness).

NOTE: If the original image contains a low level of detail, setting a high resolution is unnecessary and may even hinder progress during the linking process.

- **Text Labels:** One probably wishes to always preserve the vertical/horizontal scaling as entered on the tracing; rather than enforcing a font size.
- **# of Polygons found:** The SVG conversion resulted in this total number. If the original had more, then either small/narrow ones are not being resolved, a polygon was missing closure, or other problem.
- **COLOR ERROR NOTES:** Read this – it is a guide to correct any mistakes, as guessed by TS-Creator. If there are Red-flagged items, then *TS-Creator* will not allow saving of the datapack.

<u>The Display</u>

The transect-display may look warped or barely recognizable compared to the traced SVG when the default Column-Width of 300 is grossly disproportionate to the length of the Red-Box. Adjust the Column-Width until *TS-Creator* renders the transect with correct proportions.

By enlarging the view, one can check if the line-styles are as desired, if polygons have appropriate patterns and other features. Don't worry about the label-sizing, because this is a simplified version.

If you click on any polygon, the pop-up shows in the box below. At this point, one can enter any new text within that box. Or, if a polygon pop-up doesn't' show, then one can enter a pop-up text.

<u>Trouble-shooting at this stage:</u>

When working with complicated diagrams and complex rules, you will often run into errors. Fortunately, we designed Time Scale Creator to catch these issues early so you can correct them before finalizing the image!

The preview screen at the right of the Transect Template Loader shows *TS-Creator*'s interpretation of your uploaded SVG file under the current resolution settings. In this screen, you can see any errors that *TS-Creator* has detected, as described in the text

Notes:
If there are any errors in the template, adding and saving are disabled. Errors include:

- Intersections. If two lines intersect they are colored red.
- Overlap. If three or more polygons use the same line it is colored orange.

If a polygon doesn't border anything, the border is colored green. This is not an error, it is useful to make sure that there are no unexpected gaps between polygons. There should be a green outline only around the outer edge of the polygons. If you notice some green lines inside a region that should be solid, then there is an error in the template. This can probably be fixed by increasing the merge distance, but might require fixing the template.

If there are errors it is worth increasing the merge distance and grid options. If they do not solve the problem, the template must be drawn more accurately. This means polygon points close together, no crossing polygons, etc.

Here is a short list of the most common errors as flagged by color:

(1) **Red** and **orange** borders appear between adjacent polygons when:
- One or more anchor points have been misplaced or are missing altogether. Most of the time it is because of mismatched anchor points (see Anchor points must match)
- You placed two non-contacting polygons very close to one another, but TS-Creator assumes they crossed borders. Lower the values Point Merge Distance and Snap X/Age.

(2) Polygons are completely missing, or surrounded by a **green** border when:
- The polygon was unclosed when drawn, or someone tried to unsuccessfully close it later (see the tips on closing polygons).
- Part of the polygon extends beyond the red rectangle.

(3) **Green** borders also surround completely enclosed polygons (see Enclosed polygons are okay) – in this case, the entire outer edge of the transect are not errors.

TIP: It is tempting to directly modify the SVG (we often do this), but we strongly recommend that you edit the original .ai file and create a new SVG with the corrections instead. This way you can reference the underlying art while making corrections. Therefore, the corrected Illustrator version can be used for later enhancements, adding more polygons, using new lithologies, etc.

(a) The Conversion tells me that I have polygons, but none are showing in the viewer or I'm getting a very weird display.

Solution – Sometimes Illustrator doesn't save the Red-Box as a rectangle-box (especially on occassions when a transect-panel layer is duplicated to other transect-panel layers). Open your SVG in Illustrator, and replace that Red-Box outline with a new one, using the Rectangle tool; and

the RGB color (not CMYK) to make the outer border Red, and no fill. Be sure that there are Top/Bottom Ages for this SVG – they are essential for the vertical-conversion.

Other solution – You saved an SVG with multiple layers. Delete all but the panel-layer and re-save.

(b) A polygon is missing a pattern; but I thought I had used a Fill.

Solutions – Either the pattern name (as derived from the Swatch) is not in the TS-Creator internal set (e.g., you used an Australian-set), or you accidentally opened the Template FROM Illustrator (rather than Open Illustrator by double-clicking on the Template.svg). If the Australian-set (or similar), then one can check this at the next step by examing the .txt datapack. If another problem is suspected; then open the SVG in Illustrator, and hold the Mouse over the swatch set to see what names these have – if the Template was opened inappropriately at the beginning, then these swatch-patterns were assigned names-with-numbers, rather than "Sandstone" names. In that case, one can change those pattern-names for each polygon upon entering into Excel by finding the appropriate pop-up to know which polygon is which.

(c) All my wavy and interfingering lines are missing; but they are shown on the original SVG.

Solution – Sometimes Illustrator doesn't copy the templates for these line-segment modifiers correctly -- mainly on occasions when a transect-panel layer is duplicated to other transect-panel layers. Do another copy-paste of these line-templates from the original template.svg file directly to that panel layer, and replace all the line-segment designators with this "direct" set. [*We've only seen this problem once, but it took a half-day to decipher. Nasty Illustrator* …]

(d) I still can't figure out what is going wrong.

Contact Jim Ogg (jogg@purdue.edu) or one of his students (see Contact us above). We've become quite good at spotting anomalous mistakes.

4. Save the Transect-conversion as a Text-file

Once you have corrected all errors and are satisfied with the preview, you must **rename** the image when saving. The default name is "Transect", and *TimeScale Creator* will duplicate or overwrite data when the user uploads columns with identical names. Be sure to enter a name for the Title and click "Apply Changes" before saving.

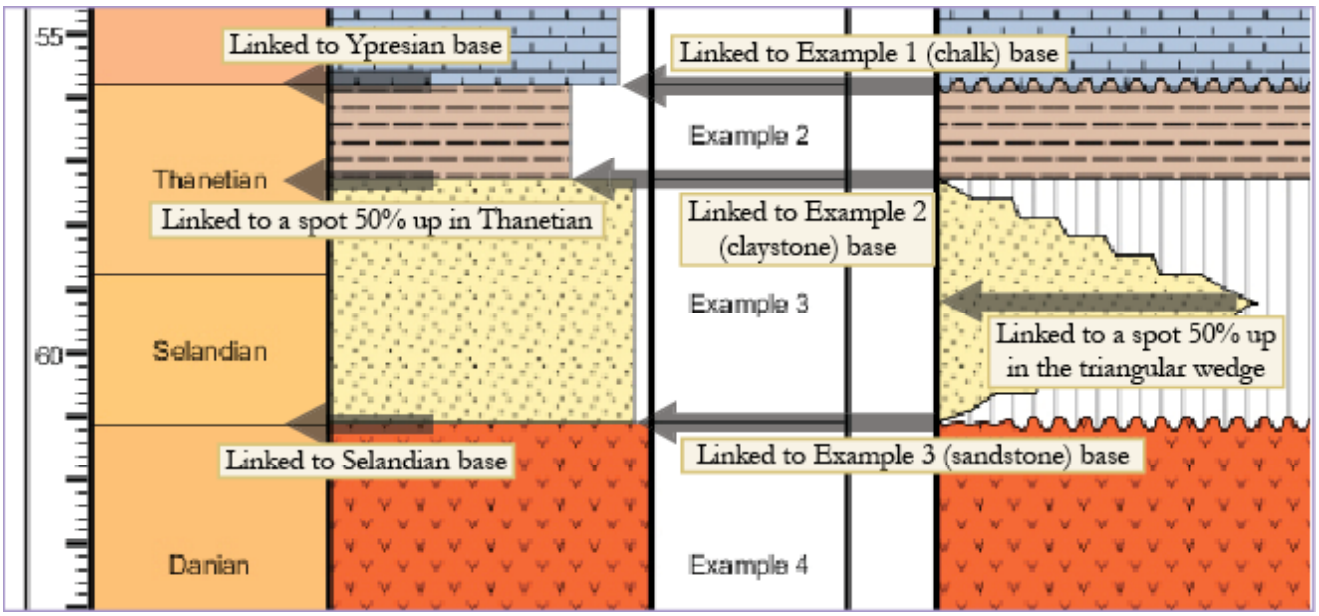
The "*Save as Datafile...*" button will save the transect as a tab-delimited text file. We recommend a name that includes the SETTINGS for X-Grid-Snap and Y-Grid-Snap, plus Point-Merge-Distance – e.g., "*Transect_SouthEngland_PanelA_3_4_0.2.txt*" if a Point-merge of 3, X-Snap of 4%, and Y-Snap of 0.2 myr was used. This way, one knows the parameters in case one later wishes to modify the SVG conversion by re-loading that SVG or a revised one.

NOTE: The "*Add Column*" button will immediately load the transect into TS-Creator so you can see how it looks adjacent to other preloaded data. BUT, if you Export the datafile first before you click "Add Column" or you will have to reload and recalibrate your traced SVG again to make the datapack.

Part D. Inter-Linking Transect panels to Reference wells

1. Overview

Transects are based on reference wells, and we have entered the detailed lithology-age details for a pair of those wells that border the "transect-panel" between. Now, we will link age-facies points in that transect to their corresponding formations in the "parent" reference well, which in turn were linked to the master chronostrat. This provides much more precise ages on each transect polygon than the interpolation using the "Red-Box" by TS-Creator. In addition, any change to either the master time scale or the reference well "trickles down" to the transects.



The above illustration – a Reference Well-column on the Left, and a Transect-column on the Right -- contains border-linked anchor points and a floating anchor point.

- Border-linked anchor points lie on the boundary between the transect and its parent reference well. As shown above, the transect polygon-ages would link directly to the base of a formation (or lithology-change) as recorded in that reference well. The three arrows spanning the white space originate from border-linked anchor points.
- Floating anchor points cannot directly link to reference wells. Instead, they must use two border-linked anchor points (e.g., a Percentage-up within the Sandstone age-span), OR be independently linked to the Master Chronostratigraphy. The point at the rightmost tip of the triangular sandstone wedge is a floating anchor point

2. Understanding how TS-Creator uses transect data

From this point forward, you will be working with raw data so it is best to familiarize yourself with output files.

Click on the tab-delimited output file "*Transect_XXXa_4_5_etc.txt*" that was saved from the SVG Conversion. In this raw-text viewer, you will see our secret-method for making transects (taken from a poster by Alex Huang):

File, group, and data headers

Horizontal distance across the column in % (x-coordinate)

Vertical distance within the column in millions of years (y-coordinate)

```
Format version: 1.3
date:   12/15/2005

Group   :       Example

Example transect        500     255/255/255             on
        0       30      50      70      100
        0.00    X1                      X2
        10              X5
        20              X6
        30                      X7
        40      X4                      X3
POLYGON pattern: Sandstone;     Background polygon
        1
        2
        3
        4
POLYGON pattern: Claystone;     Example polygon with one wa
        5
        lapping
        6
        wavy
        7
TEXT    5       25      ABC     font-family: Arial; font-si
TEXT    5       75      XYZ     font-family: Arial; font-si
```

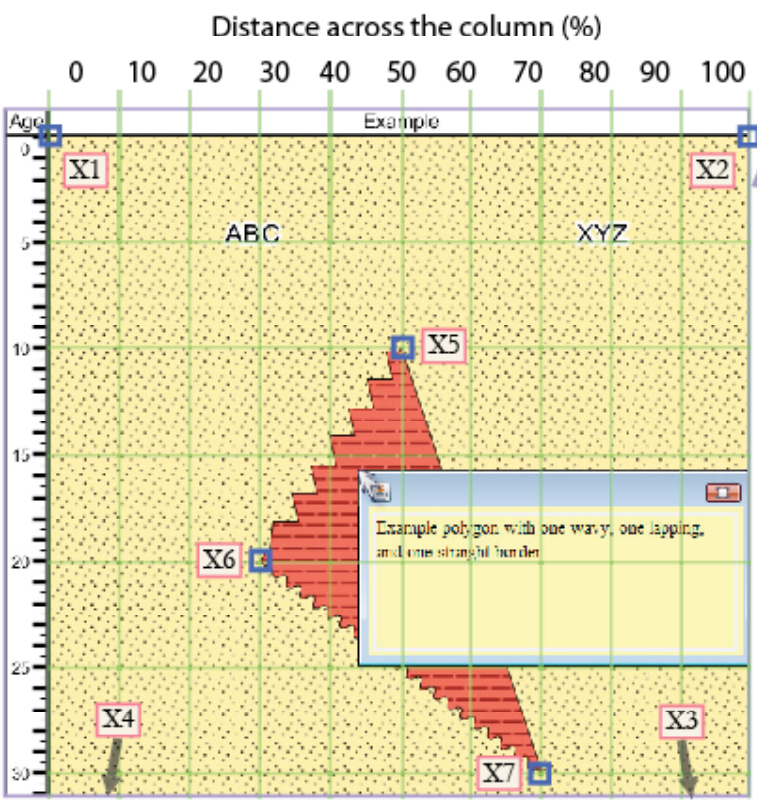
This "grid" is a position blueprint. It contains a field of "gridpoints," each with a numerical designation (the number after the X) and an x and y-coordinate based on its position in the grid.

TIP:

If your file does not look reasonably like this example, make sure the "**word wrap**" or "**text wrap**" feature is disabled.

The code for one label. The coordinates are given in (y, x) format, so this example resides at 5 Ma down and 25% across the column.

The code for one polygon. *Time Scale Creator* draws polygons by connecting the dots between gridpoints. In this example, the gridpoints X1, X2, X3, and X4 are drawn in sequence to create a large rectangle filled with the "Sandstone" pattern.



TS-Creator rendition

This image has been modified to show how gridpoints (positions marked with ◻) and text labels fit into the x and y-coordinate system. The lower quarter of the dotted background polygon has been truncated. Gridpoints X3 and X4 reside at its bottom right (100%, 40 Ma) and bottom left corners (0%, 40 Ma), respectively.

The Y(age)-X(percent) grid has a set of "X34" or similar "X" numbers. These are flags to the Polygons – a set of X-Y coordinates for drawing line segments; followed by the indicated fill-pattern. If these line-segments have a wavy or interfingering ("lapping") style, then this designation is between the two anchor-points.

At the bottom of the Transect, below the Polygons, is the set of Labels. Each has a similar X-Y coordinate (the "age" is the left-column), then "Label" text, followed by information on the font and text-box sizing:

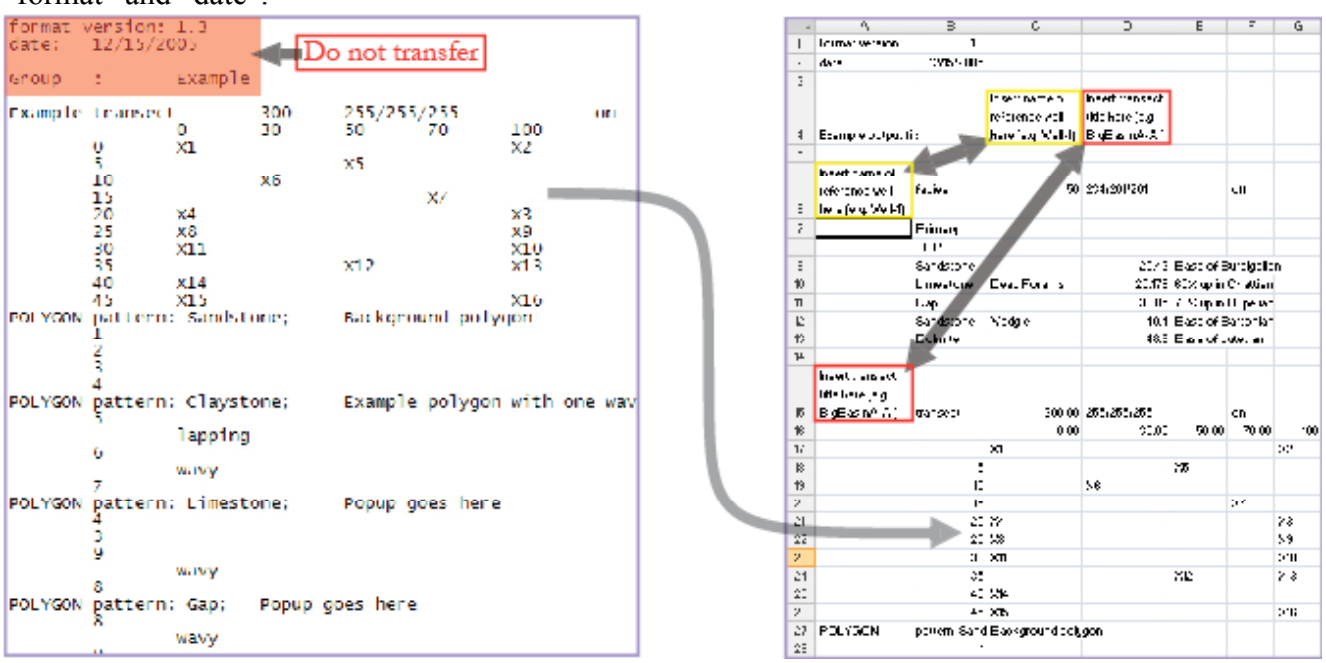
1080	TEXT	3.68	18.75	Kowai Fm	font-family: Arial; font-size: 10;	2.07	28.83
1081	TEXT	16.46	4.04	Brechin Fm	font-family: Arial; font-size: 10;	2.07	33.15
1082	TEXT	17.48	40.81	Curiosity Shop S	font-family: Arial; font-size: 10;	2.07	53.34
1083	TEXT	25.66	57.35	Berydale Gnsd	font-family: Arial; font-size: 10;	2.07	42.90
1084	TEXT	26.68	27.94	Otekaike Lst	font-family: Arial; font-size: 10;	2.07	36.04
1085	TEXT	27.71	0.37	Swin Sst	font-family: Arial; font-size: 10;	2.07	25.23
1086	TEXT	33.33	2.21	Coleridge Sst	font-family: Arial; font-size: 8;	1.66	31.14
1087	TEXT	34.35	50.00	Amuri Lst	font-family: Arial; font-size: 10;	2.07	27.39
1088	TEXT	36.40	68.38	Nessing Gnsd	font-family: Arial; font-size: 8;	1.66	32.58
1089	TEXT	38.95	24.27	Iron Creek Gnsd	font-family: Arial; font-size: 10;	2.07	47.58
1090	TEXT	43.55	11.40	Charteris Bay Ss	font-family: Arial; font-size: 10;	2.07	50.45
1091	TEXT	45.60	66.54	Homebush Sst	font-family: Arial; font-size: 8;	1.66	34.03
1092	TEXT	51.22	2.21	Broken River Fm	font-family: Arial; font-size: 8;	1.66	38.92
1093	TEXT	88.03	55.52	Monro Cgl	font-family: Arial; font-size: 10;	2.07	29.91
1094	TEXT	98.76	42.65	Mt Somers Volcs	font-family: Arial; font-size: 10;	2.07	49.01

3. Insertion into Excel; and set-up of mirrored ages

Close the version in Text-Edit. Then, using WORD, open the tab-delimited output file "*Transect_XXXa_4_5_etc.txt*" that was saved from the SVG Conversion. [*This is to avoid a problem with line-feeds from Text-Edit into Excel; which doesn't happen with Word.*]

Open our Excel file; switch to the **output** spreadsheet.

Copy and paste (insert) your transect data from the tab-delimited file to the Excel file BENEATH the reference well output (*that we prepared in Part B*). Do not transfer the headers of "format" and "date".



NOTE for advanced users – By specifying the order of well-transect-well as a subdirectory, then TS_Creator will place these columns in that order. In this case, one can group all Reference Wells column-output-blocks (separated by blank-lines between) followed by each Transect-column-block output. See example below:

Transect TB_NS-2	:	Tapawera-1 TB_NS	Transect TB_NS-2/1	Surville-1 TB_NS	Transect TB_NS-2/2	Maui-2 TB	Transect TB_NS-2/3	Taimana-1 TB	T

While this Transect-data insert is still selected, change the font to Arial 10.

If needed, change the column-name of the transect's header to match the transect-name on our spreadsheet (see example, above, where linked cells are indicated by double-tipped arrows).

NOTE: If a transect-conversion had used an X-Grid with 3-percent resolution, then the Right-edge is "99" percent on the output. Change this "99" to be "100" (the real right-edge of our transect panel).

Mirrored-Age setup:

(1) Transect Ages

Open a window into the Well-Transect-Well sheet.

From the inserted transect data, copy the Age-set for the X-Y grid into "Polygon original" ages for our transect panel (the 3rd column in the example below). PLUS, to avoid confusion, copy the same set into "*Polygon ages relative to Reference Wells*. [NOTE: in the example below, this second pasted set has already been partially replaced with inter-linking.]

Great South Basin; southeast transect 27 (one panel)							
Item	Age control	Polygon original	Polygon ages relative to Reference Wells	Text item	Text age control	Text original age	Text relative to formations
Top of Penrod Group	<-- Left	0	0.00	Penrod Gp	50% up in full extent of Penrod Group	7.68	7.34
Base of Penrod in Right-center	Middle of Wc	1.5	0.99				

Now, on the Transect-output sheet, replace the Age-set for the X-Y grid with a LINK to the *Polygon ages relative to reference wells*.

(2) Label Text and Label Ages

We perform the same mirroring for the Labels. Go to the Bottom of the Transect-output. The Text fields may require sorting to put into descending-age order – Select only the TEXT suite, then use "Data -> Sort" from the Excel menu to sort Descending upon the Age column ("B").

Now, select the sorted-ages, and paste into the Well-Transect-Well sheet at the "*Text original age*" column, and again into the "*Text relative to formations*" column.

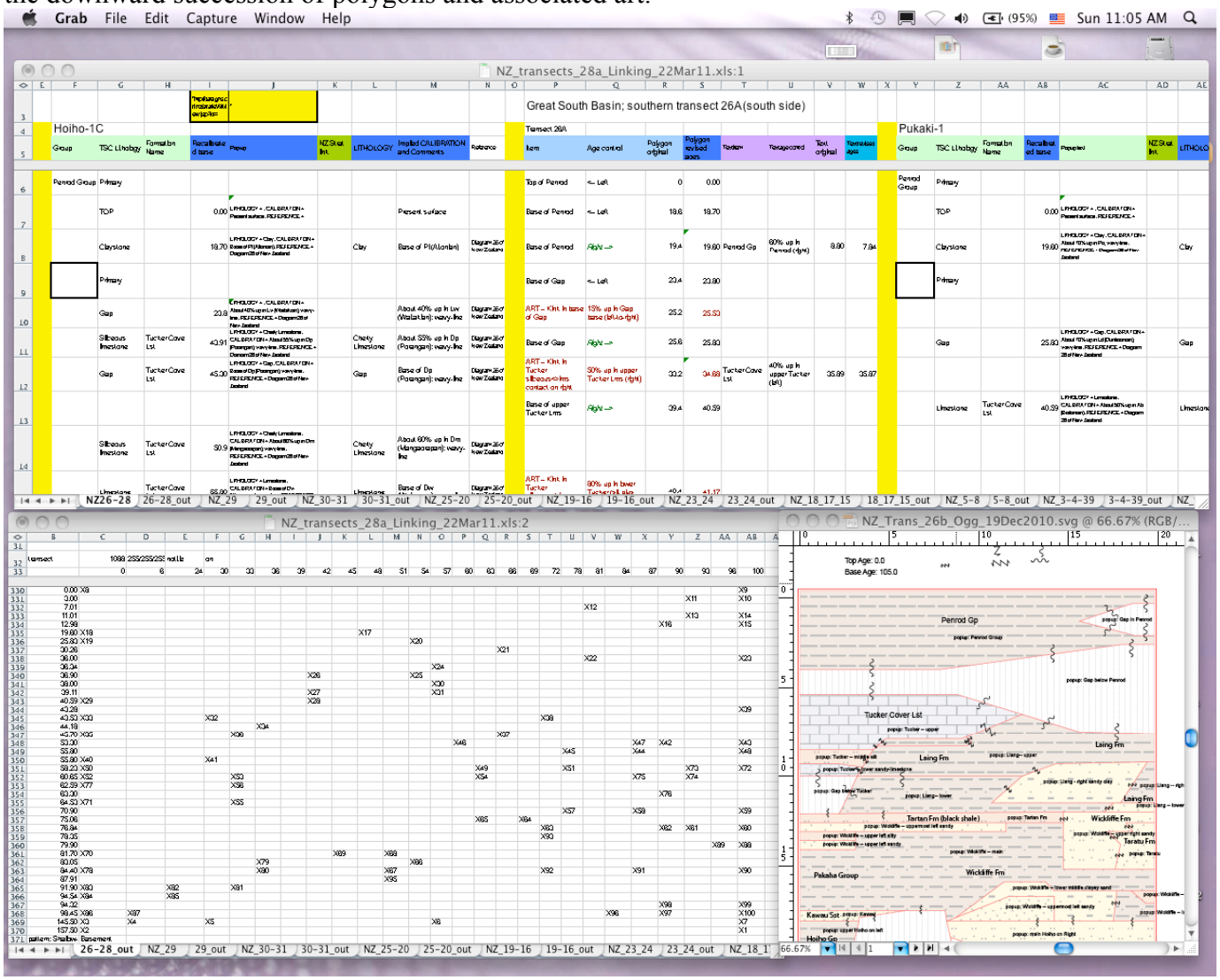
As we did with Transect-ages, for those TEXT ages on the transect-output, replace the Age-set with a LINK to the *Text relative to formations* (See previous figure)

Repeat this copy-paste, and linking for the Transect-label texts. In that way, a change to the labels on the "Well-Transect-Well" sheet will cause the transect-output text to also change.

3. Linking to Reference wells – 3 cases

Working-screen setup

We recommend using two windows into Excel; each with a split -- so one can simultaneously see the Transect-Grid suite and the Well-Transect-Well. This helps one to know which transect-age is associated with which-polygon. In addition, the Illustrator file with the Transect polygons (and underlying Original-Scan and Ruler layer) is viewed to enable one to see the downward succession of polygons and associated art.



One Excel window includes the "to-be-linked" Transect (middle 8 columns) and the lithostratigraphy of the adjacent Reference wells. The other Excel window into Transect-output has a split below the horizontal-percent row and the polygon-anchor-point array. [*NOTE: we typically use dual-monitors or 27-inch screens for this Linking process*.]

It is important to save a Copy of your Excel file (with date), before proceeding to link, just in case you need to re-examine an un-linked original value.

By progressively working down, row-by-row, through the polygon-anchor-age suite, each of those output ages can be linked to EITHER one of the adjacent reference wells, to the Master Chronostratigraphy, or as proportions within formations.

Linking methodology

Each link entry includes:

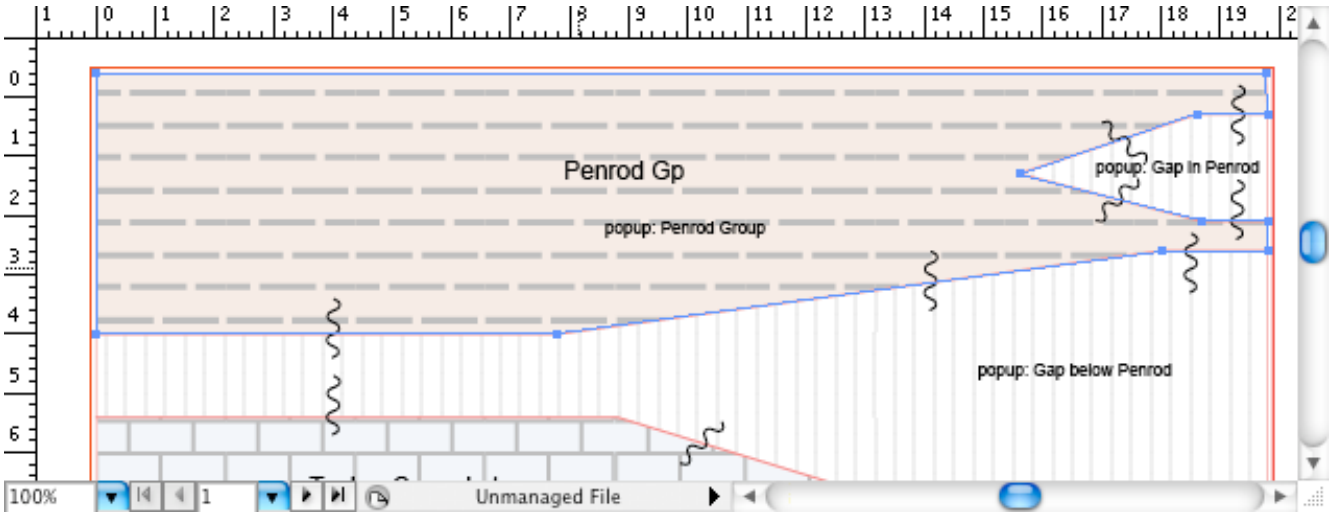
- **Item**: A brief description identifying an anchor point by describing its location in the diagram. This aid in cross-checking one's ties.
- **Age control**: A brief text description of the point's vertical positioning – a record of what calibration you used (only for your usage and cross-checking). For border-linked anchor points linked directly to lithostratigraphy in adjacent reference wells, simply enter "*Left*" or "*Right*" Well. Floating anchor points require explanations.
- **Polygon original**: This is the original polygon set, as you prepared above. It serves as a useful reference.
- **Polygon revised ages**: Each cell will contain a link to an adjacent reference well, an independent tie to Master Chronostratigraphy, or a proportional formula assigning a precise age to the anchor point. These are the values mirrored to the final transect output.

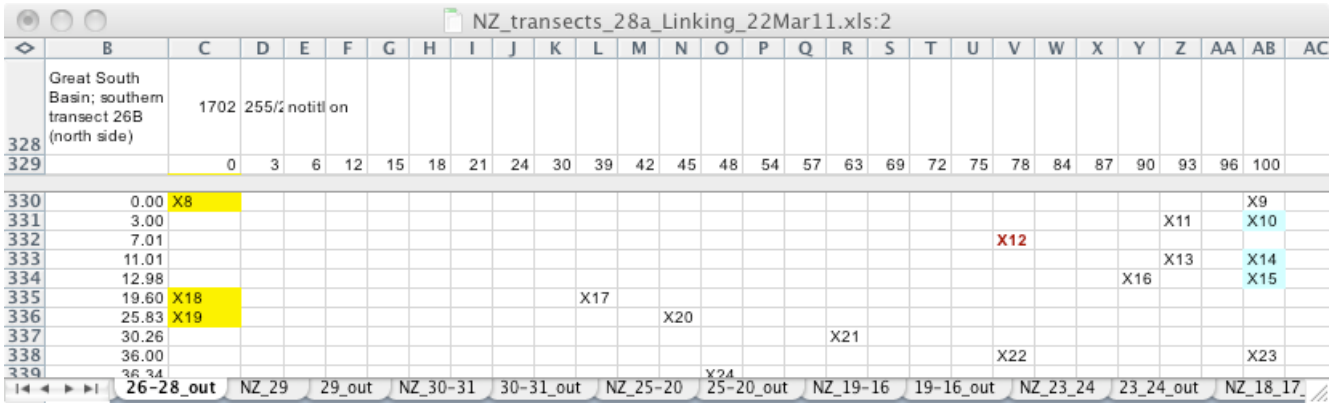
There are 3 cases:

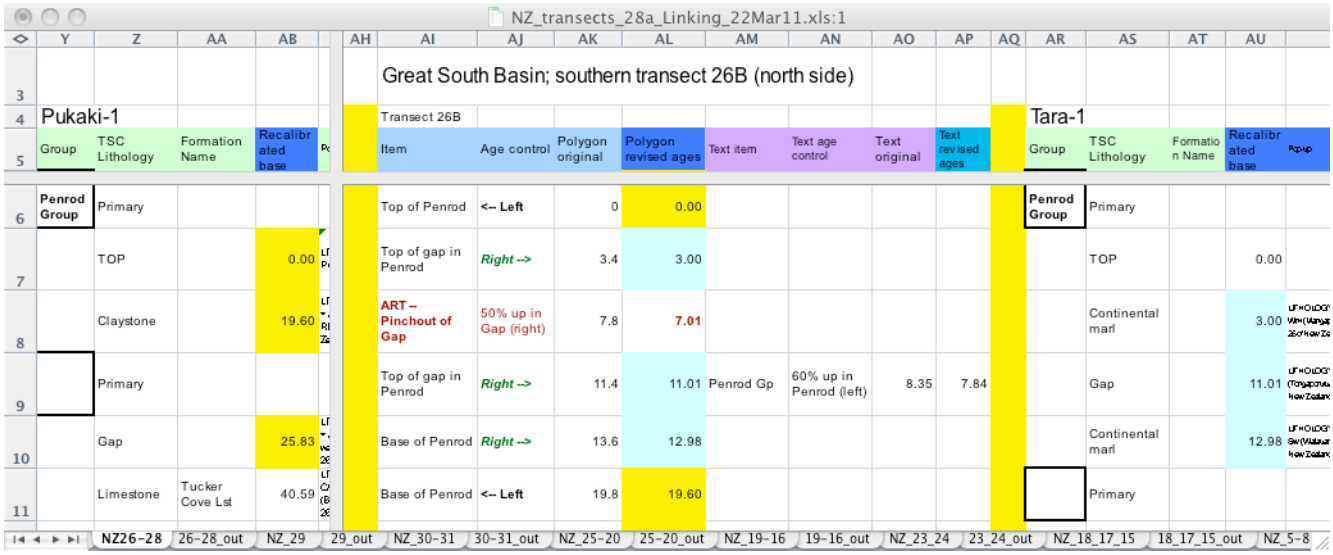
(a) **Direct** link to lithology boundaries

In the example below, the left and right limits of the Penrod Group polygon and the anchor-points for the right-side "Gap" have associated formation boundaries in either the Left (YELLOW-Highlighted) or Right (CYAN-Highlighted). In the Grid-output, one can quickly identify these levels as being "X" markers under "0" or "100" percent, respectively (highlighted below).

The ***Polygon revised age*** column is a linking of that Polygon anchor points to the appropriate Reference well. The examples below show the associated Spreadsheet entries (*Excel file as shown uses an additional vertical-split to place the Left-Well items next to the Transect suite*). Notice the comparison to the "***Polygon original***" ages, as interpolated by TS-Creator from the Red-Box, the ***Polygon revised age*** sets have precise ages based on the ruler-measured Well lithostratigraphy tied to Master Chronostratigraphy. These revised ages are now mirrored to the Transect-grid output (*as shown in this example*).







NOTE: This linking using a **TIE-to-Cell** to the entries in the Reference well (*see example below*). Never type in a numerical value, otherwise the output will never re-calibrate if the assigned age of a reference-well formation is changed!

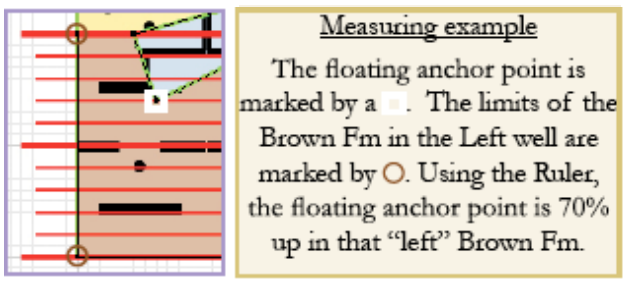
sert name of reference well here (e.g. Well-1)					Insert transect title here (e.g. BigBasinA-A')								
up	Text Lithology	Formation Name	Base (relative to stage lines)	Popup text	Item	Age control	Polygon original	Polygon relative to formations	Text label	Text age control	Text original	Text relative to formations
	Primary											
	TOP		0.00		Top left of column	<- WELL	0	0.00				
					Upper tip of clay triangle	75% up in Ss block	5	5.11				
					Leftmost tip of clay triangle	50% up in Ss block	10	10.22				
					Lower tip of clay triangle	25% up in Ss block	15	15.33				
	Sandstone		20.48	Base of Burdigalian	Bottom left of Ss block	<- WELL	20	20.48				
	Limestone	Dead Forams	25.18	60% up in Chattian	Bottom left of Dead Forams	<- WELL	25	G9	Dead Forams	49% up in Dead Forams	22.50	22.85
	Gap		30.05	70% up in Rupelian	Upper tip of Wedge	<- WELL	30	30.05				
					Rightmost point of Wedge	50% up in Wedge	35	35.23	Wedge	40% up in Wedge	35.00	35.13
	Sandstone	Wedge	40.40	Base of Burdigalian	Bottom tip of Wedge	<- WELL	40	40.40				

Example 1

(b) **Art** scaling

Look at the Penrod Group example above: there is a "Gap" on the right-side that pinches out in the middle of the transect panel. The anchor-point for the tip of this pinchout is probably schematic, and is approximately 50% within the span of the Gap in the RIGHT Reference-well. Therefore, for the "***Polygon revised age***", we use an equation that computes this approximation, using relationships to the appropriate Cells. This "ART" was done in the Penrod example (Entries highlighted in RED).

One can apply this concept of "proportion-within-a-formation" to more elaborate "artistic" sets of anchor-points; and utilize the Ruler on our source Illustrator diagram to measure relative placements.



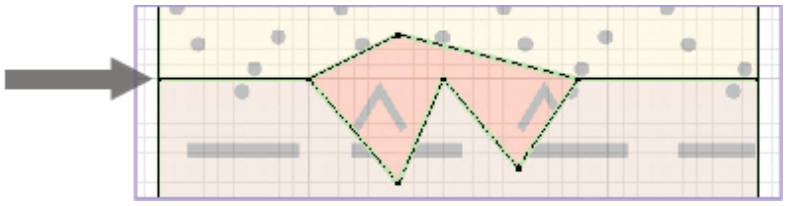
Example 2 – Age control for a "clay triangle" relative to the boundaries of a Ss sandstone formation (which has age-controls on its base and top in a Left well). The Clay-triangle anchor-point ages are computed as equations relative to appropriate Ss-block cells.

	J	K	L	M	N
1	Insert transect title here (e.g. BigBasinA-A')				
2	Item	Age control	Polygon original	Polygon relative to formations	Text label
3					
4	Top left of column	<- WELL	0	0.00	
5	Upper tip of clay triangle	75% up in Ss block	5	5.11	
6	Leftmost tip of clay triangle	50% up in Ss block	10	10.22	
7	Lower tip of clay triangle	25% up in Ss block	15	M8-0.25*(M8-M4)	
8	Bottom left of Ss block	<- WELL	20	20.48	
9	Bottom left of Dead Forams	<- WELL	25	25.18	Dead Forams

NOTE: For ease in later checking, we usually denote these "internal proportions" for "art" by using a **dark-red** font color.

(c) Linking units **floating** within transect-panel to Chronostratigraphy

In the example below, an isolated volcanic-buidup is in the middle of a transect panel.



One option is to tie the onsets of volcanism (lower two anchor-points) to Stages; using the same process as we did for lithostratigraphy of the side reference-wells. One would use the Ruler layer to enter a proportional position relative to the Stage base and duration; and the entries in the Excel Transect "***Age control***" and "***Polygon revised ages***" are ties to the Master Chronostratigraphy.

Below is an example for a New Zealand transect, a late-onset of Penrod Group in center of transect panel that was tied to the middle of a New Zealand stage (abbreviated *Wc*) in the Master Chronostratigraphy sheet.

Great South Basin; southeast transect 27 (one panel)							
Item	Age control	Polygon original	Polygon ages relative to Reference Wells	Text item	Text age control	Text original age	Text relative to formations
Top of Penrod Group	<-- Left	0	0.00	Penrod Gp	50% up in full extent of Penrod Group	7.68	7.34
Base of Penrod in Right-center	Middle of Wc	1.5	0.99				

4. Label linking

After linking the anchor points for the Transect polygons, link the Text Labels to the recomputed transect items:

- **Text label**: The Label on the transect.
- **Text age control**: Brief description of where you decided to position the Label (its base).
- **Text original**: The age-interpolations for those Labels from the SVG-conversion by TS-Creator. It will not be used in the final output.
- **Text relative to formations**: Generally, we assign ages to Text Labels the same way as for "Art" anchor points (see above) using the top and bottom of the "host" labeled-formation as references.

A sample of Label-age-linking is shown below for our Penrod example.

Great South Basin; southern transect 26B (north side)							
Transect 26B							
Item	Age control	Polygon original	Polygon revised ages	Text item	Text age control	Text original	Text revised ages
Top of Penrod	**<-- Left**	0	0.00				
Top of gap in Penrod	***Right -->***	3.4	3.00				
ART -- Pinchout of Gap	50% up in Gap (right)	7.8	7.01				
Top of gap in Penrod	***Right -->***	11.4	11.01	**Penrod Gp**	60% up in Penrod (left)	8.35	**7.84**
Base of Penrod	***Right -->***	13.6	12.98				
Base of Penrod	**<-- Left**	19.8	19.60				

5. Output, testing, editing

Repeat the procedures of polygons, labels, SVG saving/conversion, and inter-linking for each Transect Panel. Be careful to only activate the appropriate Transect-panel-Layer when drawing polygons – a common mistake is accidentally draw these or the labels on a wrong Layer.

The Transect_Output file should have alternating "facies" and "transect" sets, separated by at least one blank line. We usually add an additional color-strip for ease in seeing the different column-sets. The final output item would be the right-most Reference-well lithostratigraphy.

SAVE your Excel file (and include a date in the file name).

Generating the Datapack

Only AFTER you've Saved your Excel work, go under "*Save As*", select "***Text Tab-delimited***". Save this as a .txt file. [*NOTE: Excel will try to discourage you, just keep insisting that you want to save a text version*.]

Then, CLOSE your Excel file – again, Excel will give a confusing warning "*do you want to save changes*" – Click "***Don't Save***" – we've already saved the desired text version.]

OPEN the Text-Output in WORD (by clicking with the right-Mouse on the file, then using "open with"). You should see something like:

```
format version:      1.3
date:      09/27/2010

Great South Basin and SE tip of South Island; southern transect 26-27-28    :
     Hoiho-1C  Transect 26A   Pukaki-1  Transect 26B   Tara-1    Great South
Basin; southeast transect 27 (one panel)     Takapu-1A Great South Basin;
southeast coast transect 28A (southern end of 28) Shag Point composite     Great
South Basin; southeast coast transect 28B (northern end of 28)   Oamaru
Composite

Hoiho-1C  facies    50   234/201/201         off
Penrod Group   Primary
     TOP       0.00 LITHOLOGY = .  CALIBRATION = Present surface.  REFERENCE =

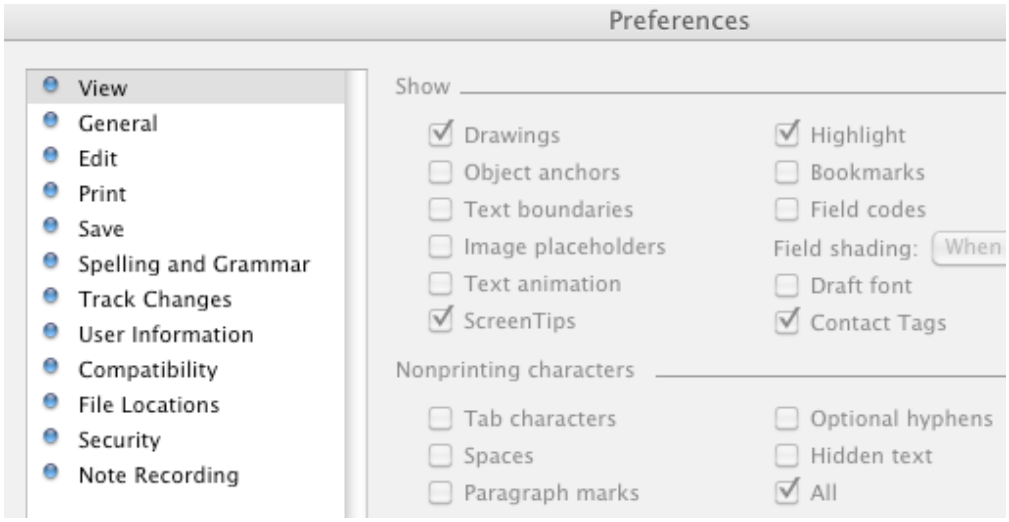
     Claystone      18.70     LITHOLOGY = Clay.  CALIBRATION = Base of Pl
(Altonian).  REFERENCE = Diagram 26 of New Zealand

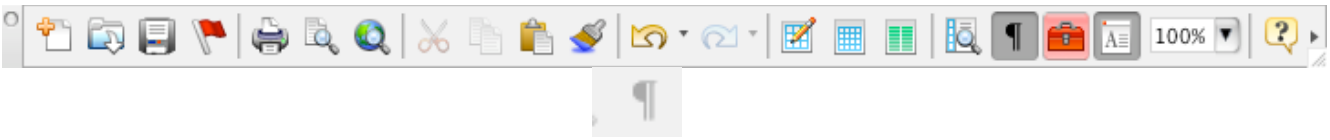
     Primary
     Gap       23.80     LITHOLOGY = .  CALIBRATION = About 40% up in Lw
(Waitakian); wavy-line.  REFERENCE = Diagram 26 of New Zealand

     Siliceous limestone Tucker Cove Lst     43.91     LITHOLOGY = Cherty
Limestone.  CALIBRATION = About 55% up in Dp (Porangan); wavy-line.  REFERENCE =
Diagram 26 of New Zealand
     Gap  Tucker Cove Lst     45.30     LITHOLOGY = Gap.  CALIBRATION = Base of
```

This looks odd – lots of extra spaces and lines (e.g., an apparent extra line between TOP and Claystone) – because Microsoft Excel insists on adding lots of additional tabs to "fill out" each entry to the longest row in the original sheet; plus adds additional quote-marks to many entries.

Turn on "*Show Non-Printing Characters*" under Excel preferences (either via the *Preferences* menu – Excel 2004 version shown below – click "***Show All***"), or activating the "Paragraph-icon" on the tool bar.



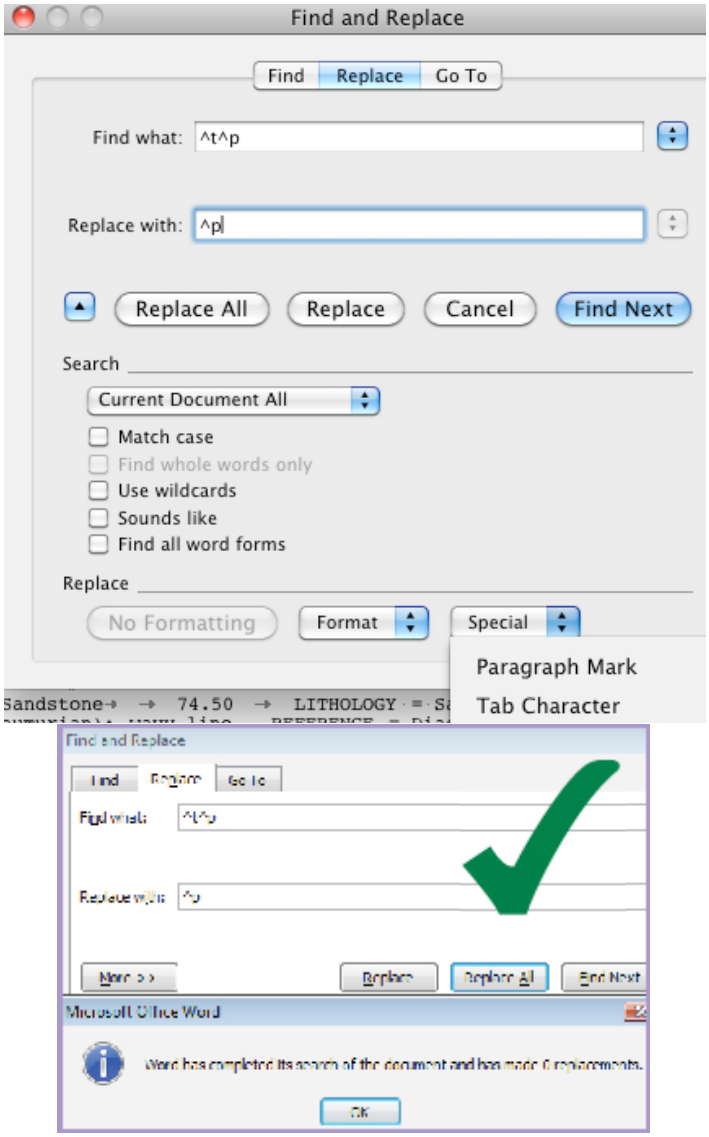


You will now see the surplus of Tabs that Excel saved during “Save Text”:

```
format version:  →  1.3→  →    →    →    →    →    →    →    →    →    →  ¶
date:  →  09/27/2010  →    →    →    →    →    →    →    →    →    →    →  ¶
¶
Great South Basin and SE tip of South Island; southern transect 26-27-28 → :
  →  Hoiho-1C → Transect 26A → Pukaki-1 → Transect 26B → Tara-1  →  Great South
Basin; southeast transect 27 (one panel)  →  Takapu-1A→Great South Basin;
southeast coast transect 28A (southern end of 28)→Shag Point composite  →  Great
South Basin; southeast coast transect 28B (northern end of 28) → Oamaru
Composite¶
¶
Hoiho-1C → facies  →  50 → 234/201/201  →    →  off→  →    →    →    →    →    →  ¶
Penrod Group → Primary →   →    →    →    →    →    →    →    →    →    →  ¶
  →  TOP→  →  0.00→LITHOLOGY = .  CALIBRATION = Present surface.  REFERENCE = →
  →    →    →    →    →    →    →  ¶
  →  Claystone→  →  18.70  →  LITHOLOGY = Clay.  CALIBRATION = Base of Pl
(Altonian).  REFERENCE = Diagram 26 of New Zealand  →    →    →    →    →    →
  →    →  ¶
 →  Primary →   →    →    →    →    →    →    →    →    →    →  ¶
  →  Gap→  →  23.80  →  LITHOLOGY = .  CALIBRATION = About 40% up in Lw
(Waitakian); wavy-line.  REFERENCE = Diagram 26 of New Zealand →   →    →    →
  →    →    →    →  ¶
  →  Siliceous limestone→Tucker Cove Lst  →  43.91  →  LITHOLOGY = Cherty
Limestone.  CALIBRATION = About 55% up in Dp (Porangan); wavy-line.  REFERENCE =
Diagram 26 of New Zealand  →    →    →    →    →    →    →    →  ¶
  →  Gap→Tucker Cove Lst  →  45.30  →  LITHOLOGY = Gap.  CALIBRATION = Base of
Dp (Porangan); wavy-line.  REFERENCE = Diagram 26 of New Zealand→  →    →    →
  →    →    →    →  ¶
  →  Siliceous limestone→Tucker Cove Lst  →  50.90  →  LITHOLOGY = Cherty
```

We’ve tried to write TS-Creator to ignore these extra tabs (and quote marks); but sometimes it gets overwhelmed. Therefore, we recommend “cleaning” the text output.

With REPLACE in WORD, use the Special (shown by clicking the lower-left arrow on the main menu) to replace “Tab”-“Paragraph” with just “Paragraph”. [*Excel 2004 for Mac and Excel 2008 version for Windows shown below*]



Repeat until all extra end-of-line tabs are replaced.

To remove extra quote marks, do the following In Order (and, only a single time each) –

Replace “Paragraph”-quote with “Paragraph”

quote-“Paragraph” with “Paragraph”

“Tab”-quote with “Tab”

quote-“Tab” with “Tab”

quote-quote with quote (this removed double-sets of quotes)

The reason to do “in order” and only a single-time is that some URL commands require single quote marks; which might otherwise get deleted if the URL is at the end of a Comment, etc.

The result should now be:

```
format version:  →  1.3¶
date:  →  09/27/2010¶
¶
Great South Basin and SE tip of South Island; southern transect 26-27-28 → ;
  →  Hoiho-1C → Transect 26A → Pukaki-1 → Transect 26B → Tara-1  →  Great South
Basin; southeast transect 27 (one panel)  →  Takapu-1A→Great South Basin;
southeast coast transect 28A (southern end of 28)→Shag Point composite  →  Great
South Basin; southeast coast transect 28B (northern end of 28) → Oamaru
Composite¶
¶
Hoiho-1C → facies  →  50 → 234/201/201  →    →  off¶
Penrod Group → Primary¶
  →  TOP→   →  0.00→LITHOLOGY = .  CALIBRATION = Present surface.  REFERENCE = ¶
  →  Claystone→   →  18.70  →  LITHOLOGY = Clay.  CALIBRATION = Base of Pl
(Altonian).  REFERENCE = Diagram 26 of New Zealand¶
  →  Primary¶
  →  Gap→   →  23.80  →  LITHOLOGY = .  CALIBRATION = About 40% up in Lw
(Waitakian); wavy-line.  REFERENCE = Diagram 26 of New Zealand¶
  →  Siliceous limestone→Tucker Cove Lst  →  43.91  →  LITHOLOGY = Cherty
Limestone.  CALIBRATION = About 55% up in Dp (Porangan); wavy-line.  REFERENCE =
```

SAVE the cleaned file –text should be the default save (*although WORD will give a confusing warning that formating and characters will not be preserved – Click **YES** at this warning*).

Loading and Reviewing the Datapack

Open TimeScale Creator. Under "FILE", use "ADD DATAPACK"; and add the Transect text output. The Green-loading items will flash at the top until finished.

Select a time interval; under Columns select the Transect (NOTE – unless indicated, facies columns have a default "no shown" – turn ON as appropriate). GENERATE.

Ideally, everything is displayed as desired.

Trouble-shooting

TS-Creator will give an error with "line number" if an anomalous entry is encountered. The original Excel output-page can be used to find this entry; although often the actual error is within some of the lines immediately preceeding or the header to this column set.

Most common errors by our group:

(1) The Header for the column is missing "facies" or "transect" type (2nd cell); or the other entries were mis-placed in successive cells.

(2) "Primary" lacks a [SPACE] before the preceding tab at beginning of line. This can also be checked using the .txt file; after turning ON "display non-printing characters".

(3) An extra row or line is inserted within the column-block. There should be NO non-data lines/rows within a Transect block (including through the TEXT Labels),or within a Lithology block. Sometimes this can happen if a "Comment" field had been copy-pasted from a PDF or other file, and included an embedded line-feed.

(4) A blank row/line is Missing – each column set must have at least one blank row/line between to flag TS-Creator that one set of data is finished, and another column-set begins.

(5) An AGE is missing from a Lithology entry.

(6) If there is an "empty" pattern in the lithostrat column; then probably the lithology-pattern-name was mistyped (e.g., "claystone" instead of the "Claystone"). This should not happen with transects, thanks to the template system.

(7) The name for a column or transect is not identical to the name in the sub-directory list. This can be avoided by linking the transect-header name to that subdirectory-list or both to the Well-Transect-Well sheet.

Editing Transects

(1) Change **Polygon lithology pattern** – find the Polygon-block on the output-sheet (here is where the pop-ups are invaluable); then enter the new lithology-pattern name. Be careful to have the correct case-sensitive and under-score sensitive name (look for an example in other Polygon-blocks).

(2) Change **Polygon age-position**. One can move the "X" marker in the Transect-grid. If a new Horizontal position is desired that is not in the interpolated-set, then carefully insert a new percentage value (you'll need to either drag the right-cells by one column, or highlight just the grid-set portion of the adjacent column and use "Insert Cells – move to right"). For adding an Age, one inserts a new Row into the Grid, and in the Well-Transect-Well sheet, uses "insert cells" to carefully open a new Age-entry. Add the details and computation for that new Age, and then mirror it to your new-row in the output-grid.

(3) **Add a new Polygon** – If you can use the current Transect age-position grid for a new set of "X" values (incremented after the highest one in the current set), then it might be possible. But, it is usually safer to return to the original Illustrator file, do the polygon addition/revision, save the SVG, convert, and re-insert the new transect grid/polygon/text set (being careful to avoid overwriting the underlying output of the next well). Most of the age-position grid will be similar to the previous one, so the interlinking work can be largely recycled.

(4) Revise **Polygon popup** – This is the cell immediately after lithology-pattern-name. One can link these to a master "lithology description" list; or a link to mirror the appropriate Reference Well lithology. To add a URL link, see instructions under Reference Well set-up above.

(5) Change a **Label position** – Use the Revised-age to vary the "height", and the TEXT "X" (third column" to change the percentage-horizontal.

(6) Change a **Label sizing**. In the transect-output, at the end of the TEXT entries, one can change the default FONT; but you will also need to increase/decrease the "bounding box" that follows that font-size cell. Esssentially, if you change a font from "10" to "12", then increase the bounding-box values by 20% also.

(7) Add a **new Label** – quite easy. Add a row to the Transect TEXT set; and fill in the placement/sizing using the others as a guide. In the Well-Transect-Well, enter a new Label text, and age-linking; and mirror that computed age to the TEXT output cell.

(8) Change the **Transect default width** – In the Header for the transect, use a larger/smaller value (the value immediately after "transect").

Part F. Advanced Graphic-interface

1. **Width of Transect** – Conversion of Lat-Long to distance

Distance between Lat-Long pairs on Sphere (*taken from Wikipedia "geographical_distance" entry*)

Radius of Earth = R 6371.01 km

Distance (km) = R * sqrt ($(\text{Lat\_diff})^2 + (\cos(\text{Mean\_Lat})*(\text{Long\_diff}))^2$

For Excel's cos formula, the **Mean_Lat** and **Long_diff** must be in **radians** = degrees * (pi/180)

Example:

Location 1 40.7 173.45
Location 2 41.35 172.8
Transect Distance = 90.54 km

For New Zealand's extensive set of crossing transects (ca. 100 panels), we use a Transect-width equal to 10x the km-distance between the bounding-Reference-wells on each transect panel.

2. Geographic Interface output

The following is an example from the New Zealand set – this Excel set would be saved as tab-delimited text; then zipped into a ".map" file with the map-images and well-transect datapack. See our Geographic Interface manual (included above) for details; or a similar manual posted on the TS-Creator website (*www.tscreator.org*).

Portion of Reference Well suite (and Map-Image information for plotting):

	A	B	C	D	E	F	G	H
1	MAP-VERSION	1						
2								
3	HEADER-MAP INFO	MAP NAME	IMAGE	NOTE				
4	MAP INFO	New Zealand	NewZealand_Basemap.png	*Provided by Craig Jones to JimOgg (summer 2009). Close to square; but slight dist*				
5								
6	HEADER-PARENT MAP	PARENT NAME	COORDINATE TYPE	UPPER LEFT LON	UPPER LEFT LAT	LOWER RIGHT LON	LOWER RIGHT LAT	
7	PARENT MAP	World Map	RECTANGULAR	164	-32.5	179	-48	
8								
9	HEADER-COORD	COORDINATE TYPE	UPPER LEFT LON	UPPER LEFT LAT	LOWER RIGHT LON	LOWER RIGHT LAT		
10	COORD	RECTANGULAR	164	-32.5	179	-48		
11								
12	COMMENT	DataColumns						
13	HEADER-DATACOL	NAME	LAT	LON	NOTE			
14	DATACOL	Mt Roskill	-36.911	174.7282	Northland transect 1A (1a)			
15	DATACOL	Kamo	-35.7061	174.3576	Northland transect 1 A-B (1g)			
16	DATACOL	North Cape	-34.4659	172.9427	Northland transect 1B (1o)			
17	DATACOL	Kaikoura Peninsula	-42.4247	173.6815	East Coast transect 32A (32a) and 33 (33d)			
18	DATACOL	Deadman Stream	-42.0545	173.9555	East Coast transect 32A-B (32e) and 34 (34e)			
19	DATACOL	Long Point (NE corner of South Island)	-41.8209	174.2	East Coast transect 32B-C (32i); NE corner of South Island			
20	DATACOL	Te Kau Kau Point (SE corner of North Island)	-41.5663	175.4448	East Coast transect 32C-D (32j); SE corner of North Island			
21	DATACOL	Flat Point	-41.2528	175.9177	East Coast transect 32D-E (32o) and 35 (35f)			
22	DATACOL	Te Mai Stream	-40.7357	176.1912	East Coast transect 32E-F (32q); SE corner of North Island			

Portion of Transect suite (indicates end-point reference wells for each transect):

100	HEADER-TRANSECTS	NAME	STARTLOC	ENDLOC	NOTE
101	TRANSECT	Northland N-S transect 1A (southern side)	Mt Roskill	Kamo	
102	TRANSECT	Northland N-S transect 1B (northern side)	Kamo	North Cape	
103	TRANSECT	East Coast, NE corner of South Island, N-S transect 32A (southernmost side)	Kaikoura Peninsula	Deadman Stream	
104	TRANSECT	East Coast, NE corner of South Island, N-S transect 32B (northernmost side)	Deadman Stream	Long Point (NE corner of South Island)	
105	TRANSECT	East Coast, Cook Straight, N-S transect 32C	Long Point (NE corner of South Island)	Te Kau Kau Point (SE corner of North Island)	
106	TRANSECT	East Coast, SE corner of North Island, N-S transect 32D (southernmost side)	Te Kau Kau Point (SE corner of North Island)	Flat Point	
107	TRANSECT	East Coast, SE corner of North Island, N-S transect 32E	Flat Point	Te Mai Stream	
108	TRANSECT	East Coast, SE corner of North Island, N-S transect 32F	Te Mai Stream	Angora Stream and Wainui River	

3. Depth-to-Age conversion (stratigraphic columns)

See Manual on Cross-Plotting and Depth-to-Age conversion included above for details; or a similar manual posted on the TS-Creator website (*www.tscreator.org*).

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NSF

Sample Format Demo file
(as used in the majority of the Format-examples in this manual)

```
format version:   1.4
date: 15/12/2011
default chronostrat:    UNESCO
age units:  Ma
chart title:      TimeScale Creator format demo set

Mid-Lt Miocene Stages   block 110   240/240/240 notitle     on
      TOP   3.6         Zanclean/Piacenzian boundary
      Zanclean    5.333       Base Pliocene     255/255/179
      Messinian   7.246       Chron C3Br.1r     255/255/115
      Tortonian   11.608                  255/255/102
      Serravallian      13.82       Mi-3b cooling.    255/255/89
      Langhian    15.97 dashed      Chron C5Br  255/255/77

First set = Event, Range      :     Mid-Lt Miocene Stages   Some datums Two
ranges      _TITLE_OFF

Some datums event 120   210/240/250       on
FAD
      A Base datum      14    dotted
      One with top/base 12          For a Range
LAD
      A Top datum       4     dashed
      One with top/base 5           Top of range
EVENT
      This happens here 7     dashed      An event

Two ranges  range 100   250/240/210       on
      Mid-Miocene horse 7     TOP
      Mid-Miocene horse 8     rare
      Mid-Miocene horse 12    frequent
      Mid-Miocene horse 14    rare
      Lt-Miocene donkey 3.5         "blank" = TOP
      Lt-Miocene donkey 4     abundant
      Lt-Miocene donkey 4.5   flood
      Lt-Miocene donkey 5     missing
      Lt-Miocene donkey 5.5   common
      Lt-Miocene donkey 6     sample

Second set = Sequence, Trend, Chrons      :     M-Lt. Miocene sequences M-Lt.
Miocene T-R Cycles      Mid-Miocene mag   Other mag example _TITLE_OFF

M-Lt. Miocene sequences sequence                            SEPM set
            MFS   5.47  Major Nanno CN10a
      Me2   SB    5.77  Major Middle Nanno CN9d
            MFS   5.99  Medium
      Me1   SB    7.26  Minor Middle Nanno CN9b
            MFS   7.72  Medium      in CN9a
      Tor2  SB    9.22  Minor in CN8
            MFS   10.51 Major
      Tor1  SB    11.8  Major Base Nanno CN5b
            MFS   12.26 Minor
      Ser3  SB    12.72 Minor Middle Nanno CN5a
```

```
M-Lt. Miocene T-R Cycles      trend             notitle           SEPM
            MFS   2.92  Medium      Pliocene transgression
      Me2   SB    5.77  Medium      Lt. Miocene regression maximum
            MFS   10.51 Major Flooding event
      Tor1  SB    11.8  Major Max mid-Miocene regression

Mid-Miocene mag   chron
part of C-Sequence      Primary
      TOP         13.363
      N     C5AB  13.608      C5ABn
      R     C5AB  13.739      C5ABr
      N     C5AC  14.07 C5ACn
      R     C5AC  14.163      C5ACr
      N     C5AD  14.609      C5ADn
      R     C5AD  14.775      C5ADr
      N     C5B   14.87 C5Bn.1n
      R     C5B   15.032      C5Bn.1r
      N     C5B   15.16 C5Bn.2n
      R     C5B   15.974      C5Br

Other mag example chron 50    250/250/250       off
Options for types Primary
      TOP         13.3
      N     Tom   13.6
      R     Tom   13.7
      No Data     Rachel      14.5
      R     Dick  14.6
      U     Dick  15.0
      N     Dick  15.5
Adjacent    Secondary
      TOP         13.5
      N     Frank 13.9
      R     Frank 14.3
      U     Gap   14.7
      R     Dick  15.0
      N     Dick  15.5

Third set = Curves with overlay, Facies   :     Neogene Benthic Oxygen-18
Composite   Sample lithostrat

Neogene Benthic Oxygen-18 Composite point 150   255/245/230             Data
provided by I. Raffi (RED and SMOOTHED = data of Shackleton & Hall (1997); 9 to
10 Ma)
nopoints    255/0/0     nofill      2     3.5   smoothed
      8.973 2.77
      8.979 2.92
      8.986 2.77
      8.992 2.73
      8.992 2.76
      8.999 2.58
      8.999 2.85
      9.005 2.88
      9.012 2.75
      9.019 2.72
      9.025 3.02
      9.031 3.09
      9.038 2.89
      9.044 2.87
      9.050 3.10
      9.050 2.64
      9.056 2.79
      9.062 2.96
```

```
      9.067 2.76
      9.076 3.08
      9.085 2.82
      9.094 2.86
      9.103 2.79
      9.112 2.86
      9.121 2.92
      9.130 2.66
      9.139 2.93
      9.147 2.69

Westerhold 2005 (black) point-overlay     150   255/245/230             BLACK =
Site 1085 d18O
points      0/0/0 nofill      2     3.5   notsmoothed
      8.971 3.17
      8.975 3.17
      8.979 3.02
      8.979 2.88
      8.981 3.06
      8.985 3.01
      8.989 3.10
      8.992 3.20
      8.992 3.10
      8.995 2.88
      8.995 2.94
      8.999 2.42
      8.999 2.88
      9.002 2.87
      9.002 2.93
      9.005 2.94
      9.005 2.99
      9.009 3.09
      9.010 3.32
      9.014 2.97
      9.016 2.94
      9.017 2.97
      9.019 3.05
      9.021 2.57
      9.022 2.86
      9.024 3.00
      9.026 3.07
      9.028 2.75
      9.030 3.19
      9.033 3.27
      9.043 3.35
      9.049 3.12
      9.049 2.79
      9.052 3.31
      9.055 3.13
      9.065 3.09
      9.075 3.60
      9.078 3.27
      9.085 2.97
      9.091 3.13
      9.098 3.15
      9.101 3.03
      9.104 3.10
      9.108 2.86
      9.111 3.18
      9.114 3.08
      9.121 3.17
      9.125 3.16
```

```
      9.128 3.09
      9.131 3.22
      9.134 3.22
      9.137 3.19
      9.140 3.56
      9.146 3.08


Sample lithostrat facies      150
Upper Group Primary
      TOP         3
      Claystone   Some mud    6
      Sandy claystone   Some mud    7
      Claystone   Some mud    8     Name spans set
      CS dark purple          9     Comment -- weird soil ??
      Primary                 [NOTE: Space in first column]
      Gap         10
Lower Group Primary
      NZ Conglomerate   alluvial    12
      NZ Coal sandstone Wellington Fm     14

Lms wedge   freehand-overlay  150
POLYGON     closed            Oolitic limestone
      61    4
      40    4
      20    4.5
      -1    4.5
      -1    5
      20    5
      40    5
      61    5



Horse Evolutionary Tree range       226/220/230
      Parahippus  15          Parahippus: <img align="middle" src="none">
CALIBRATION OF TOP=mid-Miocene
      Parahippus  19    branch      Merychippus       Americas    dashed
      Branch to Merychippus dashed late-Early Miocene.  REFERENCE = MacFadden
(2005) Science    250/100/250 10
      Parahippus  23    branch      Archaeohippus                 dashed
      Branch to Archaeohippus dashed mid-Early Miocene.  REFERENCE = MacFadden
(2005) Science    120/110/120 7
      Parahippus  25    frequent     CALIBRATION OF BASE= latest Oligocene.
REFERENCE= MacFadden (2005) Science
      Archaeohippus     10          Archaeohippus: <img align="middle"
src="none">  CALIBRATION OF TOP=mid-Late Miocene
      Archaeohippus     22    common       CALIBRATION OF BASE= mid-Early
Miocene.  REFERENCE= MacFadden (2005) Science
      Merychippus 11          Merychippus: <img align="middle"
src="Merychippus.png">  CALIBRATION OF TOP=early-Late Miocene
      Merychippus 12    branch      Dinohippus        North America horses
      dotted      Branch to Dinohippus dotted .  REFERENCE = MacFadden (2005)
Science     100/200/250 10
      Merychippus 16    branch      Pliohippus        South America horses
      Branch to Pliohippus  .  REFERENCE = MacFadden (2005) Science
      250/150/100 7
      Merychippus 18    frequent     CALIBRATION OF BASE= late-Early Miocene.
REFERENCE= MacFadden (2005) Science
      Dinohippus  3           Dinohippus: <img align="middle" src="none">
CALIBRATION OF TOP=mid-Pliocene
```

```
      Dinohippus  6     branch      Equus             dashed      Branch to
Equus dashed mid-Late Miocene.  REFERENCE = MacFadden (2005) Science
      10
      Dinohippus  10    rare   CALIBRATION OF BASE= early-Late Miocene.
REFERENCE= MacFadden (2005) Science
      Pliohippus  6           Pliohippus: <img align="middle" src="none">
CALIBRATION OF TOP=latest Miocene
      Pliohippus  9     branch      Hippidion               dashed      Branch
to Hippidion dashed mid-Late Miocene.  REFERENCE = MacFadden (2005) Science
      7
      Pliohippus  15           CALIBRATION OF BASE= mid-Miocene.  REFERENCE=
MacFadden (2005) Science
      Equus 0.012       Equus: <img align="middle" src="Equus.png">
CALIBRATION OF TOP=Eaten by early indians at ca. 12,000 ?
      Equus 5     abundant     CALIBRATION OF BASE= Base of Miocene.
REFERENCE= MacFadden (2005) Science
      Hippidion   1           Hippidion: <img align="middle" src="none">
CALIBRATION OF TOP=mid-Quaternary
      Hippidion   8     frequent     CALIBRATION OF BASE= mid-Late Miocene.
REFERENCE= MacFadden (2005) Science
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