

# Package: ananke (via r-universe)

June 29, 2024

**Title** Quantitative Chronology in Archaeology

**Version** 0.0.0.9000

**Description** What the package does (one paragraph).

**License** GPL (>= 3)

**URL** <https://packages.tesselle.org/ananke/>,  
<https://github.com/tesselle/ananke>

**BugReports** <https://github.com/tesselle/ananke/issues>

**Depends** R (>= 3.5)

**Imports** aion (>= 1.0.3), arkhe (>= 1.6.0), graphics, grDevices,  
methods

**Suggests** knitr, markdown, tinytest

**VignetteBuilder** knitr

**Encoding** UTF-8

**LazyData** true

**Roxygen** list(markdown = TRUE)

**RoxygenNote** 7.3.1

**Collate** 'AllClasses.R' 'AllGenerics.R' 'ananke-internal.R'  
'ananke-package.R' 'c14\_calibrate.R' 'c14\_combine.R'  
'c14\_curve.R' 'c14\_ensemble.R' 'c14\_f14c.R' 'c14\_spd.R'  
'c14\_uncalibrate.R' 'coerce.R' 'data.R' 'interval\_hdr.R'  
'mutators.R' 'pb\_age.R' 'plot.R' 'proxy.R' 'reexport.R'  
'statistics.R' 'subset.R' 'validate.R' 'zzz.R'

**Repository** <https://tesselle.r-universe.dev>

**RemoteUrl** <https://github.com/tesselle/ananke>

**RemoteRef** HEAD

**RemoteSha** d39f8c2c09769ccaed9bd73ee013bb3327fc27f5

## Contents

c14_calibrate	2
c14_combine	4
c14_curve	6
c14_ensemble	9
c14_plot	10
c14_spd	12
c14_uncalibrate	13
data.frame	14
F14C	15
hdr	16
ksarakil	18
labels	18
mean	19
median	20
mutators	21
pb_age	22
proxy_ensemble	24
proxy_plot	26
quantile	28
rec_plot	29
subset	30

<b>Index</b>	<b>31</b>
--------------	-----------

---

c14_calibrate	<i>14C Calibration</i>
---------------	------------------------

---

### Description

Calibrates radiocarbon dates.

### Usage

```
c14_calibrate(values, errors, ...)

## S4 method for signature 'numeric,numeric'
c14_calibrate(
  values,
  errors,
  names = NULL,
  curves = "intcal20",
  reservoir_offsets = 0,
  reservoir_errors = 0,
  from = 55000,
  to = 0,
  resolution = 1,
```

```

    normalize = TRUE,
    F14C = FALSE,
    drop = TRUE,
    eps = 1e-06
  )

```

### Arguments

values	A <b>numeric</b> vector giving the BP ages or F14C values to be calibrated.
errors	A <b>numeric</b> vector giving the standard deviation of the values to be calibrated.
...	Currently not used.
names	A <b>character</b> vector specifying the names of the samples (e.g. laboratory codes).
curves	A <b>character</b> vector specifying the calibration curve to be used. Different curves can be specified per sample.
reservoir_offsets	A <b>numeric</b> vector giving the offset values for any marine reservoir effect (defaults to 0; i.e. no offset).
reservoir_errors	A <b>numeric</b> vector giving the offset value errors for any marine reservoir effect (defaults to 0; i.e. no offset).
from	length-one <b>numeric</b> vector specifying the earliest data to calibrate for, in cal. BP years.
to	A length-one <b>numeric</b> vector specifying the latest data to calibrate for, in cal. BP years.
resolution	A length-one <b>numeric</b> vector specifying the temporal resolution (in years) of the calibration.
normalize	A <b>logical</b> scalar: should the calibration be normalized?
F14C	A <b>logical</b> scalar: should the calibration be carried out in F14C space? If TRUE, values must be expressed as F14C.
drop	A <b>logical</b> scalar: should years with zero probability be discarded? If TRUE (the default), results in a narrower time range.
eps	A length-one <b>numeric</b> value giving the cutoff below which calibration values will be removed.

### Value

A **CalibratedAges** object.

### Note

Adapted from `Bchron::BchronCalibrate()` by Andrew Parnell and `rcarbon::calibrate()` by Andrew Bevan and Enrico Crema.

### Author(s)

N. Frerebeau

## References

Bronk Ramsey, C. (2008). Radiocarbon Dating: Revolutions in Understanding. *Archaeometry*, 50:249-275. doi:10.1111/j.14754754.2008.00394.x.

## See Also

Other radiocarbon tools: [F14C](#), [c14\\_combine\(\)](#), [c14\\_curve\(\)](#), [c14\\_ensemble\(\)](#), [c14\\_plot](#), [c14\\_spd\(\)](#), [c14\\_uncalibrate\(\)](#), [rec\\_plot](#)

## Examples

```
## Calibrate a single date
cal <- c14_calibrate(300, 20)
plot(cal, panel.first = graphics::grid())

## Calibrate multiple dates
cal <- c14_calibrate(
  values = c(5000, 4500),
  errors = c(45, 35),
  names = c("X", "Y")
)
plot(cal, calendar = BP(), panel.first = graphics::grid())
plot(cal, interval = FALSE)
plot(cal[, 1, ], col.interval = "red")

plot(cal, density = FALSE, level = 0.68, lwd = 5)
plot(cal, density = FALSE, level = 0.95, lwd = 5)

## Out of 14C range?
out <- c14_calibrate(130, 20)
plot(out)
```

---

c14\_combine

*Combine 14C*

---

## Description

Combines radiocarbon dates.

## Usage

```
c14_combine(ages, errors, ...)

## S4 method for signature 'numeric,numeric'
c14_combine(ages, errors, groups = NULL)
```

**Arguments**

ages	A <b>numeric</b> vector giving the BP ages to be calibrated.
errors	A <b>numeric</b> vector giving the standard deviation of the ages to be calibrated.
...	Currently not used.
groups	A <b>factor</b> in the sense that <code>as.factor(groups)</code> defines the the groups to combine with. If NULL (the default), all dates are combined. NAs will be treated as isolated dates.

**Value**

A `data.frame` with the following columns:

groups	Group names
ages	Combined 14C ages
errors	Combined 14C standard deviations
chi2	Chi-squared test statistic
p	Chi-squared test p-value

**Author(s)**

N. Frerebeau

**References**

Ward, G. K. and Wilson, S. R. (1978). Procedures for Comparing and Combining Radiocarbon Age Determinations: A Critique. *Archaeometry* 20(1): 19-31. doi:10.1111/j.14754754.1978.tb00208.x.

**See Also**

Other radiocarbon tools: [F14C](#), [c14\\_calibrate\(\)](#), [c14\\_curve\(\)](#), [c14\\_ensemble\(\)](#), [c14\\_plot](#), [c14\\_spd\(\)](#), [c14\\_uncalibrate\(\)](#), [rec\\_plot](#)

**Examples**

```
## Replicate Ward and Wilson (1978), p. 28
polach1972 <- data.frame(
  samples = c("ANU-7", "ANU-7", "ANU-7", "W-1571", "ANU-5",
             "C-800", "L-698D", "FSU-3", "Tx-44"),
  ages = c(14550, 15000, 13700, 14650, 11700, 10860, 11840, 11245, 10700),
  errors = c(270, 600, 300, 500, 260, 410, 100, 450, 210)
)

c14_combine(
  ages = polach1972$ages,
  errors = polach1972$errors,
  groups = polach1972$samples
)
```

c14\_curve

*14C Calibration Curve***Description**

14C Calibration Curve

**Usage**

c14\_curve(name, ...)

```
## S4 method for signature 'character'
c14_curve(name)
```

```
## S4 method for signature 'CalibratedAges'
c14_curve(name)
```

**Arguments**

name            A [character](#) vector naming calibration curves (see details).  
 ...            Currently not used.

**Details**

The following calibration curves are available:

<b>Curve</b>	<b>Reference</b>
bomb04NH1	Hua and Barbetti 2004
bomb04NH2	Hua and Barbetti 2004
bomb04NH3	Hua and Barbetti 2004
bomb04SH	Hua and Barbetti 2004
bomb13nh1	Hua, Barbetti and Rakowski 2013
bomb13nh2	Hua, Barbetti and Rakowski 2013
bomb13nh3	Hua, Barbetti and Rakowski 2013
bomb13sh12	Hua, Barbetti and Rakowski 2013
bomb13sh3	Hua, Barbetti and Rakowski 2013
bomb21nh1	Hua et al. 2022
bomb21nh2	Hua et al. 2022
bomb21nh3	Hua et al. 2022
bomb21sh12	Hua et al. 2022
bomb21sh3	Hua et al. 2022
cariaco04	Hughen et al. 2004
intcal04	Reimer et al. 2004
intcal09	Reimer et al. 2009
intcal13	Reimer et al. 2013
intcal20	Reimer et al. 2020
intcal98	Stuiver et al. 1998

Kueppers04	Kueppers et al. 2004
marine04	Hughen et al. 2004
marine09	Reimer et al. 2009
marine13	Reimer et al. 2013
marine20	Heaton et al. 2020
marine98	Stuiver, Reimer and Braziunas 1998
shcal04	McCormac et al. 2004
shcal13	Hogg et al. 2013
shcal20	Hogg et al. 2020

### Value

A list of three-column `data.frame`:

CALBP	Calibrated age BP
AGE	Uncalibrated radiocarbon age
ERROR	Standard deviation

### Author(s)

N. Frerebeau

### References

- Heaton, Timothy J, Peter Köhler, Martin Butzin, Edouard Bard, Ron W Reimer, William E N Austin, Christopher Bronk Ramsey, et al. (2020). Marine20 The Marine Radiocarbon Age Calibration Curve (0-55,000 Cal BP). *Radiocarbon*, 62(4): 779-820. doi:10.1017/RDC.2020.68.
- Hogg, Alan G, Timothy J Heaton, Quan Hua, Jonathan G Palmer, Chris SM Turney, John Southon, Alex Bayliss, et al. (2020). SHCal20 Southern Hemisphere Calibration, 0-55,000 Years Cal BP. *Radiocarbon*, 62(4): 759-78. doi:10.1017/RDC.2020.59.
- Hogg, Alan G, Quan Hua, Paul G Blackwell, Mu Niu, Caitlin E Buck, Thomas P Guilderson, Timothy J Heaton, et al. (2013). SHCal13 Southern Hemisphere Calibration, 0-50,000 Years Cal BP. *Radiocarbon*, 55(4): 1889-1903. doi:10.2458/azu\_js\_rc.55.16783.
- Hua, Quan, and Mike Barbetti (2004). Review of Tropospheric Bomb 14C Data for Carbon Cycle Modeling and Age Calibration Purposes. *Radiocarbon*, 46(3): 1273-1298. doi:10.1017/S0033822200033142.
- Hua, Quan, Mike Barbetti, and Andrzej Z Rakowski (2013). Atmospheric Radiocarbon for the Period 1950-2010. *Radiocarbon*, 55(4): 2059-2072. doi:10.2458/azu\_js\_rc.v55i2.16177.
- Hua, Quan, Jocelyn C Turnbull, Guaciara M Santos, Andrzej Z Rakowski, Santiago Ancapichún, Ricardo De Pol-Holz, Samuel Hammer, et al. (2022). Atmospheric Radiocarbon for the Period 1950-2019. *Radiocarbon*, 64(4): 723-745. doi:10.1017/RDC.2021.95.
- Hughen, K., S. Lehman, J. Southon, J. Overpeck, O. Marchal, C. Herring, and J. Turnbull (2004). 14C Activity and Global Carbon Cycle Changes over the Past 50,000 Years. *Science*, 303(5655): 202-207. doi:10.1126/science.1090300.
- Hughen, Konrad A, Mike G L Baillie, Edouard Bard, J Warren Beck, Chanda J H Bertrand, Paul G Blackwell, Caitlin E Buck, et al. (2004). Marine04 Marine Radiocarbon Age Calibration, 0-26 cal kyr BP. *Radiocarbon*, 46(3): 1059-1086. doi:10.1017/S0033822200033002.

Kueppers, Lara M., John Southon, Paul Baer, and John Harte (2004). Dead Wood Biomass and Turnover Time, Measured by Radiocarbon, along a Subalpine Elevation Gradient. *Oecologia*, 141(4): 641-651. doi:[10.1007/s004420041689x](https://doi.org/10.1007/s004420041689x).

McCormac, F G, A G Hogg, P G Blackwell, C E Buck, T F G Higham, and P J Reimer (2004). Shcal04 Southern Hemisphere Calibration, 0-11.0 cal kyr BP. *Radiocarbon*, 46(3): 1087-1092. doi:[10.1017/S0033822200033014](https://doi.org/10.1017/S0033822200033014).

Reimer, P J, M G L Baillie, E Bard, A Bayliss, J W Beck, P G Blackwell, C Bronk Ramsey, et al. (2009). IntCal09 and Marine09 Radiocarbon Age Calibration Curves, 0-50,000 Years cal BP. *Radiocarbon*, 51(4): 1111-1150. doi:[10.1017/S0033822200034202](https://doi.org/10.1017/S0033822200034202).

Reimer, Paula J, William E N Austin, Edouard Bard, Alex Bayliss, Paul G Blackwell, Christopher Bronk Ramsey, Martin Butzin, et al. (2020). The IntCal20 Northern Hemisphere Radiocarbon Age Calibration Curve (0-55 cal kBP). *Radiocarbon*, 62(4): 725-757. doi:[10.1017/RDC.2020.41](https://doi.org/10.1017/RDC.2020.41).

Reimer, Paula J, Mike G L Baillie, Edouard Bard, Alex Bayliss, J Warren Beck, Chanda J H Bertrand, Paul G Blackwell, et al. (2004). Intcal04 Terrestrial Radiocarbon Age Calibration, 0-26 cal kyr BP. *Radiocarbon*, 46(3): 1029-1058. doi:[10.1017/S0033822200032999](https://doi.org/10.1017/S0033822200032999).

Reimer, Paula J, Edouard Bard, Alex Bayliss, J Warren Beck, Paul G Blackwell, Christopher Bronk Ramsey, Caitlin E Buck, et al. (2013). IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0-50,000 Years cal BP. *Radiocarbon*, 55(4): 1869-1887. doi:[10.2458/azu\\_js\\_rc.55.16947](https://doi.org/10.2458/azu_js_rc.55.16947).

Stuiver, Minze, Paula J. Reimer, Edouard Bard, J. Warren Beck, G. S. Burr, Konrad A. Hughen, Bernd Kromer, Gerry McCormac, Johannes van der Plicht, and Marco Spurk (1998). INTCAL98 Radiocarbon Age Calibration, 24,000-0 cal BP. *Radiocarbon*, 40(3): 1041-1083. doi:[10.1017/S0033822200019123](https://doi.org/10.1017/S0033822200019123).

Stuiver, Minze, Paula J. Reimer, and Thomas F. Braziunas. (1998). High-Precision Radiocarbon Age Calibration for Terrestrial and Marine Samples. *Radiocarbon*, 40(3): 1127-1151. doi:[10.1017/S0033822200019172](https://doi.org/10.1017/S0033822200019172).

## See Also

Other radiocarbon tools: [F14C](#), [c14\\_calibrate\(\)](#), [c14\\_combine\(\)](#), [c14\\_ensemble\(\)](#), [c14\\_plot](#), [c14\\_spd\(\)](#), [c14\\_uncalibrate\(\)](#), [rec\\_plot](#)

## Examples

```
## IntCal20
intcal20 <- c14_curve("intcal20")
head(intcal20[[1]])

## IntCal
intcal <- c14_curve(c("intcal09", "intcal13", "intcal20"))
lapply(X = intcal, FUN = head)
```



---

c14_ensemble	<i>Radiocarbon Event Count</i>
--------------	--------------------------------

---

## Description

Radiocarbon Event Count

## Usage

```
c14_ensemble(object, ...)

## S4 method for signature 'CalibratedAges'
c14_ensemble(
  object,
  from = NULL,
  to = NULL,
  by = 10,
  n = 100,
  calendar = BP(),
  progress = getOption("ananke.progress")
)
```

## Arguments

object	A <a href="#">CalibratedAges</a> object.
...	Currently not used.
from	length-one <a href="#">numeric</a> vector specifying the earliest data to calibrate for (in cal BP years).
to	A length-one <a href="#">numeric</a> vector specifying the latest data to calibrate for (in cal BP years).
by	A length-one <a href="#">numeric</a> vector specifying the temporal resolution (in years) of the calibration.
n	An <a href="#">integer</a> specifying the number of item to choose randomly.
calendar	A <a href="#">TimeScale</a> object specifying the calendar of from and to (see <a href="#">calendar()</a> ). Defaults to <a href="#">CE()</a> .
progress	A <a href="#">logical</a> scalar: should a progress bar be displayed?

## Value

An [RECE](#) object.

## Author(s)

N. Frerebeau

## References

Carleton, W. C. (2021). Evaluating Bayesian Radiocarbon-dated Event Count (REC) Models for the Study of Long-term Human and Environmental Processes. *Journal of Quaternary Science*, 36(1): 110-23. doi:10.1002/jqs.3256.

## See Also

Other radiocarbon tools: [F14C](#), [c14\\_calibrate\(\)](#), [c14\\_combine\(\)](#), [c14\\_curve\(\)](#), [c14\\_plot](#), [c14\\_spd\(\)](#), [c14\\_uncalibrate\(\)](#), [rec\\_plot](#)

---

c14\_plot

*Plot Calibrated Radiocarbon Ages*

---

## Description

Plot Calibrated Radiocarbon Ages

## Usage

```
## S4 method for signature 'CalibratedAges,missing'
plot(
  x,
  calendar = getOption("ananke.calendar"),
  density = TRUE,
  interval = TRUE,
  level = 0.954,
  sort = TRUE,
  decreasing = TRUE,
  main = NULL,
  sub = NULL,
  axes = TRUE,
  frame.plot = FALSE,
  ann = graphics::par("ann"),
  panel.first = NULL,
  panel.last = NULL,
  col.density = "grey",
  col.interval = "#77AADD",
  ...
)

## S4 method for signature 'CalibratedSPD,missing'
plot(
  x,
  calendar = getOption("ananke.calendar"),
  main = NULL,
  sub = NULL,
  ann = graphics::par("ann"),
```

```

    axes = TRUE,
    frame.plot = FALSE,
    panel.first = NULL,
    panel.last = NULL,
    ...
)

```

### Arguments

x	A <a href="#">CalibratedAges</a> or <a href="#">CalibratedSPD</a> object.
calendar	A <a href="#">TimeScale</a> object specifying the target calendar (see <a href="#">calendar()</a> ).
density	A <a href="#">logical</a> scalar: should density be drawn?
interval	A <a href="#">logical</a> scalar: should highest density region be drawn?
level	A length-one <a href="#">numeric</a> vector giving the confidence level. Only used if interval is TRUE.
sort	A <a href="#">logical</a> scalar: should the data be sorted?
decreasing	A <a href="#">logical</a> scalar: should the sort order be decreasing? Only used if sort is TRUE.
main	A <a href="#">character</a> string giving a main title for the plot.
sub	A <a href="#">character</a> string giving a subtitle for the plot.
axes	A <a href="#">logical</a> scalar: should axes be drawn on the plot?
frame.plot	A <a href="#">logical</a> scalar: should a box be drawn around the plot?
ann	A <a href="#">logical</a> scalar: should the default annotation (title and x and y labels) appear on the plot?
panel.first	An expression to be evaluated after the plot axes are set up but before any plotting takes place. This can be useful for drawing background grids.
panel.last	An expression to be evaluated after plotting has taken place but before the axes, title and box are added.
col.density, col.interval	A specification for the plotting colors.
...	Other <a href="#">graphical parameters</a> may also be passed as arguments to this function.

### Value

plot() is called it for its side-effects: it results in a graphic being displayed. Invisibly returns x.

### Author(s)

N. Frerebeau

### See Also

Other radiocarbon tools: [F14C](#), [c14\\_calibrate\(\)](#), [c14\\_combine\(\)](#), [c14\\_curve\(\)](#), [c14\\_ensemble\(\)](#), [c14\\_spd\(\)](#), [c14\\_uncalibrate\(\)](#), [rec\\_plot](#)

**Examples**

```

## Calibrate a single date
cal <- c14_calibrate(300, 20)
plot(cal, panel.first = graphics::grid())

## Calibrate multiple dates
cal <- c14_calibrate(
  values = c(5000, 4500),
  errors = c(45, 35),
  names = c("X", "Y")
)
plot(cal, calendar = BP(), panel.first = graphics::grid())
plot(cal, interval = FALSE)
plot(cal[, 1, ], col.interval = "red")

plot(cal, density = FALSE, level = 0.68, lwd = 5)
plot(cal, density = FALSE, level = 0.95, lwd = 5)

## Out of 14C range?
out <- c14_calibrate(130, 20)
plot(out)

```

---

c14\_spd

*Summed Probability Distributions*


---

**Description**

Computes summed probability distributions (SPD) of radiocarbon dates.

**Usage**

```

c14_spd(object, ...)

## S4 method for signature 'CalibratedAges'
c14_spd(object, normalize_date = FALSE, normalize_spd = FALSE)

```

**Arguments**

object	A <a href="#">CalibratedAges</a> object.
...	Currently not used.
normalize_date	A <a href="#">logical</a> scalar: should the total probability mass of the calibrated dates be normalised (to sum to unity within the time-span of analysis)?
normalize_spd	A <a href="#">logical</a> scalar: should the total probability mass of the SPD be normalised (to sum to unity)?

**Author(s)**

N. Frerebeau

**See Also**

Other radiocarbon tools: [F14C](#), [c14\\_calibrate\(\)](#), [c14\\_combine\(\)](#), [c14\\_curve\(\)](#), [c14\\_ensemble\(\)](#), [c14\\_plot](#), [c14\\_uncalibrate\(\)](#), [rec\\_plot](#)

**Examples**

```
## Radiocarbon data from Bosch et al. 2015
data("ksarakil")

## Calibrate
cal <- c14_calibrate(
  values = ksarakil$date,
  errors = ksarakil$error,
  names = ksarakil$code,
  curves = "marine13",
  reservoir_offsets = 53,
  reservoir_errors = 43,
  from = 50000, to = 0
)
plot(cal, level = 0.68, flip = TRUE)

## SPD
s <- c14_spd(cal)
plot(s)
```

---

c14\_uncalibrate

*Uncalibrate a Radiocarbon Date*

---

**Description**

Uncalibrate a Radiocarbon Date

**Usage**

```
c14_uncalibrate(object, ...)
```

## S4 method for signature 'numeric'

```
c14_uncalibrate(object, curves = "intcal20")
```

## S4 method for signature 'CalibratedAges'

```
c14_uncalibrate(object, ...)
```

**Arguments**

object	A <a href="#">CalibratedAges</a> object or a <a href="#">numeric</a> vector of calibrated ages (BP).
...	Currently not used.
curves	A <a href="#">character</a> vector specifying the calibration curve to be used. Different curves can be specified.

**Author(s)**

N. Frerebeau

**See Also**

Other radiocarbon tools: [F14C](#), [c14\\_calibrate\(\)](#), [c14\\_combine\(\)](#), [c14\\_curve\(\)](#), [c14\\_ensemble\(\)](#), [c14\\_plot](#), [c14\\_spd\(\)](#), [rec\\_plot](#)

**Examples**

```
## Not run:
## Calibrate multiple dates
cal <- c14_calibrate(
  values = c(5000, 4500),
  errors = c(45, 35),
  names = c("X", "Y")
)

## Uncalibrate
c14_uncalibrate(cal)

## End(Not run)
```

---

data.frame

*Coerce to a Data Frame*

---

**Description**

Coerce to a Data Frame

**Usage**

```
## S4 method for signature 'CalibratedAges'
as.data.frame(x, ..., calendar = getOption("ananke.calendar"))

## S4 method for signature 'RECE'
as.data.frame(x, ..., calendar = getOption("ananke.calendar"))

## S4 method for signature 'ProxyRecord'
as.data.frame(x, ..., calendar = getOption("ananke.calendar"))
```

**Arguments**

`x` An object.

`...` Further parameters to be passed to `data.frame()`.

`calendar` A `TimeScale` object specifying the target calendar (see `calendar()`). If `NULL`, *rata die* are returned.

**Value**

A `data.frame` with an extra time column.

**Author(s)**

N. Frerebeau

**See Also**

Other mutators: `labels()`, `mutators`, `subset()`

**Examples**

```
## Calibrate multiple dates
cal <- c14_calibrate(
  values = c(5000, 4500),
  errors = c(45, 35),
  names = c("X", "Y")
)

head(as.data.frame(cal))
head(as.data.frame(cal, calendar = BP()))
head(as.data.frame(cal, calendar = NULL))
```

---

F14C

*F14C*

---

**Description**

Converts F14C values to 14C ages.

**Usage**

```
BP14C_to_F14C(ages, errors, ...)

F14C_to_BP14C(values, errors, ...)

## S4 method for signature 'numeric,numeric'
BP14C_to_F14C(ages, errors, lambda = 8033)

## S4 method for signature 'numeric,numeric'
F14C_to_BP14C(values, errors, lambda = 8033, asymmetric = FALSE)
```

**Arguments**

ages	A <b>numeric</b> vector giving the radiocarbon ages.
errors	A <b>numeric</b> vector giving the standard deviations.
...	Currently not used.
values	A <b>numeric</b> vector giving the F14C values.
lambda	A length-one <b>numeric</b> vector specifying the mean-life of radiocarbon (defaults to 14C half-life value as introduced by Libby 1952).
asymmetric	A <b>logical</b> scalar: should asymmetric 14C errors be returned?

**Value**

A **data.frame**.

**Author(s)**

N. Frerebeau

**References**

- Bronk Ramsey, C. (2008). Radiocarbon Dating: Revolutions in Understanding. *Archaeometry*, 50:249-275. doi:10.1111/j.14754754.2008.00394.x.
- van der Plicht, J., Hogg, A. (2006). A Note on Reporting Radiocarbon. *Quaternary Geochronology*, 1(4): 237-240. doi:10.1016/j.quageo.2006.07.001.

**See Also**

Other radiocarbon tools: [c14\\_calibrate\(\)](#), [c14\\_combine\(\)](#), [c14\\_curve\(\)](#), [c14\\_ensemble\(\)](#), [c14\\_plot](#), [c14\\_spd\(\)](#), [c14\\_uncalibrate\(\)](#), [rec\\_plot](#)

**Examples**

```
## Asymmetric 14C errors (van der Plicht and Hogg 2006)
F14C_to_BP14C(0.0052, 0.0006, asym = TRUE)

## Symmetric 14C errors (Bronk Ramsey 2008)
F14C_to_BP14C(0.0052, 0.0006, asym = FALSE)
```

---

hdr

*Highest Density Regions*

---

**Description**

Highest Density Regions



## Usage

```
## S4 method for signature 'CalibratedAges,missing'  
interval_hdr(x, level = 0.954, calendar = getOption("ananke.calendar"), ...)
```

## Arguments

x	A <a href="#">CalibratedAges</a> object.
level	A length-one <a href="#">numeric</a> vector giving the confidence level.
calendar	A <a href="#">TimeScale</a> object specifying the target calendar (see <a href="#">calendar()</a> ).
...	Currently not used.

## Value

Returns a [list](#) of numeric [matrix](#).

## Author(s)

N. Frerebeau

## References

Hyndman, R. J. (1996). Computing and graphing highest density regions. *American Statistician*, 50: 120-126. doi:[10.2307/2684423](https://doi.org/10.2307/2684423).

## See Also

[stats::density\(\)](#), [arkhe::interval\\_hdr\(\)](#)

Other statistics: [mean\(\)](#), [median\(\)](#), [quantile\(\)](#)

## Examples

```
## Calibrate multiple dates  
cal <- c14_calibrate(  
  values = c(5000, 4500),  
  errors = c(45, 35),  
  names = c("X", "Y")  
)  
  
## HDR  
interval_hdr(cal, level = 0.683)  
interval_hdr(cal, level = 0.954)  
interval_hdr(cal, level = 0.997)
```

---

ksarakil	<i>Ksâr 'Akil Radiocarbon Dates</i>
----------	-------------------------------------

---

**Description**

Ksâr 'Akil Radiocarbon Dates

**Usage**

ksarakil

**Format**

A `data.frame` with 16 rows and 5 variables:

**code** Laboratory code.

**date** Radiocarbon date (year BP).

**error** Radiocarbon error (year).

**layer** Stratigraphic layer.

**phase** Chronological phase.

**Source**

Bosch, M. D., Mannino, M. A., Prendergast, A. L., O'Connell, T. C., Demarchi, B., Taylor, S. M., Niven, L., van der Plicht, J. and Hublin, J.-J. (2015). New Chronology for Ksâr 'Akil (Lebanon) Supports Levantine Route of Modern Human Dispersal into Europe. *Proceedings of the National Academy of Sciences* 112(25): 7683-8. doi:10.1073/pnas.1501529112.

---

labels	<i>Find Labels from Object</i>
--------	--------------------------------

---

**Description**

Find a suitable set of labels from an object for use in printing or plotting, for example.

**Usage**

```
## S4 method for signature 'CalibratedAges'
labels(object, ...)
```

**Arguments**

object	An object from which to find labels.
...	Currently not used.

**Value**

A [character](#) vector.

**Author(s)**

N. Frerebeau

**See Also**

Other mutators: [data.frame](#), [mutators](#), [subset\(\)](#)

---

mean

*Mean*

---

**Description**

Mean

**Usage**

```
## S4 method for signature 'CalibratedAges'
mean(x, na.rm = FALSE, ..., calendar = getOption("ananke.calendar"))
```

```
## S4 method for signature 'ProxyRecord'
mean(x, na.rm = FALSE, ...)
```

**Arguments**

<code>x</code>	A <a href="#">CalibratedAges</a> object.
<code>na.rm</code>	A <a href="#">logical</a> scalar: should NA values be stripped before the computation proceeds?
<code>...</code>	Currently not used.
<code>calendar</code>	A <a href="#">TimeScale</a> object specifying the target calendar (see <a href="#">calendar()</a> ).

**Value**

A [numeric](#) vector.

**Author(s)**

N. Frerebeau

**See Also**

Other statistics: [hdr](#), [median\(\)](#), [quantile\(\)](#)

**Examples**

```
## Calibrate multiple dates
cal <- c14_calibrate(
  values = c(5000, 4500),
  errors = c(45, 35),
  names = c("X", "Y")
)

## Statistics
quantile(cal)
median(cal)
mean(cal)

## Plot
plot(cal, calendar = CE())

## Need to set 'calendar'
abline(v = median(cal, calendar = CE()), lty = 2, col = "blue")
abline(v = mean(cal, calendar = CE()), lty = 2, col = "red")
```

---

 median

*Median*


---

**Description**

Median

**Usage**

```
## S4 method for signature 'CalibratedAges'
median(x, na.rm = FALSE, ..., calendar = getOption("ananke.calendar"))
```

**Arguments**

x	A <a href="#">CalibratedAges</a> object.
na.rm	A <a href="#">logical</a> scalar: should NA values be stripped before the computation proceeds?
...	Currently not used.
calendar	A <a href="#">TimeScale</a> object specifying the target calendar (see <a href="#">calendar()</a> ).

**Value**

A [numeric](#) vector.

**Author(s)**

N. Frerebeau

**See Also**

Other statistics: [hdr](#), [mean\(\)](#), [quantile\(\)](#)

**Examples**

```
## Calibrate multiple dates
cal <- c14_calibrate(
  values = c(5000, 4500),
  errors = c(45, 35),
  names = c("X", "Y")
)

## Statistics
quantile(cal)
median(cal)
mean(cal)

## Plot
plot(cal, calendar = CE())

## Need to set 'calendar'
abline(v = median(cal, calendar = CE()), lty = 2, col = "blue")
abline(v = mean(cal, calendar = CE()), lty = 2, col = "red")
```

---

mutators

*Get or Set Parts of an Object*

---

**Description**

Getters and setters to extract or replace parts of an object.

**Arguments**

x	An object from which to get or set element(s).
value	A possible value for the element(s) of x.

**Value**

An object of the same sort as x with the new values assigned.

**Author(s)**

N. Frerebeau

**See Also**

Other mutators: [data.frame](#), [labels\(\)](#), [subset\(\)](#)

---

pb\_age

*Geological Model Age from Lead Isotope Analysis*

---

### Description

Compute geological model age (T) and U/Pb ( $\mu$ ) and Th/U ( $\kappa$ ) ratios from lead isotopic measurements.

### Usage

```
pb_age(x, y, z, ...)
```

```
## S4 method for signature 'numeric,numeric,numeric'
```

```
pb_age(  
  x,  
  y,  
  z,  
  t0 = 3.8,  
  x_star = 18.75,  
  y_star = 15.63,  
  z_star = 38.86,  
  mu = 9.66,  
  kappa = 3.9,  
  th232 = 0.049475,  
  u238 = 0.155125,  
  u235 = 0.98485,  
  u238_235 = 137.79,  
  tolerance = sqrt(.Machine$double.eps)  
)
```

```
## S4 method for signature 'list,missing,missing'
```

```
pb_age(  
  x,  
  t0 = 3.8,  
  x_star = 18.75,  
  y_star = 15.63,  
  z_star = 38.86,  
  mu = 9.66,  
  kappa = 3.9,  
  th232 = 0.049475,  
  u238 = 0.155125,  
  u235 = 0.98485,  
  u238_235 = 137.79,  
  tolerance = sqrt(.Machine$double.eps)  
)
```

**Arguments**

x	A <b>numeric</b> vector of 206Pb/204Pb ratios. If y and z are missing, must be a <b>list</b> (or a <b>data.frame</b> ) with numeric components (columns) x, y and z.
y	A <b>numeric</b> vector of 207Pb/204Pb ratios. If missing, an attempt is made to interpret x in a suitable way.
z	A <b>numeric</b> vector of 208Pb/204Pb ratios. If missing, an attempt is made to interpret x in a suitable way.
...	Currently not used.
t0	A <b>numeric</b> value giving the time of the second stage of the reference model.
x_star	A <b>numeric</b> value giving the 206Pb/204Pb ratio at $t = 0$ .
y_star	A <b>numeric</b> value giving the 207Pb/204Pb ratio at $t = 0$ .
z_star	A <b>numeric</b> value giving the 208Pb/204Pb ratio at $t = 0$ .
mu	A <b>numeric</b> value giving the 238U/204Pb ratio of the reference model.
kappa	A <b>numeric</b> value giving the 232Th/238U ratio of the reference model.
th232	A <b>numeric</b> value giving the decay constants of 232Th.
u238	A <b>numeric</b> value giving the decay constants of 238U.
u235	A <b>numeric</b> value giving the decay constants of 235U.
u238_235	A <b>numeric</b> value giving the 238U/235U ratio.
tolerance	A <b>numeric</b> value specifying the tolerance (stopping criteria for the Newton–Raphson method).

**Value**

A four columns **data.frame**:

age	Geological model age (in Ma)
mu	238U/204Pb ratio
kappa	232Th/238U ratio
f	

**Note**

Reference values from Albarede & Juteau (1984).

**Author(s)**

N. Frerebeau, F. Albarede (original Matlab code)

**References**

- Albarède, F., Desautly, A.-M. & Blichert-Toft, J. (2012). A Geological Perspective on the Use of Pb Isotopes in Archaeometry. *Archaeometry*, 54: 853-867. doi:10.1111/j.14754754.2011.00653.x.
- Albarède, F. & Juteau, M. (1984). Unscrambling the Lead Model Ages. *Geochimica et Cosmochimica Acta*, 48(1): 207-12. doi:10.1016/00167037(84)903648.

**Examples**

```
## Reference values from Albarede & Juteau (1984)
Pb <- data.frame(
  x = c(18.23247, 18.22936, 18.23102), # Pb206/Pb204
  y = c(15.65199, 15.65216, 15.65097), # Pb207/Pb204
  z = c(38.5167, 38.51516, 38.51601) # Pb208/Pb204
)

pb_age(Pb)
```

---

 proxy\_ensemble

*Layer-Counted Proxy Records Uncertainties*


---

**Description**

Represents layer-counted proxy records as sequences of probability distributions on absolute, error-free time axes.

**Usage**

```
proxy_ensemble(depth, ...)

## S4 method for signature 'numeric'
proxy_ensemble(
  depth,
  proxy,
  proxy_error,
  step,
  time,
  time_error,
  calendar,
  from = NULL,
  to = NULL,
  by = NULL,
  n = 30,
  progress = getOption("ananke.progress"),
  verbose = getOption("ananke.verbose")
)
```

**Arguments**

depth	A positive <b>numeric</b> vector giving the depth at which proxy values and calendar ages were measured. It must be in decreasing order (i.e. in chronological order).
...	Currently not used.
proxy	A <b>numeric</b> vector giving the proxy values.
proxy_error	A <b>numeric</b> vector giving the proxy uncertainties.



step	A length-one <b>numeric</b> vector specifying the step size (in units of proxy) at which proxy records densities are to be estimated.
time	A <b>numeric</b> vector giving the calendar ages (in years).
time_error	A <b>numeric</b> vector giving the calendar age uncertainties (in years).
calendar	A <b>TimeScale</b> object specifying the calendar of time (see <a href="#">calendar()</a> ).
from	A length-one <b>numeric</b> vector specifying the starting value of the temporal sequence at which densities are to be estimated (in years).
to	A length-one <b>numeric</b> vector specifying the end value of the temporal sequence at which densities are to be estimated (in cal BP years).
by	A length-one <b>numeric</b> vector specifying the increment of the temporal sequence at which densities are to be estimated (in years).
n	An <b>integer</b> specifying the number of item to choose randomly.
progress	A <b>logical</b> scalar: should a progress bar be displayed?
verbose	A <b>logical</b> scalar: should extra information be reported?

**Value**

A [ProxyRecord](#) object.

**Author(s)**

N. Frerebeau

**References**

Boers, N., Goswami, B. & Ghil, M. (2017). A Complete Representation of Uncertainties in Layer-Counted Paleoclimatic Archives. *Climate of the Past*, 13(9): 1169-1180. doi:10.5194/cp131169-2017.

**See Also**

Other proxy tools: [proxy\\_plot](#)

**Examples**

```
## Not run:
## Get NGRIP records
data("ngrip2010", package = "folio")
ngrip2010 <- subset(ngrip2010, !is.na(MCE))
ngrip2010 <- ngrip2010[nrow(ngrip2010):1, ] # Sort in chronological order

## Replicate fig. 3d from Boers et al. (2017)
## !\ This may take a while... !\
ngrip_record <- proxy_ensemble(
  depth = ngrip2010$depth,
  proxy = ngrip2010$delta,
  proxy_error = 0.01,
  step = 0.001,
```

```

    time = ngrip2010$age,
    time_error = ngrip2010$MCE,
    calendar = b2k(), # /\
    by = 20,
    n = 30
  )

plot(ngrip_record)

## End(Not run)

```

---

proxy\_plot

*Plot Layer-Counted Proxy Records Uncertainties*


---

## Description

Plot Layer-Counted Proxy Records Uncertainties

## Usage

```

## S4 method for signature 'ProxyRecord,missing'
plot(
  x,
  calendar = getOption("ananke.calendar"),
  iqr = TRUE,
  xlab = NULL,
  ylab = NULL,
  col = grDevices::hcl.colors(12, "YlOrRd", rev = TRUE),
  col.mean = "black",
  col.iqr = col.mean,
  lty.mean = 1,
  lty.iqr = 3,
  lwd.mean = 2,
  lwd.iqr = lwd.mean,
  ...
)

```

## Arguments

x	A <a href="#">ProxyRecord</a> object.
calendar	A <a href="#">TimeScale</a> object specifying the target calendar (see <a href="#">calendar()</a> ).
iqr	A <a href="#">logical</a> scalar: should the mean and IQR be displayed?
xlab, ylab	A <a href="#">character</a> string giving a label for the x and y axis.
col	A list of colors such as that generated by <a href="#">grDevices::hcl.colors()</a> .
col.mean, col.iqr	A specification for the line colors. Only used if iqr is TRUE.

lty.mean, lty.iqr  
A specification for the line types. Only used if iqr is TRUE.

lwd.mean, lwd.iqr  
A specification for the line widths. Only used if iqr is TRUE.

...  
Further parameters to be passed to `graphics::image()`.

### Value

`plot()` is called it for its side-effects: it results in a graphic being displayed. Invisibly returns `x`.

### Author(s)

N. Frerebeau

### See Also

Other proxy tools: `proxy_ensemble()`

### Examples

```
## Not run:
## Get NGRIP records
data("ngrip2010", package = "folio")
ngrip2010 <- subset(ngrip2010, !is.na(MCE))
ngrip2010 <- ngrip2010[nrow(ngrip2010):1, ] # Sort in chronological order

## Replicate fig. 3d from Boers et al. (2017)
## !\ This may take a while... !\
ngrip_record <- proxy_ensemble(
  depth = ngrip2010$depth,
  proxy = ngrip2010$delta,
  proxy_error = 0.01,
  step = 0.001,
  time = ngrip2010$age,
  time_error = ngrip2010$MCE,
  calendar = b2k(), # !\
  by = 20,
  n = 30
)

plot(ngrip_record)

## End(Not run)
```

---

quantile

*Quantiles of a Density Estimate*

---

### Description

Quantiles of a Density Estimate

### Usage

```
## S4 method for signature 'CalibratedAges'
quantile(
  x,
  probs = seq(0, 1, 0.25),
  na.rm = FALSE,
  ...,
  calendar = getOption("ananke.calendar")
)

## S4 method for signature 'ProxyRecord'
quantile(x, probs = seq(0, 1, 0.25), na.rm = FALSE, ...)
```

### Arguments

x	A <a href="#">CalibratedAges</a> object.
probs	A <a href="#">numeric</a> vector of probabilities with values in [0, 1].
na.rm	A <a href="#">logical</a> scalar: should NA values be stripped before the computation proceeds?
...	Currently not used.
calendar	A <a href="#">TimeScale</a> object specifying the target calendar (see <a href="#">calendar()</a> ).

### Value

A numeric [matrix](#) containing the quantiles.

### Author(s)

N. Frerebeau

### See Also

Other statistics: [hdr](#), [mean\(\)](#), [median\(\)](#)

**Examples**

```
## Calibrate multiple dates
cal <- c14_calibrate(
  values = c(5000, 4500),
  errors = c(45, 35),
  names = c("X", "Y")
)

## Statistics
quantile(cal)
median(cal)
mean(cal)

## Plot
plot(cal, calendar = CE())

## Need to set 'calendar'
abline(v = median(cal, calendar = CE()), lty = 2, col = "blue")
abline(v = mean(cal, calendar = CE()), lty = 2, col = "red")
```

---

rec\_plot

*Plot a Radiocarbon Event Count Ensemble*

---

**Description**

Plot a Radiocarbon Event Count Ensemble

**Usage**

```
## S4 method for signature 'RECE,missing'
plot(x, calendar = getOption("ananke.calendar"), ...)
```

**Arguments**

x	An <a href="#">RECE</a> object.
calendar	A <a href="#">TimeScale</a> object specifying the target calendar (see <a href="#">calendar()</a> ).
...	Further parameters to be passed to <a href="#">graphics::image()</a> .

**Value**

[image\(\)](#) is called for its side-effects: it results in a graphic being displayed (invisibly returns x).

**Author(s)**

N. Frerebeau

## References

Carleton, W. C. (2021). Evaluating Bayesian Radiocarbon-dated Event Count (REC) Models for the Study of Long-term Human and Environmental Processes. *Journal of Quaternary Science*, 36(1): 110-23. doi:10.1002/jqs.3256.

## See Also

Other radiocarbon tools: [F14C](#), [c14\\_calibrate\(\)](#), [c14\\_combine\(\)](#), [c14\\_curve\(\)](#), [c14\\_ensemble\(\)](#), [c14\\_plot](#), [c14\\_spd\(\)](#), [c14\\_uncalibrate\(\)](#)

---

subset

*Extract or Replace Parts of an Object*

---

## Description

Operators acting on objects to extract or replace parts.

## Usage

```
## S4 method for signature 'CalibratedAges'  
x[i, j, k, drop = FALSE]
```

## Arguments

x	An object from which to extract element(s) or in which to replace element(s).
i, j, k	Indices specifying elements to extract or replace.
drop	A <a href="#">logical</a> scalar: should the result be coerced to the lowest possible dimension? This only works for extracting elements, not for the replacement.

## Value

A subsetted object.

## Author(s)

N. Frerebeau

## See Also

Other mutators: [data.frame](#), [labels\(\)](#), [mutators](#)

# Index

- \* **datasets**
  - ksarakil, 18
- \* **isotope analysis**
  - pb\_age, 22
- \* **mutators**
  - data.frame, 14
  - labels, 18
  - mutators, 21
  - subset, 30
- \* **proxy tools**
  - proxy\_ensemble, 24
  - proxy\_plot, 26
- \* **radiocarbon tools**
  - c14\_calibrate, 2
  - c14\_combine, 4
  - c14\_curve, 6
  - c14\_ensemble, 9
  - c14\_plot, 10
  - c14\_spd, 12
  - c14\_uncalibrate, 13
  - F14C, 15
  - rec\_plot, 29
- \* **statistics**
  - hdr, 16
  - mean, 19
  - median, 20
  - quantile, 28
- [, CalibratedAges-method (subset), 30
  
- arkhe::interval\_hdr(), 17
- as.data.frame, CalibratedAges-method (data.frame), 14
- as.data.frame, ProxyRecord-method (data.frame), 14
- as.data.frame, RECE-method (data.frame), 14
  
- Bchron::BchronCalibrate(), 3
- BP14C\_to\_F14C (F14C), 15
  
- BP14C\_to\_F14C, numeric, numeric-method (F14C), 15
- BP14C\_to\_F14C-method (F14C), 15
  
- c14\_calibrate, 2, 5, 8, 10, 11, 13, 14, 16, 30
- c14\_calibrate, numeric, numeric-method (c14\_calibrate), 2
- c14\_calibrate-method (c14\_calibrate), 2
- c14\_combine, 4, 4, 8, 10, 11, 13, 14, 16, 30
- c14\_combine, numeric, numeric-method (c14\_combine), 4
- c14\_combine-method (c14\_combine), 4
- c14\_curve, 4, 5, 6, 10, 11, 13, 14, 16, 30
- c14\_curve, CalibratedAges-method (c14\_curve), 6
- c14\_curve, character-method (c14\_curve), 6
- c14\_curve-method (c14\_curve), 6
- c14\_ensemble, 4, 5, 8, 9, 11, 13, 14, 16, 30
- c14\_ensemble, CalibratedAges-method (c14\_ensemble), 9
- c14\_ensemble-method (c14\_ensemble), 9
- c14\_plot, 4, 5, 8, 10, 10, 13, 14, 16, 30
- c14\_spd, 4, 5, 8, 10, 11, 12, 14, 16, 30
- c14\_spd, CalibratedAges-method (c14\_spd), 12
- c14\_spd-method (c14\_spd), 12
- c14\_uncalibrate, 4, 5, 8, 10, 11, 13, 13, 16, 30
- c14\_uncalibrate, CalibratedAges-method (c14\_uncalibrate), 13
- c14\_uncalibrate, numeric-method (c14\_uncalibrate), 13
- c14\_uncalibrate-method (c14\_uncalibrate), 13
- calendar(), 9, 11, 15, 17, 19, 20, 25, 26, 28, 29
- CalibratedAges, 3, 9, 11, 12, 14, 17, 19, 20, 28
- CalibratedSPD, 11

- CE(), 9
- character, 3, 6, 11, 14, 19, 26
- data.frame, 5, 7, 14, 15, 16, 18, 19, 21, 23, 30
- data.frame(), 15
- F14C, 4, 5, 8, 10, 11, 13, 14, 15, 30
- F14C\_to\_BP14C (F14C), 15
- F14C\_to\_BP14C, numeric, numeric-method (F14C), 15
- F14C\_to\_BP14C-method (F14C), 15
- factor, 5
- get (mutators), 21
- graphical parameters, 11
- graphics::image(), 27, 29
- grDevices::hcl.colors(), 26
- hdr, 16, 19, 21, 28
- integer, 9, 25
- interval\_hdr, CalibratedAges, missing-method (hdr), 16
- ksarakil, 18
- labels, 15, 18, 21, 30
- labels, CalibratedAges-method (labels), 18
- list, 17, 23
- logical, 3, 9, 11, 12, 16, 19, 20, 25, 26, 28, 30
- matrix, 17, 28
- mean, 17, 19, 21, 28
- mean, CalibratedAges, missing-method (mean), 19
- mean, CalibratedAges-method (mean), 19
- mean, ProxyRecord, missing-method (mean), 19
- mean, ProxyRecord-method (mean), 19
- median, 17, 19, 20, 28
- median, CalibratedAges, missing-method (median), 20
- median, CalibratedAges-method (median), 20
- mutators, 15, 19, 21, 30
- numeric, 3, 5, 9, 11, 14, 16, 17, 19, 20, 23–25, 28
- pb\_age, 22
- pb\_age, list, missing, missing-method (pb\_age), 22
- pb\_age, numeric, numeric, numeric-method (pb\_age), 22
- plot, CalibratedAges, missing-method (c14\_plot), 10
- plot, CalibratedSPD, missing-method (c14\_plot), 10
- plot, ProxyRecord, missing-method (proxy\_plot), 26
- plot, RECE, missing-method (rec\_plot), 29
- proxy\_ensemble, 24, 27
- proxy\_ensemble, numeric-method (proxy\_ensemble), 24
- proxy\_ensemble-method (proxy\_ensemble), 24
- proxy\_plot, 25, 26
- ProxyRecord, 25, 26
- quantile, 17, 19, 21, 28
- quantile, CalibratedAges, missing-method (quantile), 28
- quantile, CalibratedAges-method (quantile), 28
- quantile, ProxyRecord, missing-method (quantile), 28
- quantile, ProxyRecord-method (quantile), 28
- rcarbon::calibrate(), 3
- rec\_plot, 4, 5, 8, 10, 11, 13, 14, 16, 29
- RECE, 9, 29
- set (mutators), 21
- stats::density(), 17
- subset, 15, 19, 21, 30
- TimeScale, 9, 11, 15, 17, 19, 20, 25, 26, 28, 29