

# Package ‘detzrcr’

March 27, 2019

**Type** Package

**Title** Compare Detrital Zircon Suites

**Version** 0.2.5

**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.

**License** GPL-3

**URL** <https://github.com/magnuskristoffersen/detzrcr>

**LazyData** TRUE

**RoxygenNote** 6.1.1

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

**Suggests** knitr, rmarkdown

**VignetteBuilder** knitr

**Encoding** UTF-8

**NeedsCompilation** no

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---

calc_ab	<i>Calculate slope and intercept</i>
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---

**Description**

Calculate slope and intercept

**Usage**

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

**Arguments**

t2	upper intercept
t1	lower intercept

---

calc_dens	<i>Calculate 1D density of age data</i>
-----------	---

---

**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	<i>Calculate scaled 1d density</i>
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---

**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	<i>Dvoretzky-Kiefer-Wolfowitz inequality</i>
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---

**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	<i>Calculate hafnium values.</i>
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---

## Description

Calculates the initial  $^{176}\text{Hf}/^{177}\text{Hf}$  values, the initial epsilon hafnium values, the model age using the measured  $^{176}\text{Lu}/^{177}\text{Hf}$  value and the model age assuming the parental magma was produced from an average continental crust ( $^{176}\text{Lu}/^{177}\text{Hf} = 0.015$ ) 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 $^{176}\text{Lu}$ , $^{176}/^{177}\text{Hf}$ CHUR, $^{176}\text{Lu}/^{177}\text{Hf}$ CHUR, $^{176}/^{177}\text{Hf}$ DM, $^{176}\text{Lu}/^{177}\text{Hf}$ DM and $^{176}\text{Lu}/^{177}\text{Hf}$ 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	<i>Calculate 1-O</i>
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---

**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	<i>Calculate intercepts and associated p-value</i>
--------------	--

---

**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	<i>Calculate quantiles</i>
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---

**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	<i>Check concordancy of input ages</i>
------------	--

---

**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
-----	-----------



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dzt_mix	<i>Calculate mixing model</i>
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---

**Description**

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

**Usage**

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

**Arguments**

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

**Examples**

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

---

find_maxima	<i>Find maxima.</i>
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---

**Description**

Find maxima.

**Usage**

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

**Arguments**

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

---

find_plot_max	<i>Find maximum value for plotting.</i>
---------------	---

---

**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	<i>Find minimum value for plotting</i>
---------------	--

---

**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	<i>Wrapper function for find_plot_min and find_plot_max</i>
-------------------	---

---

**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	<i><math>^{176}\text{Hf}/^{177}\text{Hf}</math> value of CHUR.</i>
-----------	--

---

**Description**

$^{176}\text{Hf}/^{177}\text{Hf}$  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	<i>176Lu/177Hf value of DM.</i>
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---

**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 Acherbergh, 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	<i>Produce CHUR and DM lines</i>
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---

**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 Acherbergh, 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  $^{176}\text{Lu}$  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	<i>Decay constant of <math>^{176}\text{Lu}</math>.</i>
-----------	--

---

**Description**

Decay constant of  $^{176}\text{Lu}$ .

**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  $^{176}\text{Lu}$  decay constant determined by  $^{176}\text{Lu}/^{177}\text{Lu}$  and  $^{235}\text{U}/^{238}\text{U}$  isotope systematics of Precambrian mafic intrusions. *Earth and Planetary Science Letters* 219, 311-324.

---

lambda_u235	<i>Decay constants of <math>^{235}\text{U}</math>.</i>
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---

**Description**

Decay constants of  $^{235}\text{U}$ .

**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	<i>Decay constants of 238U.</i>
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---

**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	<i><sup>176</sup>Lu/<sup>177</sup>Hf value of CHUR.</i>
-----------	---

---

**Description**

<sup>176</sup>Lu/<sup>177</sup>Hf 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	<i>176Lu/177Hf value of DM.</i>
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---

**Description**

$^{176}\text{Lu}/^{177}\text{Hf}$  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 Acherbergh, 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	<i>176Lu/177Hf value of average continental crust.</i>
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---

**Description**

$^{176}\text{Lu}/^{177}\text{Hf}$  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	<i>Produce data.frame of 1-O matrix suitable for geom_tile</i>
-------------	--

---

**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	<i>Dataset Natal group</i>
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---

**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	<i>Axes limits for ggplot2</i>
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---

**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	<i>Stripped down theme for ggplot2</i>
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---

**Description**

Stripped down theme for ggplot2

**Usage**

```
plot_bw_theme()
```

**Value**

Returns ggplot2 theme

---

plot_dens	<i>Plot 1d density</i>
-----------	------------------------

---

**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	<i>Plot 1d density with histogram</i>
----------------	---------------------------------------

---

**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	<i>Plot Lu-Hf data</i>
---------	------------------------

---

**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	<i>Labels for ggplot2 plots</i>
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---

**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	<i>Add manual shape scale to scatter plot</i>
------------------	---

---

**Description**

Add manual shape scale to scatter plot

**Usage**

```
plot_point_scale()
```

---

plot_quantiles	<i>Plot quantiles</i>
----------------	-----------------------

---

**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	<i>Plot likelihood of intercept ages</i>
--------------	--

---

**Description**

Plot likelihood of intercept ages

**Usage**

```
plot_reimink(dat)
```

**Arguments**

dat	data.frame
-----	------------

---

plot_text_options	<i>Modify text options of plots</i>
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---

**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	<i>Tile plot of I-O matrix</i>
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---

**Description**

Tile plot of I-O matrix

**Usage**

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

**Arguments**

dat	data.frame
type	What to plot

---

populate_matrix	<i>Populate matrix</i>
-----------------	------------------------

---

**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	<i>Calculate confidence bands for lower and upper quartile</i>
--------------	--

---

**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	<i>Calculate upper and lower concordia intercepts from discordant detrital zircon data</i>
---------	--

---

**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	<i>Apply tile_func to vector</i>
--------	----------------------------------

---

**Description**

Apply tile\_func to vector

**Usage**

```
tiling(z)
```

**Arguments**

z	1-O parameter vector
---	----------------------

---

u238_u235_ratio	<i>Atomic ratio of 238U and 235U.</i>
-----------------	---------------------------------------

---

**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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