Package 'IsoplotR'

May 10, 2016

Title Statistical Toolbox for Radiometric Geochronology

Version 0.3

Description An R implementation of Ken Ludwig's popular Isoplot add-in to Microsoft Excel. Currently plots U-Pb data on Wetherill and Tera-Wasserburg concordia diagrams, taking into account error correlations. Future versions will include functionality for the Ar-Ar, Rb-Sr, Sm-Nd, Re-Os, U-Th-He, fission track and cosmogenic nuclide methods, including isochrons, age spectra, ternary diagrams, kernel density estimates, radial plots, banana diagrams and multidimensional scaling plots. A graphical user interface is provided as an RStudio Shiny app.

Author Pieter Vermeesch [aut, cre]

Maintainer Pieter Vermeesch <p.vermeesch@ucl.ac.uk>

Depends R (>= 3.0.0)

Imports methods

License GPL-2

LazyData true

RoxygenNote 5.0.1

R topics documented:

concordia.plot 2
get.covmat 2
get.ellipse 3
get.ratios 4
I.A 4
lambda 5
read.data 6
read.matrix 6
U238U235 7
UPb 8

Index **9**

concordia.plot *Concordia diagram*

Description

Wetherill and Tera-Wasserburg concordia diagrams

Usage

```
concordia.plot(x, limits = NULL, alpha = 0.05, wetherill = TRUE,
  show.numbers = FALSE, ellipse.col = rgb(0, 1, 0, 0.5),
  concordia.col = "darksalmon", dcu = TRUE)
```

Arguments

x	an object of class UPb
limits	age limits of the concordia line
alpha	confidence cutoff for the error ellipses
wetherill	boolean flag (FALSE for Tera-Wasserburg)
show.numbers	boolean flag (TRUE to show grain numbers)
ellipse.col	background colour of the error ellipses
concordia.col	colour of the concordia line
dcu	show decay constant uncertainty?

Examples

```
data(UPb)
concordia.plot(UPb)
```

get.covmat *Get the covariance matrix of a sample*

Description

Returns the covariance matrix of the ith sample

Usage

```
get.covmat(x, i)
```

Arguments

x	an object of class UPb
i	the index of the sample of interest

Value

a covariance matrix of size [3x3]

Examples

```
data(UPb)
get.covmat(UPb,2)
```

`get.ellipse` *Get coordinates of error ellipse for plotting*

Description

Construct an error ellipse age a given confidence level from its centre and covariance matrix

Usage

```
get.ellipse(x, y, covmat, alpha = 0.05)
```

Arguments

`x`	x-coordinate (scalar) for the centre of the ellipse
`y`	y-coordinate (scalar) for the centre of the ellipse
`covmat`	covariance matrix of the x-y coordinates
`alpha`	the probability cutoff for the error ellipses

Value

a [50x2] matrix of plot coordinates

Examples

```
x = 99; y = 101;
covmat <- matrix(c(1,0.9,0.9,1),nrow=2)
ell <- get.ellipse(x,y,covmat)
plot(c(90,110),c(90,110),type='l')
polygon(ell,col=rgb(0,1,0,0.5))
points(x,y,pch=21,bg='black')
```

get.ratios *Calculate the isotopic ratio for a given age*

Description

Predict the daughter/parent ratio for a given U-Pb age

Usage

```
get.ratios(age, method = "U-Pb")
```

Arguments

age	the geological age [Ma]
method	currently only 'U-Pb', other chronometers will be added later

Value

a two element list containing:

x: a vector with predicted isotopic ratios

cov: the covariance matrix of the predicted isotopic ratios taking into account decay constant uncertainties

Examples

```
get.ratios(4567,'U-Pb')
```

I.A *Isotope abundance*

Description

Gets or sets the natural abundance of isotopes

Usage

```
I.A(nuclide, x = NULL, e = NULL)
```

Arguments

nuclide	one of either 'U', 'U238', 'U235', or 'Th232'
x	new value for the isotope abundance
e	new value for the standard error of the abundance

Value

if x == e == NULL, returns a two element list containing:

x: a number or a vector of numbers between 0 (absent) and 1 (dominant)

and

e: the standard error or covariance matrix of x

or, if `nuclide = 'U'`:

cov: the covariance matrix of all naturally occurring isotopes

Examples

```
print(I.A('U238')$x)
# use the 238U/235U ratio of Steiger and Jaeger (1977)
U238U235(138.88,0)
print(I.A('U238')$x)
```

---

lambda *Decay constants*

Description

Gets or sets the decay constants of radioactive istopes

Usage

```
lambda(nuclide, x = NULL, e = NULL)
```

Arguments

nuclide	the nuclide name
x	new value for the decay constant
e	new value for the decay constant uncertainty

Value

if x == e == NULL, returns a two-item list containing:

x: the decay constant [in Ma-1]

e: the standard error of the decay constant [in Ma-1]

Examples

```
print(lambda('U238')$x)
# use the decay constant of Kovarik and Adams (1932)
lambda('U238',0.0001537,0.0000068)
print(lambda('U238')$x)
```

read.data *Read geochronology data*

Description

Cast a .csv file into one of IsoplotR's data classes

Usage

```
read.data(fname, method = "U-Pb", format = 1, ...)
```

Arguments

fname	file name (.csv format)
method	one of 'U-Pb', 'Ar-Ar', 'Rb-Sr', 'Sm-Nd', 'Re-Os', 'U-Th-He', 'fission tracks', 'cosmogenic nuclides' or 'other'
format	formatting option, depends on the value of method. If method = 'U-Pb', then format is one of either: 1: 7/6, s[7/6], 6/8, s[6/8], 7/5, s[7/5]
...	optional arguments to the read.csv function

Value

an object of class 'UPb', 'ArAr', 'RbSr', 'SmNd', 'ReOs', 'UThHe', 'fission', 'cosmogenics', or 'other'

Examples

```
# load one of the built-in .csv files:
fname <- system.file("UPb.csv",package="IsoplotR")
UPb <- read.data(fname,'U-Pb')
concordia.plot(UPb)
```

read.matrix *Read geochronology data*

Description

Cast a matrix into one of IsoplotR's data classes

Usage

```
read.matrix(x, method = "U-Pb", format = 1)
```

Arguments

x	a matrix
method	see read.data for details
format	see read.data for details

Value

see read.data for details

Examples

```
# load one of the built-in .csv files:
fname <- system.file("UPb.csv",package="IsoplotR")
dat <- read.csv(fname,header=TRUE)
UPb <- read.matrix(dat,method='U-Pb',format=1)
concordia.plot(UPb)
```

U238U235 *238U/235 ratio*

Description

Gets or sets the natural 238U/235 ratio. The default value of 137.818 is taken from Hiess et al. (2012)

Usage

```
U238U235(x = NULL, e = NULL)
```

Arguments

x	new value for 238U/235U ratio
e	new value for its standard error

Value

if x == e == NULL, returns a two-item list containing:

x: the 238U/235U ratio

e: the standard error of the 238U/235U ratio

Examples

```
print(U238U235()$x)
# use the 238U/235U ratio of Steiger and Jaeger (1977)
U238U235(138.88,0)
print(U238U235()$x)
```

UPb *An example U-Pb dataset*

Description

An example U-Pb dataset provided with Ludwig's Isoplot add-in

Details

UPb is an object of class UPb, i.e. a list with two items

x: a matrix formatted according to format

format: an integer defining the format of x. Options are:

1: 7/6, s[7/6], 6/8, s[6/8], 7/5, s[7/5]

Author(s)

Ken Ludwig and Pieter Vermeesch

Examples

```
data(UPb)
concordia.plot(UPb)
```

Index

concordia.plot, 2

get.covmat, 2
get.ellipse, 3
get.ratios, 4

I.A, 4

lambda, 5

read.data, 6
read.matrix, 6

U238U235, 7
UPb, 8