Package 'hydrogeo'

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Title Groundwater Data Presentation and Interpretation

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Description Contains one function for drawing Piper diagrams (also called Piper-Hill diagrams) of water analyses for major ions.

Depends R (>= 2.6.0)

Imports methods

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URL http://rockhead.biz

NeedsCompilation no

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RoxygenNote 6.0.1

Suggests testthat

R topics documented:

hydrogeo *Groundwater data presentation and interpretation.*

Description

Contains one function, for drawing Piper (or Piper-Hill) diagrams from water analyses for major ions, and a dataset from Zaporozec

Details

Package:	hydrogeo
Type:	Package
Version:	0.5-1
Date:	2016-11-17
License:	BSD
LazyLoad:	yes

Author(s)

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See Also

piper and toPercent zaporozec

Examples

```
library(hydrogeo)
data(zaporozec)
zaporozec$CO3 <- rep(0,9) # toPercent expects CO3
zaporozec$Na <- rep(0,9)  # toPercent expects Na
z <- toPercent(zaporozec)
pz <- piper(z)
plot(pz,cex=1.5)
```

piper *Create a new piper object*

Description

Create a new piper object

Usage

```
piper(d, ...)
```

Arguments

d	list passed to class piper, piper
...	additional arguments, as for piper

See Also

piper-class and toPercent

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piper-class *Class* piper

Description

Objects of this class are plotable as Piper-Hill diagrams. A dataframe of major ions as percentages can be used to initialise a piper object.

Usage

```
## S4 method for signature 'piper'
initialize(.Object, l, ..., call = NULL, pt.col = NULL)

## S4 method for signature 'piperplot'
labelAxes(x, cex.axis = 0.35, side = -1, ...)

## S4 method for signature 'piper'
plot(x, type = "p", cex = 0.75, ...)

## S4 method for signature 'piper'
show(object)
```

Arguments

.Object	object of class piper
l	list of data, see 'Examples' below
...	additional arguments, as for piper
call	the call that asked for the new piper object
pt.col	Object of class vector of colours for points
x	an object of class piperplot
cex.axis	magnification to be used for axis annotation relative to the current setting of 'cex', see help("par")

side	integer between 1 and 10 specifying which side to lable, the default is to label all
type	what type of plot should be drawn, only "p" for *p*oints is useful
cex	magnification to be used for symbols relative to the current setting of 'cex', see help("par")
object	an object of class piper

Methods (by generic)

- initialize: Initialiser
- labelAxes: Label the axes
- plot: Plot an object of class piper
- show: Show an object of class piper

Slots

Ca Object of class vector — Calcium

Mg Object of class vector — Magnesium

Cl Object of class vector — Chloride

SO4 Object of class vector — Sulphate

anion.x x coordinate of the point on the anion triangle (internal)

anion.y y coordinate of the point on the anion triangle (internal)

cation.x x coordinate of the point on the cation triangle (internal)

cation.y y coordinate of the point on the cation triangle (internal)

diamond.x x coordinate of the point on the diamond (internal)

diamond.y y coordinate of the point on the anion diamond (internal)

IDs Object of class vector of sample identifiers

pt.col Object of class vector of colours for points

pt.pch Object of class vector of symbols for points

call Object of class character — call that created it

Author(s)

Myles English <myles@rockhead.biz>

References

A. Zaporozec, "Graphical interpretation of water quality data," Ground Water 10, no. 2 (1972): 32–43.

Examples

```
showClass("piper")

l <- list( Ca = c(43,10,73,26,32),
           Mg = c(30,50,3,14,12),
           Cl = c(24,10,12,30,43),
           SO4 = c(24,10,12,30,43))

lp <- piper(l)
plot( lp, main="Piper-Hill Diagram of Water Quality" )

# change symbols and colours to differentiate water type groups
lp@pt.pch = c(2,2,4,4,4)
lp@pt.col = c(0,1,0,1,2)

# use larger symbols
plot( lp, main="Piper-Hill Diagram of Water Quality", cex=1.4 )
```

`piperPaper` *Create a new piperplot object*

Description

Create a new piperplot object

Usage

```
piperPaper(size = NULL, ...)
```

Arguments

`size`	integer related to the size of the plot area
`...`	additional arguments, as for `piperplot`

Examples

```
library(hydrogeo)
p = piperPaper(size=1)
plot(p)
```

piperplot-class *Class* piperplot

Description

Objects of this class are plottable as empty (i.e. no points) Piper-Hill diagrams

Usage

```
## S4 method for signature 'piperplot'
Axis(x = NULL)
```

Arguments

x	an object of class piperplot

Methods (by generic)

- Axis: Add axes to a piperplot

Slots

size Object of class numeric — Length of the (square) plot area, defaults to 300

call R call that created it

plot,piperplot-method *Plot the diagram area with two triangles and a diamond*

Description

Plot the diagram area with two triangles and a diamond

Usage

```
## S4 method for signature 'piperplot'
plot(x, axes = TRUE, ...)
```

Arguments

x	object of class piperplot
axes	logical saying whether to draw the axes or not, defaults to TRUE
...	further arguments to plot.default

testData — *Major ions as a percentage of total major ions - Test Data*

Description

Major ions as a percentage of total major ions - Test Data

Usage

```
testData(n)
```

Arguments

n	Number of test samples to be generated.

Examples

```
library(hydrogeo)
lp <- piper( testData(26) )
```

toPercent — *Major ions as a percentage of total major ions*

Description

Expects certain column names

Usage

```
toPercent(d)
```

Arguments

d	list or data.frame with the following columns: Ca, Mg, Na, K and Cl, SO4, CO3, HCO3

Examples

```
library(hydrogeo)
l <- list( Ca = c(43,10,73,26,32),
          Mg = c(30,50,83,14,62),
          Na = c(54,76,3,14,12),
          K = c(31,22,32,22,11),
          Cl = c(24,10,12,30,43),
          SO4 = c(24,10,12,30,43),
  CO3 = c(24,10,12,30,43),
  HCO3 = c(42,110,12,3,4),
```

```
          IDs = c("A","B","C","D","E") )
d <- toPercent(l)
# check, should add up to 100%
z <- as.data.frame(d)
for(i in 1:length(z[[1]])) { print(sum(z[i,5:8])) }
for(i in 1:length(z[[1]])) { print(sum(z[i,1:4])) }
```

`zaporozec` *Major ions for groundwaters reported by Zaporozec*

Description

This data set contains major ion analyses for three groundwaters.

Format

A data frame with 9 observations on the following 15 variables:

- `location` a factor with levels `Tertiary, Czechoslovakia` `Upper Cambrian, Wisconsin` `Upper Cretaceous, Czechoslovakia`
- `K` a numeric vector - potassium
- `Mg` a numeric vector - magnesium
- `Ca` a numeric vector - calcium
- `Mn` a numeric vector - magnesium
- `Fe` a numeric vector - iron
- `Cl` a numeric vector - chloride
- `NO3` a numeric vector - nitrate
- `HCO3` a numeric vector - bicarbonate
- `SO4` a numeric vector - sulphate
- `sigma` a numeric vector - standard deviation
- `TDS` a numeric vector - total dissolved solids
- `tempC` a numeric vector - temperature
- `pH` a numeric vector - pH
- `units` a factor with levels `meq/l` `meq_pc` `mg/l`

Source

Zaporozec, "Graphical interpretation of water quality data," *Ground Water* 10, no. 2 (1972): pages 32–43.

Examples

```
data(zaporozec)
str(zaporozec)
```

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