SEDI- A DATABASE ORIENTED ANALYSIS AND EVALUATION TOOL FOR PROCESSING SEDIMENT PARAMETERS

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INTRODUCTION

Aim of a granulometric analysis is the grain size frequency distribution to derive characteristic statistical parameters. SeDi computes those parameters and displays the sigmoid of the grain size distribution after the input of the results of the sieving analysis of the sediment samples. Furthermore SeDi offers the possibility to sum up the weights of grain size classes of several single samples before calculating the parameters ("group evaluation"). This feasibility is useful, if separately sieved sediment samples have to be lumped together (e.g. adjacent depth layers with similar grain size distribution).

SeDi is running on a single workstation but it is designed as a multi-user application within a network. It is based on the common use of an MsACCESS data base (with different tables) to make the data available to several users. Furthermore, the data are also available for other. **MsACCESS** applications. compatible, Generally. SeDi is multilingual. German and English are realized at present. The author is to be contacted if further languages are required.

SeDi is written and tested as a Visual Basic application under MsWinNT 4.0. All tested workstations had conventional configuration of memory and disk space. Α minimum configuration was not determined. Graphic card and screen should be set on 1024*768 points resolution. SeDi requires a minimum resolution of 800*600 points.

MATHEMATICAL BACKGROUND

The data base

SeDi saves data at two places. Data, which are important for the local PC (such as path onto the data base or the last user of the appropriate PC) are stored in the registry. Since this program is based on the common use of an MsACCESS data base with different tables. evaluated data. proposal lists and user data are stored in this MsACCESS data base, which can be used by several users. The SeDi data base contains eight tables (Table.1). lt is usually called SEDI.MDB. but it can be renamed at any time.

Calculation of sediment-describing parameters

The **quartiles** (Q_{25} , Q_{50} = Median, Q_{75}) are derived from the cumulative grain size distribution. Since the grain size distribution obtained after sieving is a frequency distribution, the sigmoid is a discrete function assuming the gradient between the grain size class values to be linear and steady. The quartiles are interpolated trigonometrically. Quartiles are calculated as follows:

qx=X1+(X2 - X1)*((yq-Y1)/(Y2-Y1)) (1)

qx = quartile (grain diameter in mm) X1 = lower limit of the grain size class

(mm) containing the quartile

X2 = upper limit of the grain size class (mm) containing the quartile

Yq = % value of the quartile (i.e. 25, 50 or 75).

Y1 = % value of the lower limit of the grain size class containing the quartile

Y2 = % value of the upper limit of the grain size class containing the quartile.

Table 1: Tables of the SeDi database.

Name of Table:	Saved data:
River ("Bach"):	proposal list of rivers
Grain size classes ("KorrTab"):	proposal list of grain size classes
Method ("Methode"):	proposal list of methods
Sample ("Probe"):	the frame data of the sample (name of the river, time of sampling, location of the samples, , method, remarks, sediment depth, used grain size classes, wet and dry weight of the sample
Analysed data ("Daten"):	sieving data of all samples
User ("User"):	data of user specifications
Activity ("Aktivitaet"):	data of user activities
Text ("Texte"):	the different languages for the user-interface

The sorting coefficient (S_o) is a measure for dispersion (i.e. the number of the grain sizes occurring in a sample). The sorting coefficient is independent of the class breath, at least in theory and is calculated as follows:

So =
$$(Q_{75} / Q_{25})^{1/2}$$
 (2)

The **skewness** (S_k) indicates the deviations from the symmetry of the grain size distribution determined by a greater number of grain sizes in the coarser range than in the fine-grained range or vice versa:

Sk = $(Q_{25} * Q_{75}) / (Q_{50})^2$ (3)

The **relative amount of grains <1mm** is also displayed by SeDi, because of its biological importance: with increasing grain size the colonizable surfaces for biofilms are increasing logarithmically but interstitial spaces decrease. In addition the grain size classes 1 to 10mm, >10mm and the largest grain size class are also given.

For determination of the **porosity** of river sediments, the water content of the sample is determined by measuring the weight loss after drying the sample at <100°C and the porosity (the total amount of interstitial spaces) is estimated as follows:

Porosity (%) =
$$V_{water} / V_{sample}$$
 (4)

where V_{water} is the volume of the water (ml) and V_{sample} is the volume of the sample.

$$V_{water} = W_{water}$$
, (5)

where W_{water} (g) is the weight of the water in the sample . This equation is valid, because the specific weight (g) of the water is 1.

(6)

$V_{sample} = G_{sample} / \gamma$

where G_{sample} is the weight (g) of the dry matter (the sediments) of the sample and y is the mean specific weight (g) of the matter. The mean specific weight used in SeDi is 2.6 g. This value is empirically determined for the sediments of the Lunz area (BERGER pers. com.) and is valid for (dolomitic) limestone. It may also be used in areas with sediments made up mainly by granite because feldspar and quartz have also a mean specific weight around 2.6 (MÜLLER, 1964). The authors are to be contacted if another specific weight is used for

example if one works in areas of iron rich geology, where the specific weight of the sediments are higher.

USE OF SEDI

Start and login

After activating the program (by clicking the entry SeDi in the start file or at the desktop), the programme is initialized. Depending on computer velocity, initialization passes differently fast. The SeDi start menu (Fig. 1) appears during initialization.



Fig.1 The SeDi start menu (exists in German only)

The login window is displayed afterwards (Fig. 2). To log on to the program, the user name has to be selected, the password has to be entered and either the key "enter" (on

User	Gernot	13.	*
Password	***********		
deutsch	J Market		

Fig.2 The login window

the keyboard) or the button "login" has to be pressed optionally. The language of the login window can be switched (from the English login window to the German one and vice versa) with the aid of the language selection button. If SeDi was started by mistake, the button "cancel" closes the program immediately.

The main menu

The main menu window appears after login. The data analysis window, the data input window and the user management can be operated by these buttons (Fig. 3). The "Info" button indicates the SeDi start menu again. From here, one changes back to the main menu with the "Fertig" button.





The button "Exit" completes operation with SeDi. The program has to be always finished with this button! If this is not possible anymore, for example because of a computer crash, SeDi has no chance to release the data base. In this case, those users have to be removed from the user list by the SeDi administrator.

Management of master data

Following characteristics are used to identify the data records in the data base clearly: river name, date, position, depth of sediment layer, grain size classes and method. To prevent typographical errors and different expressions for identical data and to make the input work as user-friendly as possible,

- the name of the river
- used grain size classes and
- methods

are in proposal lists. The desired data can be retrieved in the data input

window (Fig. 4) by simple clicking. If the desired data are not in the proposal list, new rivers, new methods and new grain size lists have to be added. The master data input windows for rivers and methods are achieved through pressing the button "add new" in the data input window (Fig. 4.).



Fig.4 The data input window of SeDi

Adding new rivers is done in the same way as adding new methods. Therefore, this procedure is described on the example of adding a new rivername:

River		Ok
Oberer Seebach Donau Bahrini Seebach/Ritrodat Njoro Sagana	River IdNr.	
		 delete

Fig.5 The master data input window for rivers

A list of all brooks already set up is indicated in the list box on the left side of master data input window of rivers (Fig. 5). For setting up a new river, its name is written into the right text field (Fig. 5). A possible other entry there can be overwritten without any problems. After typing this new rivername and after pressing the key "add new" the new entry appears in the list on the left side of the window and is available from now on.

River			Ok
Oberer Seebach Donau	River	Donau	
Bahrini Seebach/Ritrodat Njoro Sagana	ldNr.	2	
	change	add new	delete

Fig.6 The master data input window after selection of a river

In order to change an entry select by clicking on it in the list-box on the left side of the master data input window (Fig. 6). Then, the selected river is shown in the text field and the desired the revision changes (e.g. of typographical errors) can be made here (Fig. 6). The change is stored by a mouse click on the button "change". It has to be considered that this change has an effect on all data records which are connected with this river! For example, if samples from the Danube have already been entered, and the entry Danube is changed into Isar, all samples from the Danube will appear as samples from the Isar from now on.

In order to delete an entry (e.g. a river, which is already in the list-box) this has to be selected in the list-box by mouse clicking and the key "delete" has to be pressed afterwards. The selected entry is deleted after a security query. It has to be considered that this river is possibly still used in the data base! Entries should only be deleted in case it is absolutely certain, that they are of no use anymore. As already mentioned above, the same holds for adding, changing and deleting methods.

In order to add, change or delete grain size tables (used mesh sizes of the granulometric analysis), the button "new grain sizes" has to be pressed in the SeDi data input window (Fig. 4). The master data input window for grain sizes appears then (Fig. 7). In order to set up a new grain size list, a name for the grain size table (identifiers, e.g. "Danube") and the used mesh sizes are entered into the corresponding fields. The mesh sizes of the sieves have to be entered in descending order. During entering the mesh sizes, the cursor may be moved from one cell to the subordinate one either with the mouse or through pressing the key "enter". Finally, the smallest value (mesh size) must be repeated (Fig. 7). Since this is a "sieve list", the data are treated as "bigger than the entered value" with the exception of the last value. The last value is set on "smaller than the entered value" automatically. The characters ">" and "<" must not be entered. They are added by the program automatically.

rain size list			Ok
Standard	identifier	Danube	
agana Danube	IdNr	3	
		100	
		80	
		60	
		40	
	1 A 1 1 1	20	
		15	
		10	
		6.3	
		1	
		0.5	
		0.1	
		0.063	
		0.063	
			change
			add new
			dalata

Fig.7 The master data input window for grain size lists

An available grain size table can be corrected (e.g. on account of typographical errors) and it is also possible to delete it. The procedure is the same one, as already explained for changing and deleting rivers and methods. However. the same precautions have to be considered! SeDi returns from the master data input window back to the data input window with the button "OK".

Data input

Data input can only be performed by users who are authorized by the administrator. Otherwise, the button "data input" (Fig.3) is not released.

Di - Main menu	
data analysis	currently active user
data input	Georg - analyze
User administration	Biologische Station Lunz am See Österreich
Exit	info

Fig.8: The main menu, when data input is clicked and another user is analysing data or only logged in.

In order to provide a plausible and perfect data base, data input can only be performed if no other user is logged in to the program at the same time. If the button "input data" is clicked and at least one other user is analyzing data or only logged in, a list of these user is displayed in the right area of the SeDi main menu window (Fig. 8).

If another user is entering data at the very moment, a warning is displayed (Fig. 9) before the main menu appears. If the button "input data" is clicked the list of the logged user is displayed again (Fig.10). In these cases, these other user have to be asked to leave the program. If they have already left the program and names of users appear still in the list box after pressing the button "data input" again (this might happen, if SeDi has not been finished correctly or after a computer crash) they have to be removed from the user list by the administrator (see chapter main menu). After all users have left SeDi, one reaches the data input window (Fig. 4).



Fig.9 Windows displayed, when another user is entering data at the moment.



Fig.10 The main menu, when data input is clicked and another user is entering data

First, the desired river, the method and the grain size tables have to be selected from the proposal lists though clicking on the arrow at the right side of the boxes (Fig. 11.A) and clicking on the requested river (Fig. 11B, method and grain size table, respectively). The sampling date (DD.MM.JJ, Fig. 12.A) and the position (Fig. 12.B) is entered then. After entering the depth layer (cm; Fig. 12.C), the new data record is defined and the sediment weights (g) per grain size class (Fig. 12.D) and - if available - wet and dry weight (g) of the sample are entered (Fig. 12.E).



Fig.11 Selection of river, grain size table and method in the main menu. A: Arrows, which activate the proposal lists. B: the proposal list for rivers where the requested one may be selected.



Fig.12 Data input window after a sample is entered

To make the input of sediment weights per grain size class as user-friendly as possible, the cursor can be moved from one cell to the subordinate one either with "return" or with the mouse. The data input window of SeDi also provides the possibility to insert supplementary remarks (Fig. 12.F). After clicking on "save", the data record is saved in the data base, some fields of the entry form are reset. (Fig. 13) and the program is ready for the next sample. Fields still occupied with data (River, Date, Position, Depth-layer, Method and remarks) can be changed, if they are not in accordance with the new sample. After all samples are entered, the data input window is left by pressing the button "OK" at the right top border of the window and SeDi returns to the main menu window (Fig.3).



Fig.13 Data input window after the entered sample is saved

Data analysis

The data analysis - window is reached via the main menu window (Fig. 3) through a mouse-click on the button "data analysis". The analysis window is essentially divided into the following parts (Fig. 14):

- selection area
- grain size distribution of the sample
- additional data of the sample (add. data)
- results
- graph

Analysis of a single sample:

For the correct identification of a sample (e.g. data record), each sample is defined by the name of the river, the sampling date, the sampling position and the depth layer. A sample is selected by clicking on the requested river. After this, all sampling dates of

this river appear in the field "Date". The same holds for the selection of date, position and depths layer: If the requested date is selected by simple sampling positions clicking. all available are listed in the next field and after a position is chosen, all depth available are given. lavers After selecting a depth layer, the sample is defined and all sediment parameters (Quartiles; largest grain size; sorting coefficient; skewness; the percentages of the grain size classes smaller than 1mm, from 1 to 10mm and bigger than 10mm; weight of water, water content and porosity), grain sizes, wet and dry weight, method, additional remarks and the graph (the sigmoid) are displayed (Fig. 14).

Group evaluation:

SeDi offers the possibility to sum up the weights of grain size classes of several samples before calculating the parameters. This possibility is useful, if separately sieved sediment samples have to be lumped together before analysis (i.e. adjacent depth layers with similar grain size distribution). Generally, SeDi imposes no limitations in summing up samples neither with regard to the number of samples which should be summed up, nor with regard to the type of the samples (different depth layers, positions, sampling dates or rivers), as long as the grain size classes used are the same. The user himself has to decide, whether the respective addition of samples makes sense or not.

First, one sample has to be selected through mouse-click on the requested river, sampling date, position and depth layer. The results and the graph of this sample are given as described above and in the right lower edge of the selection area is written "single sample" (Fig. 14). After clicking the button "add to list" the data for identification of the sample appear in



Fig.14: SeDi analysis window, after selection of a single sample.

the list box of the selection area (Fig. 15) and in the right lower edge of the selection area is written "sum calc.". As only one sample is selected until now, the results are of course the same.

If another sample is selected in the same way as already described above, and the data of selected single sample is given, indicated by "single sample" in the right lower edge of the selection area. As soon as "add to list" is pressed, the identification parameters of this second sample are added in the list box below the first sample (Fig. 16). Furthermore, the values of sediment weights of the grain size classes of these two samples are summed up and the results and the graph are calculated for the added values. This is indicated by "sum calc." in the right lower edge of the selection area.

This procedure can be repeated as often as desired.

The expression "sum calc." indicates that the sum of all samples in the list box is subjected to calculation of the descriptive parameters. If the user wants to have a look on a single sample, this is possible with selecting the requested sample (river, date, position, depth layer). Change over to the results of sum evaluation occurs by clicking on the text "single sample".

After clicking on the button "show", the chosen samples and their descriptive parameters are displayed in an own window (Fig. 17).

The button "clipboard" loads the selected single sample or the sum evaluation into the clipboard so that this can be inserted fast and simply into other programs (e.g. MsEXCEL). The selected single sample or the sum



Fig.15: SeDi analysis window: first step of group analysis.

evaluation is stored in a file with the button "save". A detailed description of the use of the clipboard and how to save a data record with its results is given below.

The removal of all chosen samples in the list box is done with the button "delete". With the key "new", the analysis window is put into the original state again. With "OK" the analysis task is finished and SeDi changes to the main menu window.

Data output

SeDi provides two export facilities for data records and calculated results for both single or group evaluation via data analysis window (Fig. 16): the clipboard and storage in seperate files (save-function). These data records can be imported into other programs (e.g. MsEXCEL) for further statistical treatment.

If the storage of the data record and its results (the values of a single or a group evaluation indicated currently at the data analysis window) in an own file is preferred, press the key "save". Then, SeDi indicates a file selection mask where the path and the desired file name (inclusive extension preferably .txt) has to be selected and/or entered. The data record is saved as an ANSI text file for further use in windows programs.

The other convenient tool to export results from SeDi and import them into other programs is the clipboard. The sample and the results loaded into the clipboard can be inserted into other programs easily with the function "paste" (Strg +V).



Fig.16: Data analysis window: group evaluation of the two samples indicated in the list

Following data are exported out of SeDi with the two procedures described above:

- identification data of the sample: River, Date, Position, Depth Layer (if it is a question of a single evaluation). In the case of a group evaluation, SeDi indicates "groupevaluation" only. The samples examined have to be specified with a name by the user himself.
- Sediment weights per grain size class in descending order of the grain size class
- the cumulative percentages of the weights per grain size class
- the quartiles (Q₂₅, Q₅₀ and Q_{75,)}
- the sorting coefficient and the skewness,
- the wet and the dry weight of the sample, the water weight, the water

content (in percent of weights) and the porosity of the sample (in percent of volumes)

These data are exported as a table where every data record represents one row.

The evaluation indicated on the screen can also be brought to paper by means of the button "print". After pressing onto the button "print" the windows standard dialogue appears, where the printer is selected. The print page is then indicated.

In the case of a single evaluation, the sample data, the results, the graph, and a text field with the supplementary remarks already entered during the data input are printed (Fig.18). Other remarks may be entered in the text field, if this is requested. With the button "print" (in the right top corner of

SeDi - analy	vsis							
River	Date	Position	from to	Q ₂₅ Q ₅₀	Q ₇₅	s _o	S _k Σ <1mm	Σ Σ 1-10mm >10mm
Donau	21.04.93	1925/li/C1	40 50	0.84 4.31	11.76	3.741	0.531 6.5	53.41 40.09
Donau	21.04.93	1925/li/C1	50 F 60 F	0.94 5.88	13.25	3.754	0.36 5.41	46.5 48.09
1. 199.2								
Cliph	nard	SAVA						
								Ok

Fig.17: Overview of the selected samples

the window), the printout of the indicated screen is started. With the button "cancel" (in the left top corner of the window), printing is prevented and SeDi returns to the evaluation window.

In the case of a group evaluation, "group analysis" and "samples in supplement" are indicated instead of the sample identification data (Fig. 19). The individual samples examined in those group evaluation are printed on a second page. However, this second page is not indicated in the screen during the printing selection. Further procedure of printing the page or cancelling the printing is done as described above. After printing, SeDi returns to the data analysis window.

Data correction

Data can be corrected (e.g. in case of typographical errors) via the data input

window (Fig.4). At first, one has to switch from the data input window into the sample selection window (Fig. 20) with the button "choose" (at the left top margin of the window, Fig. 12G).

First, the sample to be corrected is selected as already described in the chapter "Data analysis - analysis of a single sample". After definition of the sample, sediment parameters, grain sizes, wet and dry weight, method and additional remarks are shown (Fig. 20). The values (weights of grains, wet and dry weight of the sample and additional remarks) can be changed and saved now. The old data are overlaid and after clicking on the button "save", they are gone for ever. It is not possible to change the identification data of a sample (river name, date, position, depth-layer and method). In this case, the sample must be deleted in the data base (button "delete"). One returns with the "add new" button to the data

input window and with the "OK"-button to the main menu.



Fig.18: The printout of a single sample (screen resolution 1024 * 768).

_ 🗆 ×

print

🖌 Form1



SeDi - analysis

group analysis

samples in supplement



Fig.19: The printout of a group evaluation (screen resolution 1024 * 768).

Di					UN
Hiver	Date	Position	Depthlayer	Standard	
iberer Seebach	31.03.93	1942////01	0.10	new	grain sizes
onau ahrini	21.04.93	1942/re/C1 1942/re/C2	10 - 20 20 - 30	>100	1243
eebach/Ritrodat	14.12.93			>80	0
joro agana	31.03.99			>60	0
est				>40	573,2
				>20	953,9
				>15	251,9
add. Data				>10	90
dathand .			Line a	>6.3	197,3
	VFC 🗾	wetweight	4250.4 9		485,1
	add new	dry weight	3952.4 9	>0.5	37,3
				>0.1	17.0
marks				20.063	17,6
IIdika				KU.063	31,4

Fig.20 The sample selection window, where data of already entered samples can be changed.

LICENCE

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ORDER OF THE PROGRAM SEDI AND USER MANUALS

SeDi is free software, and the most recent version of this software may be downloaded from the web - server of the Biological Station Lunz (http://www.bsl.oeaw.ac.at). Besides of this user manual, a short description of SeDi may also be found on the Lunz-Server.

The authors are to be contacted, if you are interested in the program on disk and/or the copy of the User Manual, which may be duplicated as many times as you wish. Only copy and forwarding expenses are charged in this case.

In order to support the development of SeDi, the Administrator Manual is available for sale. Two types of Administrator Manuals are available single licenses, and licenses which allow you to make as many copies as you wish for use at your site. Purchasing any manual license also gets you direct access to the author.

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References

MÜLLER, G. (1964): Methoden der Sediment-Untersuchung. Teil I.- E. Schweitzerbart'sche Verlagsbuchhandlung, Stuttgart: 303 pp.

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