AUTOMATED DATA PROCESSING. CUSTOM SOFTWARE APPLICATION FOR GEOECOLOGY (MS EXCEL BUILT-IN PROGRAMS)

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Abstract. The built-in MSExcell program herein presented allows for automating repeated tasks; editing and customizing recorded macros to suit our needs; editing recorded macros, viewing and modifying them, reading code, editing and adding comments to it, finding, replacing, moving and copying code; providing useful personalized complex programs; managing the way the user interacts with the application, to exchange information between application and its users, through Dialog Boxes, (DB), created by the user himself; inserting a new type of sheet, the dialog sheet, in a workbook, and placing objects such as buttons, edit boxes, list boxes within it to create a custom dialog box that acts like the built-in DB supported by MSExcel, (MSE) ; enhancing the Application with predefined DB; placing Controls on a Worksheet or Dialog Sheet; Using the Menu Editor, Button Image Editor; creating automatic procedures and add-in applications, using EVENTS etc. The main results of our personalized built-in program are the following: a very easy access to all, very numerous necessary parameters of a complete granulometric analysis; the complex graphic representations for each individual sample or for sample groups in every chosen number from 1 to 65,000 simultaneously, in probability paper diagrams (probability plots) or in linear scales, frequencies histograms and polygons, every MSExcel standard diagram type data presentation; input and output data table and main graphical results for flow and channel profile determination; simple and complex ternary diagrams from all fields, geology and especially sedimentology; Dozens of analytic and synthetic indices for a thorough ecological description of an ecosystem (constancy, abundance, density of population, ecological significance index, dominance, rank for each species as well as Simpson's indices of diversity and evenness for every site, similarity matrix, dendrograms etc); bathymetry and GPS data formatting, synchronization, processing etc - all those as the main purpose of all directly MSExcel built-in programs, in order to allow entire work as if everything would have been programmed by Microsoft itself, beginning from raw data input, intermediate and final processing, until the results presentation, everything in only one workbook, by a mere click on the customized buttons of a standard or personalized toolbar, but absolutely similar to the original Excel toolbars.

Key words: automating and customizing repeated tasks, macro, procedure, dialog box, edit box, menu editor, button image editor, events

INTRODUCTION

There are certain tasks routinely performed in Microsoft Excel (MSE) like regularly updating tables, figures, plotting data on charts, applying special formats. Many of these tasks can be automated to save our time and effort, by using the powerful Visual Basic programming language in Microsoft Excel, MSE. There is no need to understand computer programming to begin to put Visual Basic to work, because MSE includes a Macro Recorder, a tool built-in MSE that creates VB code for us, and so on, but recording **macros** should only be the beginning. We can also need to edit and customize recorded macros to suit our needs, or others can do that for us, to essentially facilitate our life.

A **macro** is a series of commands that MSE (or other programming systems) carries out automatically. For example, to format a range of cells we might choose the Cells command from the Format menu→ select a Font tab→ select a Font name, style and size and then choose the OK button. With a macro we can combine all these tasks and accomplish them in a single step. So, we can tailor MSE to our own needs and work even more efficiently. Once recorded, a macro (as a first, minimal but very important step to complex personal automation) can be assigned to a menu or a button, an icon on a standard or special toolbar. Then running the macro (or a very complex program, which is, in fact, a smaller or bigger association of macros) is as simple as choosing the menu item or clicking the button. We should at least consider recording macro any time we find ourselves regularly typing the same keystrokes, choosing the same commands, or going through the same sequence of actions (Opening a group of workbooks, printing several ranges of cells; Opening a database, sorting it, creating a report, and closing it; Setting up a new worksheet by entering titles, adjusting column widths, and applying special formats…).

MSE provides a Visual Basic toolbar that we can display by choosing the Toolbars command from the View menu, and we can use its buttons to record, run and stop recording macros. Then, we can make our macro easier to use, adding it to the Tools menu, assigning it to a button on a sheet, to a button on a toolbar, to a graphic object etc. We can then edit recorded macros, view and modify them, read VB code, edit and add comments to code, find, replace, move and copy code, record code into an existing macro, insert text from a file, make a macro interactive, add control structures, print VB Module, even customize VB, create user-defined functions; then we can evolve to a next step by introducing VB objects, collections of objects, VB procedures …to procedures of procedures and realize useful personalized complex programs, step by step learning about operators, constants, variables, statements, procedures and modules, objects, types and subtypes, control structures, and finally Testing and Debugging our code, Handling errors or error values.

One important aspect of creating a custom application in MSE is managing the way the user interacts with the application, in order to exchange information between our application and its users, through Dialog Boxes (DB) we create and support with VB procedures: use simple predefined Dialog Boxes, DB, insert a new type of sheet, the dialog sheet, in a workbook, and place objects such as buttons, edit boxes, list boxes within it to create a custom dialog box that acts like the built-in DB supported by MSE. We can use the objects called **controls** to create our own data-entry forms and wizards, use VB code to set and change the properties of controls and collect groups of controls together on a dialog sheet to create custom DB, develop procedures that present a custom DB to a user and respond to the information entered in it and finally associate procedures with actions taken in a DB, for example use a procedure to validate data entered in an edit box when the user presses the ENTER key (enhancing the Application with predefined DB; placing Controls on a Worksheet or Dialog Sheet; linking Controls to Worksheets; assigning Code to Controls and DB; displaying a Custom DB; Getting information from a DB etc). MSE comes with a set of default menus in a system of menus, menu commands, and shortcut menus. Using the Menu Editor, we can change this menuing system to suit our own needs: add a menu to any menu bar, add a menu command to that menu and assign it a procedure that runs when the user chooses the command. Toolbars provide a graphical counterpart to menu commands and work best for actions that are taken frequently. With Button Image Editor one can design toolbar buttons that picture an action to be taken. We can also create custom toolbars that work the same way the built-in toolbars do and assign procedures to toolbar buttons that run when someone clicks the button.

After customizing our applications, in quite a short time, we can even try to create automatic procedures and add-in applications, using the last major mode of interaction between MSE and other applications: **EVENTS** (where event is the occurrence of an action such as opening a workbook, switching to a sheet, using a particular key combination, recalculating a worksheet, and so on). Some events are initiated by the user, others are initiated by MSE or other applications. By assigning procedures to events, we can enhance the way the user interacts with his application.

There are three main classes of events, organized by the way the procedures associated with the events are implemented:

I - by using the Assign Macro command on the Tools menu to associate a procedure with the action of clicking a button/object.

II - by assigning **procedures to run automatically** when events occur by using a naming convention that begins with **AUTO**.

III - by creating **OnEvent** procedures (*i.e.* OnWindow/OnCalculate property) that run when their associated events occur.

IV - Finally, one can package MSE worksheets, controls, menus, toolbars, and supporting VB modules in the form of an **add-in application**, useful to assemble and distribute custom features that act as if they are built into MSE itself.

II - (creating Automatic Procedures, AP): an AP is stored in a workbook and runs automatically, such as when the workbook is opened (Auto_Open procedure) or closed (Auto_Close procedure). One can place AP in any VB module in the workbook. Workbook-level AP are identified by their names as they appear in the module: Auto_Open or Auto_Close. An Auto_Open procedure runs when a workbook is opened and it can set up menu bars (created with Menu Editor, for instance), customize the workbook for the operating system on which it is running, display a custom startup screen, initiate links to other files or applications.

More, one can create Defined-Name Automatic procedures (with names that begin with Auto_Open, Auto_Close, Auto_Activate, Auto_Deactivate) that are associated with specific worksheets rather than the whole workbook. Examples: Auto_Open_Public, Auto_Open_Files, Auto_Open_StartupScreen …

III - (creating **OnEvent procedures**, OE): an OE procedure (also called an **event_handler**) runs when a specified event occurs (an action generated by MSE environment, not necessarily by the user, such as the completion of a specified interval of time, the activation of a window, the recalculation of a worksheet, the pressing of a specific key sequence).

III A - one can use the OnTime method to run an OnTime event_handler at a specific time of day or after a specific period has passed (for example, in order to print or display a report). To run a procedure only once, set the **earliestTime** argument to a date and time rather than using the time alone.

III B - an OnSheetActivate handler runs whenever the user (and not another procedure) switches to a worksheet in an open workbook, in order to ensure that a specific toolbar that belongs to the workbook is displayed whenever the user switches to that workbook. Other methods and properties useful for this type of automation and customization: OnSheetDeactivate, OnWindow, OnKey, OnEntry, OnRepeat, OnUndo, **OnCalculate, OnData,** etc with names that by themselves suggest their use; so they run when the user: switches to a specified window, presses a specified key combination, enters data in a worksheet, chooses any of the various forms of the Repeat command, after a worksheet is recalculated or when data arrives from an application other than MSE, respectively.

Station	St. 1	St. 2	St. 10	Number of occurences	Frequency / Number of occurences/ Number of stations	Total abundance	Average density	Ecological density	Dominance Ab/AbT	Ecological significance index	Rank for each species	Current number
Species	**D m-2**	**D m-2**	**D m-2**	**Nooc**	**F%**	**A_D**	**D_{AVG}**	**D_{ECO}**	**D%**	**W**	**R_{kD}**	
Ammonia becarii	2064	1290	1290	10	100,00	16082	1608	1608	5,82	24,12	4	1
Ammonia perlucida				1	10,00	86	9	86	0,03	0,56	68	2
Ammonia tepida	172		602	6	60,00	2408	241	401	0,87	7,23	16	3
Halacareus basterii affinis	172	172	430	6	60,00	1634	163	272	0,59	5,96	24	79
Eugyra adriatica				1	10,00	86	9	86	0,03	0,56	80	80
Molgula euprocta		86	86	2	20,00	172	17	86	0,06	1,12	64	81
Total densities	32165	22016,5	22189	81		276411	27641		100			
Total number of the species in the site	45	32	42						90,45			
HMAX	5,49	5,00	5,39						26			
H	4,03	3,60	4,33									
Evennes: E=H/log(S),H/HMAX	0,73	0,72	0,80									
Simpson index: D=sum(pi*pi)	0,12	0,14	0,08									
Simpson's index of diversity: 1-D	0,88	0,86	0,92									
Simpson's reciprocal index: 1/D	8,09	7,23	11,92									

Fig. 1 The 4 corners of one big table with raw data and the computed ecological indices

	1	2	3	4	5	6	7	8	9	10	
1		0,701	0,638	0,373	0,638	0,579	0,729	0,493	0,786	0,759	1
2	0,701		0,593	0,391	0,536	0,603	0,639	0,433	0,648	0,649	2
3	0,638	0,593		0,317	0,466	0,575	0,629	0,338	0,523	0,593	3
4	0,373	0,391	0,317		0,526	0,444	0,370	0,286	0,302	0,393	4
5	0,638	0,536	0,466	0,526		0,655	0,500	0,500	0,603	0,515	5
6	0,579	0,603	0,575	0,444	0,655		0,507	0,475	0,514	0,548	6
7	0,729	0,639	0,629	0,370	0,500	0,507		0,500	0,684	0,707	7
8	0,493	0,433	0,338	0,286	0,500	0,475	0,500		0,507	0,571	8
9	0,786	0,648	0,523	0,302	0,603	0,514	0,684	0,507		0,667	9
10	0,759	0,649	0,593	0,393	0,515	0,548	0,707	0,571	0,667		10
	1	2	3	4	5	6	7	8	9	10	

CAPTION: SIMILARITY INDICES

0.2...0.3	0.3...0.4	0.4...0.5	0.5...0.6	0.6...0.7	0.7...0.8	0.8...1

Fig. 2 The coloured Similarity Matrix for the group of ten sites

	1	2	3	4	5	6	7	8	9	10	
1		0,701	0,638	0,373	0,638	0,579	0,729	0,493	0,786	0,759	1
2			0,593	0,391	0,536	0,603	0,639	0,433	0,648	0,649	2
3				0,317	0,466	0,575	0,629	0,338	0,523	0,593	3
4					0,526	0,444	0,370	0,286	0,302	0,393	4
5						0,655	0,500	0,500	0,603	0,515	5
6							0,507	0,475	0,514	0,548	6
7								0,500	0,684	0,707	7
8									0,507	0,571	8
9										0,667	9
10											10
	1	2	3	4	5	6	7	8	9	10	

CAPTION: SIMILARITY INDICES

0.2...0.3 0.3...0.4 0.4...0.5 0.5...0.6 0.6...0.7 0.7...0.8 0.8...1

Fig. 3 The black and white Similarity Matrix for the previous case presented in figures 1, 2

EXAMPLES

Most of the above-mentioned possibilities – particularly, procedures or even very complex programs attached to buttons on either standard or customized toolbars – have been used for our main results, namely:

- parts of the results table for ecological indices calculation, a dendrogram, a similarity matrix;-Granulometry, sedimentology: results table for all parameters; graphical results such as Cumulative Curves Probability Plot, individual sample complete card, histograms, simple frequencies polygons, Shepard and Folk ternary diagrams, Passega, pie, bar, scatter and many other diagram types.
- flow and channel profile determination: input and output data table, main graphical results;
- simple and complex ternary diagrams from all fields, geology, mostly and particularly sedimentology;
- bathymetry and GPS: data formatting, synchronization and processing.

A - **Computing programme for analytic and synthetic ecological indices describing ecosystems**, has been created and made available (customized) for GeoEcoMar biology and ecology scientists, validated on Danube Delta and Black Sea sites but workable for any other natural ecosystem. Dozens of analytic and synthetic indices for a thorough ecological description of an ecosystem (constancy, abundance, density of population, ecological significance index, dominance, rank for each species as well as Simpson's indices of diversity and evenness for every site, similarity matrix, dendrograms, etc) are but a click away. Just push the button of this MSExcel built-in program, illustrated here by data from some sites of the 2002 Danube Delta research campaign – in Uzlina, Caraorman and so on. It proved to be the best possible solution as both raw data (densities and biomasses) and final results (columns, tables, graphics, dendrograms) need tabular input, processing, editing and presentation.

All operations of this programme (input, intermediate and output data) from the beginning to final editing in the form of graphics, tables, dendrograms, schemes, etc are realized in only one workbook, or, where possible, in only one sheet, the best solution being to introduce in a first sheet the raw data, a line for each found species (up to 65,000 different species) and a column for each investigated site (up to 200 sites simultaneously) and the results are obtained in a few seconds, as follows (Figs. 1, 2, 3, 4):

- on successive columns, at the right of the last site's raw data column, we obtain all desired ecological indices, such as constancy, abundance, average and ecological density of population, number and frequency of appearance, ecological significance index, dominance, rank for each species etc.
- on rows, under the last line of raw data of the last species of the primary table, we obtain the characteristic ecological indices of the sites, such as the Total Densities in the site, the Total Number of the species in the site, Simpson's indices of diversity and evenness for every site.
- similarity matrix of the searched sites and coenotic affinity matrix of species found, together with the drawing of the dendrograms, on the same sheet or on separated sheets, to facilitate the further editing-processing according to the needs of the study or presentation

- automatic making evident (especially in red *versus* black colours) of data of peculiar interest (for example, colouring in red the first ten species with the highest ranks, the different colouring of the species whose summarized dominance reach a limit of 90% in the site etc.).

The programme's use is overly simplified by interaction, message and data input boxes, special control panel, visible on request, with graphic buttons which display the command's name by simply keeping the mouse pointer stationary on them, the same way to the MSExcel implicit bars and buttons, with the buttons' aspect editing possibilities, password protection, read-only display, and so on. Direct access to the source-code, for maximum efficiency, allows for automations and customizations of the programme according to user.

Since the input-output data table is very big, Fig. 1 only illustrates its four corners; a yellow column and a yellow row, the raw data, from the left-up corner, are automatically separated by the programme, from the output data, obtained in the other three corners. Space do not allow for the selection of all the columns (corresponding to all sites studied) and all dozens / hundreds / thousands of rows (species), found in them, to be represented on a A4 sheet, so we selected only the first two and the latest columns-sites, and the first three and latest three rows-species only, separated by two void rows and one void column which represent the breaking in table between the first and latest data. In red, under the species' dominance column, one can notice that the species sum up to 26, a total that exceeds the threshold of 90% (90.45% in this case, to be more exact), three out of 26 being included in our selection of 6 species, at the table's beginning and end, one of them having the rank between the first ten, *i.e.* the first in the table, *Ammonia becarii*, with the rank 5, written in red, the dominance 5.82% and the current number 1.

Fig. 2 shows the coloured Similarity Matrix for this group of ten sites from the October 2002 Danube Delta-Seaside research campaign with suitable cell colouring (darker hues, from yellow to garnet-red, as the similarity value of the two corresponding sites that determine a cell increase), but which cannot replace a dendrogram, which give us the accurate sites junctions values and, in favour of which, the Similarity Matrix serves only as a departure point of automated display.

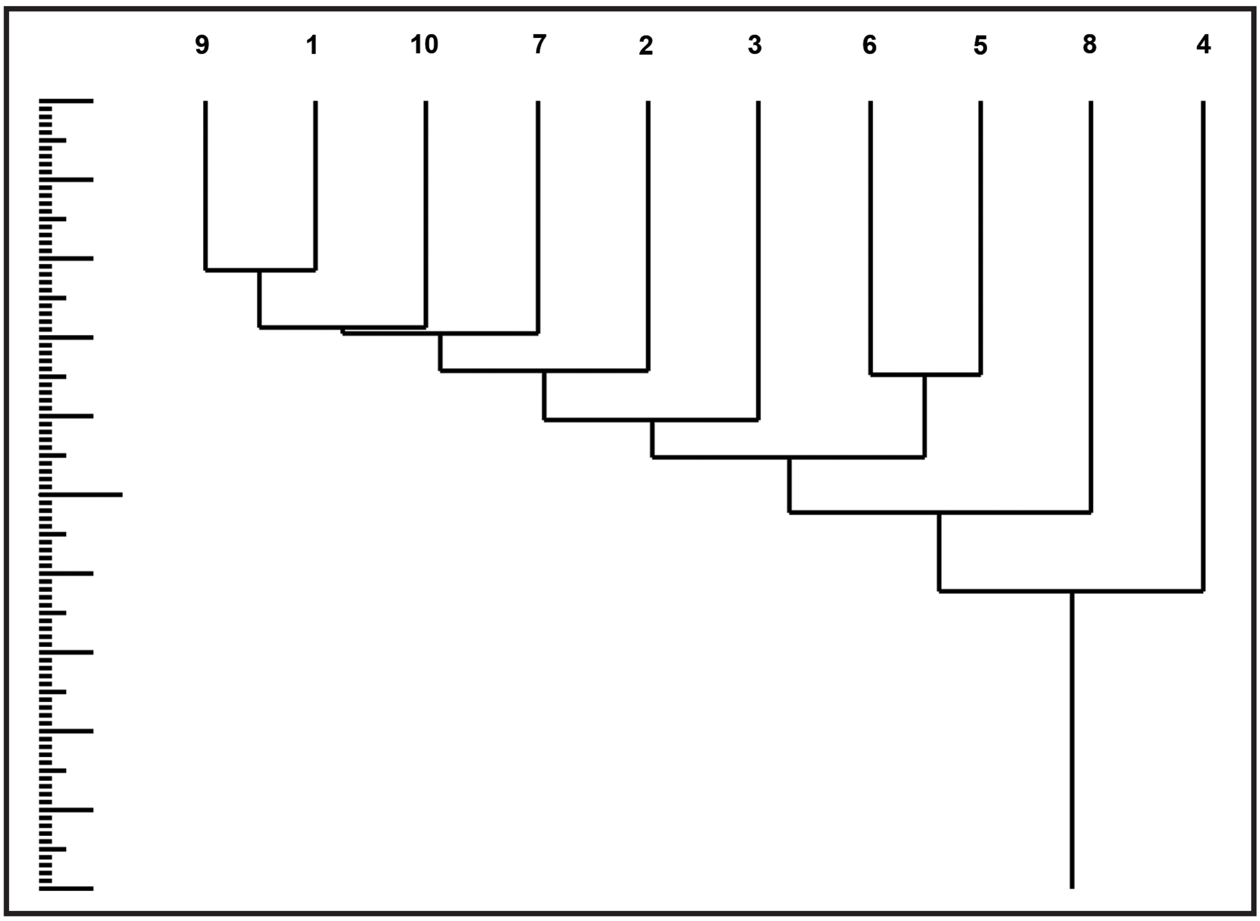


Fig. 4 The dendrogram for the case of 10 sites, October 2003, Danube Delta – Black Sea Seaside

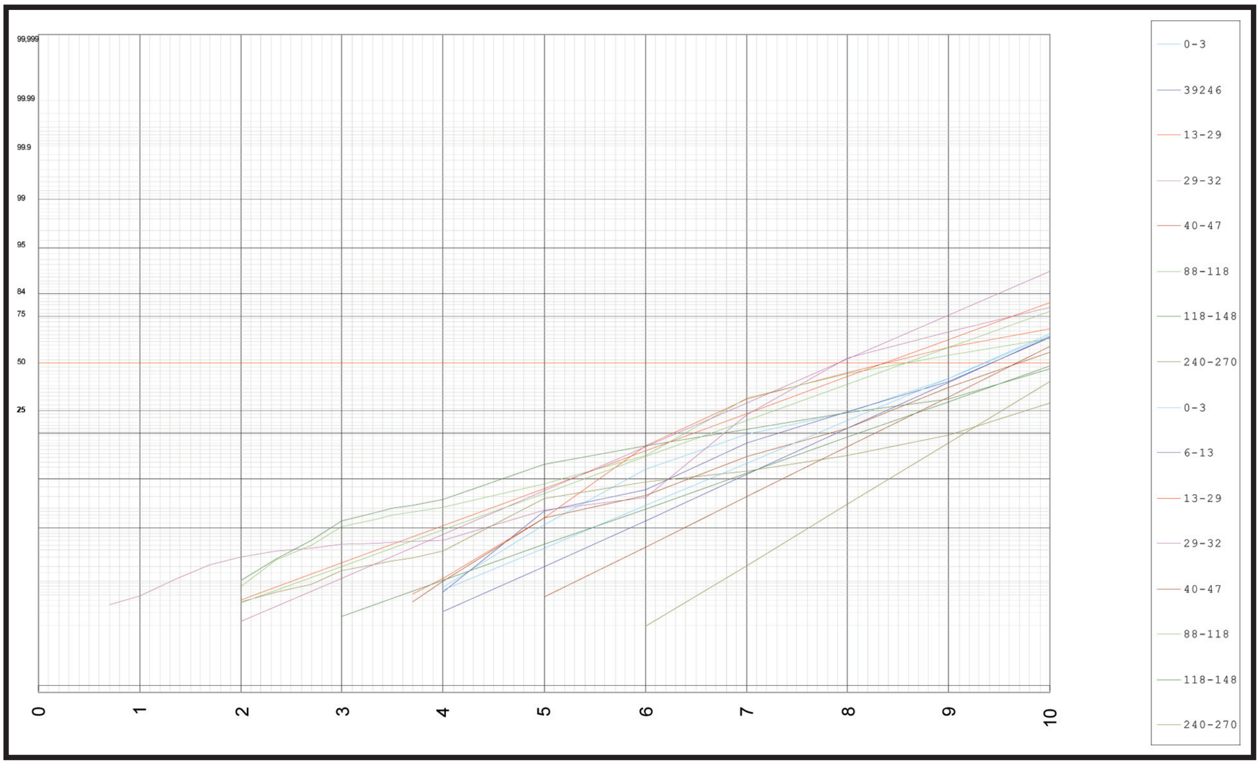


Fig. 5 Cumulative Curves Probability Plot, CEX 2006

The dendrogram corresponding to the matrix above is displayed in the next figure, 4, with the sites in their precise order, which cannot be strictly defined from the Similarity Matrix, but only by the accurate computations for the dendrogram building, in many steps, presented in the mentioned work, using a special table of step by step calculations.

B - **MSExcel built-in program for flow and channel profile determination**. The results of this program are a quick display of the flow through a transversal section and a display of the section's area and of its profile, all these in the same worksheet as the input data (bathymetric data, speeds and depths measured on a minimum number of at least 3 Verticals on each profile).

Once the input data (already pre-prepared by using personal special routines: depths, East and North geographical positions, etc) is adequately introduced, a simple mouse click on the (built-in Excel) DEB button is needed, which will start virtually instantly the automated achievement of all tabular and graphical desired results, presented in a single MSExcel sheet. The program is exemplified with the Sf. Gheorghe km108,4 profile from the 2004 campaign (Fig.11).

The 4 graphics automatically obtained, simultaneously with and on the data table, show: B1-Lat.N-Long.E, with the measurement point's geographic positions, as well as with their projections on the line joining the two borders marks; B2-Depths(m)- Distances(m); B3-Depths(m)-Eastern Longitude;B4-Depths(m)-Inverse Distances(m);

The first graphic, B1, upper-left, "Trajectories", was entirely described in the mentioned work, and the 3 subsequent graphics display the channel's profile as follows: B2 represents additionally, in blue, the bathymetry projections curve; in red, the 5 Verticals projections depths (with the values enclosed), and in black, the curve of the 6 degree polygon that the best approximate, as a function, the blue bathymetric curve, while the equation of the 6 degree function is written, just in the middle of the 3 functions, under the table: the first function, of degree 1, is, obviously, the equation of the line joining the two borders, on which the bathymetry and the Verticals profile are projected, while the last, third function is the polynomial function of the same degree 6, (the maximum degree with which Excel and its incorporated language, VBA, work), which best approximate the red, Verticals profile curve. The last two graphics, B2 and B3, in right side, also represent the depths, in meters, but not as functions of the East geographic coordinates, but as functions of the distances to the two borders, in meters (D, to a border, and Dinv to the other border).

C. **Complex MSExcel built-in program for sedimentology, granulometry.** The main results of this personalized built-in program are: a very easy access to all, very numerous necessary parameters of a complete granulometric, grain size analysis (simple and cumulative frequencies, percentages-percentiles, mean, median, dispersion-standard deviation-sorting, asymmetry, kurtosis, skewness, gravel-sand-silt-clay factions and their sub-factions from Very Coarse Gravel to Fine Clay - the names are in keeping with the Shepard/Link/Folk ternary classifications); the complex graphic representations for each individual sample or for sample groups in every chosen number from 1 to 65,000 simultaneously, in probability paper diagrams, probability plots, or in linear scales, frequencies histograms and polygons, every MSExcel diagram type (column, bar, line, pie, xy-scatter, area, doughnut, radar, surface, stock etc); the possibility to use absolutely all MS-Office graphic and table facilities of selecting, copying, pasting, resizing, moving, aligning, colouring, sorting, filtering, every font formatting, transferring of texts, tables and graphics between different applications, pivot tables and reports, etc as the main purpose of all directly MS-Excel built-in programs, in order to allow entire work as if everything would have been programmed by Microsoft itself, beginning from raw data input, intermediate and final processing, until the results presentation, everything in only one workbook, by a mere click on the buttons of a toolbar, but absolutely similar to the original Excel toolbars.

It should, once again, be strongly emphasized that the colours are crucial to this program, too, both for presenting the maximum amount of information (since coloured presentations supply much more information than a black-white–grey graphic, which, however, provides incomparably more information than the mere text, without graphics) and to facilitate the following of one and the same sample through all possible types of graphic presentations (simple and cumulative frequencies in arithmetic and probability plots or in linear scales, frequencies histograms and polygons, every MSExcel standard diagram type (column, bar, line, pie, xy-scatter, area, doughnut, radar, surface, stock,etc). The program can also automatically colour the sample data/numbers from tables, in the same colour as the sample's graphics; the program user can also choose a second colour correspondence between a) the colours of the segments bar indicating sub-factions fields (from Coarse Gravel, Medium Gravel,…, to Coarse, Medium and Fine Clay) on the graphics probability paper type and b) the colours of corresponding segments on the bar, column, ring, doughnut, etc diagrams.

Fig. 5 represents the Probability Plot (PP) with the global spectrum of the samples from the Black Sea (BS) bottom from depths in sediments of 0-3, …, 240-270 cm taken by a corer in the 2006 Black Sea campaign generically named CEX 2006 (at a depth of 800 m, many km off Constantza harbour, (Someş m/v), and gives us a first global image on the respective BS bottom sediment. (Our purpose now is not to thoroughly examine a certain group of samples, from a given region at a given time, but only to highlight the possibilities of our program and of the MSExcel built-in and customized programming in general. We also underline that the PP graphic, which benefits from all available MSE facilities, can be minimized to the size of a button, an icon, etc, by selecting a predefined percentage or by typing any desired percentage in the corresponding zoom area, so that the graphic can be made as distinct and detailed as possible.

RESULTS

From all viewpoints, the study is much more accurately displayed on the computer screen than on printed paper, on as big format as we need, be it even A3, A2, A1, due to other MS Office facilities, such as the automatic appearance of a narrow band with the name of the curve on which the user sets the mouse pointer and waits for the menu to appear (so that we can have hundreds and even thousands of curves on the screen simultaneously, in numerous colours and shades, and the user can still find out the name of each of them. Yet, since the entire range of horizontals of the paper's grid are displayed (from 0.01 to 0.01 % inclusive, in intervals of the very little and very big frequencies, respectively, as the main PP purpose is precisely the emphasizing of these extreme fields, by transforming every "S" curve into a straight-line curve), the screen would appear unattractively oversaturated with a permanent display of all horizontals marks values which makes them difficult to read and, thus, useless. One can learn, on the screen, each horizontal value by simply touching a point of it with the mouse arrow point. Moreover, any horizontal marking can be selected and erased, thickened or coloured at request, although, generally speaking, it is not needed, because the main horizontals, those of the percentiles used in the computation of the statistical granulometric parameters (graphical mean, sorting/standard deviation, asymmetry, kurtosis), calculated based on the Folk and Ward formulae, namely the 1,5,16,25,75,86,and 99 (%) percentiles, are anyhow, highlighted by the program, with black versus grey for the rest of the grid, while the most important percentile, of 50%, which corresponds to the median, is represented by an extremely visible red horizontal. The program was mainly conceived to enable the user to work directly on the screen. Thus, apart from the maximum information gain, easy access and clarity the program also helps save a great amount of paper and, especially, coloured ink, a very expensive consumable, because only some graphics will be printed, with some especially selected samples. Meanwhile, the user can study on the screen millions of PP simulations without supplementary cost, for each sample separately or for samples groups selected at request in as many numbers as we

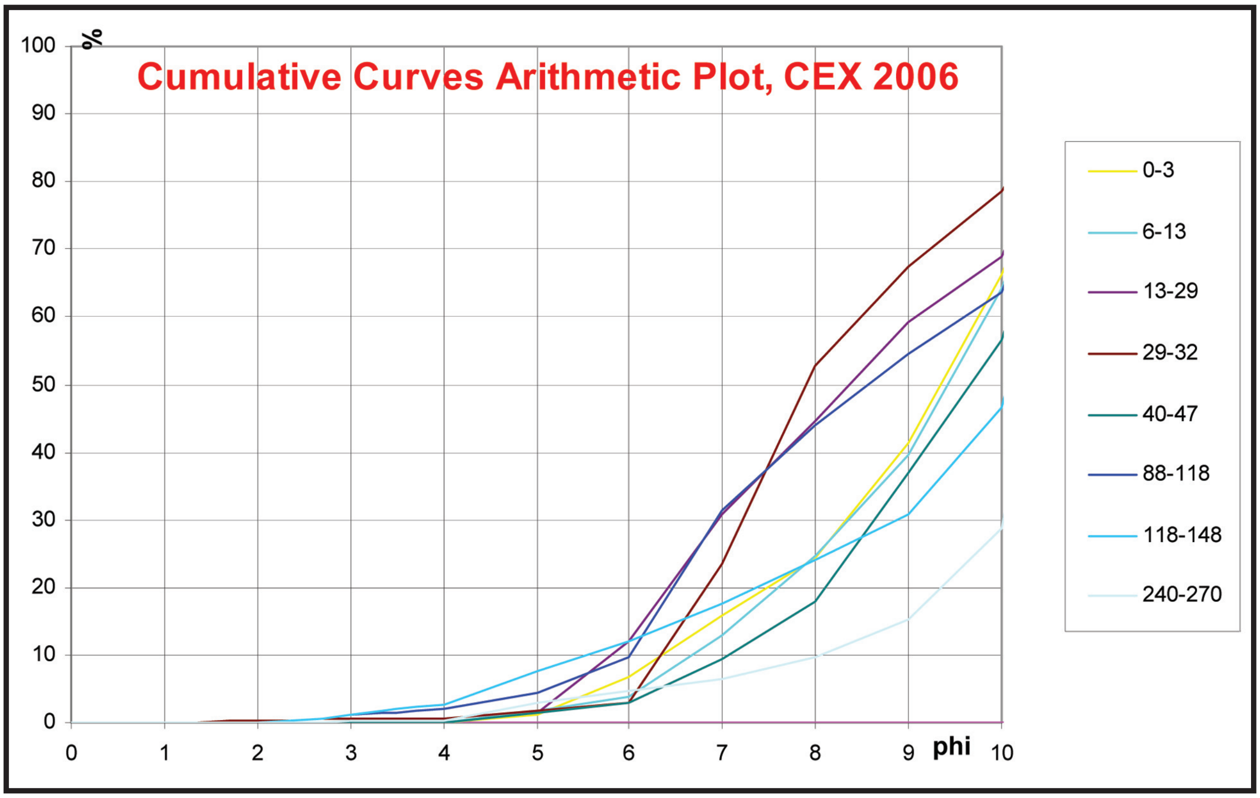


Fig. 6 Cumulative Curves Arithmetic Plot, CEX 2006

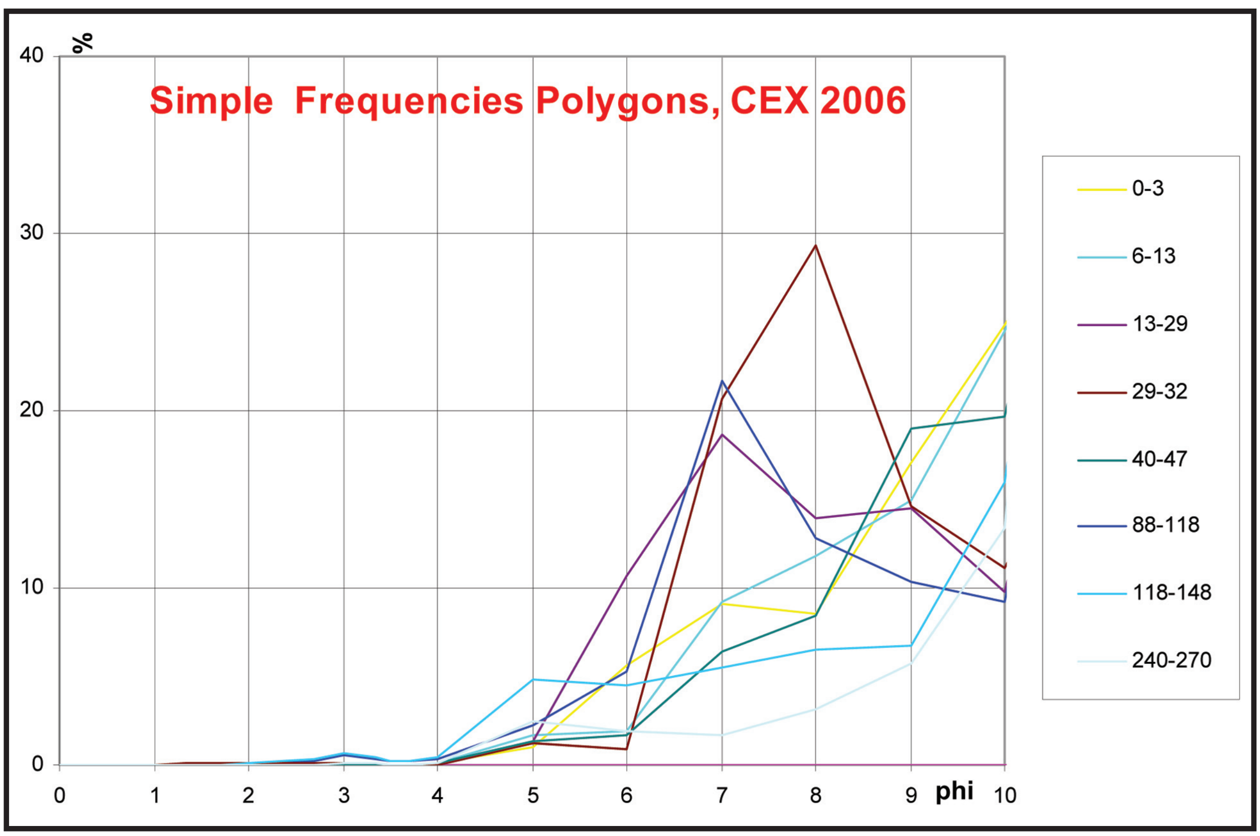


Fig. 7 Simple Frequencies Polygons, CEX 2006

please, from one to hundreds and even thousands. Only the most representative graphics will be printed, namely, those to be finally included in scientific works.

Considering the above explanations, it is easy to perceive the possibilities offered by the program for the following very rapid conclusions. So, from figure 5, for the particular case studied, everyone can immediately see that:

- all curves begin from the right of the Ø=0 abscissa, so no sample contains gravel; in fact, only one begins from the left of 2 Ø, (MediumSand, "NisipMediu", NM) only 3 of them from the left of 3 Ø (NFF="NisipFoarteFin", Very Fine Sand); More, all of them intersect the Ø=4 abscissa under the horizontal percentile of 5 (%), that is they all contain < 5% Sand, and most of them even < 1% Sand, (N), they being pure mud, S+A, (SA, AS or even A, "argile", clays !). All these conclusions are also obvious from the Results Table, and strongly confirmed by the other graphics, figures 6, 7 etc (arithmetic cumulative curves, frequencies polygons, histograms etc) → that is why we eliminated the left sides from the graphics, the negative Ø values, keeping only the right sides, for positive Ø values, (Ø>0, 0-10 Ø intervals, from Fine Sand to Clays, that is the textural types NF,NFF, S and A).
- all real PPCC curves (Probability Plot Cumulative Curves) have very little abatements from their straight Gaussian Normal Segments (represented in the same colours on the same PP graphic, Fig. 5), that is very little lognormal abatments, indicating mesokurtic to very platicurtic aspect, bad sorting, etc.
- from the results table one can easily see the samples granulometric content of 0% P, (gravel), 0.05-2.7 % N, (Sand) (more, in fact only the sample from 29-32 cm has an insignificant quantity, 0.0485 %, of Coarse Sand, NG. This one also has the smallest median value, 7.9 Ø Mdn and 8.26 Ø Mdz, the only one easy positive Ski (0.2643), the only one marking in the SA Shepard field (all the rest being AS or even pure A). Anyhow, all are pure mud, without gravel and very little grained sands.

These results are also confirmed by other table's columns:

- the column of median place name, cf. Wentworth, shows that 29-32 cm sample has the only one median in the SFF ("SiltFoarteFin", VeryFineSilt) Wentworth field, all other 7 being in the Clays ("Argile", A) fields, namely 2 samples in AG, 3 in AM and 2 samples even in the AF field ("ArgileFine", FineClays); This 29-32cm sample is the only one with positive asymmetry, the other ones being most with strongly negative asymmetry (5 samples), negative (1 sample) and one of them having a symmetric PPCC curve.
- the sorting is poor, reduced for all samples absolutely, their standard deviation, σ, being in the 1.15-1.96 Ø interval, (0.255-0.45 mm);
- the poor sorting is evident from the PPCC graphic, Fig. 5, the PPCC abatment from lognormality (the Normal PP segments) being small; this is obvious for each sample, showed for the 6-th curve, 29-32cm, chosen by us as Individual card exemplification (Fig. 10), where everyone can see the insignificant abatment of its PPCC curve from its Normal, Gaussian straight segment.
- all these samples intersect the Ø=10 abscisa at an ordinate's narrow interval, between 25 and 75 %, indicating very fine textures, clays and even colloidal clays, which would thus need further finer detail methods (subsequent to the sand faction dry sieving followed by the pipette/sedimentation method for silt and clayey factions determination).
- the medians (the curves' intersections with the red horizontal, of the 50% percentile), are, all, at the farthest right of the figure, at the right of the Ø=7 vertical, that is, in the right of the SFF ("SiltFoarteFin", VeryFineSilt) field, the great majority in the right of 8 Ø, even in the right of 9 Ø, medium and fine clays, colloids. - the samples are silt, even clay mud, confirmed by all types of tabular values and graphics.
- same conclusions can give us the normal repartitions spectrum, if we represent it on a separate graphic, but we preferred to represent them on the same Fig. 5, each normal repartition straight segment in the same colour as its real CC correspondent. This representation supports the previous conclusions concerning the slow increases; gentle slopes of all lines substantiate the conclusion regarding the big dispersion, big σ values, or reduced sorting. We have also presented the normal repartitions spectra to demonstrate, once again, the accuracy of our program in the computerized simulation of the PP, which really transforms in straight lines all normal repartitions (which is the declared purpose of the PP invention).

The program also matches colour to entire groups of samples, whatever the number of groups and whatever the number of samples in each group. For instance, if we represent on the same graphic all hundreds of cores in a campaign, a specific colour is assigned for a certain depth in core (in this case 0-3cm, 3-6cm, 6-13cm, 13-29cm, 40-47cm…) by simply completing the Message-Box in an interactive-conversational manner; the Message-box appears on the screen by merely clicking our special button from the program's toolbar. The program can also give the order number of each sample in the input data and final results tables, of 5 maximum characters, MSE being able to work with 65,000 lines at the most, that is 65,000 different sam-

Sample	S%	N%	ST	NT	Shep	Sample	S%	N%	ST	NT	Shep	Sample	S%	N%	ST	NT	Shep
A1	35,5	28,2	57,2	28,2	NSA	C1 BODEN	83,9	1,1	97,5	1,1	S	E1	55,3	2,8	65,5	2,8	SA
A2	25,4	17,3	39,3	17,3	AS	C1 BOX	84,3	0,8	97,8	0,8	S	E3	51,8	0,7	60,3	0,7	SA
A3	37,9	10,1	49,6	10,1	AS	C2	8,3	70,8	50,4	70,8	NA	E3 0-1	45,3	0,3	52,4	0,3	AS
A4	39,6	9,8	51,4	9,8	AS	C3	1,6	96,8	57,7	96,8	N	E3 1-2	51,2	0,2	59,3	0,2	SA
A4 0-1	13,6	56,7	48,5	56,7	NA	C4	57,8	0,9	67,2	0,9	SA	E3 2-4	53,7	0,9	62,5	0,9	SA
A4 1-2	29,3	40,4	57,2	40,4	NSA	D1	42,0	36,3	69,5	36,3	NSA	E3 4-6	47,2	1,1	55,1	1,1	AS
A4 2-4	24,9	34,5	48,6	34,5	NSA	D1 0-1	30,1	53,8	65,8	53,8	NS	E3 6-8	41,6	1,1	48,7	1,1	AS
A4 4-6	26,8	28,2	47,2	28,2	NSA	D1 1-2	39,7	29,4	62,9	29,4	NSA	E3 8-10	46,2	2,3	54,6	2,3	AS
A4 6-8	19,2	24,6	36,4	24,6	AN	D1 2-4	43,3	20,6	61,9	20,6	NSA	E4	16,5	52,2	49,1	52,2	NA
A4 8-10	23,3	11,0	33,3	11,0	AS	D1 4-6	30,8	45,6	61,9	45,6	NSA	E5	15,7	26,6	33,5	26,6	AN
A5	34,9	4,0	42,6	4,0	AS	D1 6-8	44,8	16,3	61,1	16,3	SA	F1	47,0	0,6	54,6	0,6	AS
A6	28,0	23,6	46,0	23,6	NSA	D1 8-10	56,6	5,2	68,4	5,2	SA	F1 0-1	38,4	0,1	44,4	0,1	AS
B1	6,0	86,3	56,7	86,3	N	D2	5,6	91,8	59,5	91,8	N	F1 1-2	32,4	0,5	37,7	0,5	AS
B2	5,3	88,0	56,9	88,0	N	D3	8,9	82,6	58,0	82,6	N	F1 2-4	39,2	0,8	45,7	0,8	AS
B3	8,1	79,5	55,2	79,5	N	D4	2,4	94,6	57,4	94,6	N	F1 4-6	55,9	0,4	64,8	0,4	SA
B4	37,2	32,2	61,5	32,2	NSA	D5	41,5	29,9	65,2	29,9	NSA	F1 6-8	54,9	0,6	63,7	0,6	SA
B5	0,6	95,8	56,0	95,8	N	D6	32,2	30,0	54,5	30,0	NSA	F1 8-10	50,8	1,3	59,4	1,3	SA
B6	30,4	32,3	53,7	32,3	NSA	D7	0,0	100,0	57,7	100,0	N	F2	38,0	0,7	44,2	0,7	AS
B7	10,9	75,8	56,4	75,8	N							F3	31,7	29,8	53,8	29,8	NSA
												F4	41,9	0,4	48,6	0,4	AS
												F5	56,0	1,5	65,5	1,5	SA
												F6	50,3	2,1	59,3	2,1	SA

Table 1 The tabular data for fig. 8 (Shepard ternary diagram)

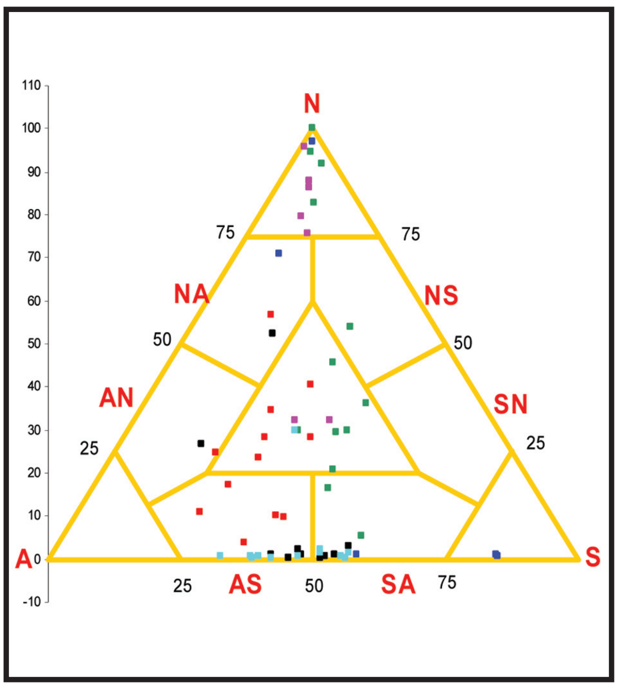


Fig. 8 Shepard ternary diagram example (data in table 1)

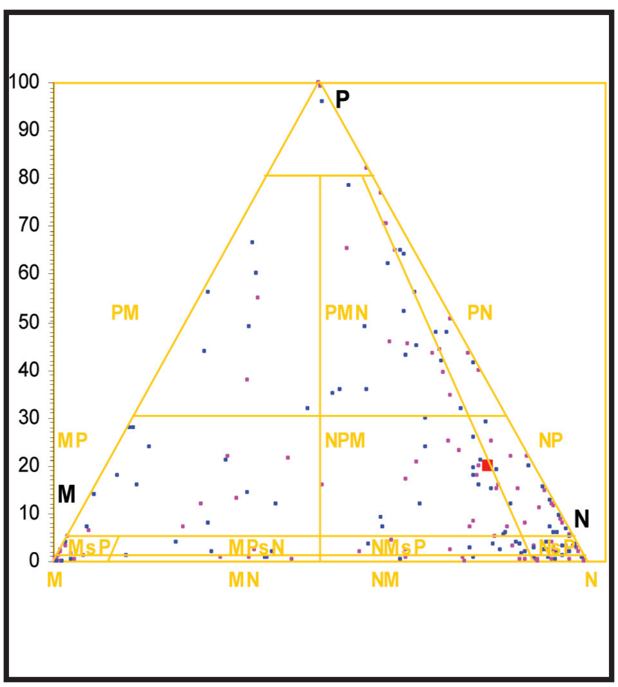


Fig. 9 Folk ternary diagram example (for samples with gravel)

ples simultaneously. Numbers are, obviously, much shorter than the names given by the researchers, up to 255 characters, that is, made as explicit as requested; aiming not to lose too much space with whole names, we often use these numbers, and not the long names.

- Fig. 5 may lead to many other conclusions, such as about the populations mixtures (if abrupt variations appear or not in the real samples slope) etc. In this peculiar case, each sample is only one granulometric population ← poor sorting, platicurtic aspect;
- the Modes (local maximums): 2 of the samples (6-13 cm and 40-47 cm) have none; their simple frequencies are permanently rising to right, to the extreme fine side, and if they however have a Mode, this can only be found by more fine analyses methods, for the colloidal field…). More precisely, the first sample, 0-3 cm, has a Mode, the Main Mode; 3 samples have 2 Modes (a secondary Mode, apart from the Main Mode); the lowest sample, 240-270cm, has 3 Modes; only our already evidentiated sample, 29-32cm, with more sand, has 5 Modes, but even they are of very little values (readable from the special columns in the table).
- some graphics are presented not only to confirm again the precision, complexity and even integrality of this program, but also to make evident once again the merit of the Probability Plot screen computerized simulation, for the real and complete repartition, with the distinct extreme sides contribution strongly emphasized (otherwise, hard to reveal), and also for the repartitions of the different constitutive populations in the same sample, by breaking the lines of the segments of the real repartitions etc, by using special "probability" scales on the vertical, instead of the linear or of any other type. Another, and still better reinforcement for the program's maximum possible precision is shown in Fig. 5 with the superposed intersections of all pairs (real curve-normal curve, of the same colour) exactly on the red horizontal of the 50% percentile, of the "median".
- other types of graphical representations – practically instantly drawn with this program (Shepard, Link, Folk ternary diagrams for samples with or without gravel; column, bar, line, pie, xy-scatter, area, doughnut, radar, surface, stock and all other diagram types), each time with the same initial dimensions, but allowing for later resizing and bettering specific to MSOffice, can be described in other works, with exactly the same samples, permanently keeping the same colours, and bringing other benefits too (pivot tables, automatic reports, autoformat, etc).

Figures 8 and 9 are the graphical illustration of the ternary diagrams of Shepard (for samples without gravel) and Folk-P (for samples containing gravel, "Pietriş", P). Table 1 presents the data of the samples represented in the Shepard diagram, Fig. 8, in text font of exactly the same colours as the corresponding graphical marks, for a maximal study's facilitation (the samples grouped under the name A, by the geologists, are coloured in red, both on the graphic and in the table; the ones grouped as B are magenta; the ones with names beginning with C are blue etc.They are different groups of locations of the same year). The table contains exclusively the data useful for the Shepard classification and diagram, namely the two columns of necessary primary data, S and N ("Silt" and "Nisip", Silt and Sand; The third component, "Argila", clay, is useless, being the difference to 100 (%) of the first two columns' sum). The two other columns, S T and N T, are the first two columns' values "transformed", by an authors' algorithm. These "transformed" values are the ones which are simply dragged & dropped, from the table, directly on the Shepard ternary diagram's surface (or by Copy…Paste Special method).

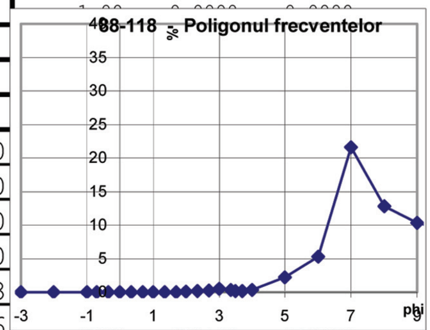
We didn't consider necessary to inflate the present work with the bigger corresponding data table for the Folk ternary diagram, Fig. 9, because this one is identical to table 1, with only one difference: the primary data are now P ("Pietriş", gravel) and N ("Nisip", Sand), while the third, useless column, the difference to 100 (%) of the first two columns' sum, so not presented, is now M ("Mâl", Mud, that is S+A, "Silt"+"Argila", Silt +Clay). We only point out that this time, (Folk diagram, Fig. 9), we presented data from two different years, in blue marks and magenta marks, respectively also making evident the possibility to discern any specific single sample from a cloud of thousands of marks, by a bigger red mark.

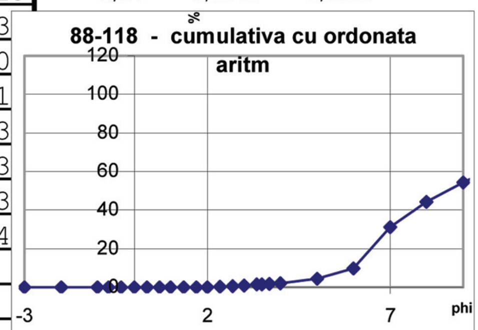
This program's tabular realizations are now as spectacular as the graphical ones. These realizations offer, in the 250 final columns, all necessary information for a complete study of the samples and for a rapid realization not only of our original special graphics (Probability Plot, Shepard and Folk-P ternary diagrams etc), now incorporated, "built-in", but also for all other types of graphics, pivot tables and reports generally allowed by MSE, as well as instantly sorting, filtering by all criteria types, etc.

Figure 10 is a spectacular very useful graphical+tabular automatically obtained combination of an individual granulometric sample, presented here only as exemplification to supplementary strongly sustain the formidable possibilities offered by MSE for personalized programming. It will be largely presented in a specially dedicated work, so we here only emphasize that the 3 graphics attached to the table (a individual sample's card), namely the frequencies polygon, the arithmetic cumulative curve and the probability plot, can individually be subsequently submitted to any MSE hundreds processings desired by any possible user.

Laboratory assistant: MF	Computer operator: PFMC	Geologist: OG	Date:
Sample (number, Name, Location): 88 - 118			
Very platicurtic, negative asymmetry, poor sorting			
Number of modes=2; Mode sample: 7 phi, 0,00781mm, SF, 21,6315%			
MS1: 3 phi, 0,52898 %		MS2: phi, %	
MS3: phi, %		MS4: phi, %	
Mdn(mm): 0,00263, (W) AG		Mdz(mm):0,00281	Sig(mm):0,26125
	$\Phi = -\log_2$ (mm)		
P1 Φ	2,9842	PF %	0,0000
P5 Φ	5,1220	PFF %	0,0000
P16 Φ	6,2934	NFG %	0,0000
P25 Φ	6,7094	NG %	0,0000
P50 Φ	8,5686	NM %	0,0783
P75 Φ	10,3127	NF %	0,9496
P84 Φ	10,5601	NFF %	1,0719
P95 Φ	10,8625	SG %	2,253
Mdn Φ	8,5686	SM %	5,300
Mdz Φ	8,4740	SF %	21,631
σ Φ	1,9365	SFF %	12,833
Ski	-0,1336	AG %	10,343
Kg	0,6529	AM %	9,163
P %	0,0000	AF %	36,374
N %	2,0999	Shep.	AS
S %	42,0185	FolkP	
A %	55,8816		
Mâl %	97,9001		

Φ	fr.sim.,%	fr.cum.,%	mm
-4,00	0,0000	0,0000	16,0000
-3,00	0,0000	0,0000	8,0000
-2,00	0,0000	0,0000	4,0000
			2,0000
			1,6245
			1,2746
			1,0000
			0,7846
			0,6156
			0,5000
			0,3923
			0,3078
2,00	0,0783	0,0783	0,2500
2,35	0,1910	0,2693	0,1961
			0,1539
			0,1250
			0,0981
			0,0884
			0,0769
			0,0625
			0,0313
			0,0156
			0,0078
8,00	12,8330	44,1184	0,0039
9,00	10,3437	54,4621	0,0020





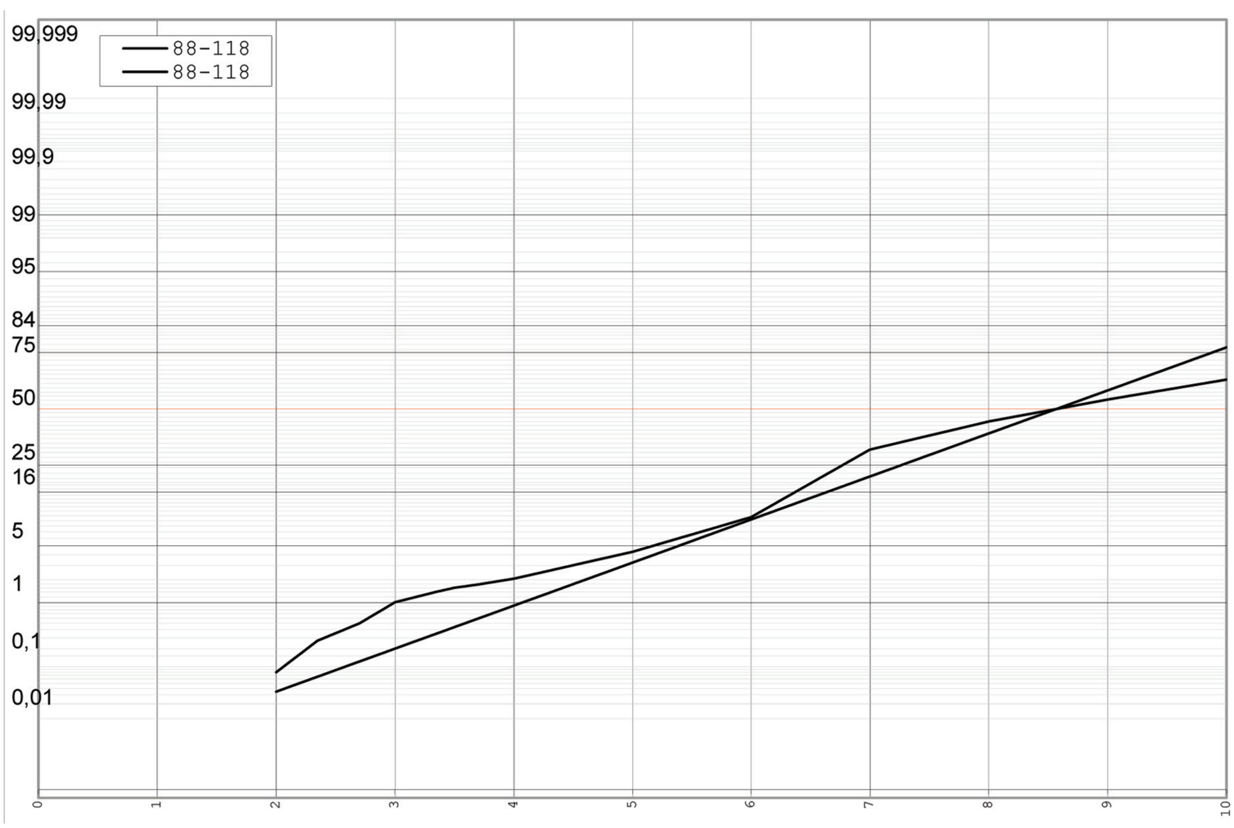


Fig. 10 A sample's thorough granulometric individual card example: CEX 2006, 180-210 cm depth in core sample

E	Nb	np	Ebpr	Nbpr	Dinv	D	Ab	Vm	Areas	Flows
740	898	2042,74	733,4	908,1	162,6	189,4	-11,9	1,004	#VALUE!	80,59
737	896	2036,1	730,4	906,2	157,2	194,8	-11,4	0,881	62,60	55,15
734	893	2028,46	726,9	903,9	151,0	201,0	-11,2	0,881	69,73	61,44
731	891	2021,82	723,9	902,0	145,6	206,4	-10,9	0,881	59,34	52,28
728	889	2015,18	720,9	900,0	140,3	211,7	-10,0	0,881	56,17	49,48
725	887	2008,54	717,9	898,1	134,9	217,1	-9,6	0,881	52,59	46,33
722	885	2001,9	714,8	896,1	129,5	222,5	-8,7	0,881	49,04	43,20
719	883	1995,26	711,8	894,1	124,1	227,9	-7,9	0,881	44,46	39,17
716	881	1988,61	708,8	892,2	118,7	233,3	-7,4	0,881	40,91	36,04
714	879	1983,52	706,4	890,7	114,6	237,4	-7,1	0,881	29,83	26,28
711	877	1976,88	703,4	888,7	109,2	242,8	-7,1	0,881	38,08	33,55
708	875	1970,24	700,4	886,8	103,8	248,2	-6,9	0,881	37,52	33,05
706	874	1966,14	698,5	885,6	100,5	251,5	-6,6	0,881	22,33	19,67
703	872	1959,5	695,5	883,6	95,1	256,9	-6,3	0,881	34,74	30,61
701	870	1954,41	693,2	882,1	91,0	261,0	-6,0	0,881	25,54	22,50
698	869	1948,77	690,6	880,4	86,4	265,6	-5,9	0,881	27,25	24,01
696	867	1943,68	688,3	878,9	82,3	269,7	-5,6	0,881	23,68	20,86
694	866	1939,58	686,4	877,7	79,0	273,0	-5,3	0,881	18,02	15,87
692	864	1934,49	684,1	876,2	74,9	277,1	-5,2	0,881	21,53	18,97
690	863	1930,39	682,2	875,0	71,5	280,5	-5,0	0,881	16,82	14,82
687	862	1924,75	679,7	873,4	67,0	285,0	-4,9	0,474	22,68	10,75
685	861	1920,66	677,8	872,2	63,6	288,4	-4,9	0,474	16,23	7,69
682	860	1915,02	675,2	870,5	59,1	292,9	-4,8	0,474	22,04	10,45
680	859	1910,92	673,3	869,3	55,8	296,2	-4,7	0,474	15,71	7,45
677	858	1905,28	670,8	867,6	51,2	300,8	-4,6	0,474	21,17	10,03
675	857	1901,19	668,9	866,4	47,9	304,1	-4,4	0,474	14,87	7,05
673	857	1898,1	667,5	865,5	45,4	306,6	-4,2	0,474	10,71	5,08
671	856	1894	665,6	864,3	42,0	310,0	-3,9	0,474	13,44	6,37
669	856	1890,91	664,2	863,4	39,5	312,5	-3,8	0,474	9,67	4,58
667	856	1887,81	662,8	862,5	37,0	315,0	-3,6	0,474	9,18	4,35
665	856	1884,72	661,4	861,6	34,5	317,5	-3,4	0,474	8,73	4,14
663	856	1881,63	660,0	860,7	32,0	320,0	-3,3	0,474	8,45	4,01
662	855	1879,08	658,8	859,9	29,9	322,1	-3,3	0,474	6,80	3,22
660	856	1876,99	657,9	859,3	28,2	323,8	-3,2	0,474	5,48	2,60
658	856	1873,89	656,5	858,4	25,7	326,3	-3,1	0,474	7,84	3,71
657	856	1872,34	655,8	857,9	24,5	327,5	-2,9	0,474	3,75	1,78
655	857	1870,25	654,8	857,3	22,8	329,2	-2,9	0,474	4,90	2,32
654	857	1868,7	654,1	856,8	21,5	330,5	-2,8	0,474	3,55	1,68
652	858	1866,61	653,1	856,2	19,8	332,2	-2,5	0,474	4,47	2,12
642	849	1842,14	642,0	849,0	0,0	352,0	0,0	0,474	24,39	11,56
E	ND								3026,35	2749,48
840	977									
642	849									
E	Nv	np	Evpr	Nvpr	Dinv	D	Av	Vm	Areas	Flows
840	977	2276,44	840,0	977,0	352,0	0,0	0,0	0,000	0,00	0,00
823	964	2237,14	822,1	965,4	320,2	31,8	-6,7	0,694	106,52	73,92
787	935	2152,45	783,5	940,5	251,5	100,5	-11,8	1,098	634,96	697,18
755	914	2081,95	751,3	919,7	194,4	157,6	-13,5	1,004	722,88	725,77
709	898	1994,79	711,6	894,0	123,7	228,3	-7,6	0,881	745,31	656,62
649	856	1859,97	650,1	854,3	14,5	337,5	-2,5	0,474	551,83	261,57
642	849	1842,14	642,0	849,0	0,0	352,0	0,0	0,474	18,06	8,56
									2779,56	2423,62

y = 0.6465x + 433.97

y = 3E-11x6 - 1E-07x5 + 0.0002x4 - 0.2318x3 + 127.98x2 - 37623x + 5E+06

y = 4E-11x6 - 2E-07x5 + 0.0003x4 - 0.293x3 + 162.58x2 - 48023x + 6E+06

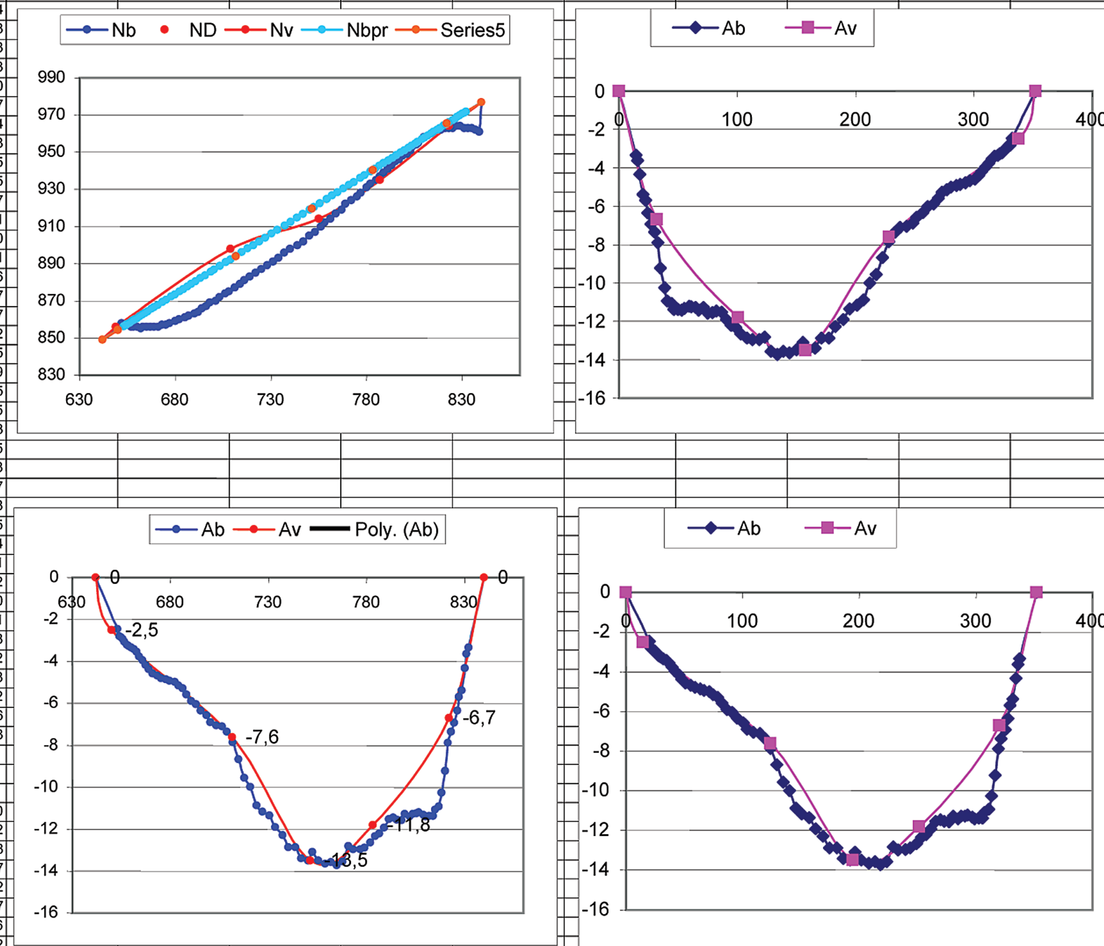


Fig. 11 A thorough flow-bathimetry sample (Sf.Gheorghe km 108)

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