Package 'detzrcr'

July 23, 2020

Type Package

Title Compare Detrital Zircon Suites

Version 0.3.1

Description Compare detrital zircon suites by uploading univariate, U-Pb age, or bivariate, U-Pb age and Lu-Hf data, in a 'shiny'-based user-interface. Outputs publication quality figures using 'ggplot2', and tables of statistics currently in use in the detrital zircon geochronology community.

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URL https://github.com/magnuskristoffersen/detzrcr

LazyData TRUE

RoxygenNote 7.1.1

Imports ggplot2, shiny, MASS, stats, graphics, utils, DT

Suggests knitr, rmarkdown

VignetteBuilder knitr

Encoding UTF-8

NeedsCompilation no

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Repository CRAN

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R topics documented:

calc_ab *Calculate slope and intercept*

Description

Calculate slope and intercept

Usage

```
calc_ab(t2, t1)
```

Arguments

t2	upper intercept
t1	lower intercept

calc_dens *Calculate 1D density of age data*

Description

Calculate the 1d density of U-Pb age data using KDE or PDD.

Usage

```
calc_dens(dat, bw = 30, type = "kde", age_range = c(0, 4560))
```

Arguments

dat	data.frame containing at least ages and percentage of discordancy
bw	Bandwidth
type	Type to calculate 'kde': proper KDE; 'pdd': detrital zircon PDD
age_range	Range over which to calculate density

Value

Density

calc_dens_hist *Calculate scaled 1d density*

Description

Calculates 1d density of age data and scales it so that it can be plotted in the same plot of a histogram of the age data

Usage

```
calc_dens_hist(
  dat,
  binwidth = 50,
  bw = 30,
  type = "kde",
  age_range = c(0, 4560)
)
```

Arguments

dat	data.frame
binwidth	Histogram binwidth
bw	Density bandwidth
type	'kde': KDE; 'pdd': detrital zircon PDD
age_range	Age range to calculated density over

Value

Returns density

calc_dkw *Dvoretzky-Kiefer-Wolfowitz inequality*

Description

Calculate confidence bands for ecdfs using the Dvoretzky-Kiefer-Wolfowitz inequality.

Usage

```
calc_dkw(dat, column = "age", alpha = 0.05)
```

Arguments

dat	data.frame
column	which column to use
alpha	Desired alpha level

Value

data.frame with ecdf and confidence bands

References

Dvoretzky, A., Kiefer, J., Wolfowitz, J., 1956. Asymptotic Minimax Character of the Sample Distribution Function and of the Classical Multinomial Estimator. Ann. Math. Stat. 27, 642-669. doi:10.1214/aoms/1177728174

`calc_hf` *Calculate hafnium values.*

Description

Calculates the initial 176Hf/177Hf values, the initial epsilon hafnium values, the model age using the measured 176Lu/177Hf value and the model age assuming the parental magma was produced from an average continental crust (176Lu/177Hf = 0.015) that originally was derived from the depleted mantle (Griffin, 2004).

Usage

```
calc_hf(dat, constants)
```

Arguments

`dat`	data.frame, list or matrix of hafnium values
`constants`	vector of constants which must be in the order decay constant 176Lu, 176/177Hf CHUR, 176Lu/177Hf CHUR, 176/177Hf DM, 176Lu/177Hf DM and 176Lu/177Hf value used for two-stage depleted mantle model age calculations

References

Bouvier, A., Vervoort, J.D. & Patchett, P.J. 2008. The Lu-Hf and Sm-Nd isotopic composition of CHUR: Constraints from unequilibrated chondrites and implications for the bulk composition of terrestrial planets. Earth And Planetary Science Letters 273(1-2), 48-57.

Griffin, W., Belousova, E., Shee, S., Pearson, N. and O'Reilly, S. 2004. Archean crustal evolution in the northern Yilgam Craton: U-Pb and Hf-isotope evidence from detrital zircons. Precambrian Research, 231-282.

Soderlund, U., Patchett, J., Vervoort, J. & Isachsen, C. 2004. The Lu-176 decay constant determined by Lu-Hf and U-Pb isotope systematics of Precambrian mafic intrusions. Earth And Planetary Science Letters 219(3-4), 311-324.

`calc_o_param` *Calculate 1-O*

Description

Calculate 1-O

Usage

```
calc_o_param(dat1, dat2, column, alpha = 0.05, digits = 2)
```

Arguments

`dat1`	data.frame
`dat2`	data.frame
`column`	string of name of column to use ('age' or 't_dm2')
`alpha`	alpha level
`digits`	number of digits

Value

1-O

References

Andersen, T., Elburg, M., Cawthorn-Blazeby, A., 2015. U-Pb and Lu-Hf zircon data in young sediments reflect sedimentary recycling in eastern South Africa. J. Geol. Soc. London. 2006-2015. doi:10.1144/jgs2015-006

`calc_p_apply` *Calculate intercepts and associated p-value*

Description

Calculate intercepts and associated p-value

Usage

```
calc_p_apply(dat, t2, t1)
```

Arguments

`dat`	data.frame
`t2`	upper intercept age
`t1`	lower intercept age

calc_quantiles *Calculate quantiles*

Description

Split up data.frame by sample-column and calculate quantiles

Usage

```
calc_quantiles(dat, column = "t_dm2", alpha = 0.05, type = 8)
```

Arguments

dat	data.frame
column	which column in data.frame to use
alpha	alpha-level (not yet used)
type	type of quantile calculation (passed on to stats::quantile)

check_conc *Check concordancy of input ages*

Description

Check the concordancy of the U-Pb data and return the data within the desired discordancy limit.

Usage

```
check_conc(dat, disc_lim = 10)
```

Arguments

dat	data.frame containing at least ages and percentage of discordancy
disc_lim	Discordancy limit

Value

Concordant data

combine_matrices *Combine two square matrices*

Description

Combine two square matrices

Usage

```
combine_matrices(mat1, mat2)
```

Arguments

mat1	Matrix for upper triangle
mat2	Matrix for lower triangle

concX *Calculate U235 at given age*

Description

Calculate U235 at given age

Usage

```
concX(age)
```

Arguments

age	input age

concY *Calculate U238 at given age*

Description

Calculate U238 at given age

Usage

```
concY(age)
```

Arguments

age	input age

dzr_mix *Calculate mixing model*

Description

Gaussian mixing model for detrital zircon data, using lower quantile upper quantile plot

Usage

```
dzr_mix(mu1, sig1, mu2, sig2)
```

Arguments

mu1	first mean
sig1	first standard deviation
mu2	second mean
sig2	second standard deviation

Examples

```
dzr_mix(500, 50, 1000, 100)
```

find_maxima *Find maxima.*

Description

Find maxima.

Usage

```
find_maxima(dist, xmin, inc)
```

Arguments

dist	distribution.
xmin	minimum value of distribution.
inc	increment.

find_plot_max *Find maximum value for plotting.*

Description

Find the maximum value for histogram plotting.

Usage

```
find_plot_max(x, accuracy = 100)
```

Arguments

x	vector of values
accuracy	round to nearest

find_plot_min *Find minimum value for plotting*

Description

Find the minimum value for histogram plotting.

Usage

```
find_plot_min(x, accuracy = 100)
```

Arguments

x	vector of values
accuracy	round to nearest

find_plot_min_max *Wrapper function for* find_plot_min *and* find_plot_max

Description

Find the minimum and maximum values for histogram plotting.

Usage

```
find_plot_min_max(x, accuracy = 100)
```

Arguments

x	Age data
accuracy	Round to nearest

Value

Returns vector of minimum and maximum plotting values

hfhf_chur *176Hf/177Hf value of CHUR.*

Description

176Hf/177Hf value of CHUR.

Usage

```
hfhf_chur
```

Format

An object of class numeric of length 1.

References

Bouvier, A., Vervoort, J.D. and Jonathan Patchett P. 2008. The Lu-Hf and Sm-Nd isotopic composition of CHUR: Constraints from unequilibrated chondrites and implications for the bulk composition of terrestrial planets. Earth and Planetary Science Letters 273, 48-57.

hfhf_dm *176Lu/177Hf value of DM.*

Description

176Lu/177Hf value of DM.

Usage

```
hfhf_dm
```

Format

An object of class `numeric` of length 1.

References

Griffin, W., Pearson, N., Belousova, E., Jackson, S., van Achterbergh, E., O'Reilly, S. and Shee, S. 2000. The Hf isotope composition of cratonic mantle: LAM-MC-ICPMS analysis of zircon megacrysts in kimberlites. Geochimica et Cosmochimica Acta 64(1), 133-147.

hf_lines *Produce CHUR and DM lines*

Description

Calculate CHUR and DM lines used for epsilon-Hf vs. age and 176/177Hf vs. age plots.

Usage

```
hf_lines(range = c(0, 4560), plot_type = "ehf", constants)
```

Arguments

`range`	range over which to calculate lines
`plot_type`	'ehf' = epsilon-Hf; any thing else gives 176/177Hf
`constants`	vector of constants which must be in the order decay constant 176Lu, 176/177Hf CHUR, 176Lu/177Hf CHUR, 176/177Hf DM and 176Lu/177Hf DM

References

Griffin, W., Pearson, N., Belousova, E., Jackson, S., van Achterbergh, E., O'Reilly, S. and Shee, S. 2000. The Hf isotope composition of cratonic mantle: LAM-MC-ICPMS analysis of zircon megacrysts in kimberlites. Geochimica et Cosmochimica Acta 64(1), 133-147.

Soderlund, U., Jonathan Patchett, P., Vervoort, J.D. and Isachsen C.E. 2004. The 176Lu decay constant determined by Lu-Hf and U-Pb isotope systematics of Precambrian mafic intrusions. Earth and Planetary Science Letters 219, 311-324.

Bouvier, A., Vervoort, J.D. and Jonathan Patchett P. 2008. The Lu-Hf and Sm-Nd isotopic composition of CHUR: Constraints from unequilibrated chondrites and implications for the bulk composition of terrestrial planets. Earth and Planetary Science Letters 273, 48-57.

`lambda_lu` *Decay constant of 176Lu.*

Description

Decay constant of 176Lu.

Usage

```
lambda_lu
```

Format

An object of class `numeric` of length 1.

References

Soderlund, U., Jonathan Patchett, P., Vervoort, J.D. and Isachsen C.E. 2004. The 176Lu decay constant determined by Lu^Hf and U^Pb isotope systematics of Precambrian mafic intrusions. Earth and Planetary Science Letters 219, 311-324.

`lambda_u235` *Decay constants of 235U.*

Description

Decay constants of 235U.

Usage

```
lambda_u235
```

Format

An object of class `numeric` of length 1.

References

Steiger, R. & Jager, E. 1977. SUBCOMMISSION ON GEOCHRONOLOGY - CONVENTION ON USE OF DECAY CONSTANTS IN GEOCHRONOLOGY AND COSMOCHRONOLOGY. Earth And Planetary Science Letters 36(3), 359-362.

`lambda_u238` *Decay constants of 238U.*

Description

Decay constants of 238U.

Usage

```
lambda_u238
```

Format

An object of class `numeric` of length 1.

References

Steiger, R. & Jager, E. 1977. SUBCOMMISSION ON GEOCHRONOLOGY - CONVENTION ON USE OF DECAY CONSTANTS IN GEOCHRONOLOGY AND COSMOCHRONOLOGY. Earth And Planetary Science Letters 36(3), 359-362.

`luhf_chur` *176Lu/177Hf value of CHUR.*

Description

176Lu/177Hf value of CHUR.

Usage

```
luhf_chur
```

Format

An object of class `numeric` of length 1.

References

Bouvier, A., Vervoort, J.D. and Jonathan Patchett P. 2008. The Lu-Hf and Sm-Nd isotopic composition of CHUR: Constraints from unequilibrated chondrites and implications for the bulk composition of terrestrial planets. Earth and Planetary Science Letters 273, 48-57.

luhf_dm *176Lu/177Hf value of DM.*

Description

176Lu/177Hf value of DM (Griffin et al., 2000) recalculated to the decay constant of Soderlund et al. (2004) and the CHUR values of Bouvier et al. (2008).

Usage

```
luhf_dm
```

Format

An object of class `numeric` of length 1.

References

Griffin, W., Pearson, N., Belousova, E., Jackson, S., van Achterbergh, E., O'Reilly, S. and Shee, S. 2000. The Hf isotope composition of cratonic mantle: LAM-MC-ICPMS analysis of zircon megacrysts in kimberlites. Geochimica et Cosmochimica Acta 64(1), 133-147.

luhf_zrc *176Lu/177Hf value of average continental crust.*

Description

176Lu/177Hf value of average continental crust.

Usage

```
luhf_zrc
```

Format

An object of class `numeric` of length 1.

References

Griffin, W., Belousova, E., Shee, S., Pearson, N. and O'Reilly, S. 2004. Archean crustal evolution in the northern Yilgam Craton: U-Pb and Hf-isotope evidence from detrital zircons. Precambrian Research, 231-282.

make_tiling *Produce data.frame of 1-O matrix suitable for geom_tile*

Description

Produce data.frame of 1-O matrix suitable for geom_tile

Usage

```
make_tiling(dat, type)
```

Arguments

dat	data.frame
type	What to calculate

Natal_group *Dataset Natal group*

Description

Detrital zircon U-Pb age and Lu-Hf data from the Natal Group, KwaZulu-Natal, South-Africa (Kristoffersen et al. 2016).

Details

Used as example of proper format of a csv-file for input in the shiny interface.

References

Kristoffersen, M., Andersen, T., Elburg, M.A., Watkeys, M.K., 2016. Detrital zircon in a super-continental setting: locally derived and far-transported components in the Ordovician Natal Group, South Africa. J. Geol. Soc. London. 173, 203-215. doi:10.1144/jgs2015-012

o_param_matrix_age *Populate matrix with age 1-O*

Description

Populate matrix with age 1-O

Usage

```
o_param_matrix_age(dat, alpha = 0.05, digits = 2)
```

Arguments

dat	data.frame
alpha	alpha level
digits	number of digits

Value

matrix of 1-O for ages

References

Andersen, T., Elburg, M., Cawthorn-Blazeby, A., 2015. U-Pb and LuHf zircon data in young sediments reflect sedimentary recycling in eastern South Africa. J. Geol. Soc. London. 2006-2015. doi:10.1144/jgs2015-006

o_param_matrix_tdm *Populate matrix with model age 1-O*

Description

Populate matrix with model age 1-O

Usage

```
o_param_matrix_tdm(dat, alpha = 0.05, digits = 2)
```

Arguments

dat	data.frame
alpha	alpha level
digits	number of digits

Value

matrix of 1-O for model ages

References

Andersen, T., Elburg, M., Cawthorn-Blazeby, A., 2015. U-Pb and Lu-Hf zircon data in young sediments reflect sedimentary recycling in eastern South Africa. J. Geol. Soc. London. 2006-2015. doi:10.1144/jgs2015-006

---

plot_axis_lim *Axes limits for ggplot2*

Description

Convenience function to change axes limits for ggplot2

Usage

```
plot_axis_lim(xlim = c(0, 4560), step = 200, ylim = NULL)
```

Arguments

xlim	x-axis limit
step	specify x-axis steps
ylim	y-axis limit

Value

list of ggplot2::coord_cartesian object

---

plot_bw_theme *Stripped down theme for ggplot2*

Description

Stripped down theme for ggplot2

Usage

```
plot_bw_theme()
```

Value

Returns ggplot2 theme

plot_dens *Plot 1d density*

Description

Creates density for U-Pb data.

Usage

```
plot_dens(
  dat,
  bw = 30,
  type = "kde",
  age_range = c(0, 4560),
  facet = FALSE,
  fixed_y = FALSE,
  step = 200
)
```

Arguments

dat	data.frame
bw	density bandwidth
type	'kde': traditional KDE 'pdd': detrital zircon PDD
age_range	range over which to calculate density
facet	logical, facet samples?
fixed_y	logical, fixed y-axis?
step	specify x-axis steps

Value

ggplot2 1d density plot with histogram

plot_dens_hist *Plot 1d density with histogram*

Description

Creates density and histogram plot of U-Pb data.

Usage

```
plot_dens_hist(
  dat,
  bw = 30,
  binwidth = 50,
  type = "kde",
  age_range = c(0, 4560),
  facet = FALSE,
  fixed_y = FALSE,
  step = 200
)
```

Arguments

dat	data.frame
bw	density bandwidth
binwidth	histogram binwidth
type	'kde': traditional KDE 'pdd': detrital zircon PDD
age_range	range over which to calculate density
facet	logical, facet samples?
fixed_y	logical, fixed y-axis?
step	specify x-axis steps

Value

ggplot2 1d density plot with histogram

---

plot_ecdf *Plot ecdf*

Description

Plot ecdf for U-Pb age or Lu-Hf model age data.

Usage

```
plot_ecdf(
  dat,
  mult_ecdf = FALSE,
  column = "age",
  conf = FALSE,
  guide = TRUE,
  alpha = 0.05
)
```

Arguments

dat	data.frame
mult_ecdf	logical, plot several ecdfs in same plot
column	which column to use
conf	logical, plot confidence bands
guide	logical, show legend
alpha	alpha-level used for confidence bands

---

plot_hf *Plot Lu-Hf data*

Description

Plot Lu-Hf data as both epsilon-Hf vs. age and 176/177Hf vs. age.

Usage

```
plot_hf(
  dat,
  range = c(0, 4560),
  plot_type = "ehf",
  guide = TRUE,
  x_errors = FALSE,
  y_errors = FALSE,
  error_bars = FALSE,
  contours = FALSE,
  x_bandwidth = NULL,
  y_bandwidth = NULL,
  contour_data = NULL,
  combine_contours = FALSE,
  constants
)
```

Arguments

dat	data.frame
range	range to display
plot_type	'ehf'=epsilon-Hf; 'hfhf'=176/177Hf
guide	logical, show legend?
x_errors	logical, include x errorbars
y_errors	logical, include y errorbars
error_bars	logical, include errorbars
contours	logical, plot contours?

x_bandwidth	bandwidth 2dkde x-direction
y_bandwidth	bandwidth 2dkde y-direction
contour_data	data.frame containing data to contour
combine_contours	logical combine contouring data
constants	vector of constants which must be in the order decay constant 176Lu, 176/177Hf CHUR, 176Lu/177Hf CHUR, 176/177Hf DM and 176Lu/177Hf DM

---

plot_labels *Labels for ggplot2 plots*

Description

Convenience function to label ggplot2

Usage

```
plot_labels(xlab = "Age (Ma)", ylab = "Density")
```

Arguments

xlab	X-axis label
ylab	Y-axis label

Value

Returns ggplot2 labels

---

plot_point_scale *Add manual shape scale to scatter plot*

Description

Add manual shape scale to scatter plot

Usage

```
plot_point_scale()
```

plot_quantiles *Plot quantiles*

Description

Plot quantiles

Usage

```
plot_quantiles(
  dat,
  column = "t_dm2",
  conf = FALSE,
  alpha = 0.05,
  type = 8,
  guide = TRUE,
  mix = FALSE,
  mix_data = NULL
)
```

Arguments

dat	data.frame
column	which column in data.frame to use
conf	logical, plot confidence interval
alpha	alpha-level
type	type of quantile calculation (passed on to stats::quantile)
guide	logical, show legend?
mix	logical, add mixing model
mix_data	mixing model data

plot_reimink *Plot likelihood of intercept ages*

Description

Plot likelihood of intercept ages

Usage

```
plot_reimink(dat)
```

Arguments

dat	data.frame

plot_text_options *Modify text options of plots*

Description

Modify text options of plots

Usage

```
plot_text_options(
  font_name = "Helvetica",
  title_size = 10,
  label_size = 7,
  legend_size = 10,
  strip_text_y_size = 8
)
```

Arguments

font_name	Name of font to use
title_size	Font size of x- and y-axis titles
label_size	Font size of x- and y-axis tick labels
legend_size	Font size of legend
strip_text_y_size	Font size of vertical panel text

plot_tile *Tile plot of 1-O matrix*

Description

Tile plot of 1-O matrix

Usage

```
plot_tile(dat, type)
```

Arguments

dat	data.frame
type	What to plot

populate_matrix *Populate matrix*

Description

Populate matrix

Usage

```
populate_matrix(dat, FUN, ...)
```

Arguments

dat	data.frame
FUN	Function used to populate matrix
...	Additional parameters passed to function

Value

Populated matrix

quant_bounds *Calculate confidence bands for lower and upper quartile*

Description

Calculate confidence bands for lower and upper quartile

Usage

```
quant_bounds(dat, column = "t_dm2", alpha = 0.05)
```

Arguments

dat	data.frame
column	column to use for calculations
alpha	alpha-level

`reimink` *Calculate upper and lower concordia intercepts from discordant detrital zircon data*

Description

Calculate upper and lower concordia intercepts from discordant detrital zircon data

Usage

```
reimink(dat, step = 5)
```

Arguments

`dat`	data.frame
`step`	Chord spacing

References

Reimink, J.R., Davies, J.H.F.L., Waldron, J.W.F., Rojas, X. (2016). Dealing with discordance: a novel approach for analysing U-Pb detrital zircon datasets. Journal of the Geological Society. doi: 10.1144/jgs2015-114

`run_detzrcr` *Launch shiny interface*

Description

Launch shiny interface

Usage

```
run_detzrcr(...)
```

Arguments

`...`	Pass arguments on to shiny::runApp

satkoski_1d *Calculate 1d likeness of detrital zircon populations*

Description

Calculates the likeness of detrital zircon populations in 1 dimension after Satkoski et al. (2013).

Usage

```
satkoski_1d(x, y, bw = 30, digits = 3)
```

Arguments

x	vector
y	vector
bw	bandwidth
digits	number, round result to significant digits

References

Satkoski, A.M., Wilkinson, B.H., Hietpas, J., Samson, S.D., 2013. Likeness among detrital zircon populations - An approach to the comparison of age frequency data in time and space. GSA Bulletin 125, 1783-1799.

satkoski_1d_matrix *Pairwise Satkoski likeness*

Description

Populate a matrix with pairwise Satkoski 1d likeness.

Usage

```
satkoski_1d_matrix(dat, bw = 30, digits = 3)
```

Arguments

dat	data.frame
bw	density bandwidth
digits	number, round result to significant digits

References

Satkoski, A.M., Wilkinson, B.H., Hietpas, J., Samson, S.D., 2013. Likeness among detrital zircon populations - An approach to the comparison of age frequency data in time and space. GSA Bulletin 125, 1783-1799.

`satkoski_2d` *Calculate 2d (age and Lu-Hf) likeness of detrital zircon populations*

Description

Calculates the likeness of detrital zircon populations in 2 dimensions after Satoski et al. (2013).

Usage

```
satkoski_2d(x, y, bw = c(30, 2.5), digits = 3)
```

Arguments

`x`	vector
`y`	vector
`bw`	vector of density bandwidths
`digits`	number, round result to significant digits

References

Satkoski, A.M., Wilkinson, B.H., Hietpas, J., Samson, S.D., 2013. Likeness among detrital zircon populations - An approach to the comparison of age frequency data in time and space. GSA Bulletin 125, 1783-1799.

`satkoski_2d_matrix` *Pairwise 2d Satkoski likeness*

Description

Populate a matrix with pairwise Satkoski 12 likeness.

Usage

```
satkoski_2d_matrix(dat, bw = c(30, 2.5), digits = 3)
```

Arguments

`dat`	data.frame
`bw`	vector of density bandwidths
`digits`	number, round result to significant digits

References

Satkoski, A.M., Wilkinson, B.H., Hietpas, J., Samson, S.D., 2013. Likeness among detrital zircon populations - An approach to the comparison of age frequency data in time and space. GSA Bulletin 125, 1783-1799.

tile_func *Ready 1-O matrix for tile plot*

Description

Ready 1-O matrix for tile plot

Usage

```
tile_func(x)
```

Arguments

x	1-O parameter vector

tiling *Apply tile_func to vector*

Description

Apply tile_func to vector

Usage

```
tiling(z)
```

Arguments

z	1-O parameter vector

u238_u235_ratio *Atomic ratio of 238U and 235U.*

Description

Atomic ratio of 238U and 235U.

Usage

```
u238_u235_ratio
```

Format

An object of class `numeric` of length 1.

References

Steiger, R. & Jager, E. 1977. SUBCOMMISSION ON GEOCHRONOLOGY - CONVENTION ON USE OF DECAY CONSTANTS IN GEOCHRONOLOGY AND COSMOCHRONOLOGY. Earth And Planetary Science Letters 36(3), 359-362.

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