# Documentation GloRiSe – A global database on riverine sediment composition

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This document summarizes the files belonging to the database, and explains their content and structure. The meaning of abbreviations used in each of the variables and their units within the files can found in the corresponding second sheet of each file. Data is provided in Excel-format (.xlsx) and as a Matlab datafile (.mat) for easy import and processing.

## References

File: “*SedimentDatabase\_ref.xlsx*”

All information on the references of the included observation can be found here. This includes a Source\_ID, that is a 3 digit abbreviation also used in the Sample\_ID (see *ID*), the type of the source (paper, report or book chapter), if the specific reference was peer-review (YES/NO), publication year and access date along with the short (= in-text) citation. Full citation are appended as a bibtex and endnote files (“References\_GloRiSe”).

Content:

|  |  |
| --- | --- |
| Source\_ID | 3-digit unique identifier of the data sources used |
| Source\_type | Literature type: Report, Paper or Book chapter |
| Peer\_reviewed | Yes/No |
| citation | in-text citation. Full citation given in References.pdf |
| Pub\_year | publication year |
| Access\_date | date on which data source was accessed |

## Location

File: “*SedimentDatabase\_Location.xlsx*”

The Location sheet summarizes all information on sampling locations, such as geographic coordinates (WGS 84), elevation (where given), country and region/site of the measurement. Where no coordinates were given, all available information in the sources was used to estimate coordinates via © GoogleEarth, which usually can be trusted to precision of at least 20 km. However, this precision finally depends on the quality of the information used, which is the quality of the maps provided for most papers/reports. For spatial averages, the central position is given. A unique 12-digit identifier of a location “Location\_ID”, which is composed of the DIN-ISO-alpha-3 country code (3 digit) indicating the country in which the river mouth is located , a 3-digit abbreviation for the main river basin (here defined as the most downstream river that is a tributary only to the ocean or big inland water masses for endorheic drainage), and a running 6-digit number starting from 111111, can be used to trace all samples to a certain location. Under “Citation” all papers are listed, that provide observation from that same location.   
Each Location was assigned a Basin\_ID, which is a unique numerical identifier of the main river basin. The Basin\_ID is a 4-digit number, where the first digit represents the geographical area, while the other 3-digits represent running numbers. Geographical areas are here loosely and functionally defined as follows: 1) South- and Central America, 2) North America (including parts of southern Canada), 3) Europe (extending from Portugal to the Black Sea and from the Mediterranean to the Scandinavia), 4) East and South-East Asia, including island states, 5) Africa, 6) Australia and New Zealand, 7) Antarctica, and 8) the Arctic region (Northern Canada & Alaska, Greenland, Scandinavia to far-east Siberia (north of the Amur river). Antarctica is still empty, but may be filled in future. Basin\_IDs and main river basin abbreviations are listed in the second sheet of the file. Number of samples per location and the type of data provided are listed in the columns Observations and Content, respectively.

Content:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  | | --- | --- | | Citation | in-text citation. Full citation given in References.pdf | | Location\_ID | Unique ID of sampling location, composed of DIN-ISO-aplha 3 country code of main river mouth location, abbreviation for main river and and running 4-digit number | | Basin\_ID | 4-digit ID assigning each sample to the main river, 1st digit corresponds to the geographic region of the river basin (see documentation and tab ""Basin\_ID") | | Lat\_deg | Latitude of sampling location (WGS 84) | | Lon\_deg | Longitude of sampling location (WGS 84) | | Accuracy | ex: Coordinates given in the reference; est: Estimate of coordinates from site name and/or maps | | Elevation\_masl | Elevation in meter above sea level | | Country | Country of sampling (as stated in the reference) | | Region | Region of sampling (as stated in the reference) | | Content | What kind of data provided at this location? ME: Major Elements; Min: Mineral and/or Petrographic content; TE: Trace Elements | | Observations | How many measurements provided per location? | |  |

## ID

File: “SedimentDatabase\_ID.xlsx”

All information necessary to identify each unique observation in the database is given in this sheet. Each observation has a unique identifier (“Sample\_ID”), that is composed of the Location\_ID plus the Source\_ID and a running number. Citations and locations are linked to the Sample\_ID in this sheet along with the Original ID (the one used in the original data source), sampling date and time (as precise as possible), notes on the type of observation (from single measurement to spatial and annual averages, where original data was not accessible) and if it represents export to the ocean (“Rep\_ID”). The later provides the possibility to easily isolate samples that can be used to estimate riverine particulate fluxes to the ocean, because it excludes tributaries, far-upstream measurement and such measurement that may be already influence by the marine realm. Date and time of sampling are also available from this table. The closest information on sampling date is given as a string, and day, month and year of these sampling dates are additionally given as separate numerical variables.

Content:

|  |  |
| --- | --- |
| Citation | in-text citation of the data source |
| Location\_ID | Unique ID of sampling location, composed of DIN-ISO-aplha 3 country code of main river mouth location, abbreviation for main river and and running 4-digit number |
| Sample\_ID | Location\_ID + Source\_ID and running number |
| Original\_ID | ID used in the original data source |
| Date\_yyyy-mm-dd | most accurate available information on sampling date and time given as text |
| Day | Day of sampling given as number |
| Month | Month of sampling given as number, ranges are ignored, for two following months the more recent is given |
| Year | Year of sampling given as number, ranges are ignored, for two following years the more recent is given |
| Hour | hour of sampling given as number |
| Minute | minute of sampling given as number |
| Obervation type | Type of observation: single: single measurement or mean of repeated measurements of the same sample; sa: spatial average; sea: seasonal average; ssea: spatial and seasonal average, an: annual or multi-annual average |
| Rep\_ID | Representation export to the ocean? 0: No, tributary, upstream sample or marine influence, 1: Yes, sampled in the lowermost course of the main river before significant marine influence, 2: Yes, as 1 but during storm or flood event, 3: No, endorheic catchment |

## Major Elements, Minor Elements and Nutrients

File: “SedimentDatabase\_ME\_Nut.xlsx”

All measurements of major and minor elements (expressed as Oxide-concentration) and nutrients (C and N in elemental concentration) along with hydro-chemical information (where given) are listed in this file, and are linked to Location\_ID and Sample\_ID. Where given, instantaneous water discharge and suspended sediment concentrations, grain size distribution in %, as well as average grain size (in µm), filter size (as a lower limit of grain size in µm) and sieve size (as an upper limit for grain sizes in µm) are listed, further describing the sample. For traceability, original units from which concentrations were converted and sample type (suspended sediment (SS) or bed sediment including active riverbank deposits (BS)), methods of sample treatment and measurements are given. If multiple methods were used all of them are listed, separated by a “/”. Similarly, multiple units are separated by “,”. Type of observation (single or average), Basin\_ID and Rep\_ID are repeated in this sheet, because they are considered to be the most important grouping variables and may be used for simple calculations without merging all datasets before.

Content:

|  |  |
| --- | --- |
| Sample\_ID | Location\_ID + Source\_ID and running number |
| Location\_ID | Unique ID of sampling location, composed of DIN-ISO-aplha 3 country code of main river mouth location, abbreviation for main river and and running 4-digit number |
| SeaCat | Seasonal Category based on northern hemispheric seasons, see tab "Seasons" |
| Observationtype | Type of observation: single: single measurement or mean of repeated measurements of the same sample; sa: spatial average; sea: seasonal average; ssea: spatial and seasonal average, an: annual or multi-annual average |
| Sampletype | Type of sample: SS: Suspended sedimetn; BS: Bed, bar and riverbank sediment |
| Basin\_ID | 4-digit ID assigning each sample to the main river, 1st digit corresponds to the geographic region of the river basin (see documentation and tab ""Basin\_ID") |
| Original\_Unit | Original unit reported in the data source: El\_perc: weight percentage of element in dry sediment; wtOx: weight percentage of oxide in dry sediment; (m)g/kg: (m)g of element in kg of sediment; ppm: = mg/kg; µmol/g: µmol of element within 1 g of sediment; µg/L µg of (solid-form) element within one liter of river water; ratios: Element or oxide ratios are converted using concentration of the element they were normalised to (e.g. Na/Al \*Al = Na) |
| Treatment | Sample treatment: dig: digested; fused: sample fusion at > 1000 degree Celsius, ign: ignited or ashed at < 650 degree C, combinations common |
| Method | Method of measuring chemical concentrations: AAS: Atomic Absorption Spectrometry; Ox: Oxidation for measuring organic content by weight difference; Vol: Volumetric or barometric measurement of carbonate 7or organic carbon content after degassing; SpPh: Spectrophotometry; EA: Element Analyzer (mostly for C, N and S); IR: IR-spectroscopy (mostly for CO2 after degassing); EDX: Energy-dispersive X-ray spectrometry; EPMA: Electron Probe Micro Analysis (either wavelength- or energy dispersive); ES: Emission spectroscopy; AES: Atomic Emission Spectrometry; AAS: Atomic absorption spectrometry; MS: Mass spectrometry; ICP-...: Inductively-coupled plasma as ionisation source; XRF: X-ray fluorescence spectrometry; Coul: Coulometry; grav: gravimetry; tit: titration; FIA: Flow Injection analysis; UV: Ultra violet spectrometry; NAA: Neutron Activation Analysis, ?: method not specified in the data source |
| Rep\_ID | Representation export to the ocean? 0: No, tributary, upstream sample or marine influence, 1: Yes, sampled in the lowermost course of the main river before significant marine influence, 2: Yes, as 1 but during storm or flood event, 3: No, endorheic catchment |
| filtersize\_mum | pore size of filter used in µm providing minimum grain size; decant: decanted with no grain size limit; cent: centrifuged with no grain size limit; TFF: tangential flow filtration |
| sievesize\_mumm | pore size of the sieve used in µm |
| Discharge\_m3\_s | instantaneous water discharge |
| TSS\_mg\_L | Suspended sediment concentration |
| Sand\_perc | percentage of sand in sample |
| Silt\_perc | percentage of silt in sample |
| Clay\_perc | percentage of clay in sample |
| AvgGrainSize\_mum | average grain size in µm |
| SiO2\_wt | solid concentration |
| Al2O3\_wt | solid concentration |
| Fe2O3T\_wt | solid concentration of total Fe (ferric and ferrous) |
| MnO\_wt | solid concentration |
| CaO\_wt | solid concentration |
| MgO\_wt | solid concentration |
| K2O\_wt | solid concentration |
| Na2O\_wt | solid concentration |
| TiO2\_wt | solid concentration |
| P2O5\_org\_wt | solid concentration of organic part |
| P2O5\_inorg\_wt | solid concentration of inorganic part |
| P2O5\_tot\_wt | solid concentration(total) |
| LOI\_wt | solid concentration |
| SO3\_wt | solid concentration |
| N\_org\_wt | solid concentration of organic part |
| C\_org\_wt | solid concentration of organic part |
| C\_inorg\_wt | solid concentration of inorganic part |
| C\_tot\_wt | solid concentration (total) |
| Ca\_mumol\_L | concentration of element in dissolved form |
| Mg\_mumol\_L | concentration of element in dissolved form |
| K\_mumol\_L | concentration of element in dissolved form |
| Na\_mumol\_L | concentration of element in dissolved form |
| Cl\_mumol\_L | concentration of element in dissolved form |
| Si\_mumol\_L | concentration of element in dissolved form |
| DIC\_mumol\_L | concentration of all carbonates in dissolved form, expressed in terms of C |
| DOC\_mumol\_L | concentration of organic carbon in dissolved form, expressed in terms of C |
| SO4\_mumol\_L | concentration of species in dissolved form |
| HCO3\_mumol\_L | concentration of species in dissolved form |
| T\_water DegC | water temperature in degree C |
| pH | negative decadal logarithm of H+ concentration |
| Alk\_mumol\_L | Alkalinity (mostly titration alkalinity, some charge balance alkalinity) expressed in µmol/L |
| Cond\_muS\_cm | Electrical conductivity (µS/cm) |
| SI(Cal) | saturation state of calcite |

## Trace Elements

File: “SedimentDatabase\_TE.xlsx”

This file contains all information on trace element concentrations (elemental concentrations in ppm) along with Sample\_ID, Location\_ID, Basin\_ID and metadata, i.e. observation type, filter and sieve sizes, sample treatment and methods of measurement, instantaneous water discharge and suspended sediment concentration.

Content:

|  |  |
| --- | --- |
| Sample\_ID | Location\_ID + Source\_ID and running number |
| Location\_ID | Unique ID of sampling location, composed of DIN-ISO-aplha 3 country code of main river mouth location, abbreviation for main river and and running 4-digit number |
| Basin\_ID | 4-digit ID assigning each sample to the main river, 1st digit corresponds to the geographic region of the river basin (see documentation and tab ""Basin\_ID") |
| Observationtype | Type of observation: single: single measurement or mean of repeated measurements of the same sample; sa: spatial average; sea: seasonal average; ssea: spatial and seasonal average, an: annual or multi-annual average |
| Rep\_ID | Representation export to the ocean? 0: No, tributary, upstream sample or marine influence, 1: Yes, sampled in the lowermost course of the main river before significant marine influence, 2: Yes, as 1 but during storm or flood event, 3: No, endorheic catchment |
| Sampletype | Type of sample: SS: Suspended sedimetn; BS: Bed, bar and riverbank sediment |
| filtersize\_mum | pore size of filter used in µm providing minimum grain size; decant: decanted with no grain size limit; cent: centrifuged with no grain size limit; TFF: tangential flow filtration |
| sievesize\_mumm | pore size of the sieve used in µm |
| Treatment | Sample treatment: dig: digested; fused: sample fusion at > 1000 degree Celsius, ign: ignited or ashed at < 650 degree C, combinations common |
| Method | Method of measuring chemical concentrations: AAS: Atomic Absorption Spectrometry; Ox: Oxidation for measuring organic content by weight difference; Vol: Volumetric or barometric measurement of carbonate 7or organic carbon content after degassing; SpPh: Spectrophotometry; EA: Element Analyzer (mostly for C, N and S); IR: IR-spectroscopy (mostly for CO2 after degassing); EDX: Energy-dispersive X-ray spectrometry; EPMA: Electron Probe Micro Analysis (either wavelength- or energy dispersive); ES: Emission spectroscopy; AES: Atomic Emission Spectrometry; AAS: Atomic absorption spectrometry; MS: Mass spectrometry; ICP-...: Inductively-coupled plasma as ionisation source; XRF: X-ray fluorescence spectrometry; Coul: Coulometry; grav: gravimetry; tit: titration; FIA: Flow Injection analysis; UV: Ultra violet spectrometry; NAA: Neutron Activation Analysis, ?: method not specified in the data source |
| Discharge m3\_s | instantaneous water discharge |
| TSS\_mg\_L | Suspended sediment concentration |
| Rb\_ppm | element concentration within solid phases |
| Cs\_ppm | element concentration within solid phases |
| Li\_ppm | element concentration within solid phases |
| Ba\_ppm | element concentration within solid phases |
| Sr\_ppm | element concentration within solid phases |
| Th\_ppm | element concentration within solid phases |
| U\_ppm | element concentration within solid phases |
| Y\_ppm | element concentration within solid phases |
| Zr\_ppm | element concentration within solid phases |
| Nb\_ppm | element concentration within solid phases |
| Hf\_ppm | element concentration within solid phases |
| Sc\_ppm | element concentration within solid phases |
| Cr\_ppm | element concentration within solid phases |
| Co\_ppm | element concentration within solid phases |
| V\_ppm | element concentration within solid phases |
| Ni\_ppm | element concentration within solid phases |
| Pb\_ppm | element concentration within solid phases |
| Be\_ppm | element concentration within solid phases |
| Au\_ppm | element concentration within solid phases |
| Ag\_ppm | element concentration within solid phases |
| Pt\_ppm | element concentration within solid phases |
| Cu\_ppm | element concentration within solid phases |
| Zn\_ppm | element concentration within solid phases |
| Ga\_ppm | element concentration within solid phases |
| Ge\_ppm | element concentration within solid phases |
| As\_ppm | element concentration within solid phases |
| Se\_ppm | element concentration within solid phases |
| Br\_ppm | element concentration within solid phases |
| Cd\_ppm | element concentration within solid phases |
| Sn\_ppm | element concentration within solid phases |
| Sb\_ppm | element concentration within solid phases |
| Te\_ppm | element concentration within solid phases |
| I\_ppm | element concentration within solid phases |
| B\_ppm | element concentration within solid phases |
| La\_ppm | element concentration within solid phases |
| Ce\_ppm | element concentration within solid phases |
| Pr\_ppm | element concentration within solid phases |
| Nd\_ppm | element concentration within solid phases |
| Sm\_ppm | element concentration within solid phases |
| Eu\_ppm | element concentration within solid phases |
| Gd\_ppm | element concentration within solid phases |
| Tb\_ppm | element concentration within solid phases |
| Dy\_ppm | element concentration within solid phases |
| Ho\_ppm | element concentration within solid phases |
| Er\_ppm | element concentration within solid phases |
| Tm\_ppm | element concentration within solid phases |
| Yb\_ppm | element concentration within solid phases |
| Lu\_ppm | element concentration within solid phases |
| Hg\_ppm | element concentration within solid phases |
| Tl\_ppm | element concentration within solid phases |
| Bi\_ppm | element concentration within solid phases |
| Mo\_ppm | element concentration within solid phases |
| Ta\_ppm | element concentration within solid phases |
| W\_ppm | element concentration within solid phases |

## Minerals

File: “SedimentDatabase\_Minerals.xlsx”

This file lists are information on the mineral (= modal) composition of the sediment samples. Units differ with the method of measurement, i.e. quantitative XRD measurement will be given in wt%, while semi-quantitative (older) XRD measurements will be given in terms of intensity ratios and results from light microscopic investigations are given in area %. As sediments are often composed of lithic fragments to a large fraction, these were also included and grouped. E.g. the variable “L” is the sum of all lithic components, while Lv is the sum of all Lithic clasts that stem from volcanic rocks and Lvf only contains lithic clasts derived from felsic volcanic rocks. The last section (tot(HM), the total Heavy Mineral content, and the following variables) represent heavy mineral contents expressed in % of the total heavy mineral fraction. Thus, the user needs to assure comparability of the used samples and variables using metadata given in the first columns. Similar to the chemical data, SeaCat, observation type, sample type, Basin\_ID, Sample\_ID, and Location\_ID are given along with methods of sample treatment and measurement, and their original unit (which corresponds to the reported unit here).

Content:

|  |  |
| --- | --- |
| Sample\_ID | Location\_ID + Source\_ID and running number |
| Location\_ID | Unique ID of sampling location, composed of DIN-ISO-aplha 3 country code of main river mouth location, abbreviation for main river and and running 4-digit number |
| Observationtype | Type of observation: single: single measurement or mean of repeated measurements of the same sample; sa: spatial average; sea: seasonal average; ssea: spatial and seasonal average, an: annual or multi-annual average |
| Sampletype | Type of sample: SS: Suspended sedimetn; BS: Bed, bar and riverbank sediment |
| Basin\_ID | 4-digit ID assigning each sample to the main river, 1st digit corresponds to the geographic region of the river basin (see documentation and tab ""Basin\_ID") |
| Unit | Original unit reported in the data source: area\_perc: percentage of the mineral covering a 2-D view (e.g. through a light microscope); count\_perc: percentage of grains within a window; int\_perc: percentage of X-ray intensity in XRD diffractograms, wt: percent by weight |
| Method | Method of measuring modal composition: LM: Light microscopy; Raman: Raman spectroscopy; XRD: X-Ray diffraction |
| Rep\_ID | Representation export to the ocean? 0: No, tributary, upstream sample or marine influence, 1: Yes, sampled in the lowermost course of the main river before significant marine influence, 2: Yes, as 1 but during storm or flood event, 3: No, endorheic catchment |
| filtersize\_mum | pore size of filter used in µm providing minimum grain size; decant: decanted with no grain size limit; cent: centrifuged with no grain size limit; TFF: tangential flow filtration |
| sievesize\_mumm | pore size of the sieve used in µm |
| Discharge\_m3\_s | instantaneous water discharge |
| TSS\_mg\_L | suspended sediment concentration |
| Sand\_perc | percentage of sand in sample |
| Silt\_perc | percentage of silt in sample |
| Clay\_perc | percentage of clay in sample |
| AvgGrainSize\_mum | average grain size in µm |
| Quartz | modal percentage of whole sample |
| Albite | modal percentage of whole sample |
| Plg | modal percentage of whole sample |
| Anorthite | modal percentage of whole sample |
| K-feldspar | modal percentage of whole sample |
| Feldspar | modal percentage of whole sample |
| Ampibole | modal percentage of whole sample |
| Pyroxene | modal percentage of whole sample |
| BasGlass | modal percentage of whole sample |
| totalMafic | modal percentage of whole sample |
| Olivine | modal percentage of whole sample |
| Mica | modal percentage of whole sample |
| Smectite | modal percentage of whole sample |
| Illite | modal percentage of whole sample |
| Kaolinite | modal percentage of whole sample |
| Chlorite | modal percentage of whole sample |
| Gibbsite | modal percentage of whole sample |
| Vermiculite | modal percentage of whole sample |
| BulkClay | modal percentage of whole sample |
| Calcite | modal percentage of whole sample |
| Dolomite | modal percentage of whole sample |
| BulkCarbonate | modal percentage of whole sample |
| Casulfate | modal percentage of whole sample |
| Fesulfide | modal percentage of whole sample |
| FeOxide | modal percentage of whole sample |
| FeHydroxide | modal percentage of whole sample |
| Lvf | Percentage of felsic volcanic lithics |
| Lvm | Percentage of mafic volcanic lithics |
| Lv | Percentage of volcanic lithics |
| Lp | Percentage of plutonic lithics |
| Lcd | Percentage of dolomite lithics |
| Lcc | Percentage of Ca-carbonate lithics |
| Lch | Percentage of chert |
| Ls | Percentage of sedimentary rocks |
| Lms | Percentage of metasediments |
| Lmb | Percentage of metabasites |
| Lmf | Percentage of metamorphosed felsic magmatic rocks |
| Lm | Percentage of metamorphic rocks |
| Lu | Percentage of ultramafics |
| L | Percentage of lithic fragments |
| totHM | total Heavy mineral content |
| Opq | Percentage of opaque minerals within heavy minerals |
| Ap | Percentage of apatite within heavy minerals |
| Ep | Percentage of epidote within heavy minerals |
| Grt | Percentage of garnet within heavy minerals |
| Ttn | Percentage of titanite/Sphene within heavy minerals |
| Zirc | Percentage of zircon within heavy minerals |
| Tourm | Percentage of tourmaline within heavy minerals |
| Ru | Percentage of rutile within heavy minerals |
| TiOx | Percentage of (all) Titanium-Oxides within heavy minerals |
| Px | Percentage of pyroxene within heavy minerals |
| Amp | Percentage of amphibole within heavy minerals |
| Ol | Percentage of olivine within heavy minerals |
| Sp | Percentage of spinell within heavy minerals |
| Mon | Percentage of monazite within heavy minerals |
| Ala | Percentage of allanite within heavy minerals |
| Cltd | Percentage of chloritoid within heavy minerals |
| Staur | Percentage of staurolite within heavy minerals |
| And | Percentage of andalusite within heavy minerals |
| Ky | Percentage of kyanite within heavy minerals |
| Sil | Percentage of sillimanite within heavy minerals |
| trHM | Percentage of transparent heavy minerals within all heavy minerals |

## Minerals

File: “RiverNames.xlsx”

In this file, the names of the rivers corresponding to a Basin\_ID and its abbreviation are stored.

Feedback and suggestions are welcome, as are potential future contributions!   
Please contact [g.muller@uu.nl](mailto:g.muller@uu.nl)