Supplemental Material for

STRATFIT: AN EXCEL WORKBOOK FOR CORRELATION OF MULTIPLE STRATIGRAPHIC TRENDS AN OPEN SOURCE WORKBOOK IN EXCEL FOR MULTIPLE STRATIGRAPHIC TRENDS CORRELATION

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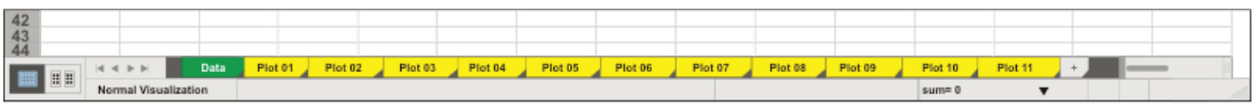
USER MANUAL

The StratFit program consists of a single Microsoft Excel workbook organized in worksheets, which allows correlation of different stratigraphic curves and immediate visualization of the results.

This program was conceived to address the needs related to the environmental magnetism analyses, as a tool to correlate two distinct stratigraphic sections by taking into account multiple trends in rock magnetic and paleomagnetic parameters. It is also very useful for obtaining signal matching between two or multiple records of other proxies.

The whole workbook is free both for use and editing.

The released version of StratFit workbook is organized in 12 worksheets

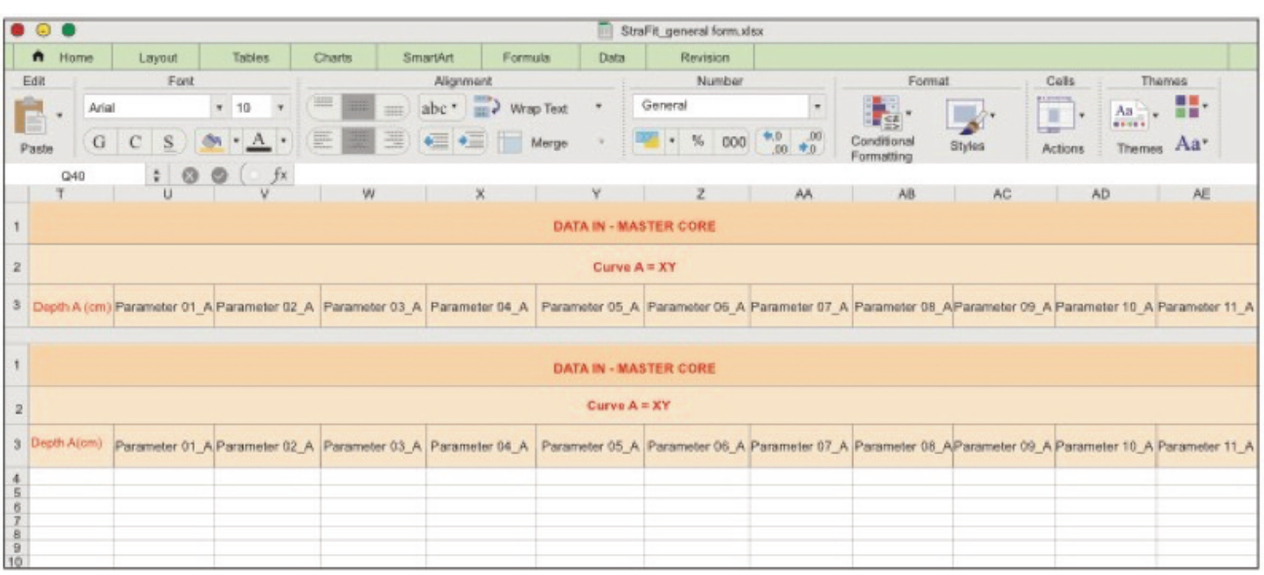


The green one is the “Data” worksheet, where the user introduces data for the two cores (one of which considered as “master” and the other as the correlative core) and makes the choice of the tie-points for the correlation. The yellow sheets show the plots of the stratigraphic trends for each parameter, where the user can visualize and check the correlations.

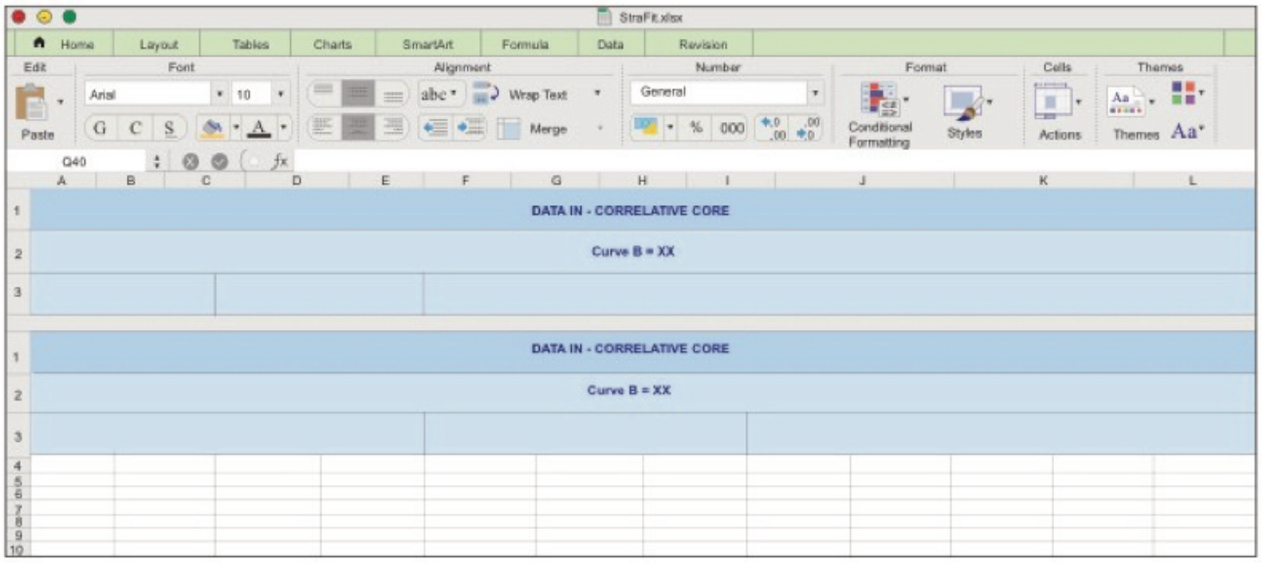
GREEN WORKSHEET

The correlation process consists in matching the depths of core B (listed in columns A to L, with headings marked in blue) with those of core A, the “master” core (listed columns T to AE, with headings marked in orange). This correlation is achieved by means of the tie-points, green cells in columns P and Q, where a depth of B is associated to a depth of A. The Excel “Forecast function” is applied in cells of column N, resulting in the correlation of each depth of core B to a corresponding depth of core A (i.e., a “common depth” in the stratigraphic framework of the master core). The stratigraphic framework (i.e., data in columns A and T) can also consist of ages rather than depths.

In practice, the user should copy the data of selected stratigraphic parameters (up to 11 in the released version) of the “master core” in columns T to AE, depths (or ages).

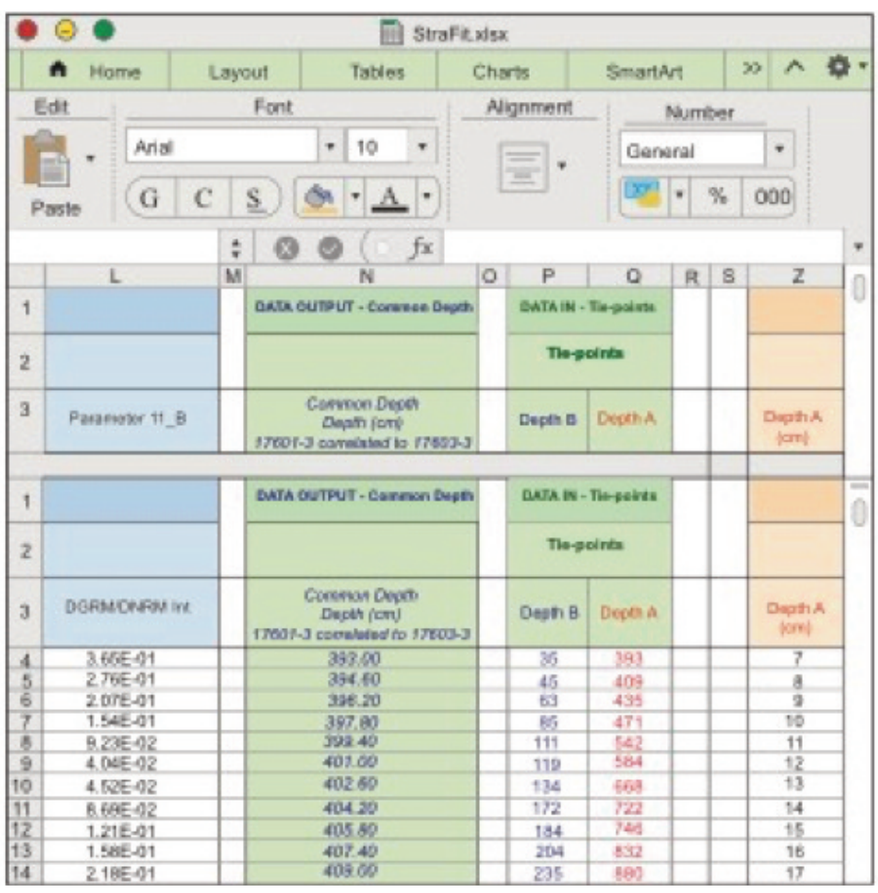


Columns A to L must be filled with data of the same parameters measured on the correlative core. In this case the depths (or ages) are in the first column A.



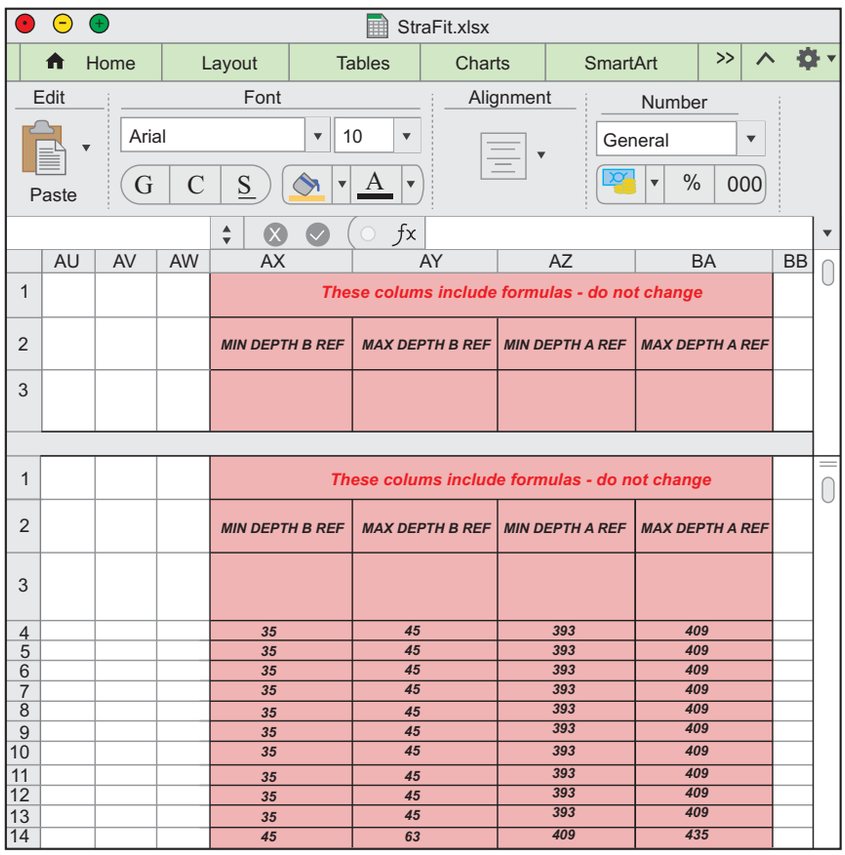
The columns P and Q are dedicated to the input of selected pairs of tie-points that allow the user to carry out the correlation among the curves finding the best common depth (or age).

The tie-points could be chosen either considering significant and coincident peaks and troughs of the stratigraphic trends or taking into account lithostratigraphic correlations and/or the information coming from other available stratigraphic constraints (e.g., ^{14}C ages).



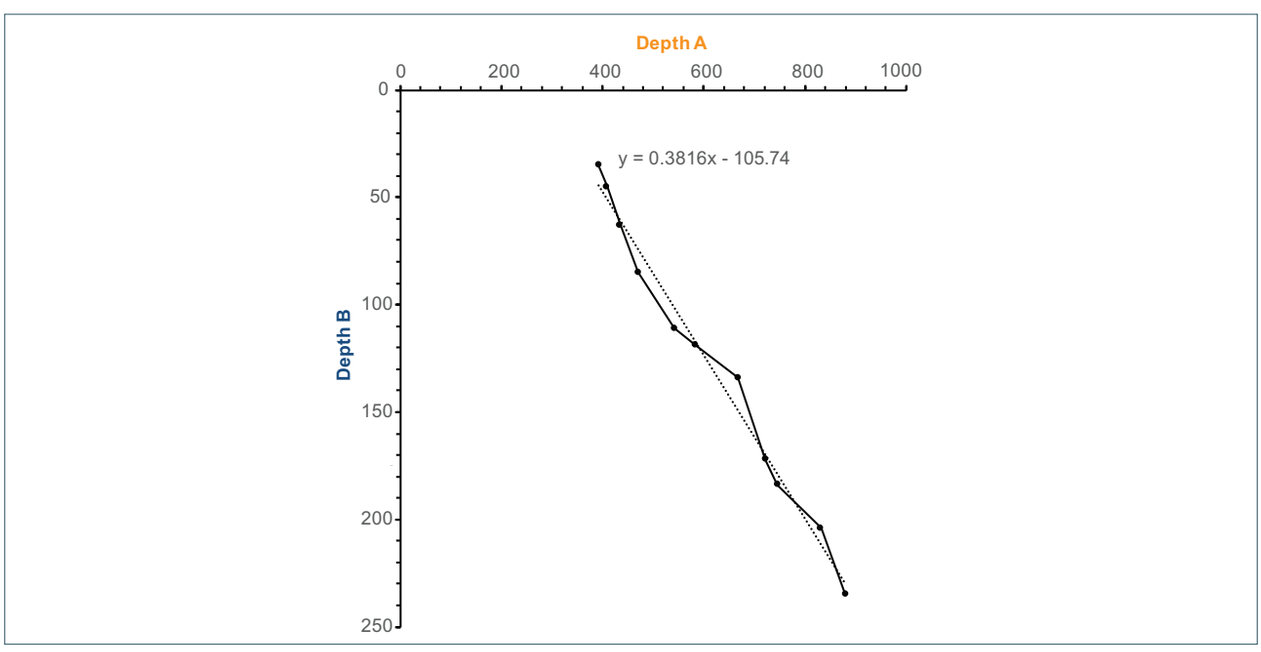
The common depth is computed in the column N according to the Forecast function.

Columns AX, AY, AZ and BA include formulas (based on the VLOOKUP, INDEX and MATCH functions) used to find the tie-point pairs on which apply the FORECAST function, for each x value of correlative core B. These columns are colored in red and should not be edited during the use of the software.



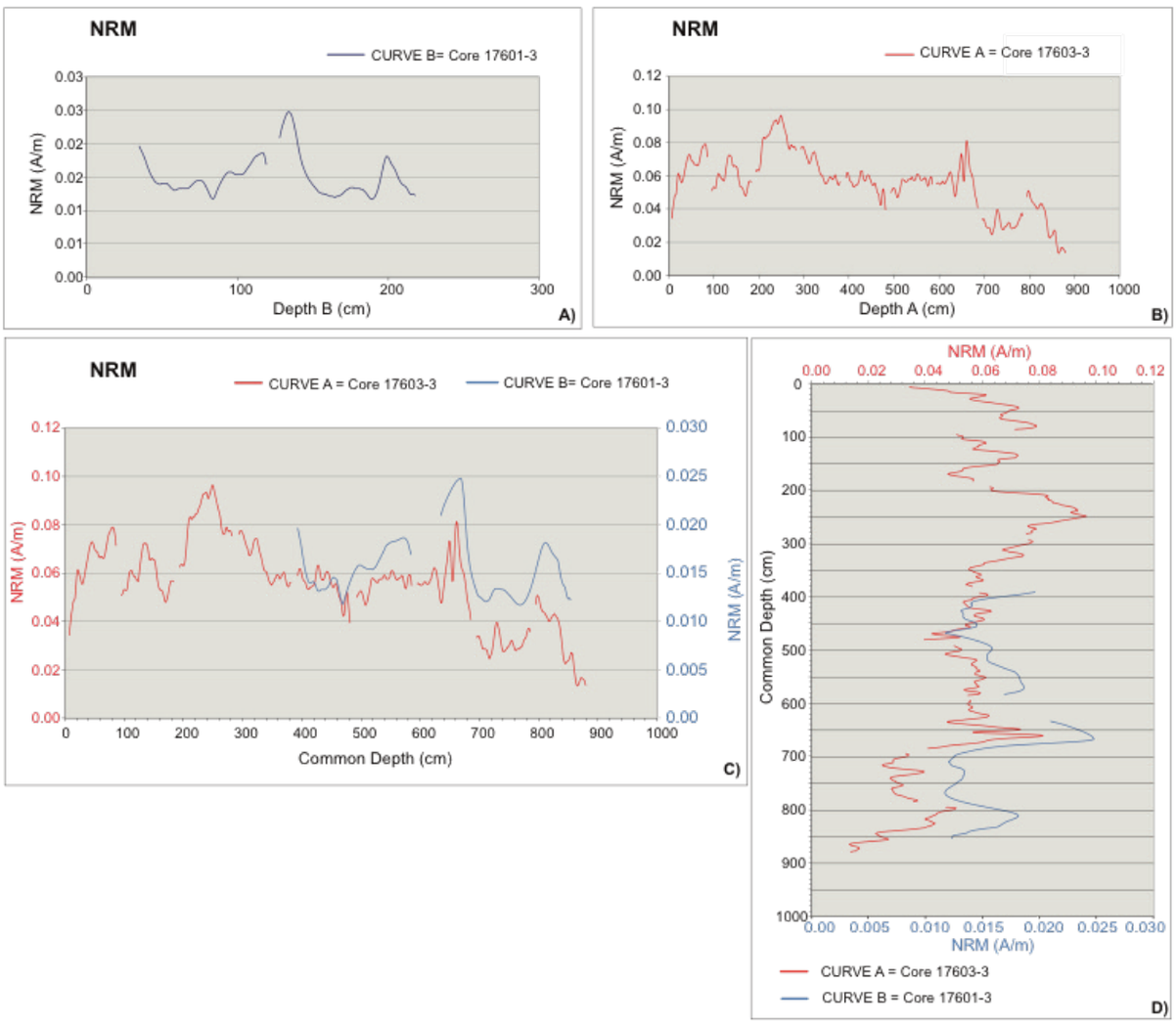
	AU	AV	AW	AX	AY	AZ	BA	BB
1				These colums include formulas - do not change				
2				MIN DEPTH B REF	MAX DEPTH B REF	MIN DEPTH A REF	MAX DEPTH A REF	
3								
1				These colums include formulas - do not change				
2				MIN DEPTH B REF	MAX DEPTH B REF	MIN DEPTH A REF	MAX DEPTH A REF	
3								
4				35	45	393	409	
5				35	45	393	409	
6				35	45	393	409	
7				35	45	393	409	
8				35	45	393	409	
9				35	45	393	409	
10				35	45	393	409	
11				35	45	393	409	
12				35	45	393	409	
13				35	45	393	409	
14				45	63	409	435	

The Data worksheet includes a graph "Depth A *vs* Depth B", to the right of column AE, resulting from the chosen tie-point pairs. This graph allows to visualize the relative variation in the sedimentation rate.



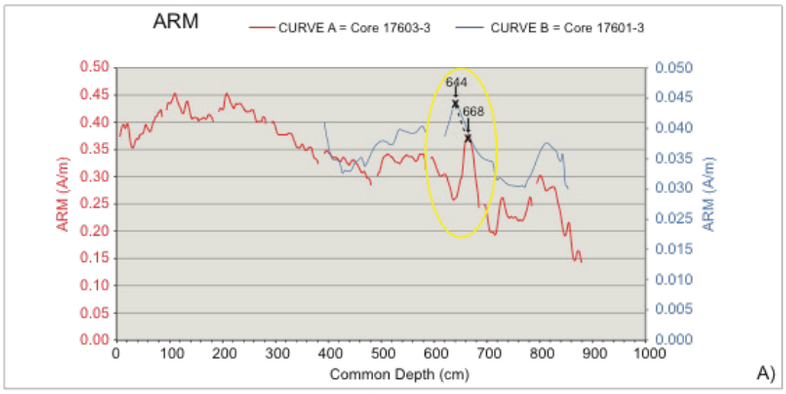
YELLOW WORKSHEETS

Each worksheet marked in yellow refers to a specific parameter and shows plots of the stratigraphic trends. On each sheet four graphs are reported. The graphs show i) the stratigraphic variation of the selected parameter in the stratigraphic coordinates (depth or age) of core B (A) ii) the stratigraphic variation of the selected parameter in the stratigraphic coordinates (depth or age) of the core A (B); iii) the stratigraphic trend of the selected parameter in a common stratigraphic framework, after correlation of core B to core A, both as horizontal (C) and vertical (D) plots. Observing the trends in the common stratigraphic framework, the effects of the matching by using the selected tie-points pairs can be promptly and easily visualized.



WORKING FLOW

The user has to paste the data in the specific columns: i) data of reference stratigraphic trends of the "master core" (Curve A) in columns T to AE, ii) data of the correlative core in columns A to L, and iii) some initial tie-points in columns P-Q. For the correct mode of operation of the worksheet the last tie-point of depth B has to be higher than the last value of the depth B. The user can then change some tie-points or add more. The initial tie-point pairs for core correlation can be deduced from available ^{14}C ages and/or lithostratigraphic constraints. After the initial stage, the correlation can be refined through an iterative process aimed to improve the matching between peaks and trough of the stratigraphic trends in multiple (up to 11) distinct parameters/proxies. To combine different peaks (or trends) the user can adjust the initial tie-points and add some additional tie-point pairs, as in the following example, referring to the stratigraphic trend of the ARM parameter, that is the intensity of the anhysteretic remanent magnetization, an artificial remanence produced by the simultaneous application of an alternating AF and a constant DC magnetic field, which depends on the concentration of ferrimagnetic minerals in the sediment.



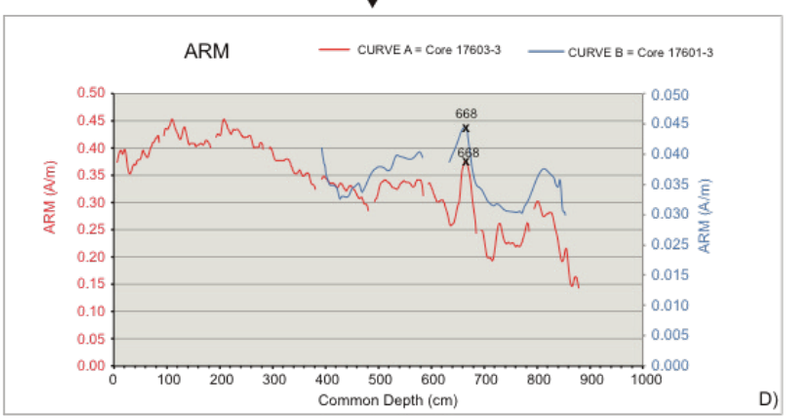
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Curve B = Core 17601-3														
Depth B (cm)	k ($10E^{-05}$SI)	NRM (A/m)	ARM (A/m)	Inc ChRM (°)	Decl ChRM (°)	MAD	MDF (NRM)	MDF (ARM)	NRM_{20mT}/ARM_{20mT} (norm-max)	NRM_{20mT}/k (norm-max)	ΔGRM /ΔNRM		Common Depth	
130	33.52	$2.28E^{-02}$	$3.60E^{-02}$	82.6	13.6	1.0	44.33	34.62	0.96	0.55	$8.72E^{-03}$		*628.71*	
131	32.19	$2.35E^{-02}$	$3.73E^{-02}$	82.3	13.3	1.1	44.57	35.35	0.96	0.59	$1.14E^{-01}$		*632.77*	
132	33.54	$2.41E^{-02}$	$3.87E^{-02}$	81.9	12.9	1.5	44.79	36.45	0.95	0.59	$2.36E^{-01}$		*636.84*	
133	33.55	$2.46E^{-02}$	$3.94E^{-02}$	81.3	12.3	1.7	44.92	37.03	0.95	0.60	$2.78E^{-01}$		*640.90*	
134	**34.90**	**$2.48E^{-02}$**	**$3.89E^{-02}$**	**80.4**	**11.4**	**1.7**	**44.90**	**36.61**	**0.97**	**0.58**	**$2.35E^{-01}$**		***644.97***	
135	33.58	$2.47E^{-02}$	$3.79E^{-02}$	79.6	10.6	1.5	44.75	35.70	0.99	0.60	$1.48E^{-01}$		*649.03*	
136	33.59	$2.42E^{-02}$	$3.69E^{-02}$	78.9	9.9	1.2	44.51	34.93	1.00	0.59	$6.43E^{-02}$		*653.10*	
137	33.60	$2.34E^{-02}$	$3.60E^{-02}$	78.8	9.8	1.1	44.25	34.53	0.99	0.57	$6.77E^{-03}$		*657.18*	
138	33.61	$2.24E^{-02}$	$3.52E^{-02}$	79.1	10.1	1.1	43.91	34.30	0.97	0.54	$0.00E^{+00}$		*661.23*	

B)

Tie-Points	
Depth B	Depth A
35	339
45	409
63	435
85	471
111	542
119	548
150	710
172	722
184	746
204	832
235	880

Tie-Points	
Depth B	Depth A
35	339
45	409
63	435
85	471
111	542
119	548
134	668
172	722
184	746
204	832
235	880

C)



Initial correlation implied the hypothesis that stratigraphic depth of 150 cm in the core B correlates to 710 cm in master core A. This assumption resulted in the plot shown in the upper figure. From this plot it is clear that the ARM peak of Core B resulting at a common depth of 644 cm depth following the correlation under the initial constraints matches closely the peak measured at 668 cm of depth in master Core A (A). In this case the initial pair of tie-points was adjusted to improve the correlation and to match the ARM peak observed in the two stratigraphic trends. To do this adjustment, the proper data were found in the "Data" worksheet, searching in column N

(Common depth) the value closest to 644 cm and finding the corresponding depth in the column A (Depth B) (B). The value is 134 cm, thus the new tie-points pair was defined as 134 - 688, which implies that depth 134 cm in core B was now linked to depth 668 cm in master core A. Typing these values in the tie-point columns (C) it is possible to visualize directly the effects of the change in the ARM stratigraphic trends from the two cores (D), as well as on all the other considered parameters, and then proceed with further analogous adjustments until the overall match is satisfactory.