I Introduction

Overview of *ArboDatMulti*© database structure

The archaeobotanical database programme **ArboDat** consists of three interrelated Microsoft *ACCESS* databases. Within *ACCESS* all data is organized in tables. Each table holds data for one specific topic.

***ArboDatMulti*©** comprises <u>one</u> Acess file ArchBotProgramm and for each language separate *ACCESS* files of ArchBotStrukDat and ArchBotDaten. The language versions of those files are marked by the suffix _EN (English), _DE (German), _CZ (Czech) and _FR (French)

ArchBotStrukDat_EN	ArchBotProgram	ArchBotDaten_EN
<u>SiteType</u> **FeatureTypes** **SampleTypes** <u>NatureU</u> (Natural regions) <u>NatureMain</u> (Main natural regions) **ArchDat** (Archaeological Dating) **ChronoDat** (Chronological Dating) **DatingMethods** **CulturGroups** **RTyp** (Type of plant-remains) **PreservState** **Fraction** **EcoSocData**	**Pre-programmed queries** **Individual queries** **Forms** **Reports** **Automated taxa lists** Hidden tables for translation and sorting	**Projects** **Features** <u>**Year_Exc**</u> **Samples** **Dating** **Results** **Details**

STypGroup (Site type group)
SiteOrigin
Periods
RTypGroups
Ecogroups

Activ
County
District
Parish

- **ArchBotProgramm** contains the utility programme including all definitions, calculations, join- properties and operational controls. Furthermore, it contains forms and reports, pre-programmed queries and and taxa lists. Additional user-defined tables, queries and other objects are stored here.
- **ArchBotStrukDat** (ArchBotStrukDat_EN) contains terms and definitions (= structural data). They are classified thematically in tables. Usually they are given as abbreviations with the corresponding explanation of terms and further related data.
- **ArchBotDaten** (ArchBotDaten_EN) contains the results, comprising all information on the archaeological sites, features, samples, and identified plant remains.

Data organization in tables

In the table design view field properties like data type and field size are visible. Generally, the table structure should not be altered.

In the table datasheet view a column corresponds to one field (unlike *EXCEL*). All data in one row of the datasheet form a database record (= dataset). Each dataset is uniquely indentified by one or more attributes, defining the so-called primary key.

The database tables are interconnected with each other via primary keys, thus ensuring a logical combination of information in the various contexts (relational database).

In **ArboDatMulti**© the names of key fields are mostly self-explanatory abbreviations, e.g. *ArchDat* for archaebotanical dating, or *PCODE* for plant code; they occur repeatedly in the database tables.

> **Example: Key fields in ArboDatMulti©**
> The field ArchDat appears both, in the table *ArchDat_E* as primary key and in the table *Samples* as simple field (foreign key). Hence, by the ArchDat field contents further field contents of the dataset are attributed to each sample.
> The sample with the ArchDat-field content „Lt1" is automatically connected to the description „Early Latène Period (A, B1, B2)" and the period „IA" (Pre-roman) Iron Age.

Interaction of the three databases

The tripartition of the archaeobotanical database **ArboDatMulti**© has practical advantages for combination and separation of data pools, as well as for programme updates. Under normal working conditions **ArboDatMulti**© acts as a single database.

In order to work with the database, simply **ArchBotProgramm** is started - ideally with a shortcut on your desktop. The programme will automatically access the joined tables of the two other partial databases.

> **ArchBotProgramm only works, if the partial databases *ArchBotStrukDat* and *ArchBotDaten* are located in the same directory, and if table names and field properties are recognizable by the programme. Field contents are not important in this context.**

> **Tip: Managing several datapools**
> The tripartition of data- and functional components allows for separate exchange or adaptation of partial databases. E.g. it is possible to create several "data" databases and to select the desired database for current work by renaming it *ArchBotDaten_EN.*

The interaction of the three partial databases effectively ensures:

- Consistency of data entries: structural data appear at the appropriate position in the input mask; possible field entries are offered in pull-down-menus.

- Data storage: entered data are stored in the appropriate tables of *ArchBotDaten.*

The field contents of all tables can be selected and added to, when working with the programme - either directly in the *tables,* or via an appropriate *form* (see below: data consistency).

In contrast, field properties would have to be changed directly by accessing the respective partial database. However, certain field names and properties must be recognizable by the

programme; hence programme users are generally not allowed to change field properties of existing fields.

> **Tip: Additional fields in tables**
> Additional fields, if required, can be added to in structural data tables; properties might be defined according to individual needs. Open *ArchBotStrukDat_EN* and choose the design view of the respective table to insert additional field names and definitions. Please note: additional fields are not contained in pre-programmed **ArboDatMulti**[©] objects.

II Translation

Multilingual structure of the database

Multilingual version of the database, called *ArboDatMulti*[©], was designed with the aim to facilitate non-German speaking users to work with the *ArboDat* database programme. The **modular** structure of the original *ArboDat* database enables to keep only one universal *ArchBotProgramm* while *ACCESS* files of *ArchBotStrukDat* and *ArchBotDaten* are separate for each language. The language versions of those files are marked by the suffix _EN (English), _DE (German), _CZ (Czech) and _FR (French). Besides, the programme includes additional database objects enabling consistency of individual language versions (hidden translation tables). Such structure ensures continuity of each language version (and the national data structures) also after each actualization of the database programme.

The majority of users will more likely work with only one language version. For that reason it is possible to keep just three *ACCESS* files - *ArchBotProgramm* and the required language version of both *ArchBotStrukDat* and *ArchBotDaten*. Other language versions could be needed only for presentation of national data via **forms** of chosen language version (using Translation - Forms). Translation of the entire Application would be used merely at the very beginning - before starting to work with the empty database.

Translation of the application/forms

After opening the database, it always appears in the same language version as it was used before the last closing. For changing the database to another language use the Translation button situated on the right side at the bottom of the start form.
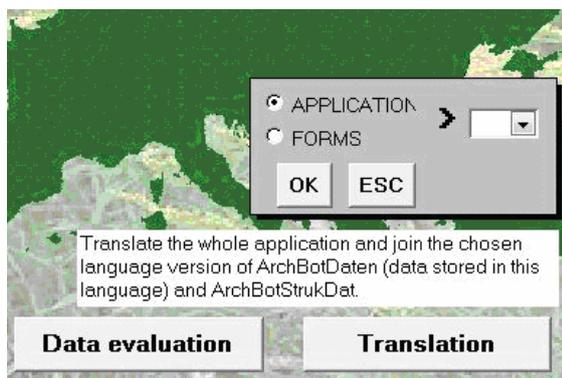
Click on the button *Translation* leads to a subform with offer of language versions and choice of translation degree (either the complete database application or just the forms). After selection of required language and translation of application/forms, click on the button OK

Translation of the application

Translation of entire application stands for translating the graphic user interfaces and for **joining** the chosen language version of *ArchBotDaten* (data tables with the data stored in

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this language) and *ArchBotStrukDat*. After this procedure, the application is completely translated (including all tables, forms, queries, and announcements).

> **Translation of the application doesn't result in translation of the data involved!**

Translation of the forms

Translation of forms stands for translation of only the graphic user interfaces (forms, announcemnts). *ArchBotDaten* and *ArchBotStrukDat* stay in current language.

Note: Language versions
It is principally (and technically) possible to create also other language versions; however, it requires some additional adjustments of the translation tables and the structural data. Besides that, it is important to keep in mind, that the language version **is not** the national version!

III Data entry

In *ACCESS*, forms are provided to control the user's interaction and to ensure clear data recording and presentation.

The start form

Upon starting the database programme, the following start form appears.
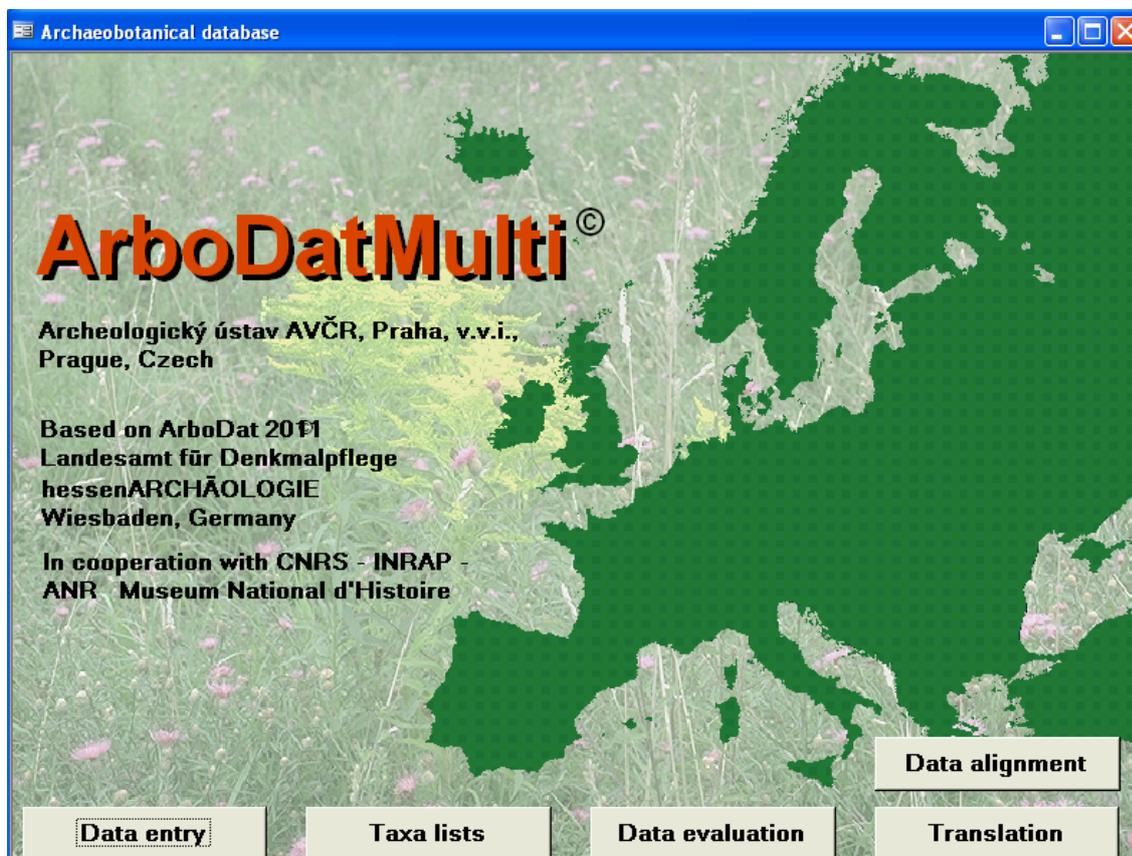
Note: The start window might completely hide the *ACCESS* window lying behind. Adjust the start form if necessary!

The start comprises four buttons indicating the main workspaces of the database, which will be explained on the following pages.

By click on the button **Data entry** the input form is opened. In this form several subforms are embedded for the recording of data concerning the project, features, samples and plant finds. Further sub-forms allow for the entry of the *absolute dating* as well as of the *years of excavation*. Recording data via input form provides for data consistency.

By click on the button **Data evaluation** the evaluation window is opened. This form includes a menu for the selection of evaluation-queries and several dialogue boxes.

Click on the button **Taxa lists** leads to the readily formatted taxalists, which are available "at the push of a button". The respective forms offer several options for data selection and presentation.

Click on the button **Translation** leads to a subform where a choice of languages for either the complete application or parts of the application is offered.

Click on the button **Data alignment** activates the automatic alignment routine for checking of data consistency in the tables *Results* and *Details*.

The entry form – structure of data entry levels

The input mask allows for clear and comfortable data recording and filing in the respective tables. With a screen resolution of 1280 x 1024 pixel or higher the form is completely shown on the screen. For lower screen resolution, all parts of the form can be reached via scrollbar.

The entry form is hierarchically structured by **four levels** for *project*, *feature*, *sample*, and *results*. The data of each level is stored in the respective tables: *projects*, *features*, *samples*, *results* and *details*. Excavation years as well as data regarding absolute dating are stored in separate tables.

Small arrows indicate pull-down menus listing predefined terms (structural data). Only terms available in the corresponding menu are accepted to guarantee consistent data entry. However, it is possible at all times to complement the terms in the structural data tables.

> **Tip: Assistance for data entry**
> To facilitate data input, short notes (=control tips) appear next to each entry field as soon as the cursor is resting there for a moment. Additionally, the control tip text appears in the status bar as soon as the cursor is placed in a field.

Command buttons in the entry levels *project, feature* and *sample*

When the cursor comes to a halt on a command button, a control-tip message appears, providing command information.

On the lefthand side of the main data-entry form, grey buttons are located, which are named like the respective data category Project, Feature and Sample. Upon selection of one of these buttons the following window appears.
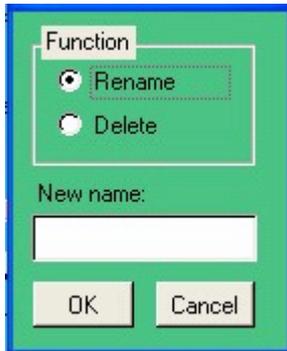
According to the input level, projects, features or samples can be renamed or deleted.

If *rename* is chosen, a further dialogue field offers the possibility to enter a new name.

Other buttons in the input mask:

Open project (feature/sample).	Green rims, when ready.
Save project (feature/sample).	Red rims, when there are new data to be saved.
New project (feature/sample).	Empty form (empty entry level).
Insert standard default data of project (feature/sample).	Applies standard entries.
Insert data of previous project (feature/sample).	Inserts data of the previously saved project (feature/sample).

Input of data

Data entry is facultative in many fields in the entry levels *Project*, *Feature* and *Sample*. It is recommended though, to aim for a comprehensive collection of data, since this will be the basis for evaluation.

Input of data in *Project* level of the entry form

Project	Identification of the project (abbreviation/number - up to 10 characters), a) selection from the list of existing sites (pull-down menu) or b) entry of a new project-number.
Abbr. Site	Abbreviation of the site name.
Location (Parish)	Location of the excavation site - administrative denomination; a) entry of a new location or b) selection from the list of existing locations (pull-down menu). Note: It is possible to create a complete list of administrative locations in the structure-data table *Parish*; moreover, it is possible to connect this data with content of the structure-data tables *District* and *County*. In that case selection of location using pull-down menu results in fill in of data in all following fields of the entry form: *Parish*, *District*, *Country*, eventually also fields *Coord. syst*, *Easting* and *Northing*.
District	Administrative district denomination.
County	Federal state/region; according to the administrative situation.
Country	State.
Place/street	Name of the place/street; according to the archaeological indication.
Reg. number	Receipt number of the institution.
Natural unit	List-selection according to customary classification of natural landscape units.
Map	Number of Topographic Map 1 : 25,000.
Coord. syst	As reference system for the following coordinates .
Easting	Easting; average value for the site.
Northing	Northing; average value for the site.
Altitude	Altitude; average value for the site in meters.
Site director	Name of site director, institution.
Archeologist	Name of scientist responsible for processing the archaeological material.
Botanist	Name of scientist responsible for botanical determination (possibly several persons).
Author(s)	Author(s) of publication/manuscript/excavation report.
Publ. year	Year of publication.
within Limes	Location within the boundaries of the Limes (in Roman imperial times).
Site OK?	Methodical classification of the site; the default is tick for the site OK.
Remarks to site	Free text entry.

Input of data in *Feature* level of the entry form

Feature	Identification of the feature (abbreviation/number - up to 10 characters), a) selection from the list of existing sites (pull-down menu) or b) entry of a new project-number.
Year(s) of exc.	Years of excavation: upon click into the field for excavation years, a dialog window for data entry appears. In the main entry form, these dates appear separated by semicolon.
Excavation area	Name of the excavation area/section; enter if the information to is available.
Site type	List-selection (pull-down menu): available terms are listed in the structure-data table *Site Type*. Obligatory information; default: *unkn* for unknown; may be replaced by a known site type.
Feature type	List-selection (pull-down menu): available terms are listed in the structure-data table *Feature Types.*
site type uncertain	Tick if the site type is uncertain, e. g. for site type - settlement, if only one pit of an archaeological period has been excavated.
Bot. determination	Author of botanical determination (possibly several persons; if seed/fruit and charcoal are treated separately).
Bot. det. - year	Year of the botanical determination.
Feature OK?	Methodical evaluation of the feature; tick (by default) means: feature OK.
Remarks to feature	Free text entry.

🛈 Information windows

On the levels *Project* and *Feature,* information windows are available, giving an overview on the current state of recorded project or feature data.

Input of data in *Sample* level of the entry form

Sample	Archaeological coding of the sample (e. g. find sheet number), a) selection from the list of existing sites (pull-down menu) or b) entry of a new project-number.
Stratum	Entry according to available information.
Sector	Entry according to available information.
Layer	Entry according to available information.
Planum	Entry according to available information.
Depth from .. to	Depth (cm) under surface.
Altitude	Absolute altitude of the sample; including negative values.
Coord. XYZ	Coordinates in the measuring field.
Sample type	List-selection (pull-down menu): available terms are listed in the structure data table *SampleTypes.*
Dating - process	Absolute dating of the sample: upon click into the field "process", a dialog window for data entry appears.
Dating available	Shows number of recorded subsamples of the sample analyzed for absolute dating.
Chronozone	List-selection (pull-down menu): available terms are listed in the structure data table *ChronoDat* (according to Mangerud et al. 1974).
Arch. dating	Archaeological dating. List-selection (pull-down menu): available terms are listed in the structure-data table *ArchDat*. Obligatory information; default *ArchDat?* may be replaced as soon as the archaeological dating is known.
Cultural group	Cultural group in the time of Roman empire. List-selection (pull-down menu): available terms are listed in the structure data table *CulturGroups.*
Analyzed fractions	ORG - organical fraction (floating), MIN - mineral fraction (at the bottom of the bucket), numbers are for the sieve size. Each list: yes/no/partly.
Micro-remain sample	Tick for yes; concerns subsamples for micro-remain analysis (pollen).
Storage find	Tick for yes; in Wiesbaden the mass finds with number of grains of ≥ 100 seeds/L are defined as "storage find". The classification as "storage find" must be always individually checked.
Inventory	State of investigation: obligatory information. Insert one of three offered options: *inv*, *wf* and *ni* for "investigated, results available", "investigated, without find" and "not investigated" respectively.
Volume	Sample volume before washing; for dir-samples usually 0.01 to 0.1L.
Dry / Wet	This field concerns the preservation conditions on site: obligatory information; default: *dry.*
Charcoal weight	With these values the multiplier for wood used in the section of *Results* is calculated; multiplier = total CH : (total CH - CH undetermined).
Remarks to sample	Free text entry; e. g. on methods of sample processing.

Data storage

Newly entered data in the levels *project*, *feature* and *sample* must be actively saved. A noticeable red rim appears to indicate the existence of yet unregistered entries (see below: command buttons). Upon click, they are stored.

In contrast, new data in the entry level *results* is saved automatically by quitting a row (each row corresponds to one dataset).

> **In the table *Details* data is saved exactly as visible during data input; this means plant finds are recorded separately for each sieving fraction.**

> **In the table *Results* each taxon appears only once in a sample with the number of pieces added up from all fractions.**

While working with the input form, the programme reliably reports situations, where either saving is required or where previous changes can be rejected. Data loss is not possible.

If saving of a dataset is not possible (e.g. if violation of a validity constraint has occurred), an error message appears.

Tip: Obligatory data input
Entries are necessary for the identification of the project, feature and sample, as well as for the *PCODE* to create and save respective datasets in the correspondent data tables *projects, features, samples, results* and *details.*

With **ArboDatMulti**[©] a very detailed recording of data is possible, but it is not obligatory for most fields. There are only few fields, which implicitly require an entry. In the entry level for features this is the field *site type,* in the samples level these are the fields *Archaelogical Dating* (ArchDat) and the Inventory fields *Seed, Charc.* (charcoal) and *Wood* (subfossil wood).

New in the update 2010 are default values for the fields *site type* with the default entry *unkn (unknown type of site)* and *archeological dating* with the entry *ArchDat? (archaeological period unknown).* If these entries are deleted and not replaced, it is not possible to register the respective datasets of the feature or the sample.

Non valid saving attempts due to missing entries are indicated by yellow fill in the respective fields, drawing the users attention directly to the reason for not allowed saving.

Old data, which was stored without entry in the respective fields in previous ArboDat versions, will remain unchanged until the respective feature or sample is edited again via input form. The new default entries will then occur instead of missing entries. It is recommended to check old data on completeness. This can either be done in the tables or using queries.

Datasets in the results level of the input form will not be saved, unless they are quantified (entry of number, fragments and/or weight). If necessary, an estimated value is recorded.

An error message occurs if an attempt is made to quit a dataset without the obligatory entries.

To delete or quit an incomplete dataset press Esc.

The sub-forms *Entry of Years of excavation* and *Dating*

Years of excavation

If the cursor is set to the field year(s) of excavation in the entry level for features, an additional subform *Entry of Years of excavation* opens.

The dates are saved in the table *Years of excavation* (ArchBot Data) and appear in the field *Year(s) of excavation* of the main input form one after the other, separated by semicolon.

Dating

The table *Dating* with its input sub-form allows for a detailed recording of relevant dating data of the sample.

Selecting the command button *process* in the samples panel of the main input form opens the *Dating* sub-form. In the main input form appears the total amount of dating entries only.

All other data can either be seen in the input form *Dating* (arrow back/forward) or directly in the table *Dating*.

Input of botanical results

Data is entered row by row. Each row is a dataset and corresponds to 1-n identifications of a taxon exhibiting the same type of plant remain, the same preservation state and origins from the same sieve fraction. Each dataset is saved as soon as the row is left.

In every dataset the plant remains are characterized regarding taxon, origin, type of plant remain and state of preservation. The corresponding pull-down menus are accessed by selecting the arrow next to each field (alternatively by F4).

Taxon	Taxon selection with a plant-code = *PCode.* The source of the *PCodes* is the tab. *EcoSocData.*
Botanical Name	Is automatically inserted by selection of the *PCodes*.
Fraction	Selection from ORG 1,0 – ORG 0,5 – ORG 0,25 – MIN 1,0 – MIN 0,5 – MIN 0,25 mm if plant remains origin from different sieve fractions of a sample (as to changing the offered sieve fractions see chapter **Database adjustments to regional requirements**.
cf. = confer (compare)	Insertion of "*cf.*" preceding the names of either species (A), genus (G), family (F), sub-species (S) or variety (V); cf. appears automatically on the respective place in the evaluation tables.
Rtyp = type of plant remain	Selection of the type of plant remains (see the following page). The source of the plant remains codes is the tab. *RTyp*.
State of preservation	Selection from: charred (**ch**) - waterlogged (**wa**) – mineralised (**mi**) – desiccated (**de**) - charred and mineralised (**cm**) – imprint (**im**) - others (**ot**); wet/dry: describes the terrain condition, not the storage condition in the lab.

Some fields contain the most common entries as default values, which are supposed to lighten the work load. Further assistance is provided by an automatic transfer of a chosen sieve fraction into the next row; it appears upon entry of a *PCODE* in the new row.

Default values must be controlled during data input and corrected, if necessary.

Identical datasets are not allowed within one sample, e.g. datasets differing from each other only with respect to the number of pieces or weight. If this rule is violated an error message appears.

Appropriate use of terms for types of plant remains

The complete overview of currently used descriptions for types of plant remains can be found in the Appendix *Tables* (the table **RTyp**). The types of plant remains are divided to several groups (see the table **RTypGroups**) e.g. wood, vegetative remains, seeds/fruits etc. The descriptions for the type of plant remains are not assigned in a strict botanical way, but are rather aimed to create clear conditions with respect to the evaluation of the results.

The largest group comprises seed or fruit (abbreviation **seed)**. For the archaeobotanic evaluation it is not useful to discriminate between seed and fruit in a botanical sense (e.g. achene, caryopsis, seed etc.).

Seed also includes e.g. pits from *Prunus, Cornus, Olea, Vitis*, *Ficus*, *Sambucus*, *Crataegus*, *Rubus, Fragaria* etc.

The description of plant remains as *seed* also includes nutshell fragments of *Corylus, Carpinus* and other „nuts" (e.g. *Pinus pinea*); the number of fragments is entered into the field *Frag* (= fragments, see below).

Furthermore, utriculi (*Carex*) and „wing-like extensions" (wings are fragments of *seed*) also are entered using *seed* as type of plant remain. Generally, the comment field should be used for a more detailed description during data input.

Exceptions are those cases, where whole „fruit" is present (e.g. also possible for *Corylus, Carpinus*); in this case **fruit** is entered.

In addition, **testa** (testa with/without hilum - Cerealia) can be used for fragments of cereals from latrine, **pericarp** for apples, or **flower** (flower part/flower, incl. perianth etc.) for remains of the cupule of *Ribes* sp. etc. The latter usually do not occur in dry soil features prevailing in many investigation areas.

Funiculus or **hilum** are not counted seperatly for Cerealia (see above), but for Fabaceae (see also the description for types of plant remains in the table *RType*). Also, we do not distinguish between testa and pericarp fragments of Cerealia from latrine samples.

Originally the table also contained „cereals" as umbrella term for types of cereal remains. In queries though, we only use the field *RtypGroups* for selecting or excluding *wood* and/or *other*. To select *cereals* we use the field *crop* provided by the table *EcoSocData*. Therefore the term "cereals" was deleted from the table *RtypGroups* and, for practical reasons, cereals are classified by now as seed/fruit.

To avoid seperate listing of spikelet forks and glume bases, spikelet **forks** are counted and registered as two glume bases (**glumBase**).

For rachis fragments with several internodes single segments are counted and the number is registered with the description **rachSeg** (rachis segment). In the comment field the number of the rachis fragments with several internodes may be noted, e.g. 1x2 segments, 3x5 segments etc.

The term **glume** is used for all sorts of husks (i.e. lemma, palea and glumes).

Quantitative capture of results

During the database meeting in may 2002, the use of different terms describing types of plant remains was discussed, as well as the counting for certain types. We agreed upon the following standard guidelines for counting and data input:

Seed

The really identified and counted number of taxa from either each complete sieve fraction or from partially examined fractions is recorded into the fields **rNumber, rFrag** and **rWeight** (r stands for real). These entries are registered in the table *Details* (*ArchBotData*) and thus available for queries at any time.

If samples are only partially examined, an extrapolation to the total quantity values of a sample is needed for the evaluation. For this purpose the respective factor (**multiplier**) is entered and the programme automatically calculates the result for the total fraction = *FNumber, FFrag* and *FWeight* (F stands for fraction).

The factor to be entered is calculated from the examined part of a fraction, e.g. for ½ examined fraction, the multiplier equals 2, for ¼ examined fraction the multiplier equals 4, etc.

> **Tip: The number of pieces is given as integer**
> By definition, only integers are accepted as piece numbers. Due to this, during calculation with fractions rounding up or down might occur. E. g. if the multiplicator was 0.2 for one cereal grain, 0 would be displayed as number of pieces. In contrast, the weight can be non-integer and up to 4 decimal places are shown.

Charcoal

For extrapolation, the weight of charcoal is multiplied by the factor *Char*. This factor is calculated according to the formula:

Total charcoal weight / (total charcoal weight – weight of not examined charcoal)

The charcoal multiplier is only active if, in the same dataset, a type of plant remain is selected, which belongs to the RTypGroup *wood*, e.g. stWood = stem-wood, *branchW* = branch-wood, etc. (see Table *RTyp* in the Appendix).

In some samples charcoal is only partially examined. Hence, the field for total charcoal weight must state the total weight of the whole sample instead of the weight of the examined subset. If the initial total weight of charcoal can not be determined (apart from examining the whole sample), the total weight is extrapolated from the respective subset.

> **Tip: Click on charcoal multiplier!**
> During data entry, the charcoal multiplier will not automatically be displayed in the multiplier field, but has to be executed by selecting the button **CH**.

Semi-quantiative data entry

A fully quantitative acquisition of data is the basis for many archaeobotanical evaluation methods. However, in exceptional cases, quantification is not possible, e.g. for large quantities of testa fragments of grain. With such semi-quantitative data (e.g. >100) calculations are not possible and these data cannot be added to quantitative data. In these cases either an approximate value is entered and marked by tick mark (see next page), or the respective plant remains are only described in the field for remarks to sample. Likewise, samples, which were only "scanned" (plant remains were not individually counted) need to be marked separately.

Approximation and fragments

For evaluation the numbers in the fields for whole pieces and for fragments are equivalently counted or added up. In these fields only integers are accepted by the programme.

By this approach it is assumed that generally it can not be known if fragments originally belonged together or not. Hence the full number of fragments is entered to "rFrag".

If though, fragments obviously origin from one entity (e.g. two halfs of a pea or 1 *Chenopodium album*, missing one corner + 1 little fragment), whole unities can be reconstructed.

For a big number of fragments of one taxon (e.g. *Agrostemma*-fragments) it is reasonable to enter an approximate value and indicate it as such. In this case an estimated total amount is entered in **rNumber** and the control box is checked, thus indicating estimation.
This may be further stressed in the comment field of the sample.

> **Tip: Estimation of Cerealia indet.**
> For **Cerealia** indet., an approximate value is entered as reconstructed grains. If the individual procedure differs from the general consensus, a precise documentation is essential for later data exchange. It was agreed on a common procedure: who has counted all fragments in the past, can divide the number of fragments by an appropriate value and enter this value with checkmark for indication of an estimated value.

> **Tip: Approximation of the sample volume**
> The sample volume of directly taken plant remains without sediment can often not be quantified (so-called dir-samples – usually applies for charcoal). As these samples should also appear in calculations with their sample volumes, a virtual sample volume is entered (usually 0.01 litre). If necessary the sample volume can also be approximated in other cases. This is then also indicated in the remarks to the site and to the sample.

Counting of results in calculations

For the input of results it is useful to keep in mind how the entered numbers might contribute to calculations. An overview on routinely calculated values is given here:

♦ **Numbers** (whole pieces) and **fragments** of *seed* are equally counted in the pre-programmed queries (as whole pieces).

♦ For each taxon, the sum of all examined fractions of a sample is not given in the input mask, but is saved in the fields of the results table named *SumFNum, SumFFrag* and *SumFWeight*.

♦ Finally, in the **evaluations** the values of whole pieces and fragments are merged even further by adding up *SumFNum* and *SumFFrag* of every taxon to *SumMR*.

♦ *SumMR* ist the relevant value for all evaluations of seed; for each taxon it comprises all plant remains of the same preservation state occurring in one sample.

♦ Individual queries must be created for a more detailed evaluation regarding really counted plant remains or whole seed and fragments. The number of really counted plant remains of every sample *rMR* is additionally listed in the automatic taxalists.

Navigation guidelines for the results level of the input form

Cursor movement:
The next entry point is reached by using the tab keys, arrow right ➜, or arrow down ⬇. The previous entry point is reached either by arrow left ⬅ or arrow up ⬆.

Page up moves the cursor to the first field of the first dataset.
Page down moves the cursor to the first field of a new dataset added below. Here also the screen view jumps to the last position and only the new dataset is visible.
Upon pressing ***End*** the cursor jumps to the last field of the last dataset.

The two scroll bars on the righthand side allow to move up and down in the results level or to chose the displayed section of data (1 scroll bar for the he complete entry form, 1 scroll bar for the sub-form results).

Selection of a dataset:
A dataset is marked by activating the small grey box in the very left of the row.

Deletion of a dataset:
Select dataset, then > Edit > Delete dataset. A dialog box asks if the dataset is really to be deleted. Completion with > OK.

Leaving a datset:
A non-completed dataset is left/deleted with Esc.

Sorting data:
Initially, data remains sorted in the entry order.
To arrange the results alphabetically, move the cursor to the first taxon-field and press the button A to Z in the tool bar. The data then remains permanently arranged in alphabetical order of the plant codes. Later entries are appended until the data is ordered once again.

Nonstandard keyboard configuration:
The key **F3** moves the cursor from any field (except from a checked estimation box) in one row to the taxon field in the next row.

Key **F4**: If the cursor is set into a field offering a pull-down menu, the key F4 will open the list. Arrow up/down is used to move to the desired position. The chosen term is selected and inserted into the respective field by return.

Autocompletion:
For the fields *Rtyp* and *Preserv.*, it is mostly sufficient to enter the first letter of the desired abbreviation and the rest will appear automatically. However, the entry should always be controlled.
Generally, this is also true for the *PCode*. Two to three letters may be sufficient to define a *PCode* precisely and the rest will be completed automatically (the displayed Botanical Name must be controlled though!). This function is further facilitated by keeping the fields with scroll-down menus non-case-sensitive. When the field is left, the entry is replaced by the correct syntax.

The PCODE

The field **PCODE** (= plant code) is the key field of the table *EcoSocData.* The taxon is unambiguously defined by the PCODE. The list of over 5000 PCODEs is available as pull-down menu in the input mask.

The PCODEs and the corresponding abbreviations originate from a Suisse nomenclature (Paulsen, J. 1995) and were adopted from the group of Stefi Jacomet, IPNA University of Basel.

Changes in the inventory of PCODEs are only carried out in common agreement, to maintain the possibility of data exchange and joint evaluation conducted by several groups. Suggestions should hence be applied for in Wiesbaden.

Abbreviation rules:
The PCODE of species and family names consists of five symbols (usually letters, numbers are exceptional), the PCODE of genus names consists of four symbols.

The PCODE for species is composed by the first two letters of the genus name, followed by the first three letters of the species denomination. For genus and family names the first four or five letters are used, respectively.

If coincident PCODEs for varying taxa result from these rules, the procedure deviates from the rules to create an unambiguous PCODE for each taxon. Hence some exceptions occur.

In Wiesbaden the Botanical Names are used according to the Flora Europaea (Consolidated Index, Cambridge, 1983). Exception: the family names and the german taxa names are adopted from Oberdorfer (Pflanzensoziologische Exkursionsflora 1990).

> **Tip: PCODEs for synonymes**
> In some cases PCODEs were adopted from less common nomenclatures, before this system was introduced in ArboDat. For example for *Myosoton aquaticum* the PCODE STAQU (*Stellaria aquatica*) is found, or for *Polygonum convolvulus/aviculare* the PCODE FAPOA (*Fallopia/P. avic.*) is used. Furthermore some special constructions exist, e.g. CEREA (Cerealia), PANIC (Panicoideae), CABIC/CATRI (*Carex* spec. bi-/tricarpellat), etc.

Further guidelines for the correct choice of the PCode are listet in the following overview tables for Triticum and Hordeum, for frequently occuring Fabaceae and Poaceae, as well as for so-called cf.-species.

Triticum overview

PCODE			
TRIT	*Triticum* spec.	Wheat undifferenciated	badly preserved grains
Hulled wheat			
TRISP	*Triticum* spec. Spelzweizen	Hulled wheat	Mostly rudimentary glume bases (di/mo/spelta)
TRMOC	*Triticum monococcum*	Einkorn	1-grained einkorn ; also for the entry of glume bases of *T. mono.*
TRMO2	*Triticum monococcum,* 2-körnig	Einkorn, 2-grained	
TRDIC	*Triticum dicoccum*	Emmer	
TRDIE	*Triticum dicoccum*, 1-körnig	Emmer, 1-grained	Convex ventral side
TRSPE	*Triticum spelta*	Dinkel	Also: unripe spelt grain
TRMOD	*Triticum monococcum/dicoccum*	Einkorn/Emmer	More relevant for the recording of glume bases
TRMSP	*Triticum monococcum,* 2-körnig/*spelta*	2-grained Einkorn/Dinkel	Grain finds
TRDSP	*Triticum dicoccum/spelta*	Emmer/Dinkel	
Naked wheat			
TRAED	*Triticum aestivum* s.l./*durum/turgidum*	Naked wheat	tetra- or hexaploid; e.g. for insufficient description of determinations found in the literature (e.g. grains = *Trit. compactum*)
TRAES	*Triticum aestivum/compactum*	Naked wheat, hexaploid	Bread wheat/Club wheat; another possible denomination is *Triticum aestivum* s.l.
TRASS	*Triticum aestivum*	Bread wheat	s. str. – when exactly identified on well preserved plant remains
TRCOM	*Triticum compactum*	Club wheat	s. str. - when exactly identified on well preserved plant remains
TRTET	*Triticum durum/turgidum*	Naked wheat, tetraploid	hard-/rivet-wheat
TRDUR	*Triticum durum*	Hard wheat	s. str. - when exactly identified on well preserved plant remains
TRTUR	*Triticum turgidum*	Rivet wheat	s. str. - when exactly identified on well preserved plant remains
Naked or hulled wheat			
TRASP	*Triticum aest.*s.l./*dur./turg./spelta*	Naked wheat/spelt	Bread-/club-/hard-/rivet-wheat/spelt
TRADD	*Triticum aest.*s.l./*dur./turg./dicoccum*	Naked wheat /emmer	Bread-/club-/hard-/rivet-wheat/emmer

TRIT   *Triticum* - **wheat**

Hulled wheat

TRISP

	2n	4n	6n
2-grained	TRMO2	TRDIC	TRDSP TRSPE
	TRMOD *mono./dic*		*dic./spelta*
1-grained	TRMOC	TRDIE	
	monococcum	*dicococcum*	*spelta*

2-grained
mono./spelta   **TRMSP**   *aest.s.l./dur./turg. /dicoccum*   **TRADD**   *aest.s.l./dur./turg. /spelta*   **TRASP**

Naked wheat

TRAED

	4n	6n
	TRTET	TRAES
	TRDUR TRTUR	TRASS TRCOM
	durum/turgidum	*aestivum/compactum (aest.s.l.)*
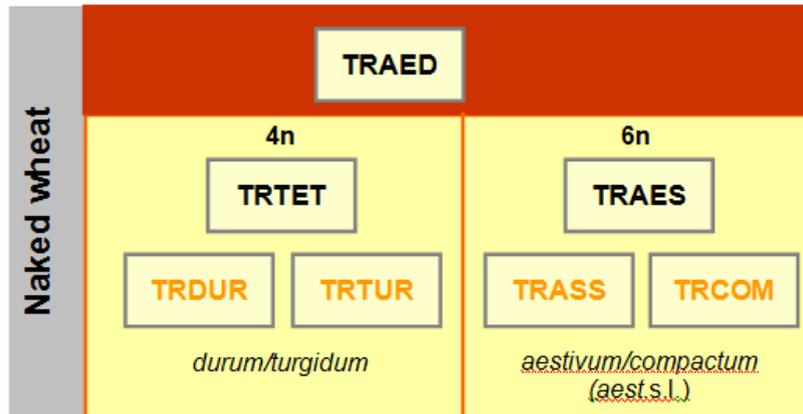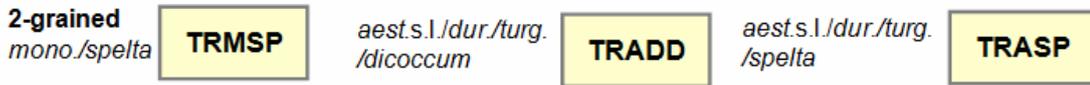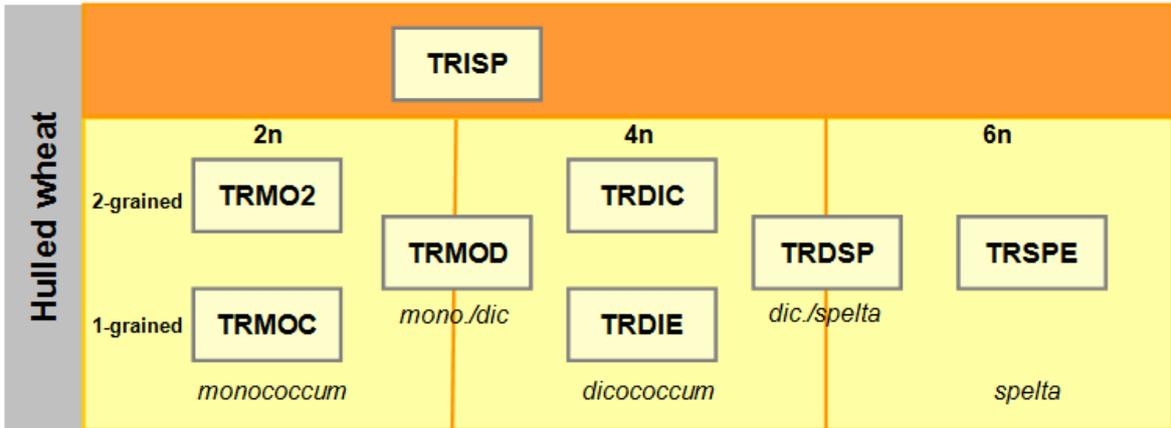
Hordeum overview

PCODE			
HORD	*Hordeum* spec.	Barley undifferenciated	Incl. wild barley (e.g. *H. murinum*)

Hordeum distichon/vulgare: Cultivated barley, 2- or multi-rowed

HODIV	*Hordeum distichon/vulgare*	Cultivated barley undiff.	*Naked* or *hulled*, usually badly preserved grains (*Hordeum* spec.)
HODVS	*Hordeum distichon/vulgare* Hulled barley	Hulled barley undiff.	grains with an edged form, seem to be cut off at the apical end (duck beak); 2 or multi-rowed
HODVN	*Hordeum distichon/vulgare* Naked barley	Naked barley undiff.	See surface grain/chaff; 2 or multi-rowed

Hordeum vulgare; cultivated barley, multi-rowed (incl. *ssp./var. vulgare/hexastichon*)

HOVUL	*Hordeum vulgare* undiff.	Cultivated barley, multi-rowed	*Hulled or naked barley,* 4- or 6-rowed; 4-rowed = ssp./var. *vulgare*; 6-rowed = ssp-./var. *hexastichon*
HOVUS	*Hordeum vulgare* Hulled barley	*Hulled barley*, multi-rowed	a. o. twisted grains
HOVUN	*Hordeum vulgare* Naked barley	*Naked barley*, multi-rowed	a. o. twisted grains
HORD4	*Hordeum vulgare* 4-rowed	Barley, 4-rowed	4-rowed hulled or naked barley, *H. vulgare* ssp./var. *vulgare*, lemma bases (lemmBase) carp mouth; rachis segments > 2,5 mm L; twisted grains
HORD6	*Hordeum vulgare* 6-rowed	Barley, 6-rowed	6-rowed hulled or naked barley, *H. vulgare* ssp./var. *hexastichon*, lemma bases (lemmBase) slim furrow; rachis internodes < 2,5 mm L; (twisted grains)
HORS4	*Hordeum vulgare* 4-rowed Hulled barley	Hulled barley 4-rowed	See above
HORS6	*Hordeum vulgare* 6-rowed Hulled barley	Hulled barley 6-rowed	See above
HORN4	*Hordeum vulgare* 4-rowed Naked barley	Naked barley 4-rowed	See above
HORN6	*Hordeum vulgare* 6-rowed Naked barley	Naked barley 6-rowed	See above

Hordeum distichon; Cultivated barley, 2-rowed

HODIS	*Hordeum distichon*	Barley, 2-rowed	Naked or hulled

HORD
Barley
undifferentiated
incl. wild barley

Cultured barley

	hulled	*naked or hulled*	*naked*	
	HODVS (a.o. edged)	**HODIV**	**HODVN**	***Hordeum distichon/vulgare*** 2- or many-rowed
		HODIS		***Hordeum distichon*** 2- rowed (never twisters)
	HOVUS	**HOVUL**	**HOVUN**	***Hordeum vulgare*** Many-rowed (twisters more likely 4-rowed)
	HORS4	**HORD4**	**HORN4**	***Hordeum vulgare* ssp./var. vulgare** 4- rowed (lemma base carp mouth, Rachis inter-nodes > 2,5 mm L)
	HORS6	**HORD6**	**HORN6**	***Hordeum vulgare* ssp./var. hexastichon** 6- rowed (lemma base slim furrow, Rachis internodes < 2,5 mm L)

Frequently needed and special PCODEs

For multiple determinations / type-denominations

When using PCODEs for multiple determinations or cf.-determinations, one should always keep in mind the consequences for later evaluation. When determinations of this kind are not suitable for any ecological evaluation it might be reasonable to harmonize data and use more general taxa denominations for data entry.

In the following table, examples of Fabaceae are listed, as well as some common PCODEs for Poaceae:

We use:	Includes the determinations:
FABAK = Fabaceae cultivated	*Lens/Pisum* and *Pisum/Vicia faba* (may be specified in the remarks field)
FABAC = Fabaceae	Fabaceae *Vicia*-Typ, *Lens/Vicia* small
LOTRI = *Lotus/Trifolium*	Fabaceae *Trifolium*-Typ
LAPIV = *Lathyrus/Pisum/Vicia*	comprises also *Lathyrus/Vicia*

BRSEC = *Bromus* cf. *secalinus*	*Bromus secalinus*-type
POBFT = Poaceae *Bromus/Festuca*-Typ	
FESLO = *Festuca/Lolium*	
AVSFB = *Avena/Bromus*	
PONAN = *Poa* non *annua*	
PHPPA = *Phleum pratense/Poa annua*	

We have tried to avoid determinations with the add-on *type*, as they are usually not suitable for an ecological evaluation. Currently the table EcoSocData only holds one PCODE for a type determination: POBFT for Poaceae *Bromus/Festuca*-type as listed above.

Tip: How to avoid type- determination

nstead of using the add-on *type* in the Botanical Name, a PCODE *for a* less differentiated determination can be used. The remarks field then allows for a more detailed description (example: Fabaceae instead of *Vicia*-type).

When justified by the spread of a species, for a more precise determination also a PCODE with *cf.* placed on the appropriate position may be used (e.g. *Bromus* cf. *secalinus* instead of *Bromus secalinus*-type).

The PCODE INDET – herbal and non-herbal varia

Determinations identifying only a type of plant remain, but not the taxon itself, are registered with the PCODE **INDET**. The finds are characterized by the type of plant remain (e.g. *seed* for seed and fruit, *veget* for vegetative remains like stem/halm fragments).

The PCODE **INDET** is also used for **Varia** like insects, coprolithes etc. The type of remains for non-herbal Varia unambiguously characterizes the determination (see below).

The entry of the precise number is optinional for non-herbal Varia. In the reasearch group Wiesbaden all fish remains, insect remains and coprolithes are counted, while all other non-herbal Varia (e. g. archaeology) is quantitatively registered as 1, merely indicating its presence (in the automatic taxalists they are represented by the + sign).

The state of preservation of insects and coprolithes usually is recognizable as charred or mineralized. For all other non-herbal Varia the state of preservation cannot always be identified under the microscope and therefore we use *other* as description for an unknown state of preservation.

Types of remains for non-herbal Varia:

phyt	phytolith		leath	leather
arch	archaeology		moll	mollusca
fish	fish remains		ostra	ostracoda
horns	horns/horn parts		crust	custacea
insect	insects/arthropoda		clad	cladocera
bones	bones/teeth		for	foraminifera
egg	egg/eggshell		stat	statoblasts/otoliths
copro	coprolites		text	textile

The table *EcoSocData*

The table *EcoSocData* contains datasets with ecological information for plant species belonging to about 5000 PCODEs. This table is much more comprehensive than all other structural data tables. The field names and contents, as well as the used literature, are described in the Appendix.

- For the majority of PCODEs, data is available in the fields *BNam* (*Botanical Name* according to Flora Europaea), *TaxAut* (author), *BNamCH, TaxAutCH* and *FamCH* and *CodeNrCH*.

- Ellenberg data could be assigned to about 2000 PCODEs (Ellenberg et al. 1991).

Recording ecological data in all other fields of the table *EcoSocData* is left to the single working groups according to their individual requirements.

The ecological groups

The identified taxa can be classified into ecological groups according to their today's main distribution. The ecological groups are based on the so-called Ellenberg indicator values (Ellenberg et al. 1991). It is known, that the Ellenberg indicator values are unequally well verified; they merely indicate trends (see the authors preface). However, for large datasets they serve as an orientation guide and can be helpful for the evaluation, if they are reconsidered critically.

Overview of the ecological groups with the respective plant-sociological unities according to Ellenberg (1991)

Overview of the ecological groups with the respective plant-sociological unities according to Ellenberg (1991)			Plant-sociological unit*
	Ecological group		
1	**Lake side, banks, river valleys**	1	fresh-water and peatland vegetation (all communities)
		3.1	Isoëto-Nanojuncetea
		3.2	Bidentetea
		3.8	Agrostietea stoloniferae
2	**Grassland vegetation**	3.7	Plantaginetea
		5	anthropo-zoogenic heath- and grassland (all communities)
		6.2	Epilobietea
3	**Ruderal vegetation** annual plants	3.33	Sisymbrietalia
		3.331	Sisymbrion
		3.332	Salsolion ruthenicae
	perennial plants	3.5	Artemisietea (all communities)
		3.6	Agropyretea (all communities)
4	**Ruderals or weeds**	3	Herbaceous vegetation in often disturbed places undifferenciated)
		3.3	Chenopodietea
5	**Crop plants**		--
6	**Weeds of hoed fields and gardens**	3.31	Polygono-Chenopodietalia
	(summer fruit)	3.311	Fumario-Euphorbion
		3.312	Spergulo-Oxalidion
		3.32	Eragrostietalia
		3.321	Eragrostion
		3.322	Digitario-Setarion
7	**Weeds of cereals**	3.4	Secalietea
	(winter fruit)	3.41	Secalietalia
		3.411	Caucalidion (lappulae)
		3.42	Aperetalia
		3.421	Aphanion arvensis
		3.422	Arnoseridion
		3.43	Lolio-Linetalia
		3.431	Lolio remotae-Linion
8	**Garden plants and imported plants**		--
9	**Coniferous forests / heathland**	7	Coniferous woodland and related heathland (all communities)
10	**Deciduous forests / shrubs**	8	Deciduous forests and related shrubs (all communities)
11	**Varia**		--

Database adjustments to regional requirements

The contents of all structural data tables of *ArchBotStrucDat,which is* transferred with the database programme or with updates to other research groups, meet the requirements of the archaebotanical research group in Wiesbaden. Probably, in some cases it might be necessary to adjust the required inventory of terms and definitions to regional requirements of the respective research group (e.g. natural units). The current contents of our structural data tables are listed in the Appendix.

There are no specific input forms for structural data tables (with the exception of EcoSocData). Data is constantly updated directly in the tables. New entries should be designed according to existing ones.

> **Tip: Creating new structural data terms**
> Please, pay attention to potential superior terms and complement them if necessary, e. g. the superior terms for the archaeological datings of the table *ArchDat* are found in the table *Periods*.
>
> The terms should be as short as possible. Sorting numbers should be chosen in a way to make the terms appear in the correct position upon automatic sorting.
>
> Please, pay attention to the field properties: select the design view of the table and place the cursor next to a field name. Subsequently, the respective field properties are displayed on the lower, left side of the screen.

A central concern of our database project is to maintain database compatibility amongst the various research groups. Consequently, it is of major importance, that all database users have a uniform inventory of *PCODEs*, and that the *PCODEs* are used in the same way. Furthermore, it is also important, that all users apply the types of plant remains of the table *RTyp* in the same way.

Information on the inventory of structural data terms, which might vary amongst the various research groups (like archaeological dating or feature types) is exchanged at the user meetings.

Attention please, read first!

1. Create a copy of the database before executing!
2. Close all other forms, reports, etc., since the procedure requires exclusive access to the database.
3. Choose the fraction to be replaced from the list of fractions and enter the new name of the fraction in the subjacent field.
4. Replace! Renaming a fraction may take some time depending on database size.
   A message is displayed at the end.

Fractions:
New fraction:
Replace

Modification of selectable sieve fractions

With the form *Fractions replacement* shown on the left-hand side the offered sieve fractions can be replaced by other mesh dimensions.

An detailed note regarding data storage appears upon opening the form.

An existing fraction can be selected and replaced by a new denomination.

Application example: if all entries from sieve fractions with a mesh width of 0,35 mm were registered with 0,5 mm due to a lack of alternatives, then they can be corrected now in only one process step.

Modification of table contents

ArboDatMulti© has been designed as a research database. Hence, users do have full access to all *ACCESS* functions and pre-programmed database objects. Consequently, tables, forms, requests, etc. can be selected directly from the *ACCESS* sections. This fact requires responsible action on behalf of all users.

On the other hand, the open database structure has the advantage that it is possible to individually create and store new database objects. Especially during data evaluation, the user can select data and do calculations with respect to individual research interests.

Due to the the open structure of *ArboDatMulti©*, data can be added to or changed directly in the tables, which, if properly done, could significantly reduce the work load. Please note, that during those direct modifications in tables, there is **no automatical alignment with other tables** of the database. *ACCESS* merely would indicate referential integrity violation, if there is any.

> **Note: Control by forms**
> In *ACCESS*, control mechanisms regarding data consistency are integrated in forms; they control data input and modification. In *ArboDatMulti©,* as well, the respective control mechanisms are tied to the input form and its various subforms.

Data consistency is always guaranteed during data input and data modification via input form!

If field contents are changed directly in the tables, it is necessary to be aware of possible interconnections to other tables and, if there are any, how these tables depend on each other. The automatic updating between tables depends on how tables are related to each other and possibly also on specific properties of the programme. Some examples:

> **Example: Alteration of a key field in the table *ArchDat_E***
> Instead of *BZ3*, the term *UK* should be used; all hitherto dating has to be changed.
>
> If one would simply replace *BZ3* by *UK* in the table *ArchDat_E*, the dating of the samples in the *Samples* table would **not** automatically change. The correct procedure would be:
> 1. Entry of new dating *UK* in the table *ArchDat_E*.
> 2. Exchange of BZ3 for *UK* in the table *Samples*, where *UK* appears as new menu item.
> 3. Control table *Samples* to avoid remaining *BZ3* dating.
> 4. Finally, delete *BZ3* dating in table *ArchDat_E.*

Alterations in the tables *Results* and *Details*

For **alterations of PCODEs**, one would proceed in the same way (see above). However, here we have a special case, as the PCODE is listed in the two „results" tables *Details* and *Results*, which are depending on each other.
Due to the link direction between these two tables, a PCODE alteration in the table *Results* is automatically adopted by the table *Details*. This is also valid for all other **qualitative information** in these two tables (cf., type of plant remains, state of preservation).

However, this procedure is not valid for alterations of **quantitative data** (number, weight), as these are calculated from the table *Details*. Hence, there is no automatic adjustment in this case, and in elder *ArboDatMulti©* versions data inconsistence could occur, if corresponding alterations were not simultaneously carried out in both tables, *Results* and *Details*. With the new **automatic alignment routine** such an invalid modification of data is cancelled automatically (see below). Thereby, data consistency is restored in both tables.

Safety measures

1. Automatic data alignment

To exclude the depicted case and further risks of **accidental, incorrect alteration of quantitative data**, the following safety measures were installed:

An automatic routine synchronizes quantitative data of the two tables *Details* and *Results*, which means that *Results* is completely recalculated based on the entries in *Details*. Hence, altered numbers in *Results* are recovered, if they had not simultaneously been modified in *Details*. A corresponding message appears whenever the table *Results* is closed.

> The *automatic alignment routine* **for the tables** *Details* **and** *Results* **is activated by the button** *Data alignment* **in the start form.**

Furthermore, the automatic alignment routine recognizes data inconsistency, if any, within the table *Details*. Such inconsistencies may evolve if, for example, the entry in the field *rNumber* was modified in a dataset without altering as well the entry in the field *FNumber*, or, without taking into account a multiplier bigger than 1.

Such corrections within one dataset are not done automatically during direct manipulations in a table. On the contrary, data entry and data changes via entry form completely guarantee consistency of data in the tables concerned.

If such errors occur, the automatic alignment routine generates a table, with incorrect actual values and correct target values highlighted in color, and proposes to correct or ignore. This warning is repeatedly displayed until *correction* is chosen. Then, the false actual value is automatically replaced by the target value.

2. Hide and save database objects

Important database tables, forms, macros and modules might be hidden (to protect them from incidental access). By this means, especially the modules with the utility programme should be protected, as well as the various forms.

Tip: Hiding objects
1) Right click on a table, form or other object > properties > select "hidden" attribute.
2) To hide/unhide all „hidden objects" choose tools > options > view > select/unselect "hidden".

> **Save data regularly - also on external storage media.**

Tip: Compact database
ArchBotProgram might grow quite fast during work because single transactions are recorded. This becomes noticeable when saving to external storage media. To ensure optimal performance, you should compact this partial database on a regular basis: extras > database utilities > **compact and repair** (applies to *ACCESS 2003*).

> **Basic knowledge of** *ACCESS* **is essential for any work done on the design of database-tables, queries and forms (see** *ACCESS* **tutorials).**

> **A continuous (handwritten) record of changes concerning the datapool(s) has proven very useful.**

Suggestions for database modifications, which would imply programming are collected and discussed (apparently) during the user meetings organized by the archaeobotanical laboratory in Wiesbaden.

Merging and deleting datasets

1. Merging: Insert data in *ArchBotDaten_EN*

For this purpose, neither source nor target database should be named *ArchBotData*. During copying, clearly different names are preferable. *ACCESS* is opened twice and source and target databases are selected. The data is then copied from one table to the other.
Select respective tables of the source database > mark datasets to be copied > edit > copy. Open respective table of the target database > edit > add to end.

Due to the interdependence of the tables the following order must be observed:

> *(1)* Table *Projects*
> (2) Table *Features*
> (3) Table *Year_Exc*
> *(4)* Table *Samples*
> *(5)* Table *Dating*
> (6) Table *Results*
> *(7)* Table *Details*

2. Deleting: Delete data from a datapool

As copying and deletion is easily accomplished when working directly in the tables, there is a risk to unintentionally delete data. Thus, always secure your last status, external if necessary!

In order to delete just a few samples, one may proceed in reversed order (see above) and begin with the table *Details*.

In order to delete several projects completely, select the tables *Year_Exc* and *Dating* and delete the respective datasets. Afterwards it is sufficient to delete the projects from the table *Projects*. As a result, all data belonging to the deleted projects and being stored in the other tables listed above, is also automatically deleted.

In order to delete single projects, features or samples from the tables of *ArchBotData*, please use the functions provided for this purpose by the entry form.

Single results of archaeobotanical determination may also be deleted line by line from the „Results"-part of the entry form (select dataset > edit > delete).

IV Data evaluation

Introduction

In *ACCESS* so called **queries** are used to select data from one or more tables and to perform calculations.

On one hand, the archaeobotanical database *ArboDatMulti©* offers already pre-programmed queries; on the other hand, new queries may be developed according to individual requirements like in all other *ACCESS* databases. They also can be stored for recurring tasks.

All queries – pre-programmed or self developed – are represented in the *queries* tab and can be displayed as **design view** or **datasheet view**. The design view allows for the creation and modification of queries. The datasheet view displays the query results as a data table.

> **Tip: Creation of queries with ArboDatMulti©**
> General help may be found in the *ACCESS* help or common *ACCESS* manuals.
>
> Specific advice on the creation of queries with the archaeobotanical database ***ArboDatMulti©*** is given in the chapter **Individual queries**.

A new feature of ***ArboDat*** since the update 2008 is the automated creation of taxa lists. Both, calculation and selection processes are integrated in the programme and hence are not visible as queries. The new update 2010 provides significantly extended functions for the automated list creation.

Another improvement is the easy access of site reports by the **reports** button in the start form, which was included in the update 2010. The two reports are based on a number of queries and sub-reports, which are visible in *ACCESS* tabs *queries* and *reports* as well as both main-reports.

As before, the pre-programmed queries contain the calculations regarding steadiness and concentration (cp. following page). A redevelopment and rearrangement of these queries, which are unchanged since the first ArboDat version, is planned.

> **Tip: Redundant evaluations**
> The evaluation components *taxalist number of plant remains per sample* and *pivot-table for useable plants,* which were still provided in programme version 2008, have become redundant. They are replaced by the new automated taxa lists or may be easily generated, using the new taxa list functions.

Pre-programmed queries

The pre-programmed queries are comprised in *ArboDatMulti©* since the first version of the programme *ArboDat.* Like other queries, they are accessible in the *ACCESS* tab *queries.* On the other hand, they can also be executed via the dialogue window *Evaluation* (see below). For each query the evaluation form offers some simple choices for data selection.
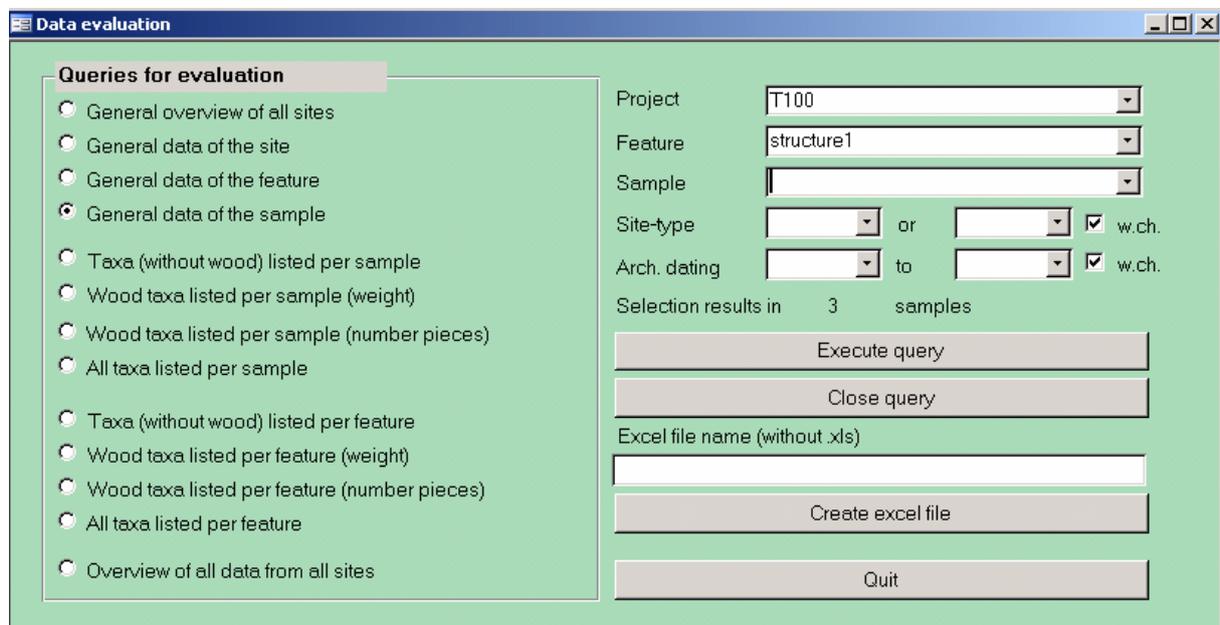
The queries are designed in a comprehensive way, which offers even to users without profound knowledge of *ACCESS* the possibility to retrieve answers to their respective questions.

Further important possible applications of the pre-programmed queries are:

- **Control of data input and of calculated values from self-constructed queries.**

- **Basic data source for the development of individual queries.**

- **Complete or partial master for the creation of new queries.**

Attention: pre-programmed queries should not be changed in their original design

Operation:
Upon activation of the button "data evaluation" in the start menu of the archaeobotanical database programme, the dialogue window "evaluation" (= evaluation form) is opened. There is a choice of several queries:

Data selection in pre-programmed queries:

In all queries (except for the first one), data stock can be narrowed down by selecting a project (right hand side of the form). Additionally, a feature or a feature <u>and</u> a sample can be selected in the third and fourth query.

In each query, the data stock to be queried can be specified by selecting the type of the site (max. 2) and/or the dating or a period between two archaeological datings (from… to...).

By activating the arrow next to the respective field, a list with query options appears. If a field is not redefined by choosing one of the options, the query will be conducted for all data available. This results in a list containing all data and calculations of all projects, features or samples for every archaeological dating, and every site. Below the query, a field gives the information "selection results in… samples". This information is updated for every change of options for the selected data; it provides a good measure to estimate the volume of the query result.

- **The pre-programmed queries number 1 to 4 provide for general information.**

- **The queries number 5 to 12 provide for taxa lists with the corresponding calculated data (concentration, steadiness). A separate window gives details on the feature and sample volumes respectively.**

- **Query number 13 contains a table with all entered data.**

Most fields appear repeatedly in several queries. A description of those fields, which are directly selected from the tables projects, excavation years, features and samples (e.g. SiteType, ArchDat, …) is given in the overviews of the respective data tables (see appendix). Additional fields containing calculated values are described in the following section.

Generally, all results are differentiated in all queries according to *archaeological dating* and *site type*.

For further processing of the resulting tables, we usually prefer *EXCEL*, in particular for simple graphical illustrations. Therefore a simple option facilitates the **Export to Excel** for all queries directly from the queries window. The programme will automatically suggest a name for the new *EXCEL* file and save the table to the same directory where the programme is located. It is possible though, to choose another name for the table and/or save/export it to another directory.

General data (queries 1 - 4)

Calculations in queries number 1-4 (overviews):

nFeat	Number of features per archaeological dating and site type.
nFeatW	Number of features with samples from dry soil per archaeological dating and site type.
nFeatD	Number of features with waterlogged samples per archaeological dating and site type.
nFeatWD	Number of features with waterlogged <u>and</u> dry samples per archaeological dating and site type.
nSampD	Number of dry samples per archaeological dating and site type.
nSampW	Number of waterlogged samples per archaeological dating and site type.
nPrTypFus	Number of samples of each sample-type per archaeological dating and site type; listing of sample-types separated by semi-colon.
nSamp	Number of samples, **including samples without finds**.
nSampSeed	Number of analysed samples with botanical remains belonging to the group of seed/fruit (RTypGroup).
nSampCharc	Number of analysed samples with botanical remains belonging to the group of wood (RTypGroup).
SumProvoSite	Sum of sample volumes of the **whole site**, or rather from the part of the site selected by choice, **including samples without finds**.
SumProvoFeat	Sum of sample volumes of the **whole feature**, or rather from the part of the feature selected by choice, **including samples without finds**.
SumProvo	Sum of sample volumes, including samples without finds.
nTaxonSite	Number of taxa identified from the **whole site**, or rather from the part of the site selected by choice.
nTaxon	Number of taxa.
nTaxonSeedSite	Number of taxa without wood (RTypGroup) identified from the **whole site**, or rather from the part of the site selected by choice.
nTaxonSeed	Number of taxa without wood.
nTaxonCharcSite	Number of taxa identified with botanical remains belonging to wood (RTypGroup) identified from the **whole site**, or rather from the part of the site selected by choice.
nTaxonCharc	Number of taxa charcoal.
SumMRSeed	Sum of plant remains without wood.
SumMRCharc	Sum of plant remains belonging to wood (*RTypGroup*).
SumWeigSeed	Sum of weight of plant remains without wood.
SumWeigCharc	Sum of weight of plant remains belonging to wood (*RTypGroup*).
SumMRSeedFeat	Sum of plant remains without wood of the **whole feature**, or rather the part of the feature selected by choice.
SumMRCharcFeat	Sum of plant remains belonging to wood (RTypGroup) of the **whole feature**, or rather from the part of the feature selected by choice.

ConcPieceSeedSite	Number of plant remains without wood (defined by row parameters) per litre sample volume of the **whole site**, or rather the choice made by selection (data contained in several rows).
ConcPieceSeedFeat	Number of plant remains without wood (defined by row parameters) per litre sample volume of the **whole feature**, or rather the choice made by selection (data contained in several rows).
ConcPieceSeed	Number of plant remains without wood per litre sample volume (all defined by row parameters).
ConcPieceCharcSite	Number of pieces charcoal (defined by row parameters) per litre sample volume of the **whole site**, or rather the choice made by selection (data contained in several rows).
ConcPieceCharcFeat	Number of pieces charcoal (defined by row parameters) per litre sample volume of the **whole site**, or rather the choice made by selection (data contained in several rows).
ConcPieceCharc	Number of pieces charcoal per litre sample volume (all defined by row parameters).
ConcWeigSeedSite	Weight of plant remains without wood (defined by row parameters) per litre sample volume of the **whole site**, or rather the choice made by selection (data contained in several rows).
ConcWeigSeedFeat	Weight of plant remains without wood (defined by row parameters) per litre sample volume of the **whole feature**, or rather the choice made by selection (data contained in several rows).
ConcWeigSeed	Weight of plant remains without wood per litre sample volume (all defined by row parameters).
ConcWeigCharcSite	Weight of charcoal (defined by row parameters) per litre sample volume of the **whole site**, or rather the choice made by selection (data contained in several rows).
ConcWeigCharcFeat	Weight of charcoal (defined by row parameters) per litre sample volume of the **whole site**, or rather the choice made by selection (data contained in several rows).
ConcWeigCharc	Weight of charcoal per litre sample volume (all defined by row parameters).
SumProvo	Sum of sample volumes, including samples without finds.
nTaxonSite	Number of taxa identified from the **whole site**, or rather from the part of the site selected by choice.
nTaxon	Number of taxa.
nTaxonSeedSite	Number of taxa without wood (RTypGroup) identified from the **whole site**, or rather from the part of the site selected by choice.
nTaxonSeed	Number of taxa without wood.
nTaxonCharcSite	Number of taxa identified with botanical remains belonging to wood (RTypGroup) identified from the **whole site**, or rather from the part of the site selected by choice.
nTaxonCharc	Number of taxa charcoal.
SumMRSeed	Sum of plant remains without wood.
SumMRCharc	Sum of plant remains belonging to wood (*RTypGroup*).
SumWeigSeed	Sum of weight of plant remains without wood.
SumWeigCharc	Sum of weight of plant remains belonging to wood (*RTypGroup*).
SumMRSeedFeat	Sum of plant remains without wood of the **whole feature**, or rather the part of the feature selected by choice.
SumMRCharcFeat	Sum of plant remains belonging to wood (RTypGroup) of the **whole feature**, or rather from the part of the feature selected by choice.

Calculations referring to the respective dataset or referring to an otherwise defined amount of data:

Usually query calculations refer to those data which are defined by other fields of the same dataset (= data contained in the same row).

E.g.: *SumProvo* equals the sum of sample volumes of those samples which are defined by other fields of the dataset like *project*, *feature*, *sample*, *dating* and *site type*.

In the pre-programmed queries there exist some exceptions, differing from this common data structure of queries. For these exceptions the data source for a calculated value is not defined by the referring dataset, but embraces a larger data stock. The respective data stock is defined by those parameters, which have been determined in the dialogue fields of the queries window.

> **Tip: Reference values for calculation**
> E.g.: If no other parameter is defined besides the project number to narrow down the selection, *SumProvo**Site*** specifies the sum of all sample volumes of one site (*Site*). If one of several types of sites is additionally selected, *SumProvo**Site*** specifies the sum of all sample volumes of the chosen site type for the respective project.
>
> All fields referring to data defined in this way are specified by the ending ***Site*** or ***Feat,*** if they refer to a site or a feature, respectively.

Taxalists (queries 5 - 12)

Calculations in queries number 5 to 12 (taxalists):
Here also data is listed block by block, according to combinations of existing archaeological dating and site type. Feature and sample volumes are displayed in separate tables.

SumProvoSite	Sum of sample volumes from the **whole** site, or rather from the **complete** choice made by selection, including samples without finds.
SumProvoFeat	Sum of sample volumes from the **whole** feature, or rather from the **complete** choice made by selection, including samples without finds.
nSampSite	Number of samples from the **whole** site, or rather from the **complete** choice made by selection, including samples without finds.
nSampFeat	Number of samples from the **whole** feature, or rather from the **complete** choice made by selection, including samples without finds.
SumMR	Number of plant remains.
Estimate	Indicating estimation incorporated in the number of plant remains.
SumWeight	Sum of weight.
SumFrag	Number of fragments.
ConcMRSite	Number of plant remains defined in the same row per litre sample volume of the whole site, or rather of the complete choice made by selection.
ConcWeigSite	Weight defined in the same row per litre sample volume of the whole site, or rather of the complete choice made by selection.
SteSamp	Frequency of a taxon occurring as one type of plant remain (%) in all (selected) samples of a site.
SteFeat	Frequency of a taxon occurring as one type of plant remain (%) in all (selected) features of a site.

Feat..,Samp..: pieces/ sumFWeight	For each feature or sample (according to the head of the column) the number of pieces and/or the weight of the plant remains of a taxon are shown, as separated by slash.
Feat ..: pieces/ SumFWeight/ ConcMR	For each sample (according to the head of the column) the number of pieces, the weight of the plant remains and the concentration (pieces/litre) of a taxon are presented, as separated by slash.
Feat.., Samp..: SumFWeight/ ConcWeig	For each sample (according to the head of the column) the weight of charcoal and the concentration (weight/litre) of a taxon are presented, as separated by slash.
Feat.., Samp..: pieces/ ConcMR	For each sample (according to the head of the column) the number of pieces of charcoal and the concentration (pieces/litre) of a taxon are presented, as separated by slash.
Feat..: pieces/ SumFWeight	For each feature (according to the head of the column) the number of pieces and/or the weight of the plant remains of a taxon are shown, as separated by slash.
Feat../Samp..	**In a separate spreadsheet:** Display of sample volume or sum of sample volumes of a feature (according to the head of the column). Here also only those samples containing plant remains of the selected group (seed/fruit or wood) are taken into account.
Feat..	

Data calculation and presentation

Differentiation regarding *site type* and *archaeological dating*: In all queries, project results are listed separately row by row as differing by their possibly varying types of sites as well as by their archaeological dating.

Queries 9/10/11: In order to use concentrations values in these queries, the respective datasets must be narrowed down to **one** combination of a single archaeological dating and a single type of site! Otherwise, all volumes will be summarized resulting in false concentration values (in contrast to queries 1-4).

Steadiness values (queries 5-12): By the contrary, the calculation of steadiness allows for multiple combinations of archaeological dating and site types in one query. This is due to the fact that the presence of a taxon is added up for **all** rows and then related to **all** features/samples. However, steadiness values for a whole site with varying dating usually are not reasonable. Hence the query should also be narrowed down to one archaeological dating!

Separate query windows for sample and feature volumes (queries 5-12): Sample and feature volumes referring to the values mentioned above are displayed in a separate query window. Upon export of the results to *EXCEL*, a separate *EXCEL* file is created for the corresponding sample and feature volumes as well. The data from these files can easily be merged in *EXCEL*.

"Empty" samples and features (queries 5-12): Empty sample means: the sample does not contain seed/fruit and wood/charcoal, but may contain remains of the RType group *Others* (zoology, archaeology, etc.).
Attention! In queries 5 -12 (= taxa lists), columns are only created for samples or features which are containing taxa. E*mpty* samples/features are *not* listed as columns. This also applies to the corresponding query datasheets with sample or feature volumes.

In contrast, calculated values of predefined columns (e.g. *SumProvoSite* = sum of all sample or feature volumes) also include *empty* samples and features.

Differentiation according to the state of preservation, the type of plant remain and cf. (queries 5-12): In the taxa lists, the sum of plant remains and other calculated values are listed for one type of plant remain and one type of preservation state in each row.

Steadiness (queries 5-12): Steadiness always refers to one type of plant remain. If cereal remains are listed for example to 50% of all samples as *glumBases* and to the other 50% as *seed,* then the steadiness is 50% each, not 100%. A separate query is necessary, if the steadiness of cereals is to be determined independently of the type of plant remain. This could be a copy of the pre-programmed query without the field *RType.*

Attention: Steadiness values based on samples or features refer to **all** samples or features of a site or of the pre-selection respectively, even if they contain various datings or site types!

Counting method for the number of taxa (queries 1-4): the number of taxa calculated for a sample, a feature or a project respectively, is given by the general overviews. Here, every available *PCODE* is counted once, **irrespective** of its appearance as various types of plant remains or preservation states or with/without cf.!
The automatically calculated number of PCODEs of *seed/fruit* comprises all "taxa without wood" plus one time INDET of the ecological group 11 *Varia.* If no *seed/fruit indet* are existent, the plant code INDET is still counted as one taxon, if archaeology or zoology (which also are entered with this PCODE) are present. This is to be corrected manually for samples without *seed/fruit.*

Multiple values in one field of a taxalist column (queries 5-12): Taxalists are cross-tables which have headlines for rows (taxa) and columns (sample or feature number). Usually, one result is found at one intersection. In contrast, the pre-programmed queries 5-12 can generate more than one value at one intersection, separated from each other by slash.

Accordingly, the column headlines of these queries consist of multiple headline parts: the original column headline (sample or feature number, occasionally both), and two or three additional terms describing the values calculated at the intersections of row and columns. An example of a column headline for a sample is given here:

Feat 50, Samp 4: pieces/sumFWeight

This headline is an abbreviation for number of pieces and weight of sample 4, feature 50.

Correction for double-species: In many cases double-species must be defined besides more unambiguously defined species, e.g. *Polygonum convolvulus, Polygonum aviculare* and the doubled species *P. convolvulus/aviculare.* In this case, three taxa would be counted and thus the number would be overestimated by one taxon. Hence a correction should be made – either by additional queries or manually in *EXCEL.*

Overview of all data from all sites (query 13)

For each result of archaeobotanical determination, the query *Overview of all data from all sites* holds all related fields of the tables *Results, Projects, Features,* and *Samples* (*ArchBotDaten*), as well as all fields of the table *EcoSocData* (*ArchBotStrukDat*) for every *PCODE.*

Additionally it contains the field **SumMR = SumFNum +SumFFrag**

The query *Overview of all data from all sites* merges all available information of the database in one table, as indicated by its name. Hence it is suited as data source for subsequently created, individual **queries**.

We would like to emphasize that pre-programmed queries will be parameterised (saved with the respective selection criteria) automatically, if they run via evaluation form. When using this query as data source for subsequent queries, it is recommended to pay special attention to the criteria line to avoid unexpected parameters (see the chapter **Individual queries**.

Automated generation of taxa lists

Since programme version 2008, formatted taxa lists are available „at the push of a button".

In the initial version different types of **taxa lists for one site each** were implemented. In the current programme version 2010, an improved set of options is provided for this type of taxa list.

In addition, the programme version 2010 was extended to a taxa list type presenting the results from several sites.

Pressing the pushbutton "**taxa lists"** opens a menu, which offers the selection of one type of taxa list, respectively. This leads to two dialogue fields, providing various options for data selection and presentation.
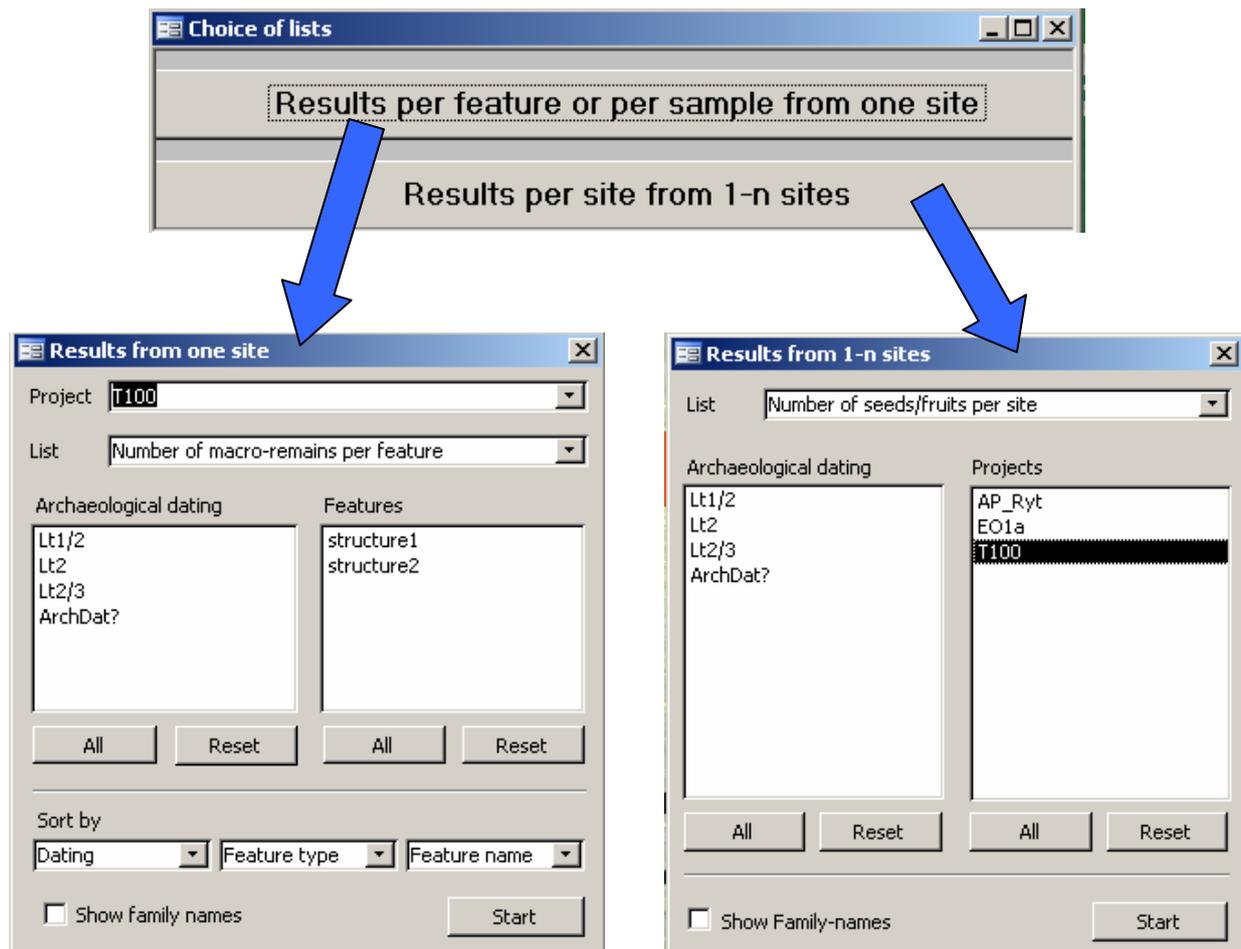
The dialog windows as well as the taxa lists are constructed analogically with respect to the choice of options.

Results per feature or per sample from one site

This choice provides the results from a single site.

Selecting the site by its project number

Choosing a list type

Options for choosing dating and feature(s)

Choice of criteria for the sorting of columns in the tables

Six different kinds of taxa lists can be selected, two for the number of pieces of seed and fruit, two for the number of pieces of charcoal, and two for the charcoal weight. In each case the sum of plant remains for each taxon is displayed for every feature or sample.

The taxa lists *number of pieces* **per feature** and *weight per feature* provide tables, which display the extrapolated number of pieces of plants remains or the extrapolated weight of charcoal <u>per feature</u>, respectively.

The taxa lists *number of pieces per sample* and *weight per sample* also contain the extrapolated values of number of pieces and weight. In addition, they contain the **values,** which were **really counted in** the processed sub-samples. Both, estimated and counted values are listed as sum for each sample.

Upon selection of a site, the two lower windows of the dialog form display existent archaeological dating and features. In those fields, the amount of displayed data can be limited by selecting dating and features. The selection in the two windows operates mutually: if specific archaeological dating is chosen, the right field will only display the features concerned. Vice versa, the selection of specific features will lead to the display of corresponding dating only.

Activation of the pushbutton *all* causes selection of all features or dating. By activation of the pushbutton *reset* the respective selections are set back.

In both windows multiple selections are possible. The ctrl-key allows for selection of discontinuous elements.

Columns can easily be sorted regarding dating, feature type and feature number by use of the three sorting windows.

Example for a taxa list with the results of one site:

The selection *pieces seed/fruit per feature* (project number *AK269* with selection of archaeological dating = *HaD*) provides the following taxa list table (below: page 1 of the 5-paged table).

AP_Ryt Prague
Number of macro-remains per feature

Botanical name	Eco	EcoUnc	Rtyp	state	0124_SA	0124_SI	0125_SI	0143_SI	0174_SI	0175_SI	Name
Archaeological dating					MA2	MA2	MA2	MA2	MA2	MA2	
Feature type					dump	dump	dump	dump	dump	dump	
Number of samples					1	1	1	1	1	1	
SampleVol (l)					1	1	1	1	1	1	
Feature					0124_SA	0124_SI	0125_SI	0143_SI	0174_SI	0175_SI	
						SumPlaRemains					Name
1 Riparian/floodplain vegetation											
Eleocharis palustris agg.	1		seed	wa	6			19			Gewöhnliche Sumpfbinse
Lycopus europaeus	1		seed	wa				1			Ufer-Wolfstrapp
Polygonum cf. amphibium	1		seed	wa				1			
Polygonum cf. hydropiper#	1		seed	wa	1						Wasserpfeffer
Polygonum lapathifolium agg.	1		seed	wa		2		2			Ampfer-Knöterich
Ranunculus flammula	1		seed	wa	1						Brennender Hahnenfuß
Rumex crispus/obtusifolius	1	x	seed	wa	1			8			Krauser/Stumpfblättriger Ampfer
Schoenoplectus tabernaemontani	1		seed	wa	1						Graue Seebinse
Solanum dulcamara	1		seed	wa		1		1			Bittersüßer Nachtschatten
2 Grassland vegetation											
cf. Alchemilla spec.#	2	x	seed	wa				1			
Carex ovalis	2		seed	wa	2	4		2			Hasen-Segge
cf. Daucus carota	2	x	seed	wa				2			Wilde Gelbe Rübe
cf. Filipendula ulmaria	2		seed	wa		1					Mädesüß
Hypericum perforatum	2		seed	wa	2	2		2			Echtes Johanniskraut
Juncus spec.	2	x	seed	wa		2					Binse
Leontodon cf. autumnalis	2		seed	wa				1			Herbst-Löwenzahn
Polygonum aviculare agg.	2	x	seed	ch					1		Vogel-Knöterich
Polygonum aviculare agg.	2	x	seed	wa	15	26		9			Vogel-Knöterich
Prunella cf. vulgaris	2		seed	wa	3			10			Kleine Brunelle
Ranunculus acris	2		seed	wa				2			Scharfer Hahnenfuß
Rumex acetosella agg.	2	x	seed	ch					1		Gewöhnlicher Kleiner Sauerampfer
Rumex acetosella agg.	2	x	seed	wa	11	6		11			Gewöhnlicher Kleiner Sauerampfer
Scirpus sylvaticus	2	x	seed	wa		1		4			Wald-Simse
Stellaria graminea	2		seed	wa		8		4			Gras-Sternmiere
Stellaria cf. graminea	2		seed	wa	14						Gras-Sternmiere
3 Ruderal vegetation											
Reseda luteola	3		seed	wa	1						Färber-Resede

For lists containing more than **255 columns** (limit in all Microsoft office applications) a message displays the number of expected columns. It is asked to divide the list regarding dating and/or feature numbers.

Only samples with an entry *in* for investigated or *wf* for without finds in the inventory columns are displayed. Project samples which have not been investigated regarding one of both groups of plant remains (wood or seed/fruit) are not listed in the taxa lists of the respective group of remains type.

Other remains (non-herbal Varia), which were entered with the PCODE INDET, are listed at the end of the taxa lists of seed/fruit.

The page view displays the automatically generated head- and footnotes as well as additional page formats. A practical improvement is provided by the display of both, **calendar date** and **date of issue**.

Results per site for <u>1- n</u> sites

Provides the results for several sites as selected.
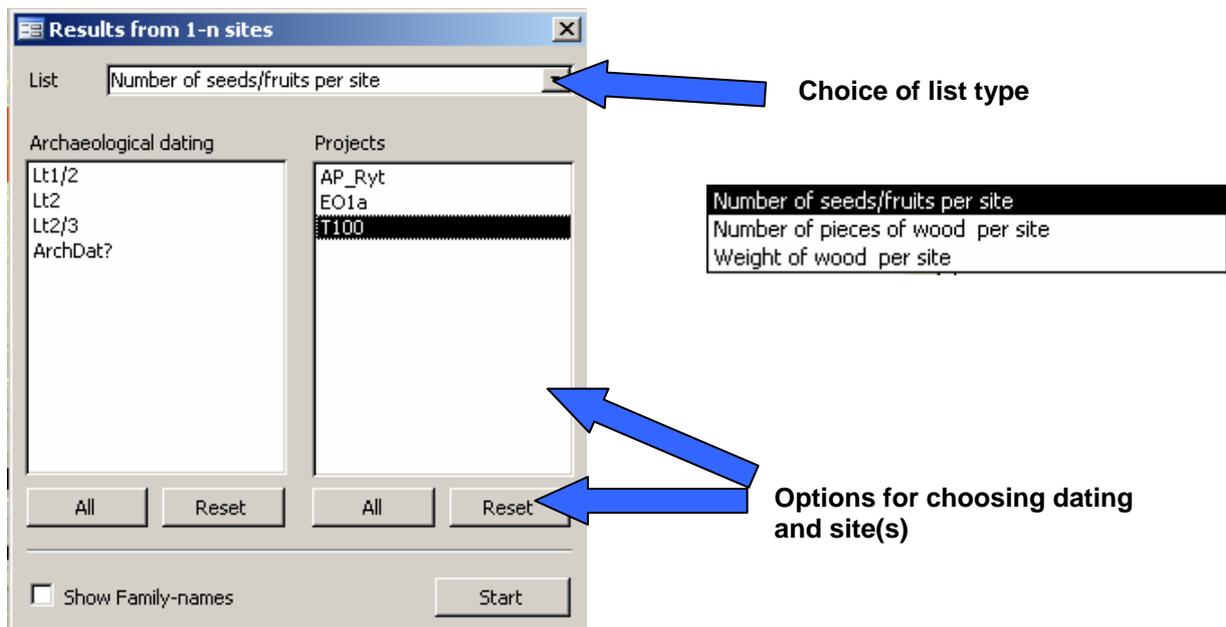
Three different types of taxa lists are offered:

- **Number of pieces of seed and fruit**

- **Number of pieces of wood (charcoal)**

- **Weight of charcoal**

For each taxon the sum of plant remains is added up and listed for each site. The taxa in this table, as well as in the tables for one site described above, are differentiated according to their preservation state (charred, mineralized, subfossile etc.), their type of plant remains (seed, glumBase, etc.) and the level of identification certainty (cf.).

Example of a taxa list with the results from several sites:

Selecting "*weight of wood per site*" of all sites with test data result in the following taxa list table.

Weight of wood per site
Lt1/2, Lt2, MA3

					Gewicht (g)		
ProjectNr					EO1a	T100	
Project					Těšnov	Test	
Archaeological dating(s)					MA3	Lt1/2, Lt2	
Number of objects					1	2	
Number of samples					1	2	
SampleVol (l)						16	
Botanical name	Eco	EcoUnc	Rtyp	state			Name
9 Coniferous forests							
Abies alba	9		wood	wa	+		Weißtanne
Picea abies	9		wood	wa	+		Fichte
Pinus cf. sylvestris	9		wood	wa	+		Wald-Kiefer
10 Deciduous forests/bushes							
Acer cf. campestre	10		wood	wa	+		Feld-Ahorn
Acer cf. platanoides	10		wood	wa	+		Spitz-Ahorn
Acer pseudoplatanus#	10		wood	wa	+		Berg-Ahorn
Carpinus betulus	10		wood	wa	+		Hainbuche
Corylus avellana	10		wood	wa	+		Hasel
Fagus sylvatica	10		wood	wa	+		Rotbuche
Fraxinus excelsior	10		branchW	ch		0,164	Gewöhnliche Esche
Ligustrum vulgare	10		wood	wa	+		Rainweide
Pomoideae	10	x	branchW	ch		0,068	Kernobstartige
Populus spec.	10		wood	wa	+		Pappel
Quercus spec.	10		stWood	ch		0,77	Eiche
Quercus spec.	10		wood	ch	+		Eiche
Quercus spec.	10		wood	wa	0,532		Eiche
Salix spec.	10		wood	wa	+		Weide
Tilia spec.	10		wood	wa	+		Linde
Laubholz indet.	10		stWood	ch		0,6	Laubholz indet.

Additionally, the programme offers the possibility to select the *Botanical Name* of the Family, which is then displayed in an additional column of the taxa list table. Thus, sorting of taxa by their family name is also possible.

All taxa lists are issued as *EXCEL* tables and can be modified applying common *EXCEL* tools (margin, pagination, page format), if necessary.

Sorting of taxa within the automated taxalists

For taxa list sorting the programme refers to the table *EcoGroups*, where all ecological groups are listed by numbers. The taxa are sorted accordingly and subheadlines are inserted. Those taxa, which are not labelled in the table *EcoSocData* with a number of an ecological group existing in the table *EcoGroups* are listed at the end of the list below a subheadline **Without Eco Group**.

Below the headlines of the ecological groups, the taxa are sorted alphabetically except for crops.

Special features are:

a) cf. sorting
E.g. *Veronica arvensis*, *Veronica* cf. *arvensis,* and cf. *Veronica arvensis* would be sorted <u>in this order,</u> one below the other.

b) Sorting of crops
Sorting of crops follows the order established in the table *T_SortBName* (hidden table). At first, cereals are listed, followed by pulses and finally by oil/fibre plants. Within these groups of crops, taxa are sorted alphabetically with the cf. determinations listed in the position directly below the respective taxon without cf. Double species are listed below the group of taxa they refer to. Cerealia indet. are placed at the end of the cereal series.

If the use of the ecological groups is rejected or if instead, a purely alphabetical list is favoured, one or more "fictitious ecological groups" (e.g. 100) can be inserted in the table *EcoGroups* with the desired denomination. Those taxa that should appear grouped by the new headline must have the same number in the field *ecogroup* in the *EcoSocData* table*.*

In any case, it is reasonable to keep the ecogroup 5 for crops, because this enables the programme to run automated sorting within the crops as explained above.
Apart from this, the ecological group 5 for crops is also used in the calculation of the number of taxa crops (automatic correction concerning double-species) in both types of site-reports.

Individual queries

Answers to general questions how to create queries with *ACCESS* can be found in *ACCESS* - manuals or on websites concerning this subject. Some tips specific to *ArboDatMulti©* are given here in the following:

- **Naming queries**

To facilitate orientation it is recommended to label one's own queries explicitly from the beginning in the *ACCESS* tab *queries*, e.g. through preceded literal abbreviations. The list of queries can grow very fast and consequently, it should be revised at times. However, queries which have been *pre-programmed* by us, must not be lost in no case.

- **Query series**

Often, the desired data table representing the evaluation results is approached by a series of several queries based on each other. Here, the pre-programmed queries and those of one's own can be used separately or in combination.

- **Building on pre-programmed queries**

Running new queries, which are based on pre-programmed ones, one has to keep in mind that pre-programmed queries are saved with chosen selection criteria if executed via evaluation form. As a consequence, it is always important to check the respective query, if it actually represents the desired data pool, and thus can serve as a basis for further data-selection (error source!). For this purpose, open the design view of the query. Often, the criteria will be found in the last panels at the end of the query.

- **Modifications of existing queries**

For the use of existing queries as **experimental basis,** it is recommendable to rather use copies of the original queries: select the query to be copied in the query menu > edit > copy > put cursor to query window > paste > enter anew name for the query.

To unhide hidden queries, chose tools > options > view > unselect "hidden".

- **Selecting data**

Specific datasets are selected from one or more sources (tables or queries) by entry of selection criteria into the criteria row of the query design grid. If, for example, the field *Project* is part of the query design, all selected data sources can be browsed for data belonging to a certain project. For this the respective project number is entered into the criteria line (pay attention to the exact spelling).

- **Frequent operators in the criteria line**

More possibilities for selection of data are provided by use of operators (see also *ACCESS* help) in the criteria line. If the field *Project* is part of the query design, some often used operators are:

Or: "AK1" or "AK2"   Datasets of both projects (AK1 and AK2) are given!

And: "AK1" and "AK2"   No datasets are given, because there is no project that fulfils. both requirements.

<> <> "Ak1"   Data of all projects are given, except for AK1!

- **Selection of yes/no data**

Data fields of the type yes/no are represented by small checkboxes in the input mask as well as in the data tables. A checked box indicates „yes", while an empty box indicates „no". Using tables as data sources in queries, „true" or „false" must be entered into the criteria line for selection of „yes" and „no", respectively.

Example: If you are searching for cereals, i.e. *PCODEs* that are checked in the field „Ce" = cereals (Table *EcoSocData*), then the table *EcoSocData* is needed as an additional data source, the field „Ce" = cereals is drawn into a panel of the query design grid and "true" is stated in the criteria row.

In contrast, the procedure differs if a query is used as data source, as yes/true are represented with an X in the pre-programmed queries, while no/false are represented by an empty field. Hence in this case yes/true is searched by entering X in the criteria line.

- **Grouping of datasets**

Datasets appear grouped, as soon as the *Totals* row is displayed in the query design (grouping means, that identical datsets are only listed once).

> ➢ Display/hide the *Totals* row: View > Total
>   Or activate the *Totals button* ∑.

Caution for numbers, e.g. the number of plant remains:
If the *Totals* row is displayed, the *Group by* function is automatically applied to all fields of the query. Consequently, numbers are also displayed grouped, which generally can not lead to the desired result. Hence, all functions must be controlled and, if necessary, an adequate function must be chosen from the menu (the menu appears upon clicking in the *Totals* line), e.g. <u>*Sum*</u> of plant remains or <u>*Count*</u> the number of *PCODEs.*

The function *Group by* is particularly necessary, if the number of different field contents in a larger stock of datasets is to be evaluated, e.g. the number of *PCODEs* of a project. The number of datasets resulting from the query is displayed in the task bar at the bottom of the datasheet view.

- **Display of fields with *Where* constraint**

In panels of the query design grid, which are used for filtering data by an entry in the *Criteria* line and by the *constraint* function <u>*Where*</u>, the *Show* box is automatically unchecked and the corresponding field is not displayed in the datasheet view. However, the field can be displayed in the results of the query (e.g. for data control) by adding it to the design grid a second time with *Group by* selected in its *Totals* row.

- **The expression *Botanical Name* (with „cf")**

Definition: an *ACCESS* <u>expression</u> is a combination of operators, constants, functions, fields, etc., which results in a single value or term.

To combine the *Botanical Name* from the field *BNAM* in the *EcoSocData* table and the field *cf* in the *Results* table, the following expression is used:

Botanischer Name: Biolname(First value([EcoSocData].[BNAM]);[results].[cf])

You may write this expression in the field row of an empty column of the query design grid or rather copy it from another query; then select _Expression_ in the _Totals_ row. Additionally, both fields, which are referred to by the expression are expected to be existent in the query design. These are the fields _BNAM_ from the table _EcoSocData_ and _cf_ from the table _Results_. The respective tables serve as data sources in the query design.

Calculating with zero values – Cz-function

In _ACCESS_ expressions containing fields with zero values become total value zero (including additions, etc.). Therefore, the Cz function (Counting zero) has to be applied in this kind of expression.

As an example, for the evaluation of the sum of plant remains of a sample, the number of whole plant remains must be added to the number of fragments. Usually one of the respective values equals zero. The required fields of the table _Results_ are _SumFNumber_ and _SumFFrag_. In each case the values correspond to the extrapolated sum of all fractions of the sample. In this case the expression is:

Sum of plant remains: sum (Cz([results]![SumFNumber])+Cz([results]![SumFFrag]))

This expression should be entered into the field row of an empty panel and "expression" should be chosen in the _Totals_ line. The table _Results_ must be available as data source (or one of the data sources) in the query design to be referred to by the expression.

Limitation of the number of columns

Like in _EXCEL,_ the number of columns is limited to 255 in all _ACCESS_ tables and datasheets. However, for archaeobotanical data the projects often exceed 255 samples or taxa. In this case a list containing the number of plant remains per sample and taxon cannot be represented by **one** cross-table. If the pre-programmed query _All taxa listed per sample_ results in too many samples to be displayed, an error message occurs. In this case the data has to be divided into two (or more) crosstab queries. The project data may be narrowed down or splitted, e.g. according to archaeological dating, feature type, feature number, or other criteria.

Post-editing tables with _EXCEL_

Usually _EXCEL_ is used to display data as diagrams or lists. _EXCEL_ tables, which are created by copying and pasting _ACCESS_ data, usually should be redesigned for better ease of reading. In addition to the common _EXCEL_ tools like search/replace, adjustment of fonts, formatting rows and columns etc., _ArboDatMulti_[©] users can utilize a small **additional programme for italicizing the _Botanical Names_.**

Post-editing is not necessary for the automated taxalists, which are completely formatted.

Queries of remark fields

Remark fields in the entry levels for projects, features and samples are designed as **memofields**, which may contain more than 255 characters. In _ACCESS_ queries though, a maximum of only 255 characters can be displayed per field. If the text exceeds this limit, the complete field contents can be edited with an _ACCESS_ report.