Package 'PbIso'

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Title Common calculations for Pb isotope data

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Description Calculates commonly used Pb isotope values such as model age, model source mu, time-integrated kappa, initial Pb isotope ratios. Includes functions for generating model curve data.

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Calc64 *Calculate the 206Pb/204Pb ratio*

Description

This function calculates the 206Pb/204Pb ratio for a given time, either by using Stacey & Kramers (1975) 2nd stage model parameters as default, or by setting optional arguments.

Usage

```
# Basic usage accepting default model parameters for Stacey & Kramers (1975) 2nd stage model.
  Calc64(t, ...)
```

```
# Advanced usage with optional arguments
  Calc64(t, T1, X1, Mu1, L8)
```

Arguments

t	sample age or time (Ma)
...	optional arguments
T1	model start time (Ma). Default is 3700
X1	206Pb/204Pb model starting composition. Default is 11.152
Mu1	238U/204Pb model. Default is 9.74
L8	238U decay constant. Default is 1.55125 * 10^-10

Examples

```
# Example of basic method using a hypothetical sample age of 2700 Ma
  Calc64(2700)
```

```
# Example of using optional arguments based on Stacey & Kramers (1975) 1st stage model
  Calc64(2700, T1 = 4570, X1 = 9.307, Mu1 = 7.19)
```

```
# Example of using the optional argument for Mu1 = 8 only, and accepting the other defaults
  Calc64(2700, Mu1 = 8)
```

Calc64in *Calculate the initial 206Pb/204Pb ratio*

Description

This function calculates the initial 206Pb/204Pb for a sample with a known age (t), measured 206Pb/204Pb (x) and measured 207Pb/204Pb (y) ratios

Usage

```
# Basic usage accepting default model parameters for Stacey & Kramers (1975) 2nd stage model
  Calc64in(t, x, y, ...)
```

```
# Advanced usage with optional arguments
  Calc64in(t, x, y, T1, X1, Y1, U8U5, L5, L8)
```

Arguments

t	sample age or time (Ma)
x	sample 206Pb/204Pb ratio
y	sample 207Pb/204Pb ratio
...	optional arguments
T1	model start time (Ma). Default is 3700
X1	206Pb/204Pb model starting composition. Default is 11.152
Y1	207Pb/204Pb model starting composition. Default is 12.998
U8U5	Present-day 238U/235U ratio. Default is 137.88
L5	235U decay constant. Default is $9.8485 * 10\text{^-}10$
L8	238U decay constant. Default is $1.55125 * 10\text{^-}10$

Examples

```
# Example of basic method using a hypothetical sample age of 2700 Ma, measured
# 206Pb/204Pb = 13.5 and 207Pb/204Pb = 14.5
  Calc64in(2700, 13.5, 14.5)

# Example of using additional optional arguments based on Stacey & Kramers (1975) 1st stage model
  Calc64in(2700, 13.5, 14.5, T1 = 4570, X1 = 9.307, Y1 = 10.294)
```

Calc74	*Calculate the 207Pb/204Pb ratio*

Description

This function calculates the 207Pb/204Pb ratio for a given time, either by using Stacey & Kramers (1975) 2nd stage model parameters as default, or by setting optional arguments.

Usage

```
# Basic usage accepting default model parameters for Stacey & Kramers (1975) 2nd stage model
  Calc74(t, ...)

# Advanced usage with optional arguments
  Calc74(t, T1, Y1, Mu1, L5)
```

Arguments

t	sample age or time (Ma)
...	optional arguments
T1	model start time (Ma). Default is 3700
Y1	207Pb/204Pb model starting composition. Default is 12.998
Mu1	238U/204Pb model. Default is 9.74
U8U5	Present-day 238U/235U ratio. Default is 137.88
L5	235U decay constant. Default is $9.8485 * 10\text{^-}10$

Examples

```
# Example of basic method using a hypothetical sample age of 2700 Ma
  Calc74(2700)

# Example of using optional arguments based on Stacey & Kramers (1975) 1st stage model
  Calc74(2700, T1 = 4570, Y1 = 10.294, Mu1 = 7.19)

# Example of using the optional argument for Mu1 = 8 only, and accepting the other defaults
  Calc74(2700, Mu1 = 8)
```

Calc74in   *Calculate the initial 207Pb/204Pb ratio*

Description

This function calculates the initial 207Pb/204Pb for a sample with a known age (t), measured 206Pb/204Pb (x) and measured 207Pb/204Pb (y) ratios

Usage

```
# Basic usage accepting default model parameters for Stacey & Kramers (1975) 2nd stage model
  Calc74in(t, x, y, ...)

# Advanced usage with optional arguments
  Calc74in(t, x, y, T1, X1, Y1, U8U5, L5, L8)
```

Arguments

t	sample age or time (Ma)
x	sample 206Pb/204Pb ratio
y	sample 207Pb/204Pb ratio
...	optional arguments
T1	model start time (Ma). Default is 3700
X1	206Pb/204Pb model starting composition. Default is 11.152
Y1	207Pb/204Pb model starting composition. Default is 12.998
U8U5	Present-day 238U/235U ratio. Default is 137.88
L5	235U decay constant. Default is 9.8485 * 10^-10
L8	238U decay constant. Default is 1.55125 * 10^-10

Examples

```
# Example of basic method using a hypothetical sample age of 2700 Ma, measured
# 206Pb/204Pb = 13.5 and 207Pb/204Pb = 14.5
  Calc74in(2700, 13.5, 14.5)

# Example of using additional optional arguments based on Stacey & Kramers (1975) 1st stage model
  Calc74in(2700, 13.5, 14.5, T1 = 4570, X1 = 9.307, Y1 = 10.294)
```

Calc84   *Calculate the 208Pb/204Pb ratio*

Description

This function calculates the 208Pb/204Pb ratio for a given time, either by using Stacey & Kramers (1975) 2nd stage model parameters as default, or by setting optional arguments.

Usage

```
# Basic usage accepting default model parameters for Stacey & Kramers (1975) 2nd stage model
  Calc84(t, ...)

# Advanced usage with optional arguments
  Calc84(t, T1, Z1, W1, L2)
```

Arguments

t	sample age or time (Ma)
...	optional arguments
T1	model start time (Ma). Default is 3700
Z1	208Pb/204Pb model starting composition. Default is 31.23
W1	232Th/204Pb model. Default is 36.84
L2	232Th decay constant. Default is 0.49475 * 10^-10

Examples

```
# Example of basic method using a hypothetical sample age of 2700 Ma
  Calc84(2700)

# Example of using optional arguments based on Stacey & Kramers (1975) 1st stage model
  Calc84(2700, T1 = 4570, Z1 = 29.487, W1 = 32.21)

# Example of using the optional argument for W1 = 30 only, and accepting the other defaults
  Calc84(2700, W1 = 30)
```

Calc84in   *Calculate the initial 208Pb/204Pb ratio*

Description

This function calculates the initial 208Pb/204Pb for a sample with a known age (t), measured 206Pb/204Pb (x), measured 207Pb/204Pb (y) and measured 208Pb/204Pb ratios.

Usage

```
# Basic usage accepting default model parameters for Stacey & Kramers (1975) 2nd stage model
  Calc84in(t, x, y, z, ...)

# Advanced usage with optional arguments
  Calc84in(t, x, y, z, T1, X1, Y1, Z1, U8U5, L5, L8, L2)
```

Arguments

t	sample age or time (Ma)
x	sample 206Pb/204Pb ratio
y	sample 207Pb/204Pb ratio
z	sample 208Pb/204Pb ratio
...	optional arguments
T1	model start time (Ma). Default is 3700
X1	206Pb/204Pb model starting composition. Default is 11.152
Y1	207Pb/204Pb model starting composition. Default is 12.998
Z1	208Pb/204Pb model starting composition. Default is 31.23
U8U5	Present-day 238U/235U ratio. Default is 137.88
L2	232Th decay constant. Default is $0.49475 * 10^{-10}$
L5	235U decay constant. Default is $9.8485 * 10^{-10}$
L8	238U decay constant. Default is $1.55125 * 10^{-10}$

Examples

```
# Example of basic method using a hypothetical sample age of 2700 Ma, measured
# 206Pb/204Pb = 13.5, measured 207Pb/204Pb = 14.5 and measured 208Pb/204Pb = 33
  Calc84in(2700, 13.5, 14.5, 33)

# Example of using additional optional arguments based on Stacey & Kramers (1975) 1st stage model
  Calc84in(2700, 13.5, 14.5, 33, T1 = 4570, X1 = 9.307, Y1 = 10.294, Z1 = 31.23)
```

CalcKa	*Calculate the time-integrated kappa*

Description

This function calculates the time-integrated kappa

Usage

```
# Basic usage accepting default model parameters for Stacey & Kramers (1975) 2nd stage model
  CalcKa(t, z, x, ...)

# Advanced usage with optional arguments
  CalcKa(t, z, x, T1, X1, Z1, L2, L8)
```

Arguments

t	sample age or time (Ma)
z	sample 208Pb/204Pb ratio
x	sample 206Pb/204Pb ratio
...	optional arguments

T1	model start time (Ma). Default is 3700
X1	206Pb/204Pb model starting composition. Default is 11.152
Z1	208Pb/204Pb model starting composition. Default is 31.23
L2	232Th decay constant. Default is 0.49475 * 10^-10
L8	238U decay constant. Default is 1.55125 * 10^-10

Examples

```
# Example of basic method using a hypothetical sample age of 2700 Ma, measured
# 208Pb/204Pb = 33 and measured 206Pb/204Pb = 13.5
  CalcKa(2700, 33, 13.5)

# Example of using optional arguments based on Stacey & Kramers (1975) 1st stage model
  CalcKa(2700, 33, 13.5, T1 = 4570, X1 = 9.307, Z1 = 31.23)
```

CalcModAge   *Calculates the model age*

Description

This function calculates the model age for given 206Pb/204Pb and 207Pb/204Pb ratios

Usage

```
# Basic usage accepting default model parameters for Stacey & Kramers (1975) 2nd stage model
  CalcModAge(x, y, ...)

# Advanced usage with optional arguments
  CalcModAge(x, y, T1, X1, Y1, U8U5, L5, L8)
```

Arguments

x	sample 206Pb/204Pb ratio
y	sample 207Pb/204Pb ratio
...	optional arguments
T1	model start time (Ma). Default is 3700
X1	206Pb/204Pb model starting composition. Default is 11.152
Y1	207Pb/204Pb model starting composition. Default is 12.998
U8U5	Present-day 238U/235U ratio. Default is 137.88
L5	235U decay constant. Default is 9.8485 * 10^-10
L8	238U decay constant. Default is 1.55125 * 10^-10

Examples

```
# Example of basic method using a hypothetical sample with measured 206Pb/204Pb = 13.5
# and 207Pb/204Pb = 14.5
  CalcModAge(13.5, 14.5)

# Example of using optional arguments based on Stacey & Kramers (1975) 1st stage model
  CalcModAge(13.5, 14.5, T1 = 4570, X1 = 9.307, Y1 = 10.294)
```

CalcMu   *Calculates the model source mu*

Description

This function calculates the model source Mu

Usage

```
# Basic usage accepting default model parameters for Stacey & Kramers (1975) 2nd stage model
  CalcMu(t, x, y, ...)

# Advanced usage with optional arguments
  CalcMu(t, x, y, T1, X1, Y1, U8U5, L5, L8)
```

Arguments

t	sample age or time (Ma)
x	sample 206Pb/204Pb ratio
y	sample 207Pb/204Pb ratio
...	optional arguments
T1	model start time (Ma). Default is 3700
X1	206Pb/204Pb model starting composition. Default is 11.152
Y1	207Pb/204Pb model starting composition. Default is 12.998
U8U5	Present-day 238U/235U ratio. Default is 137.88
L5	235U decay constant. Default is $9.8485 * 10^{-10}$
L8	238U decay constant. Default is $1.55125 * 10^{-10}$

Examples

```
# Example of basic method using a hypothetical sample age of 2700 Ma, measured
# 206Pb/204Pb = 13.5 and 207Pb/204Pb = 14.5
  CalcMu(2700, 13.5, 14.5)

# Example of using optional arguments based on Stacey & Kramers (1975) 1st stage model
  CalcMu(2700, 33, 13.5, T1 = 4570, X1 = 9.307, Z1 = 31.23)
```

---

geochron76slope   *Slope of a geochron line on a 206Pb/204Pb vs 207Pb/204Pb plot for*
                           time (t)

Description

This function calculates the geochron slope on a 206Pb/204Pb vs 207Pb/204Pb plot for a given time
(t)

Usage

```
# Calculate the geochron on a 206Pb/204Pb vs 207Pb/204Pb plot for time = 2700 Ma
  geochron76slope(2700)
```

Arguments

t	sample age or time (Ma)
...	optional arguments
T1	model start time (Ma). Default is 3700
X1	206Pb/204Pb model starting composition. Default is 11.152
Y1	207Pb/204Pb model starting composition. Default is 12.998
Mu1	238U/204Pb model. Default is 9.74
U8U5	Present-day 238U/235U ratio. Default is 137.88
L5	235U decay constant. Default is 9.8485 * 10^-10
L8	238U decay constant. Default is 1.55125 * 10^-10

Examples

```
# Calculate the geochron on a 206Pb/204Pb vs 207Pb/204Pb plot for time = 2700 Ma
  geochron76slope(2700)
```

---

geochron76yint	*Y-intercept of a geochron line on a 206Pb/204Pb vs 207Pb/204Pb plot for time (t)*

Description

This function calculates the y-intercept of a geochron line on a 206Pb/204Pb vs 207Pb/204Pb plot for a given time (t)

Usage

```
# Calculate the geochron on a 206Pb/204Pb vs 207Pb/204Pb plot for time = 2700 Ma
  geochron76slope(2700)
```

Arguments

t	sample age or time (Ma)
...	optional arguments
T1	model start time (Ma). Default is 3700
X1	206Pb/204Pb model starting composition. Default is 11.152
Y1	207Pb/204Pb model starting composition. Default is 12.998
Mu1	238U/204Pb model. Default is 9.74
U8U5	Present-day 238U/235U ratio. Default is 137.88
L5	235U decay constant. Default is 9.8485 * 10^-10
L8	238U decay constant. Default is 1.55125 * 10^-10

Examples

```
# Calculate the geochron on a 206Pb/204Pb vs 207Pb/204Pb plot for time = 2700 Ma
  geochron76slope(2700)
```

---

geochron86slope	*Slope of a geochron line on a 206Pb/204Pb vs 208Pb/204Pb plot for time (t)*

Description

This function calculates the geochron slope on a 206Pb/204Pb vs 208Pb/204Pb plot for a given time (t)

Usage

```
# Calculate the geochron on a 206Pb/204Pb vs 207Pb/204Pb plot for time = 2700 Ma
  geochron86slope(2700)
```

Arguments

t	sample age or time (Ma)
...	optional arguments
T1	model start time (Ma). Default is 3700
X1	206Pb/204Pb model starting composition. Default is 11.152
Z1	208Pb/204Pb model starting composition. Default is 31.23
Mu1	238U/204Pb model. Default is 9.74
W1	232Th/204Pb model. Default is 36.84
L8	238U decay constant. Default is $1.55125 * 10^{-10}$
L2	232Th decay constant. Default is $0.49475 * 10^{-10}$

Examples

```
# Calculate the geochron on a 206Pb/204Pb vs 207Pb/204Pb plot for time = 2700 Ma
  geochron86slope(2700)
```

---

geochron86yint	*Y-intercept of a geochron line on a 206Pb/204Pb vs 208Pb/204Pb plot for time (t)*

Description

This function calculates the y-intercept of a geochron line on a 206Pb/204Pb vs 208Pb/204Pb plot for a given time (t)

Usage

```
# Calculate the geochron on a 206Pb/204Pb vs 207Pb/204Pb plot for time = 2700 Ma
  geochron76slope(2700)
```

Arguments

t	sample age or time (Ma)
...	optional arguments
T1	model start time (Ma). Default is 3700
X1	206Pb/204Pb model starting composition. Default is 11.152
Z1	208Pb/204Pb model starting composition. Default is 31.23
Mu1	238U/204Pb model. Default is 9.74
W1	232Th/204Pb model. Default is 36.84
L8	238U decay constant. Default is $1.55125 * 10^{-10}$
L2	232Th decay constant. Default is $0.49475 * 10^{-10}$

Examples

```
# Calculate the geochron on a 206Pb/204Pb vs 207Pb/204Pb plot for time = 2700 Ma
  geochron76slope(2700)
```

---

modelcurve	*Create a dataframe with values to produce model curves*

Description

This function creates a dataframe with four columns (time, 206Pb/204Pb, 207Pb/204Pb and 208Pb/204Pb ratios). These can be used for plotting model curves.

Usage

```
# Basic method accepting default model parameters for Stacey & Kramers (1975)
# 2nd stage model
  modelcurve(t, ...)

# Advanced method using other values for optional parameters
  modelcurve(t, T1, X1, Y1, Z1, Mu1, W1, U8U5, L5, L8, L2)
```

Arguments

t	sample age or time (Ma)
...	optional arguments
T1	model start time (Ma). Default is 3700
X1	206Pb/204Pb model starting composition. Default is 11.152
Y1	207Pb/204Pb model starting composition. Default is 12.998
Z1	208Pb/204Pb model starting composition. Default is 31.23
Mu1	238U/204Pb model. Default is 9.74
W1	232Th/204Pb model. Default is 36.84
U8U5	Present-day 238U/235U ratio. Default is 137.88
L5	235U decay constant. Default is $9.8485 * 10^{-10}$
L8	238U decay constant. Default is $1.55125 * 10^{-10}$
L2	232Th decay constant. Default is $0.49475 * 10^{-10}$

Examples

```
# Create a dataframe 'df' with the default Stacey & Kramers (1975) 2nd stage values
# for the time period 3700-0 Ma; which can then be used to plot a model curve
  df <- modelcurve(0:3700)

# Create a dataframe 'df' with the Stacey & Kramers (1975) 1st stage model values
# over the time period 3700-0 Ma.
  df <- modelcurve(0:3700, T1 = 4570, X1 = 9.307, Mu1 = 7.19)

# Create a dataframe 'df' for a model source Mu value of 8, over the time period
# 3700-0 Ma.
  df <- modelcurve(0:3700, Mu1 = 8)
```

---

mslope   *Calculate the slope for a given sample age (t)*

Description

This function calculates the slope of a line from which samples of the same age (t) will fall along

Usage

```
mslope(t, ..., U8U5 = 137.88, L5 = 9.8485 * 10^-10, L8 = 1.55125 * 10^-10)
```

Arguments

t	sample age or time (Ma)
...	optional arguments
U8U5	Present-day 238U/235U ratio. Default is 137.88
L5	235U decay constant. Default is 9.8485 * 10^-10
L8	238U decay constant. Default is 1.55125 * 10^-10

Examples

```
# Example of basic method using a hypothetical sample age of 2700 Ma
  mslope(2700)
```

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