

# Package ‘rysgran’

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**Type** Package

**Title** Grain size analysis, textural classifications and distribution of unconsolidated sediments

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**Suggests** plotrix

## Description

This package is a port to R of the SysGran program, written in Delphi by Camargo (2006). It contains functions for the analysis of grain size samples (in logarithmic (phi) and geometric (micrometers) scale) based on various methods, like Folk & Ward (1957) and Methods of Moments (Tanner, 1995), among others; textural classifications and distribution of unconsolidated sediments are shown in histograms, bivariated plots and ternary diagrams of Shepard (1954) and Pejrup (1988). English and Portuguese languages are supported in outputs

**License** GPL (>= 2.0)

**LazyLoad** yes

**NeedsCompilation** no

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rysgran-package	<i>Grain size analysis, textural classifications and distribution of unconsolidated sediments</i>
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## Description

This package is a port to R of the SysGran program, written in Delphi by Camargo (2006). It contains functions for the analysis of grain size samples based on various methods, like Folk & Ward (1957) and Methods of Moments (Tanner, 1995), among others; textural classifications and distribution of unconsolidated sediments are shown in histograms, bivariated plots and ternary diagrams of Shepard (1954) and Pejrup (1988).

Versions prior to 2.0 supported only data input in logarithmic scale (phi intervals). Now rysgran can handle both logarithmic and geometric scale data (micrometers intervals).

English and Portuguese languages are supported in outputs

## Details

Package:	rysgran
Type:	Package
Version:	2.1.0
Date:	2014-07-09
License:	GPL (>= 2.0)
LazyLoad:	yes

## Author(s)

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## References

- Camargo, M. G. (2006) SysGran: um sistema de código aberto para análises granulométricas do sedimento. *Revista Brasileira de Geociências*, **345**: 345–352.

- Folk, R. L. and Ward W. C. (1957) Brazos river bar: A study in the significance of grain size parameters. *Journal of Sed. Petrol.*, **27**: 3–27.

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- Otto, G. H. (1939) A modified logarithmic probability paper for the interpretation of mechanical analysis of sediments. *Journal os Sed. Petrol.*, **9**: 62–76.
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- Shepard, F. P. (1954) Nomenclature based on sand-silt-clay ratios. *Journal Sedimentary Petrology*, **24**:151–158.
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- Trask, P. D. (1930) Mechanical analysis of sediments by centrifuge. *Economic Geology*, **25**: 581–599.

### See Also

[gran.stats](#) , [class.percent](#) , [rysgran.hist](#) , [rysgran.plot](#) , [rysgran.ternary](#)

### Examples

```
library (rysgran)
data (camargo2001)
data(sed.phi)
data(sed.metric)

#grain size analysis using Folk & Ward with verbal classification
gran.stats (camargo2001, method="folk" , verbal=TRUE)

#grain size analysis using Method of Moments with verbal classification
gran.stats (sed.metric, method="moment" , verbal=TRUE)

#weight percentages
class.percent (camargo2001, mode="total")

#histograms
rysgran.hist (camargo2001)

#bivariated plot
```

```

rysgran.plot ("mean" , "sort" , data = camargo2001, method="folk", pch=19)

#ternary diagram of Shepard
percent <- class.percent(camargo2001, mode="total")
x<-percent[2:4]
rysgran.ternary (x, method= "shepard", pch=19)

```

---

camargo2001	<i>Data Frame Containing Sample Weight (Grams) of each Mesh Size (phi units)</i>
-------------	--

---

### Description

The first line is the mesh size (phi units). The row names are the sample names

### Usage

```
data(camargo2001)
```

### Format

A data frame with 15 observations on the following 17 variables.

### References

- Camargo, M.G. (2001) *Analise experimental das interacoes biologicas da macrofauna e meio-fauna bentica de manguezais das baías de paranagua e antonina - PR.*, PhD Thesis. UFPR. Brazil.

### Examples

```
data(camargo2001)
```

---

class.percent	<i>Weight Percentages of Textural Classes</i>
---------------	---

---

### Description

Calculates the percentage of weight retained on each sieve and its corresponding textural class

### Usage

```
class.percent(data,mode = "both",
empty.col = FALSE, lang = "en-US")
```

## Arguments

data	a data matrix with grain size samples
mode	shape of textural classes matrix. mode="total" shows grouped classes of gravel, sand, silt and clay. mode="classes" shows the subclasses like fine sand, coarse silt and medium clay. mode="both" shows both the grouped classes as subclasses. Default is "both"
empty.col	logical. If TRUE empty columns (with zero percent) are displayed. Default is FALSE
lang	language . May be english ("en-US", "en-GR", "eng", "e"), or portuguese ("pt-BR", "pt-PT", "port", "p"). The default is "en-US"

## Details

The particle size matrix used in data entry must contain the first line of grain size classes (logarithmic or geometric scale), each following line should contain the weights of a sample. . No header should be used.

For further details on the structure of the input table see data examples `camargo2001`, `sed.phi` and `sed.metric` included in this package

## Value

An array of variable dimension, depending on the chosen arguments, with the relative percentages of textural classes for each sample. This matrix should be used in ternary diagrams like Shepard and Pejrup by `rysgran.ternary` function, available in this package

## Author(s)

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Mauricio G. Camargo (<camargo.ufpr@gmail.com>)

## See Also

[rysgran.ternary](#) , [gran.stats](#)

## Examples

```
#testing the different modes

library(rysgran)
data(camargo2001)

class.percent(camargo2001, mode="total", empty.col=FALSE, lang="en-US")

class.percent(camargo2001, mode="classes", empty.col=FALSE, lang="en-US")

class.percent(camargo2001, mode="both", empty.col=FALSE, lang="en-US")
```

---

gran.stats

*Statistical Analysis of Grain Size for Unconsolidated Sediments*


---

### Description

Calculates mean, median, sorting, skewness, kurtosis, fifth and sixth moments, and creates the verbal classification of the results. Uses the statistical methods of Trask (1930), Otto (1939), Folk & Ward (1957), McCammon(a) (1962), McCammon(b) (1962) and Method of Moments (TANNER, 1995)

Data input can be in logarithmic (phi) or geometric (micrometers) scale. Regardless the input data, the user can choose the output result scale through output argument

### Usage

```
gran.stats(data, output = "phi", method = "folk", verbal = FALSE, lang = "en-US")
```

### Arguments

data	a data matrix with grain size samples
output	output result scale. Could be output="phi" for logarithmic scale or output="metric" for geometric scale. The default is "phi"
method	statistical analysis method. Could be method="folk" , method="moment" , method="otto" , method="trask" , method="mcA" and method="mcB". Default is method="folk"
verbal	logical. If TRUE, columns will be added with verbal classification of statistical parameters. Default is TRUE
lang	language . Could be english ("en-US", "en-GR", "eng", "e"), or portuguese ("pt-BR", "pt-PT", "port", "p"). The default is "en-US"

### Details

The particle size matrix used in data entry must contain the first line of grain size classes (logarithmic or geometric scale), each following line should contain the weights of a sample. No header should be used

Example of particle size matrix with classes in logarithmic scale (phi units). Note that the column names (V2, V3, V4, V5, ...) are automatically created by the R when any headerless dataset is imported.

row names	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13
Samples	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
A	0.0	0.0	0.0	0.02	0.07	0.10	0.18	0.27	0.58	5.08	11.18	1.29
B	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.05	0.59	12.98	26.60	2.90

Example of particle size matrix with classes in geometric scale (micrometers). Note that the columns names (V2, V3, V4, V5, ...) are automatically created by the R when any headerless dataset is imported.

row names	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13
Samples	2828	2000	1414	1000	707	500	354	250	177	125	88	63
A	0.0	0.0	0.0	0.02	0.07	0.10	0.18	0.27	0.58	5.08	11.18	1.29
B	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.05	0.59	12.98	26.60	2.90

The grain size scale adopted in this package is those used by Udden (1914) and Wentworth (1922).

phi	micrometers	Verbal Classification
< -8	>256000	Boulder
-8 to -6	64000 to 256000	Cobble
-6 to -2	4000 to 64000	Pebble
-2 to -1	2000 to 4000	Granules
-1 to 0	1000 to 2000	Very coarse sand
0 to 1	500 to 1000	Coarse sand
1 to 2	250 to 500	Medium sand
2 to 3	125 to 250	Fine sand
3 to 4	63 to 125	Very fine sand
4 to 5	31 to 63	Coarse silt
5 to 6	16 to 31	Medium silt
6 to 7	8 to 16	Fine silt
7 to 8	4 to 8	Very fine silt
> 8	< 4	Clay

If method = "moment" the sorting, skewness and kurtosis is calculated by the method of moments as described by Tanner (1995) and the descriptive terminology is given according to the output scale chosen by the user (geometric or logarithmic), as described bellow.

#### Sorting (Geometric)

Very well sorted	< 1.27
Well sorted	1.27 to 1.41
Moderately well sorted	1.41 to 1.62
Moderately sorted	1.62 to 2.00
Poorly sorted	2.00 to 4.00
Very poorly sorted	4.00 to 16.00
Extremely poorly sorted	> 16.00

#### Skewness (Geometric)

Very positive	< -1.30
Positive	-1.30 to -0.43
Approximately symmetrical	-0.43 to 0.43
Negative	0.43 to 1.30
Very negative	> 1.30

#### Sorting (Logarithmic)

Very well sorted	< 0.35
Well sorted	0.35 to 0.50
Moderately well sorted	0.50 to 0.70
Moderately sorted	0.70 to 1.00
Poorly sorted	1.00 to 2.00
Very poorly sorted	2.00 to 4.00
Extremely poorly sorted	> 4.00

#### Skewness (Logarithmic)

Very positive	> 1.30
Positive	0.43 to 1.30
Approximately symmetrical	-0.43 to 0.43
Negative	-0.43 to - 1.30
Very negative	< -1.30

<b>Kurtosis (Geometric)</b>		<b>Kurtosis (Logarithmic)</b>	
Very platykurtic	< 1.70	Very platykurtic	< 1.70
Platykurtic	1.70 to 2.55	Platykurtic	1.70 to 2.55
Mesokurtic	2.55 to 3.70	Mesokurtic	2.55 to 3.70
Leptokurtic	3.70 to 7.40	Leptokurtic	3.70 to 7.40
Very leptokurtic	> 7.40	Very leptokurtic	> 7.40

If method = "folk", "otto", "trask", "mcA" or "mcB" the sorting, skewness and kurtosis is calculated as described by Folk & Ward (1957), Otto (1939), Trask (1930) or McCammon (1962), respectively. The descriptive terminology is given according to the output scale chosen by the user (geometric or logarithmic), as described bellow.

<b>Sorting (Geometric)</b>		<b>Sorting (Logarithmic)</b>	
Very well sorted	< 1.27	Very well sorted	< 0.35
Well sorted	1.27 to 1.41	Well sorted	0.35 to 0.50
Moderately well sorted	1.41 to 1.62	Moderately well sorted	0.50 to 0.70
Moderately sorted	1.62 to 2.00	Moderately sorted	0.70 to 1.00
Poorly sorted	2.00 to 4.00	Poorly sorted	1.00 to 2.00
Very poorly sorted	4.00 to 16.00	Very poorly sorted	2.00 to 4.00
Extremely poorly sorted	> 16.00	Extremely poorly sorted	> 4.00

  

<b>Skewness (Geometric)</b>		<b>Skewness (Logarithmic)</b>	
Very positive	-0.3 to -1.0	Very positive	0.3 to 1.0
Positive	-0.1 to -0.3	Positive	0.1 to 0.3
Approximately symmetrical	-0.1 to 0.1	Approximately symmetrical	0.1 to -0.1
Negative	0.1 to 0.3	Negative	-0.1 to -0.3
Very negative	0.3 to 1.0	Very negative	-0.3 to -1.0

  

<b>Kurtosis (Geometric)</b>		<b>Kurtosis (Logarithmic)</b>	
Very platykurtic	< 0.67	Very platykurtic	< 0.67
Platykurtic	0.67 to 0.90	Platykurtic	0.67 to 0.90
Mesokurtic	0.90 to 1.11	Mesokurtic	0.90 to 1.11
Leptokurtic	1.11 to 1.50	Leptokurtic	1.11 to 1.50
Very leptokurtic	1.50 to 3.00	Very leptokurtic	1.50 to 3.00
Extremely leptokurtic	> 3.00	Extremely leptokurtic	> 3.00

gran.stats automatically detects which scale of grain size is being used and converts the results according to the output argument

For further details on the structure of the input table see data examples camargo2001, sed.phi and sed.metric included in this package

## Value

An array of variable number of dimensions, depending on the chosen arguments, with the statistical parameters for each sample. The values of this matrix should be used in `rysgran.plot` function, available in this package



**Author(s)**

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Mauricio G. Camargo (<camargo.ufpr@gmail.com>)

**References**

- Folk, R. L. and Ward W. C. (1957) Brazos river bar: A study in the significance of grain size parameters. *Journal of Sed. Petrol.*, **27**: 3–27.
- McCammon, R. B. (1962) Efficiencies of percentile measurements for describing the mean size and sorting of sedimentary particles. *Journal of Geology*, **70**: 453–465.
- Otto, G. H. (1939) A modified logarithmic probability paper for the interpretation of mechanical analysis of sediments. *Journal os Sed. Petrol.*, **9**: 62–76.
- Tanner, W.F. (1995) *Environmental clastic granulometry*. Florida Geological Survey, *Special Publication* **40**. 142 pp.
- Trask, P. D. (1930) Mechanical analysis of sediments by centrifuge. *Economic Geology*, **25**: 581–599.
- Udden J. A. (1914) Mechanical composition of clastic sediments. *Bulletin of the Geological Society of America*, **25**: 655–744.
- Wentworth, C. K. (1922) A scale of grade and class terms for clastic sediments. *Journal of Geology*, **30**: 377–392.

**See Also**

[rysgran.plot](#) , [rysgran.ternary](#) , [rysgran.hist](#) , [class.percent](#)

**Examples**

```
library (rysgran)
data (camargo2001)
data (sed.metric)

#Folk & Ward

gran.stats(camargo2001, output="phi", method = "folk" , verbal = FALSE)

#Folk & Ward with verbal classification

gran.stats (camargo2001, output="phi", method = "folk" , verbal = TRUE)
```

```
#Folk & Ward with geometric data and verbal classification
gran.stats (sed.metric, output="phi", method = "folk" , verbal = TRUE)

#Method of Moments with geometric data and verbal classification
gran.stats (sed.metric, output="phi", method = "moment" , verbal = TRUE)
```

---

legend.bubbles

*Add Legends to Bubble Plots*


---

## Description

This functions can be used to add legends to bubble plots

## Usage

```
legend.bubbles (x, y = NULL, z = NULL, nleg = NULL, digits = NULL,
               pch, z.cex.range = NULL, x.intersp = 1, y.intersp = 1, bg="white",...)
```

## Arguments

x, y	the x and y co-ordinates to be used to position the legend. They can be specified by keyword or in any way which is accepted by <code>xy.coords</code> . The location may also be specified by setting x to a single keyword from the list "bottomright", "bottom", "bottomleft", "left", "topleft", "top", "topright", "right" and "center". This places the legend on the inside of the plot frame at the given location. Partial argument matching is used. The optional inset argument specifies how far the legend is inset from the plot margins. If a single value is given, it is used for both margins; if two values are given, the first is used for x- distance, the second for y-distance
z	a numeric vector whose values were used to define the points expansion factor (bubbles) of the plot
nleg	integer indicating the number of values (quantiles) to be drawn in the legend. The default is "3" which will return the minimum, median and maximum values of z (quantiles 0, 50 and 100 percent, respectively)
digits	integer indicating the number of decimal places to be used on legend. Default is "1"
pch	the plotting symbols appearing in the legend, either as vector of 1-character strings, or one (multi character) string. Must be the same used on plotting
z.cex.range	vector of length 2. Minimum and maximum 'cex' of the bubbles plotted. Replace the argument <code>pt.cex</code> . Must be the same used on plotting
x.intersp	character interspacing factor for horizontal (x) spacing
y.intersp	the same for vertical (y) line distances

bg                    the background color for the legend box  
 ...                   further graphical parameters. See legend() for additional options

### Details

This is a "wrapper" function for legend() that adds bubbles - legend() should be consulted for details. [legend.bubbles](#) was designed to plot legends to bubbles for the [rysgran.plot](#) and [rysgran.ternary](#) functions. For this, the values of z, z.cex.range and pch should be the same used to plot the graph and [legend.bubbles](#). To avoid problems with overlapping symbols and characters due to the different sizes of pch, arguments x.intersp, y.intersp and cex should be adjusted accordingly. Note that the option 'bty="n"' from legend is hardcoded to avoid overlapping

### Note

[legend.bubbles](#) depends on the package 'soiltexture'

### Author(s)

Eliandro R. Gilbert (<eliandrogilbert@gmail.com>)

### See Also

[rysgran.plot](#), [rysgran.ternary](#)

### Examples

```
#Shepard diagram with Sorting as bubbles
#Calculating the percentage of weight in each textural class
library(rysgran)
data(camargo2001)

percent <- class.percent(camargo2001, mode="total")

#Calculating the grain size statistics

rys <- gran.stats(camargo2001 , method="folk")

#Plotting

rysgran.ternary (x = percent[2:4], method = "shepard",
  z = rys$Sorting, z.cex.range = c(0.5,4), col = "blue", pch = 20)

legend.bubbles ("topright", z=rys$Sorting , nleg=4, pch=20, col="blue",cex=1,
  z.cex.range=c(0.5,4), x.intersp=1.2, y.intersp=1.2,digits=1, title="Sorting")

#Bivariate Plot
#Mean and Sorting with Kurtosis as bubbles
library(rysgran)
data(camargo2001)
```

```
#Calculating the grain size statistics
rys <- gran.stats(camargo2001 , method="folk")

#Ploting

rysgran.plot ("mean" , "sort" , data=camargo2001, method="folk", pch = 21,
  col = "red", z=rys$Kurtosis, z.cex.range=c(1,5),bg="red")

legend.bubbles ("bottomright", z=rys$Kurtosis , nleg=3, pch=21, col="black",
  z.cex.range=c(1,5), x.intersp=1.3, y.intersp=1.6, digits=1, title="Kurtosis")
```

---

 rysgran.hist

*Histograms of Grain Size Data*


---

### Description

rysgran.hist generates histograms of weight percentage of phi classes for each grain size sample

### Usage

```
rysgran.hist(data, subset = NULL, which = NULL, ordered = TRUE)
```

### Arguments

data	a data matrix with grain size samples. Must contain the first line of grain size classes (logarithmic or geometric scale), each following line should contain the weights of a sample. No header should be used
subset	Vector whit factor to subset the histograms. Default is NULL
which	factor from subset object argument. Default is NULL
ordered	logical. If TRUE the panels order is on the order of row in tab, if FALSE the order is alphabetical. Default is TRUE

### Details

rysgran.hist is the only function in [rysgran](#) package which uses the package lattice. Users familiarized with lattice will have no problem using this function

### Value

return multiples histograms

### Author(s)

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 Eliandro R. Gilbert (<eliandrogilbert@gmail.com>)

**See Also**

[rysgran.plot](#) , [gran.stats](#) , [rysgran.ternary](#) , [class.percent](#) , [lattice](#)

**Examples**

```
library(rysgran)
data(camargo2001)
data(sed.phi)

#histograms

rysgran.hist(camargo2001)

#histograms separated by factors

env<- rep(c("River","Tidal Flat","Subtidal","Beach"),each=10)
rysgran.hist(sed.phi, subset = env , which= "Subtidal")

#Making it more attractive

env<- rep(c("River","Tidal Flat","Subtidal","Beach"),each=10)
hist <- rysgran.hist(sed.phi, subset = env , which= "Subtidal")
hist

hist.up <- update(hist, aspect = .4,
  scales=list(x=list(cex=.7),y=list(cex=.7)),
  layout = c(2,5),
  between= list(x = c(0.2), y = c(0.2)),
  ylab = "Frequency",
  xlab = expression(paste(phi)),
  strip = strip.custom(bg = "lightblue"),
  col = "red",
  main="Histogram")
hist.up
```

---

 rysgran.plot

*Generates a Bivariate Plot*


---

**Description**

rysgran.plot generates a bivariate plot of grain size statistical parameters passed by [gran.stats](#) function

**Usage**

```
rysgran.plot(x = NULL, y = NULL, data = NULL, output = "phi", lang = "en-US",
  method= "folk", main = NULL, xlab = NULL, ylab = NULL, show.grid=TRUE,
  show.labels = FALSE, label.points = FALSE, pch = 19,
  col.labels = "black", labels = NULL, col = "black",
  cex.labels = 1, cex.points=1,
  pos = 1, z.cex.range = NULL, z = NULL, ...)
```

**Arguments**

x	the x coordinates of points in the bivariate plot. The value should be presented in quotation marks. Abbreviations are accepted in upper and lower case as well as the full name of the variable, independent of the chosen language. Examples of accepted values are: "mean", "Mean", "Sorting", "sorting", "sort", "Sort", "Skewness", "skewness", "Skew", "skew", "Kurtosis", "kurtosis", "Kurt", "kurt". The same logic applies to the Portuguese language, including the accent
y	the y coordinates of points in the bivariate plot. Has the same prerequisites for the argument x
data	a data matrix with grain size samples similar to the <a href="#">camargo2001</a> matrix in which each column contains the weight (in grams) of each mesh size (in phi or micrometers) and the lines represent the samples
output	output result scale. Could be output="phi" for logarithmic scale or output="metric" for geometric scale. The default is "phi"
lang	language . Should be English ("en-US", "en-GR", "eng", "e"), or Portuguese ("pt-BR", "pt-PT", "port", "p"). The default is "en-US"
method	statistical analysis method. Could be method="folk" (Folk & Ward, 1957), method="moment" (Tanner, 1995), method="otto" (Otto, 1939), method="trask" (Trask, 1930), method="mca" and method="mcb" (McCammon, 1962). Default is method="folk"
main	an overall title for the plot. If NULL it will be generated an automatic title according to language chosen. Default is NULL
xlab	a title for the x axis. If NULL it will be generated an automatic title according to language chosen. Default is NULL
ylab	a title for the y axis. If NULL it will be generated an automatic title according to language chosen. Default is NULL
show.grid	logical. If TRUE lines are plotted on the verbal classifications of x and y axes. Default is TRUE
show.labels	logical. If TRUE the points are replaced by text passed by labels argument. Default is FALSE
label.points	logical. if TRUE text is added, provided by the argument labels, with the points on the graph. the text position to the point should be changed by argument pos. labels.points will be automatically FALSE if show.labels is TRUE. The default is FALSE
pch	Either an integer specifying a symbol or a single character to be used as the default in plotting points. Default is "19"

col.labels	color of text if the arguments show.label, label.points or z are defined. Default is "black"
labels	a character vector or expression specifying the text to be written. If NULL labels will be the row names of the data argument. Default is NULL
col	symbol color used in pch argument. Default is "black"
cex.labels	character size of text provided by the argument labels added with the point (or replacing it) in case show.label, label.points or z arguments are defined. Default is "1"
cex.points	character size of points provided by the argument pch. Default is "1"
pos	a position specifier for the text. Values of 1, 2, 3 and 4, respectively indicate positions below, to the left of, above and to the right of the specified coordinates. Default is "1"
z.cex.range	Vector of length 2. Minimum and maximum 'cex' of the bubbles plotted if 'z' is not NULL. Replace the argument cex.points. Default is "(1,3)"
z	vector with the same length of x and y whose value must be used to define the points expansion factor and color (bubble plot). If NULL, a simple plot is drawn (no 'bubbles'). Default is "NULL"
...	further graphical parameters

### Details

The data matrix provided to data argument should be similar to the [camargo2001](#) matrix in which each column contains the weight (in grams) of each mesh size (in phi or micrometers) and the lines represent the samples. `rysgran.plot` uses the `gran.stats` function to calculate grain size statistical parameters according to the analysis method chosen by method argument. When z argument is used to draw bubble plots the `legend.bubbles` function should be used to draw the legend accordingly

### Value

return a bivariated plot

### Note

rysgran.plot depends on the package 'soiltexture'

### Author(s)

Eliandro R. Gilbert (<eliandrogilbert@gmail.com>)

### References

- Folk, R. L. and Ward W. C. (1957) Brazos river bar: A study in the significance of grain size parameters. *Journal of Sed. Petrol.*, **27**: 3–27.

- McCammon, R. B. (1962) Efficiencies of percentile measurements for describing the mean size and sorting of sedimentary particles. *Journal of Geology*, **70**: 453–465.
- Otto, G. H. (1939) A modified logarithmic probability paper for the interpretation of mechanical analysis of sediments. *Journal of Sed. Petrol.*, **9**: 62–76.
- Tanner, W.F. (1995) *Environmental clastic granulometry*. Florida Geological Survey, *Special Publication* **40**. 142 pp.
- Trask, P. D. (1930) Mechanical analysis of sediments by centrifuge. *Economic Geology*, **25**: 581–599.

### See Also

[gran.stats](#), [class.percent](#), [rysgran.ternary](#), [rysgran.hist](#), [legend.bubbles](#)

### Examples

```
library(rysgran)
data(camargo2001)
data(sed.phi)

# Plot Mean and Sorting

rysgran.plot ("mean", "sort", data=camargo2001, output="phi", method="folk")

# Using show.labels

rysgran.plot("mean" , "sort" , data=camargo2001 , method="folk",
show.labels = TRUE,labels = NULL)

# Skewness and Kurtosis with label.points

rysgran.plot ("skew" , "kurt" , data=camargo2001, output="phi",
method="folk", show.labels = FALSE, labels = NULL,
label.points = TRUE, pch = 19, col.labels = "black",
col = "blue", cex.labels = 1,cex.points = 1, pos=1)

# Mean and Sorting with Kurtosis as bubbles
# Calculating the grain size statistics
rys <- gran.stats(camargo2001, method="folk")

# Plotting
rysgran.plot ("mean" , "sort" , data=camargo2001, method="folk", pch = 21,
col = "red", z=rys$Kurtosis, z.cex.range=c(1,3),bg="red")

# Plotting the legend
```



```

legend.bubbles ("bottomright", z=rys$Kurtosis , nleg=3, pch=21, col="black",
z.cex.range=c(1,3), x.intersp=1.3, y.intersp=1.3, digits=1, title="Kurtosis")

# Mean and Sorting with Skewness as bubbles for different environments
# Calculating the grain size statistics
rys <- gran.stats(sed.phi, method="folk")
env<- as.factor(rep(c("River","Tidal Flat","Subtidal","Beach"),each=10))

# Plotting
rysgran.plot ("mean" , "sort" , data=sed.phi, method="folk", pch = 19,
col = c("red","blue","black","brown")[env], z=rys$Skewness, z.cex.range=c(1,3))

# Plotting the legends
legend.bubbles ("bottomright", z=rys$Skewness , nleg=3, pch=21, col="black",
z.cex.range=c(1,3), x.intersp=1.3, y.intersp=1.3, digits=1, title="Skewness")

legend ("bottomleft", c("Beach","River","Subtidal","Tidal Flat"),
pch=15, col=c("red","blue","black","brown"))

```

---

rysgran.ternary

*Generates the Ternary Diagrams of Shepard, Pejrup and Flemming*


---

## Description

Uses data from percentages of soil textures to generate ternary diagrams of Shepard (Shepard, 1954), Pejrup (Pejrup, 1988) and Flemming (Flemming, 2000)

## Usage

```

rysgran.ternary(x = NULL, method = "shepard", lang = "en-US",
main= NULL, z= NULL, show.labels=FALSE, label.points=FALSE,
labels = NULL, axis.labels = NULL, show.names = TRUE,
show.lines = TRUE, show.legend = TRUE, show.grid = FALSE,
z.cex.range= NULL, cex.labels= 1, cex.points=1, cex.axis=1,
cex.names = 0.8, col.names = "gray2", col = "black",
col.labels= "black", col.axis= "black", col.lines= "black",
col.grid = "gray", pos = 1, pch = 19, lty.grid = 3, ...)

```

## Arguments

x	a 3 columns matrix with percentages of Sand, Silt and Clay (exactly in this order) which should be passed by <a href="#">class.percent</a> function. The sum of each row must be 100 or 1, otherwise there may be distortions in the position of the points
method	shape of ternary diagram to be created. Should be "shepard", "pejrup" or "flemming". Default is "shepard"

lang	language . Should be English ("en-US", "en-GR", "eng", "e"), or Portuguese ("pt-BR", "pt-PT", "port", "p"). The default is "en-US"
main	an overall title for the plot. If NULL it will be generated an automatic title according to language chosen. Default is NULL
z	vector with the same length of x and y whose value must be used to define the points expansion factor and color (bubble plot). If NULL, a simple plot is drawn (no 'bubbles'). Default is "NULL"
show.labels	logical. If TRUE the points are replaced by text passed by labels argument. Default is FALSE
label.points	logical. if TRUE text is added, provided by the argument labels, with the points on the graph. the text position to the point should be changed by argument pos. labels.points will be automatically FALSE if show.labels is TRUE. The default is FALSE
labels	a character vector or expression specifying the text to be written. If NULL labels will be the row names of the data argument. Default is NULL
axis.labels	vector of length 3 with the soil textures names. If NULL the names are taken from the matrix of percentages. Default is NULL
show.names	logical. If TRUE the textural classes names will show up in the ternary diagram according with the method argument. Should be used with the argument show.legend. Default is TRUE
show.lines	logical. If TRUE the lines that separate the textural classes are displayed. Default is TRUE
show.legend	logical. If TRUE the legend of textural classes are displayed in the top left according with the argument method. Should be used with the argument show.names. Default is TRUE
show.grid	logical. If TRUE display grid lines in the ternary diagram. Default is FALSE
z.cex.range	Vector of length 2. Minimum and maximum 'cex' of the bubbles plotted if 'z' is not NULL. Replace the argument cex.points. Default is "(1,3)"
cex.labels	character size of text provided by the argument labels added with the point (or replacing it) in case show.label, label.points or z arguments are defined. Default is "1"
cex.points	character size of points provided by the argument pch. Default is "1"
cex.axis	character expansion for axis labels. Default is "1"
cex.names	character size of text of textural classes text which composes the ternary diagram according to method argument. Default is "1"
col.names	text color of textural classes which composes the ternary diagram if the argument show.names is TRUE. Default is "gray"
col	symbol color used in pch argument if the argument show.labels is FALSE. Default is "black"
col.labels	text color of labels if the arguments show.label, label.points or z are defined. Default is "black"
col.axis	text color of axis labels. Default is "black"

col.lines	color of lines that separate the textural classes case the argument show.lines is TRUE. Default is "black"
col.grid	color of grid lines case the argument show.grid is TRUE. Default is "gray"
pos	a position specifier for the text. Values of 1, 2, 3 and 4, respectively, indicate positions below, to the left of, above and to the right of the specified coordinates. Default is "1"
pch	either an integer specifying a symbol or a single character to be used as the default in plotting points. Default is "19"
lty.grid	type of grid line case the argument show.grid is TRUE. Default is "3"
...	further graphical parameters

### Details

When z argument is used to draw bubble plots the [legend.bubbles](#) function should be used to draw the legend accordingly

### Value

Display a triangular plot

### Note

rysgran.ternary can only properly display one or more sets of three proportions (sand, silt and clay) that each sum to 1 (or percentages that sum to 100), otherwise they will not plot properly and the user will be notified. Samples with considerable amount of gravel are not properly plotted. rysgran.ternary is based on plotrix package and depends on soiltexture package

### Author(s)

Eliandro R. Gilbert (<eliandrogilbert@gmail.com>)

### References

- Flemming, B. W. (2000) A revised textural classification of gravel-free muddy sediments on the basis of ternary diagrams. *Continental Shelf Research*, **20**:1125–1137.
- Pejrup, M. (1988) The triangular diagram used for classification of estuarine sediments: a new approach. in: *Tide-influenced sedimentary environments and facies*. BOER, P.L. ; GELDER, A. & NIO, S.D. (Eds). D. Reidel Publishing Company. Holland.
- Shepard, F. P. (1954) Nomenclature based on sand-silt-clay ratios. *Journal Sedimentary Petrology*, **24**:151–158.

### See Also

[gran.stats](#) , [class.percent](#) , [rysgran.ternary](#) , [rysgran.hist](#), [legend.bubbles](#)

**Examples**

```

library(rysgran)
data(camargo2001)
data(sed.phi)

#Shepard diagram
percent <- class.percent(camargo2001, mode="total")
x<-percent[2:4] #choosing only the 'sand', 'silt' and 'clay' columns
rysgran.ternary (x, method = "shepard")

#Pejrup diagram
percent <- class.percent(camargo2001, mode="total")
x<-percent[2:4] #choosing only the 'sand', 'silt' and 'clay' columns
rysgran.ternary (x, method = "pejrup")

#Flemming diagram
percent <- class.percent(camargo2001, mode="total")
x<-percent[2:4] #choosing only the 'sand', 'silt' and 'clay' columns
rysgran.ternary (x, method = "flemming")

#Shepard diagram with show.labels
percent <- class.percent(camargo2001, mode="total")
x<-percent[2:4]
rysgran.ternary (x, method="shepard", show.labels = TRUE)

#Pejrup diagram with Sorting as bubbles for different environments
#Calculating the percentage of weight in each textural class
percent <- class.percent(sed.phi, mode="total")
x<-percent[2:4]

# Calculating the grain size statistics
rys <- gran.stats(sed.phi , method="folk")
env<- as.factor(rep(c("River", "Tidal Flat", "Subtidal", "Beach"), each=10))

# Plotting
rysgran.ternary (x, method = "pejrup",
z = rys$Sorting, z.cex.range = c(0.5,3),
col = c("red", "blue", "black", "brown")[env], pch = 19)

# Plotting the legends
legend.bubbles ("right", z=rys$Sorting , nleg=4, pch=21, col="black",
cex=1, z.cex.range=c(0.5,3), x.intersp=1.2, y.intersp=1.2,
digits=1, title="Sorting")

legend ("topright", c("Beach", "River", "Subtidal", "Tidal Flat"),
pch=15, col=c("red", "blue", "black", "brown"))

```

---

sed.metric	<i>Data Frame Containing Sample Weight (Grams) of each Mesh Size (micrometers)</i>
------------	--

---

**Description**

The first line is the mesh size (micrometers). The row names are the sample names.  
Each ten samples represent a different environment (in order: Rivers, Tidal Flats, Subtidal and Beaches)

**Usage**

```
data(sed.metric)
```

**Format**

A data frame with 41 observations on the following 17 variables.

**Examples**

```
data(sed.metric)
```

---

sed.phi	<i>Data Frame Containing Sample Weight (Grams) of each Mesh Size (phi units)</i>
---------	--

---

**Description**

The first line is the mesh size (phi units). The row names are the sample names.  
Each ten samples represent a different environment (in order: Rivers, Tidal Flats, Subtidal and Beaches)

**Usage**

```
data(sed.phi)
```

**Format**

A data frame with 41 observations on the following 17 variables.

**Examples**

```
data(sed.phi)
```

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