

User Guide for NSB_ADP_wx

A Python 2.7 interactive program for plotting microfossil stratigraphic event data and constructing a line of correlation (LOC) used for creating age depth models of deep-sea cores. This program is a Python implementation combining the features of the original “Age Depth Plot (ADP)” program by Lazarus written in True Basic (1992), and the CHRONOS Java version by Bohling (2005).

Software version : 0.7
Date : July 9, 2019
Software authors: Johan Renaudie, Patrick Diver, David Lazarus.
Manual author: Johan Renaudie.

1	Installation and initial set-up	2
1.1	Installation	2
1.2	Database access	2
2	Running the program	3
2.1	Main program window	3
2.2	Selection	3
2.2.1	Working from the database	3
2.2.2	Working from local files	4
2.2.2.1	Format for CORE file	5
2.2.2.2	Format for STRAT file	5
2.2.2.3	Format for LOC file	6
2.2.3	Working from a mixture of both	7
2.3	Age-Depth plot	8
2.3.1	Key bindings	8
2.3.2	Annotating / Identifying events	10
2.3.3	Hiatuses	10
2.3.4	Legend	10
2.3.5	Configuring the plot	10
2.3.6	Inspect data	11
2.3.7	Project events on LOC	12
2.3.8	Loading extra data	12
2.3.8.1	Extra age models for comparisons	12
2.3.8.2	Extra biostratigraphic events	12
2.4	Saving the Data	13
2.5	Ending the Program	13
3	Troubleshooting	14

1 Installation and initial set-up

1.1 Installation

Program installation is not required; simply unpacking the zip archive should create a folder with the app in a ready to use state. Although the containing folder can be placed wherever is the most convenient for the user, the software itself need to stay in this folder, so that it can access the data files needed for its functioning. In particular, the folder should at least contain the following subfolders (in bold) and files:

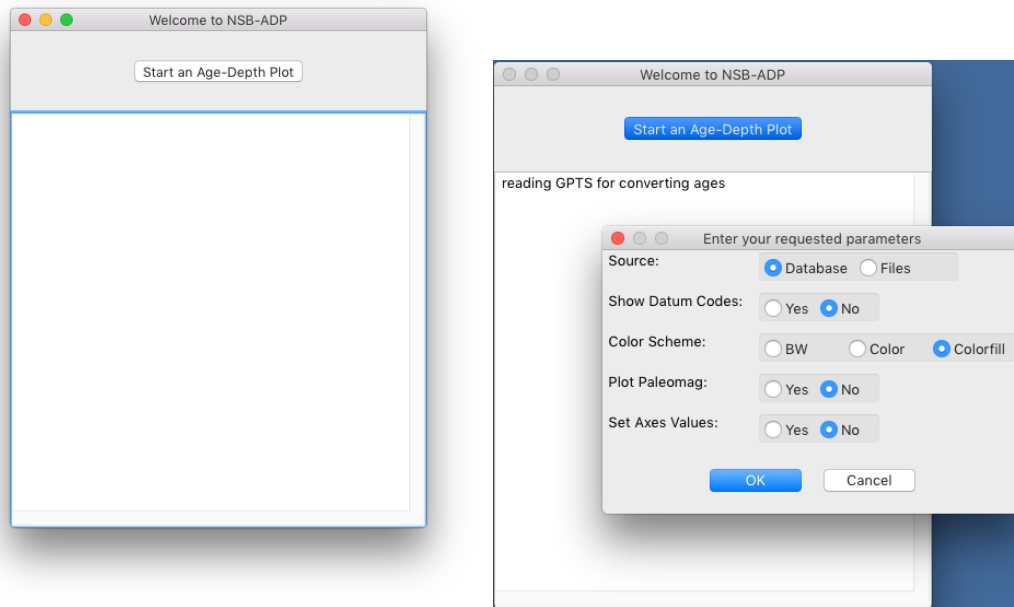
NSB_ADP_WX	CORE	1.txt 2.txt ...	<i>(this folder contains deep-sea core metadata)</i>
	LOC		<i>(this folder contains line-of-correlations)</i>
	PLOTS		<i>(this folder contains plots outputted by the software)</i>
	PROJ		<i>(this folder contains projected biostratigraphic events)</i>
	REF	gpts.txt paleomagscale.txt plot_config.txt timescale.txt manual.pdf	<i>(this file contains GPTS for work offline)</i> <i>(this file contains pmag metadata for work offline)</i> <i>(this is the configuration file for plot appearance)</i> <i>(this file is needed for work offline)</i> <i>(this user manual)</i>
	STRAT		<i>(this folder contains biostratigraphic events)</i>
	Changelog.txt		
	NSB_ADP_wx		<i>(the software itself)</i>

1.2 Database access

The software has two main functionalities: it can be used either with local files or from the NSB database. Using it from the NSB database require a user account. If you do not have one, contact the current database administrators, as mentioned on [the NSB database webpage](#). Note that some functionalities (namely updating the database based on your findings) are only possible if you were granted a specific privilege level.

2 Running the program

2.1 Main program window



Main program window at start-up and together with selection dialog.

The main program window will contain informations on the current activity of the software as well as error messages. In particular, it will display the path to the save files, the current axis limits when plotting or resizing the plot, etc.

2.2 Selection

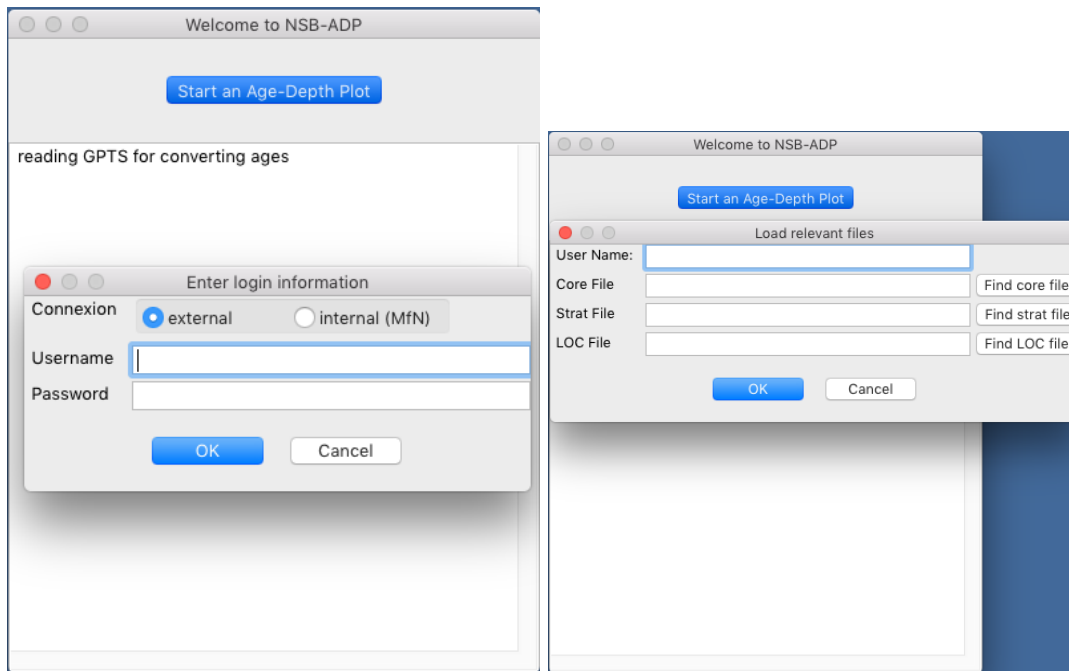
After “Start an Age-Depth Plot” is clicked on the main window, a selection dialog is triggered. The user gets to decide whether they will primarily work from the database or from local files (see following sections). Additionally, basic parameters for the plot will be selected at that point:

- Show Datum Codes: Control whether or not the names of the data points are displayed by default next to the points. Defaults to ‘No’ as most plots will contains a large amount of data points and would thus be too crowded by the labels.
- Color Scheme: Control the aesthetic of the data points: could be black-and-white (BW), completely filled with the color corresponding to the stratigraphic group (Colorfill) or half filled with that color (Color; if the event is a top event, the upper half is filled, and vice versa).
- Plot Paleomag: If working from the database, and if the data is available, will plot a secondary depth-wise axis showing the pmag recorded on that hole.
- Set Axes Values: Control whether or not the x and y-axis limits will be automatically (‘No’, default) or manually (‘Yes’) set.

2.2.1 Working from the database

If the NSB database was selected as source, the user will be prompted with the next dialog, asking for the user credentials (Username and Password), and whether the connection is external (default) or internal to the database server. ‘Internal’ is to be selected only for MfN employees working on site. The software will then remember the username and password for as long as the software is opened so that the user doesn’t have to re-enter it.

After the user entered their credentials, they will then be able to chose on which hole to work on, in a second dialog (see picture). This dialog displays, in addition to the hole identifier, the coordinates of the hole and in which ocean it was drilled (one of PAC, ATL, ANT, IND or MED), the number of samples and biostratigraphic

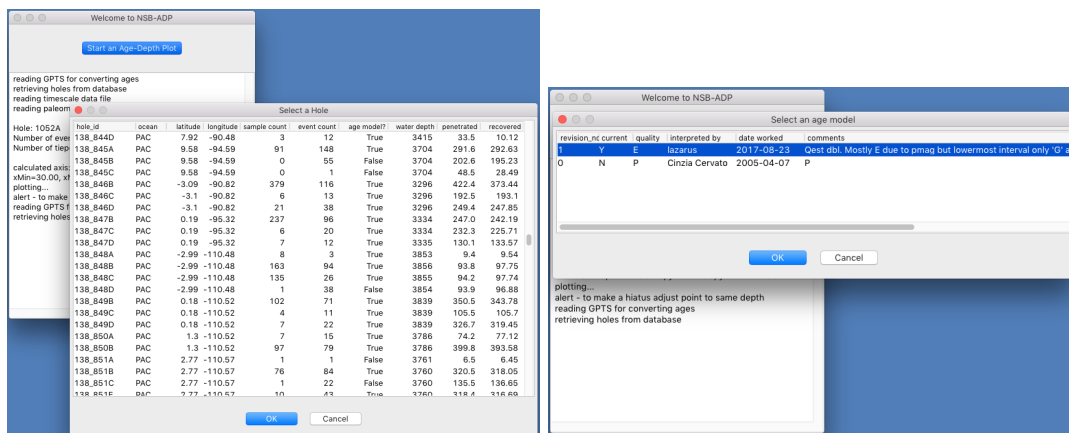


Dialogs when working with database and when working from local files.

events contained in the database for that hole, whether or not NSB holds an age model for that hole, and basic informations such as the water depth (in meters below sea level) as well as the depth of sediments penetrated and recovered by the drilling operation (in meters).

When a hole has been selected, a final dialog invites the user to select an age model to display, if NSB contains an age model for that hole. The user will then see the revision number of the age model, whether or not the age model is the one currently used to date samples in the database, what is the estimated quality of the age model (one of VP [very poor], P [poor], M [moderately good], G [good], VG [very good] or E [excellent]), who interpreted this age model and when, as well as comments (usually giving references for the age model, or explaining the age model quality estimate).

If the user selects an age model, the Age-Depth plot window will be triggered and will display the stratigraphic events (if any) and the selected age model. If the user selects 'Cancel', the Age-Depth plot window will still be triggered and will display the stratigraphic events (if any) but no age model.



Hole selection dialog and age model selection dialog.

2.2.2 Working from local files

When choosing to work from file, the user will be prompted with a dialog contains the following fields:

User name	The name the user wish to appear as metadata on saved files.
Core file	(compulsory) A file containing informations on the depth of the cores of the studied hole. The file should follow a specific format (see below) unherited from the previous incarnations of the ADP software: this software is thus backward-compatible.
Strat file	(not compulsory) A file containing the biostratigraphic data to plot. The file should follow a specific format (see below) unherited from the previous incarnations of the ADP software.
LOC file	(not compulsory) A file containing the tie-points of the age model to study. The file should follow a specific format (see below) unherited from the previous incarnations of the ADP software.

2.2.2.1 Format for CORE file

The file is tab-delimited. The first cell of the first line should be contain the hole name, as per deep-sea drilling convention, as SiteHole (e. g. 1407A). If the site did not have a ‘hole’ name (typically, early DSDP sites didn’t), just provide the site name (e. g. 357). The rest of the first line is not read in by NSB_ADP_wx but can contain additional info for backward compatibility with the two previous incarnations of the software, such as version number (2, in our case), date of file creation and source of information.

The second line contains the headers (typically ‘CORE’, TOP DEPTH’, ‘BOTTOM DEPTH OR BASE RECOVERED SEDS’, but can be anything).

Then the rest of the lines should contain every core (as an integer, in order), the top depth of the core (as a numeric, with dot as separator between the unit and the decimals) and the bottom depth of the core or of the recovered sediments for that core.

Example:

1405A	2		
CORE	TOP DEPTH	BOTTOM DEPTH OR BASE RECOVERED	SEDS
1	0.00		0.10
2	6.20		5.95
3	15.70		20.05
4	25.20		30.35
5	34.70		42.05

The hole name given in this file is the ‘master’ one, i. e. the software will prompt an error message in the main window if the hole name given in the two other files is not preferctly identical!

2.2.2.2 Format for STRAT file

The file is tab-delimited. The first cell of the first line should be contain the hole name, as per deep-sea drilling convention, as SiteHole (e. g. 1407A). If the site did not have a ‘hole’ name (typically, early DSDP sites didn’t), just provide the site name (e. g. 357). The second cell traditionally contains the version of the file format (i. e., 2). The third cell of the first line should contain a shorthand name for the GPTS on which the ages of the datapoints are to be read, i e. one of Berg85, CK95, Berg95, Pal06, Grad04, Grad12. Whichever is the original one, it will be mapped to Grad12 (Gradstein et al. 2012) GPTS i. e. the current GPTS, and the one currently used in NSB database. Any other information (source, etc.) written on the first line will not be read by NSB_ADP_wx.

The second row contains the headers, typically: GROUP, NAME, PLOTCODE, YOUNG AGE, OLD AGE, TOP DEPTH, BOT DEPTH; but could be anything.

From the third row onwards, each row should contains stratigraphic events, in the exact following order:

Header	Example	Explanation
GROUP	F	The stratigraphic group (could be a fossil group: R, D, DN, F, N; or a magnetochron boundary [M]; an isotope [I], etc.). In any case the group code need to be present in file REF/plot_config.txt.

NAME BOT Globigerinoides fistulosus
 PLOTCODE bFGLODfist

YOUNG AGE 3
 OLD AGE 5
 TOP DEPTH 0.45

BOT DEPTH 1-1,1

Example:

1069A	2	CK95				
GROUP	NAME	PLOTCODE	YOUNG AGE	OLD AGE	TOP DEPTH	BOT DEPTH
F	T Subbotina frontosa	tSfr	39.3		1-2,11	1-3,0
F	T Morozovella aragonensis	tMar	43.6		1-1,12	1-2,11
F	B Acarinina pentacamerata	BApe	50.8		6-1,128	6-2,113
F	B Morozovella aragonensis	bMar	52.3		6-5,81	6-CC
F	B Muricella broedermanni	BMbr	54.7		6-1,128	6-2,113
F	B Acarinina soldadoensis	BAso	56.5		7-3,11	7-4,7

2.2.2.3 Format for LOC file

The file is tab-delimited. The first cell of the first line should be contain the hole name, as per deep-sea drilling convention, as SiteHole (e. g. 1407A). If the site did not have a ‘hole’ name (typically, early DSDP sites didn’t), just provide the site name (e. g. 357). The second cell of the first line should contain a shorthand name for the GPTS on which this age model is to be read, i e. one of Berg85, Berg95, Pal06, Grad04, Grad12. Whichever is the original one, the age model will be mapped to Grad12 (Gradstein et al. 2012) GPTS i. e. the current GPTS, and the one currently used in NSB database. Any other information (source, etc.) written on the first line will not be read by NSB_ADP_wx. However a LOC file outputted by the software will contains, in the third cell of the first row, a repeat of the second (for compatibility with previous versions of ADP), and in the fourth the date at which the LOC was produced.

The second row contains the headers. Typically (but could be anything), ‘AGE’ and ‘DEPTH’.

From the third row onwards, each row should contains a tie-point (age first, then depth). Example:

The datum name. Can be anything, but cannot be empty.

A codified version of the latter. Will be plotted on the graph when clicking next to a data points. First letter influences the coloring pattern: a plotcode starting with ‘b’ is assumed to be a bottom event (i. e. BOT, FAD, FCO, REAP, etc.) and ‘t’ a top event (i. e. TOP, LAD, LCO, DISP, etc.). The rest of the code, though having a specific meaning in NSB database, is not enforced here and thus can be anything.

Minimum age of the event. Can be absent.

Maximum age of the event. Can be absent.

Top depth of the event. Can **not** be absent. Can be expressed in mbsf, as a numeric, or as a sample name *if it respects deep-sea drilling nomenclature*, as ‘Core-Section,Interval’. Examples: 12-3,124 or 12-CC or even 12-CC, 124. Note that there is *no* space between the comma and the interval. In the case the sample name is given instead of the sample depth, it will be translated into mbsf by the software based on the CORE file (or on the content of NSB database if the user started the plot from the database).

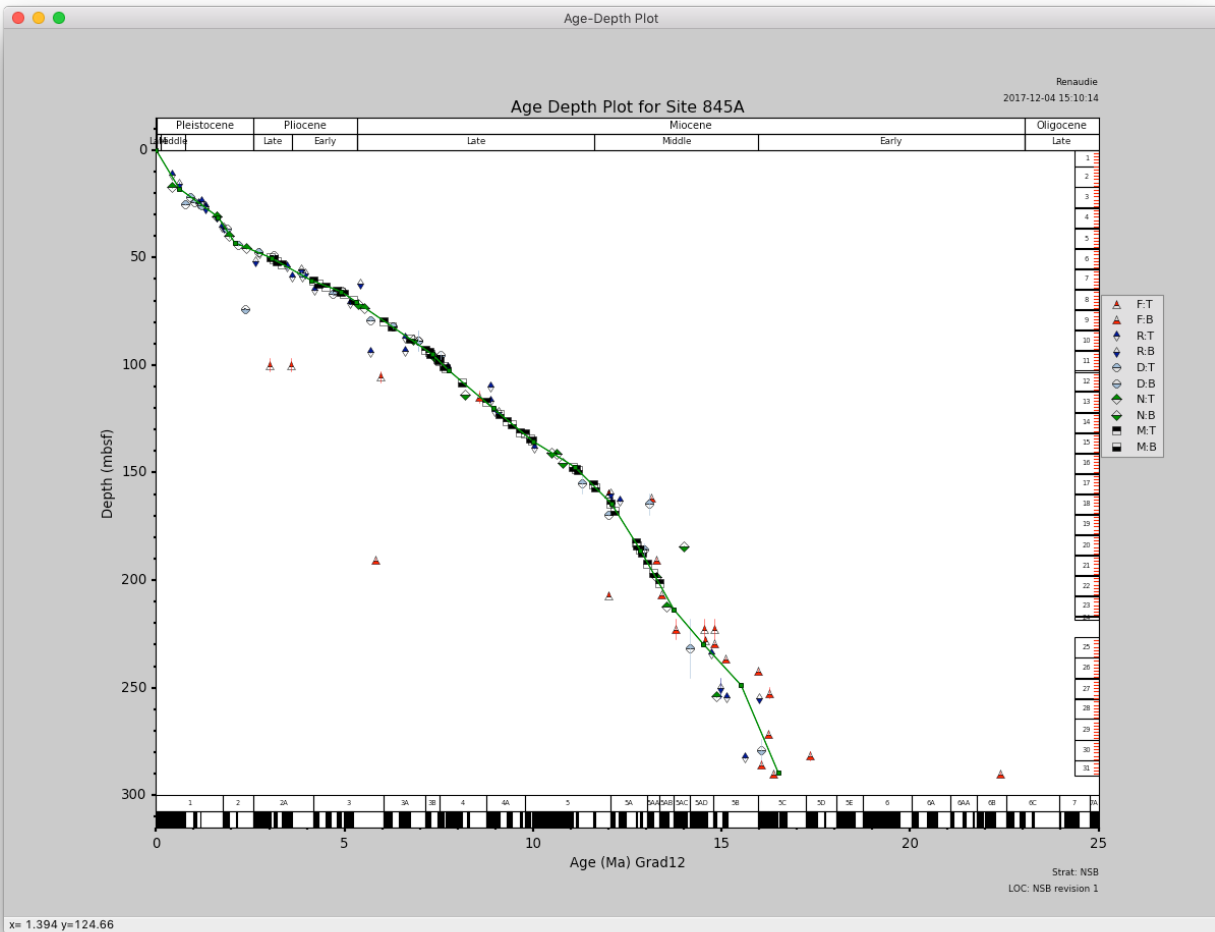
Same as above but for the bottom depth of the event. Can be absent.

1121B	Grad12	Grad12	2017-04-20
AGE	DEPTH		
58.97192	36.123		
61.245296	110.526		
63.404484	134.589		
64.888926	134.589		

2.2.3 Working from a mixture of both

To work from a mixture of both the database and local files, the user has to start with one or the other and then load additional data or age-models using the menu items Plot – Load a new LOC and Plot – Add stratigraphic events from a file. In practice, as additional stratigraphic events can only be added from a file, and that starting a plot from files necessitate a CORE file, in addition to the LOC and STRAT files, the user might find it more convenient to start from the NSB database and then add data from files. If a site is not present in the hole selection offered by the NSB database, it means the database do not contain any stratigraphic events or age model for that site: the user should thus work exclusively from local files in that case.

2.3 Age-Depth plot



Plot window.

The age-depth plot window displays a line-of-correlation, as a green line (if none was selected, the starting age model will be a line linking the minimum and maximum ages and depths of the biostratigraphic data), the selected biostratigraphic data, the timescale (at the top), the GPTS (at the bottom) and the cores and sections limits (on the right side). It also displays the username and the timestamp at which the window was started in the upper right corner (so that this information is displayed on any saved graph), the source of the stratigraphic information and of the line-of-correlation in the lower right corner, and finally the name of the hole in the title of the plot.

If comparing two LOCs, the non-active LOC will be displayed by a blue line and its source will be also displayed in the lower right corner as 'Phantom LOC'.

2.3.1 Key bindings

These are the Key-bindings when interacting with the Age-Depth Plot:

LOC

't'	toggle line off/on	Toggle the Line of Correlation (LOC) on/off
'i'	insert a vertex	To insert a new vertex (point) to create a line segment place your cursor at the x,y location where you want to insert and press 'i' on your keyboard. The program will detect if the position is valid and if so will add the point and redraw the line.

'd'	delete a vertex	To delete a vertex (and line segment), place your cursor over the vertex and press 'd' on your keyboard. The program will remove the point and redraw the line.
...	move a vertex (no key binding)	To move a vertex (no key-binding) simply click your left mouse with the cursor over a point, drag it to a new location and release the mouse button. The program will limit the placement of the point to a valid region bounded by the next higher/younger and next lower/older vertices.
's'	save LOC to file	To save the currently displayed LOC, press 's' on your keyboard when your cursor is within the bounds of the plot axes. A dialog will prompt you for a filename to save the data. The default name is the name of the hole with ".loc.txt" appended to it, and the default directory is folder "/LOC/".
'N'	switch to next LOC	Show the next LOC in the stack of saved LOC's.
'P'	switch to previous LOC	Show the previous LOC in the stack of saved LOC's.

DATA

'l'	list data	To list the events being displayed, press 'l' on your keyboard when your cursor is within the bounds of the plot axes. A display window will appear and show a tab-delimited listing of the event data. A copy/paste of the data into file will save the data which can be imported and viewed in a spreadsheet application such as MS Excel or OpenOffice.
'I'	Inspect LOC	Equivalent to menu item Plot – Inspect LOC.
'c'	Project events on the LOC	Equivalent of menu item Plot – Project events on the LOC. See the corresponding section of the help file .

PLOT

'p'	Save the plot	To save the plot as a png, pdf, svg or tiff file, press 'p' on your keyboard while the cursor is in the limit of the axes. A dialog will appear, where you will be able to choose the format, the file name and the file directory in which the plot will be saved.
'a'	axes definition	To re-define the axes limits for the plot, press 'a' on your keyboard. A dialog will appear with the default axes values for xMin, xMax, yMin, and yMax. You can change any or all of these and click "OK" or press "Enter/Return" on your keyboard. The plot will redraw with the new axes definition. Select the Cancel button to return to the plot without making changes.
'e'	edit title, axes labels	To edit the title and/or the axes labels, press 'e' on your keyboard. A dialog will appear with the default title and axes label values. You can change any or all of these and select "OK" or press "Enter/Return" on your keyboard. The plot will redraw with the new title and axes labels. Select the Cancel button to return to the plot without making changes.
'g'	toggle grid on major ticks	To add or remove a grid to the plot, press 'g' on your keyboard.

HELP

'h'	plot help	Plot help (this) - file REF/manual.pdf is read and displayed in your default PDF viewer.
-----	-----------	--

EXIT

'x'	Exit	Exit (close) the plot
-----	------	-----------------------

2.3.2 Annotating / Identifying events

To display information on a particular event (point/symbol) you can either left-click to show the plot_code (e. g. tDNITZdent) or right-click to show the plot_code, its age and depth, e. g. tDNITZdent (11.836, -69.290).

Notes: plot_code (when querying database) consists of:

event_type (lower case)	t	(here “top” = LAD)
fossil_group (usually one letter upper case)	D	(here “Diatom”)
genus of event_name (abbreviated upper case)	NITZ	(here “Nitzschia”)
species of event_name (abbreviated lower case)	dent	(here “denticulata”)

If any of the buttons are clicked again for the same point the annotation will turn off.

The first time you click on a point with a mouse button, the information will appear in the “quadrant” where you clicked near the point. You can use this to spread out annotation to minimize overposting of closely-spaced events:

Quadrant 1 (above/right of point) :	vertical/bottom, horizontal/left justification
Quadrant 2 (below/right of point) :	vertical/top, horizontal/left justification
Quadrant 3 (below/left of point) :	vertical/top, horizontal/right justification
Quadrant 4 (above/left of point) :	vertical/bottom, horizontal/right justification

If more than one point very close to the same x,y location clicked the program will attempt to place the annotation for them offset to the right and left no matter the quadrant selected.

2.3.3 Hiatuses

When dragging tie-points up and down to adjust the age model, the program limits the placement of the point to a valid region bounded by the next higher/younger and next lower/older vertices. When a tie-point (=vertex) is placed at the same depth as the previous or the following one, a dashed red line will be superimposed to that portion of the LOC to figure an hiatus. When a tie-point is placed *almost* at the same depth (i. e. when the slope thus created is lower than 5cm per million year) as the previous or next one, a bold red stripped line will be superimposed and a warning will appear in the main window, inviting the user to change it into an hiatus by dragging the point at the exact same depth.

2.3.4 Legend

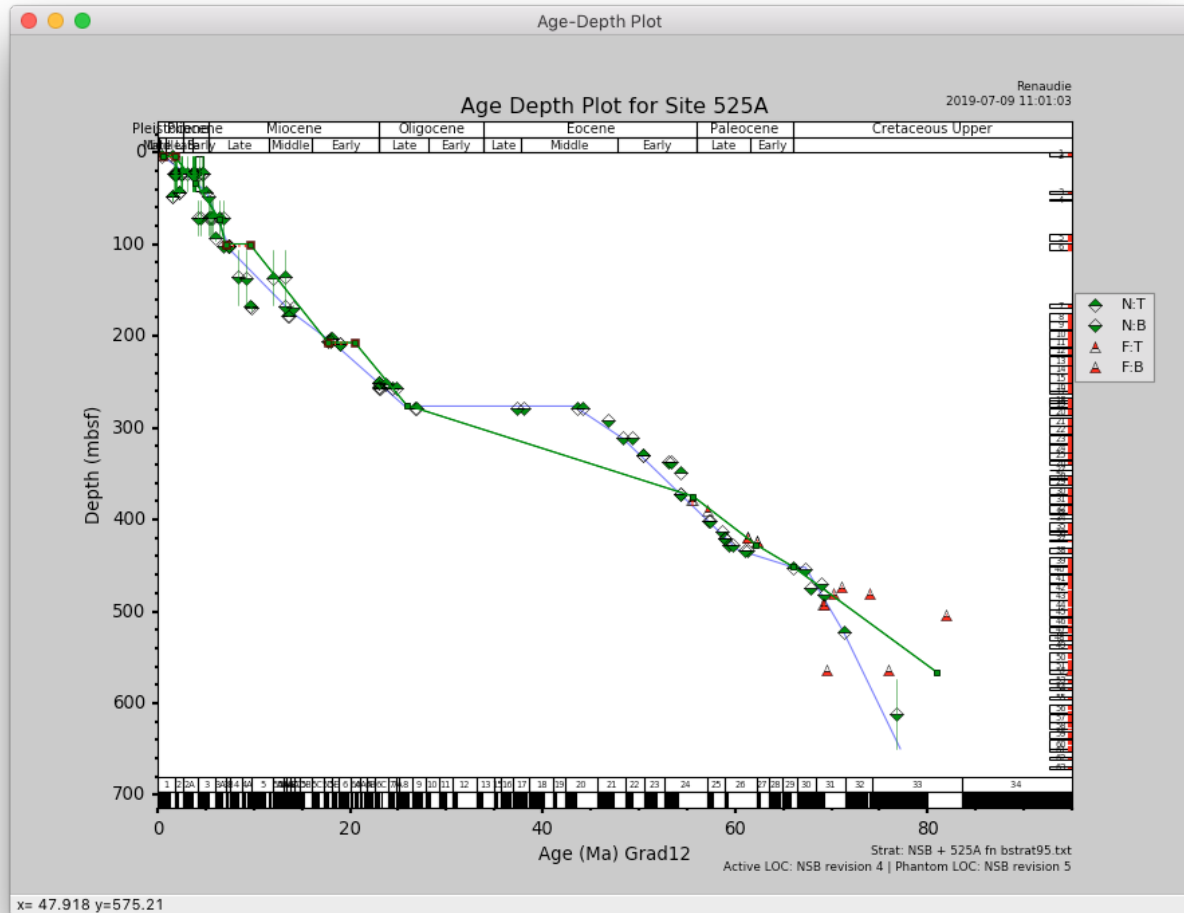
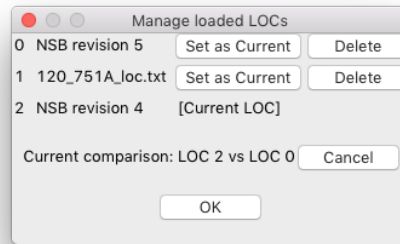
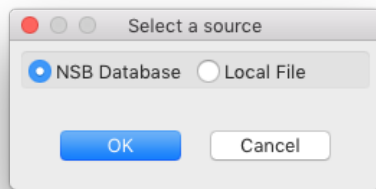
The data points are grouped and plotted according to fossil group and event type such as “D:T” for “Diatoms:TOP” or “N:B” for “Nannofossil:BOT” (BOT = BOTTOM, i. e. base, FAD or FCO). If you click a symbol for a particular group:type all the events that are a member of that group are visibly turned off, and the legend text color is turned to red from black. If you click on the same symbol again, the events are visibly turned back on and the legend text color is changed back to black. One or more groups can be turned off to unclutter the view of the plot to review a particular group:type for instance when working with a line of correlation.

2.3.5 Configuring the plot

The type of stratigraphic events that the software can recognize and their associated color and marker symbol on the plot can be configured by the user by modifying the file /REF/plot_config.txt. This file is a tab-separated matrix associating the code for a stratigraphic group, its name, its marker symbol and its color.

By default the file is the following:

fossil_group	name	symbol	color
F	Foraminifera	^	red
N	Nannofossils	D	green
R	Radiolarians	d	darkblue
D	Diatoms	8	#93B0CF
M	Magnetic reversal	s	black
DN	Dinoflagellates	o	magenta
I	Isotopes	+	grey



Dialogs for loading a new LOC and for managing the LOC stack, and Age-depth plot while comparing two age models.

Colors can be any colors recognized by python's matplotlib, i. e. can be in natural language or in RGB code preceded by a #. The complete list of possible marker symbols can be found at the following URL: http://matplotlib.org/api/markers_api.html.

2.3.6 Inspect data

At any time, while the plot window is opened, the user can have a looked at either the numerical tiepoints for the LOC (through menu Plot – Inspect LOC) or the stratigraphic data (through menu Plot – Inspect Stratigraphic

data).

2.3.7 Project events on LOC

To “project” the event data to the LOC, use the menu item Plot – Project events on LOC or press ‘c’ while the cursor is in the limit of the axes. The program will calculate the “projected age” of each event – the age of the event projected to the LOC. A dialog will prompt you for a filename to save the data. The default name is the name of the hole with “_proj.txt” appended to it, and the default directory is PROJ/. The listing will contain the original event “plot_age”, the “proj_age”, and the “proj_extension_age” which shows the difference between the plot_age and proj_age. The file is tab-delimited and may be imported to a spreadsheet program such as MS Excel or OpenOffice.

2.3.8 Loading extra data

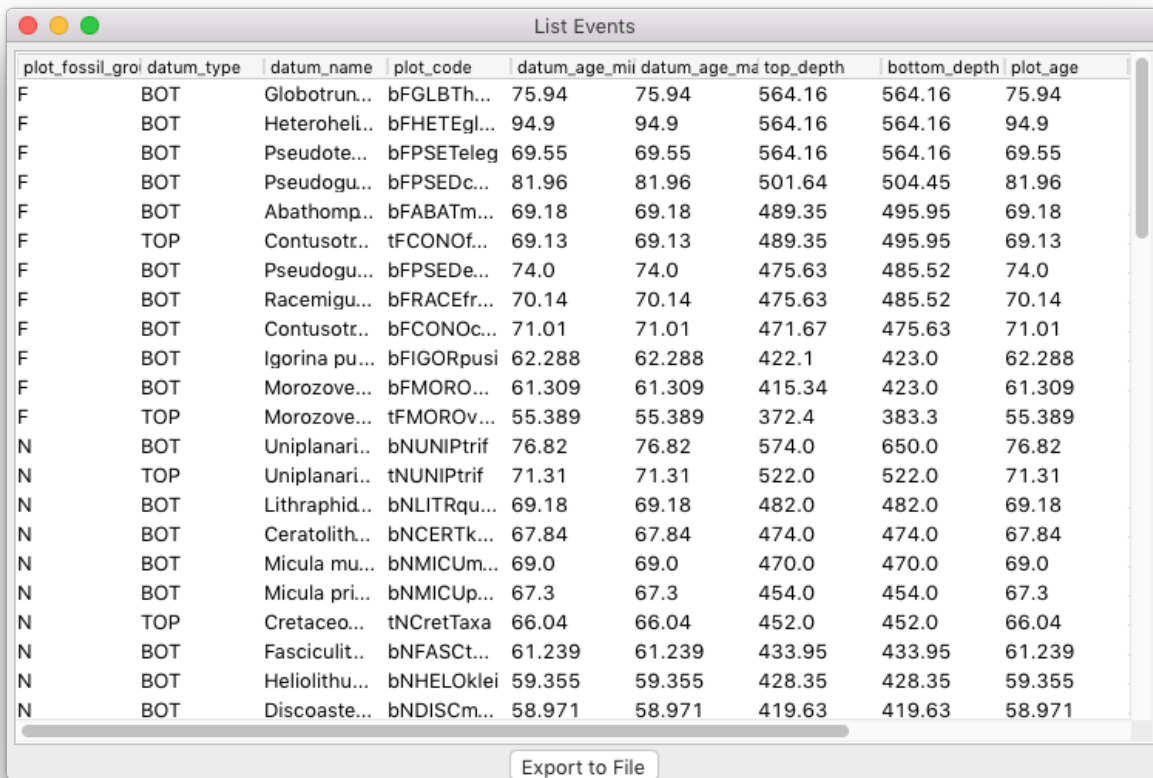
2.3.8.1 Extra age models for comparisons One can load several additional age models to compare with the current one using the menu dialog Plot – Load a new LOC.

One can load a new LOC from the database age model library or from a file. Once the age model is loaded, the LOC stack containing it and the previous one can be accessed and managed through the Plot – Manage LOCs menu item or using key-bindings ‘P’ and ‘N’ as mentioned above. The LOC manager also offer the possibility to compare 2 LOCs in which case the current, active one will be displayed in green and is modifiable while the other is displayed in blue (and will appear in the metadata as “Phantom LOC”).

Note that when a user start a new Age Depth plot, with a loaded age model on start-up, when the user starts modifying the age model, the original one is saved in the LOC stack and can be accessed and used in the same way as mentioned previously.

2.3.8.2 Extra biostratigraphic events Similarly extra biostratigraphic events can be loaded after having started the plot, but exclusively from a file. Useful when working from a mixture of data from NSB and from file.

2.4 Saving the Data



plot_fossil_group	datum_type	datum_name	plot_code	datum_age_mii	datum_age_ma	top_depth	bottom_depth	plot_age
F	BOT	Globotrunc...	bFGLBTh...	75.94	75.94	564.16	564.16	75.94
F	BOT	Heteroheli...	bFHETegl...	94.9	94.9	564.16	564.16	94.9
F	BOT	Pseudote...	bFPSETeleg	69.55	69.55	564.16	564.16	69.55
F	BOT	Pseudogu...	bFPSEdc...	81.96	81.96	501.64	504.45	81.96
F	BOT	Abathomp...	bFABATm...	69.18	69.18	489.35	495.95	69.18
F	TOP	Contusotr...	tFCNOF...	69.13	69.13	489.35	495.95	69.13
F	BOT	Pseudogu...	bFPSEdc...	74.0	74.0	475.63	485.52	74.0
F	BOT	Racemigu...	bFRACEfr...	70.14	70.14	475.63	485.52	70.14
F	BOT	Contusotr...	bFCNOc...	71.01	71.01	471.67	475.63	71.01
F	BOT	Igorina pu...	bFIGORpusi	62.288	62.288	422.1	423.0	62.288
F	BOT	Morozove...	bFMORO...	61.309	61.309	415.34	423.0	61.309
F	TOP	Morozove...	tFMOROV...	55.389	55.389	372.4	383.3	55.389
N	BOT	Uniplanari...	bNUNIPtrif	76.82	76.82	574.0	650.0	76.82
N	TOP	Uniplanari...	tNUNIPtrif	71.31	71.31	522.0	522.0	71.31
N	BOT	Lithraphid...	bNLITRqu...	69.18	69.18	482.0	482.0	69.18
N	BOT	Ceratolith...	bNCERTk...	67.84	67.84	474.0	474.0	67.84
N	BOT	Micula mu...	bNMICUm...	69.0	69.0	470.0	470.0	69.0
N	BOT	Micula pri...	bNMICUp...	67.3	67.3	454.0	454.0	67.3
N	TOP	Cretaceo...	tNCretTaxa	66.04	66.04	452.0	452.0	66.04
N	BOT	Fasciculit...	bNFASct...	61.239	61.239	433.95	433.95	61.239
N	BOT	Heliolithu...	bNHELOklei	59.355	59.355	428.35	428.35	59.355
N	BOT	Discoaste...	bNDISCm...	58.971	58.971	419.63	419.63	58.971

“Inspect Stratigraphic data” dialog

The LOC can be saved either through the menu item Plot – Save LOC or using the keybinding ‘s’. The plot can be saved either through the menu item Plot – Save Plot or using the keybinding ‘p’: the user will then be given the choice in file name, file directory and file extension (png, pdf, svg or tiff).

Stratigraphic events can be saved to a file (in the format readable by the software) by going through the menu Plot – Inspect Stratigraphic data and then clicking on “Export to File”.

Uploading to the NSB database:

2.5 Ending the Program

The current Age-depth plot can be closed with the key-binding ‘x’, but to quit the software the user needs to use the Quit option in the Menu from the main window, or in the dock (if working on mac OS X).

3 Troubleshooting

Program will not start: The software has been compiled for Mac OSX 10.11 and higher and for Windows 7 & 10. It is however not known to be compatible with prior versions of those OS.

Plot will not start when working from file: The most likely issue is that one of the files was not correctly formatted. Refer to the [sections describing the file formats for help](#). If you do not find the issue, do not hesitate to [contact the maintainer of the software](#).