Package 'Bchron'

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Type Package

Title Radiocarbon Dating, Age-Depth Modelling, Relative Sea Level Rate Estimation, and Non-Parametric Phase Modelling

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Description Enables quick calibration of radiocarbon dates under various calibration curves (including user generated ones); Age-depth modelling as per the algorithm of Haslett and Parnell (2008); Relative sea level rate estimation incorporating time uncertainty in polynomial regression models; and non-parametric phase modelling via Gaussian mixtures as a means to determine the activity of a site (and as an alternative to the Oxcal function SUM). The package includes a vignette which can be accessed via vignette('Bchron').

License GPL (>= 2)

Suggests knitr

VignetteBuilder knitr

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`Bchron-package` *Radiocarbon dating, age-depth modelling, relative sea level rate estimation, and non-parametric phase modelling*

Description

This package enables quick calibration of radiocarbon dates under various calibration curves (including user generated ones); Age-depth modelling as per the algorithm of Haslett and Parnell (2008); Relative sea level rate estimation incorporating time uncertainty in polynomial regression models; and non-parametric phase modelling via Gaussian mixtures as a means to determine the activity of a site (and as an alternative to the Oxcal function SUM).

Details

Package:	Bchron
Type:	Package
Version:	4.0
Date:	2014-03-26
License:	GPL (>= 2)

Most important functions are `BchronCalibrate` to calibrate radiocarbon (and non-radiocarbon) dates, `Bchronology` for the age-depth model of Haslett and Parnell (2008), `BchronRSL` to get rate estimates for relative sea level data, `BchronDensity` and `BchronDensityFast` for non-parametric phase modelling of age data. See the help files for these functions for examples

Author(s)

Andrew Parnell <andrew.parnell@ucd.ie>

References

See individual functions for references and examples

`BchronCalibrate` *Fast radiocarbon calibration*

Description

A fast function for calibrating large numbers of radiocarbon dates involving multiple calibration curves

Usage

```
BchronCalibrate(ages, ageSds, calCurves, ids = NULL, positions = NULL,
pathToCalCurves = system.file('data',package = "Bchron"),
eps = 1e-05, dfs = rep(100, length(ages)))
```

Arguments

`ages`	A vector of ages (most likely 14C)
`ageSds`	A vector of 1-sigma values for the ages given above
`calCurves`	A vector of values containing either 'intcal13', 'shcal13', 'marine13', or 'normal'. Should be the same length the number of ages supplied. Non-standard calibration curves can be used provided they are supplied in the same format as those previously mentioned and are placed in the same directory. Normal indicates a normally-distributed (non-14C) age.
`ids`	(optional) ID names for each age
`positions`	(optional) Position values (e.g. depths) for each age
`pathToCalCurves`	(optional) File path to where the calibration curves are located. Defaults to the system directory where the 3 standard calibration curves are stored.
`eps`	(optional) Cut-off point for density calculation. A value of eps>0 removes ages from the output which have negligible probability density
`dfs`	(optional) Degrees-of-freedom values for the t-distribution associated with the calibration calculation. A large value indicates Gaussian distributions assumed for the 14C ages

Details

This function provides a direct numerical integration strategy for computing calibrated radiocarbon ages. The steps for each 14C age are approximately as follows: 1) Create a grid of ages covering the range of the calibration curve 2) Calculate the probability of each age according to the 14C age, the standard deviation supplied and the calibration curve 3) Normalise the probabilities so that they sum to 1 4) Remove any probabilities that are less than the value given for eps Multiple calibration curves can be specified so that each 14C age can have a different curve. For ages that are not 14C, use the 'normal' calibration curve which treats the ages as normally distributed with given standard deviation

Value

A list of lists where each element corresponds to a single age. Each element contains:

`ages`	The original age supplied
`ageSDs`	The original age standard deviation supplied
`positions`	The position of the age (usually the depth)
`calCurves`	The calibration curve used for that age
`ageGrid`	A grid of age values over which the density was created
`densities`	A vector of probability values indicating the probability value for each element in ageGrid
`ageLab`	The label given to the age variable
`positionLab`	The label given to the position variable

Author(s)

Andrew Parnell <andrew.parnell@ucd.ie>

References

Forthcoming!

See Also

Bchronology, BchronRSL, BchronDensity, BchronDensityFast

Examples

```
# Calibrate a single age
ages1 = BchronCalibrate(ages=11553,ageSds=230,calCurves='intcal13',ids='Date-1')
summary(ages1)
plot(ages1)

# Calibrate multiple ages with different calibration curves
ages2 = BchronCalibrate(ages=c(3445,11553,7456),ageSds=c(50,230,110),
calCurves=c('intcal13','intcal13','shcal13'))
summary(ages2)
plot(ages2)
```

```
# Calibrate multiple ages with multiple calibration curves and including depth
ages3 = BchronCalibrate(ages=c(3445,11553),ageSds=c(50,230),positions=c(100,150),
calCurves=c('intcal13','normal'))
summary(ages3)
plot(ages3,withDepths=TRUE)
```

BchronDensity *Non-parametric phase model*

Description

This function runs a non-parametric phase model on 14C and non-14C ages via Gaussian Mixture density estimation

Usage

```
BchronDensity(ages, ageSds, calCurves, pathToCalCurves = system.file('data',
package = "Bchron"), dfs = rep(100, length(ages)), numMix = 30, iterations = 10000,
burn = 2000, thin = 8, updateAges = FALSE)
```

Arguments

ages	A vector of ages (most likely 14C)
ageSds	A vector of 1-sigma values for the ages given above
calCurves	A vector of values containing either 'intcal13', 'shcal13', 'marine13', or 'normal'. Should be the same length the number of ages supplied. Non-standard calibration curves can be used provided they are supplied in the same format as those previously mentioned and are placed in the same directory. Normal indicates a normally-distributed (non-14C) age.
pathToCalCurves	(optional) File path to where the calibration curves are located. Defaults to the system directory where the 3 standard calibration curves are stored.
dfs	(optional) Degrees-of-freedom values for the t-distribution associated with the calibration calculation. A large value indicates Gaussian distributions assumed for the 14C ages
numMix	(optional) The number of mixture components in the phase model. Might need to be increased if the data set is large and the phase behaviour is very complex
iterations	The number of iterations to run for
burn	The number of starting iterations to discard
thin	The step size of iterations to keep
updateAges	Whether or not to update ages as part of the MCMC run. Default is FALSE. Changing this to TRUE will improve performance but will fit a slightly invalid model

Details

This model places a Gaussian mixture prior distribution on the calibrated ages and so estimates the density of the overall set of radiocarbon ages. It is designed to be a probabilistic version of the Oxcal SUM command which takes calibrated ages and sums the probability distributions with the aim of estimating activity through age as a proxy.

Value

output = list(theta = thetaStore, p = pStore, mu = mu, calAges = xSmall, G = G) class(output) = "BchronDensityRun" An object of class BchronDensityRun with the following elements:

`theta`	The posterior samples of the restricted ages
`p`	Posterior samples of the mixture proportions
`mu`	Values of the means of each Gaussian mixture
`calAges`	The calibrated ages from `BchronCalibrate`
`G`	The number of mixture components. Equal to numMix

Author(s)

Andrew Parnell <andrew.parnell@ucd.ie>

References

Forthcoming!

See Also

`Bchronology`, `BchronRSL`, `BchronDensityFast` for a faster approximate version of this function

Examples

```
## Not run: # Read in some data from Sluggan Moss
data(Sluggan)

# Run the model
SlugDens = BchronDensity(ages=Sluggan$ages,ageSds=Sluggan$ageSds,
calCurves=Sluggan$calCurves,numMix=50)

# plot it
plot(SlugDens)
## End(Not run)
```

`BchronDensityFast` *Non-parametric phase model (faster version)*

Description

This function runs a non-parametric phase model on 14C and non-14C ages via Gaussian Mixture density estimation through the mclust package

Usage

```
BchronDensityFast(ages, ageSds, calCurves, pathToCalCurves = system.file('data',
package = "Bchron"), dfs = rep(100, length(ages)), samples = 2000, G = 30)
```

Arguments

`ages`	A vector of ages (most likely 14C)
`ageSds`	A vector of 1-sigma values for the ages given above
`calCurves`	A vector of values containing either 'intcal13', 'shcal13', 'marine13', or 'normal'. Should be the same length the number of ages supplied. Non-standard calibration curves can be used provided they are supplied in the same format as those previously mentioned and are placed in the same directory. Normal indicates a normally-distributed (non-14C) age.
`pathToCalCurves`	(optional) File path to where the calibration curves are located. Defaults to the system directory where the 3 standard calibration curves are stored.
`dfs`	(optional) Degrees-of-freedom values for the t-distribution associated with the calibration calculation. A large value indicates Gaussian distributions assumed for the 14C ages
`samples`	(optional) Number of samples of calibrated dates required
`G`	(optional) Number of Gaussian mixture components

Details

This is a faster approximate version of `BchronDensity` that uses the `densityMclust` function to compute the Gaussian mixtures for a set of calibrated ages. The method is an approximation as it does not fit a fully Bayesian model as `BchronDensity` does. It is designed to be a probabilistic version of the Oxcal SUM command which takes calibrated ages and sums the probability distributions with the aim of estimating activity through age as a proxy.

Value

An object of class BchronDensityRunFast with the following components:

`out`	The output from the run of `densityMclust` with the given number of mixture components
`calAges`	The calibrated ages from the `BchronDensity` function

Author(s)

Andrew Parnell <andrew.parnell@ucd.ie>

References

See the mclust package for references about this method.

See Also

Bchronology, BchronCalibrate, BchronRSL, BchronDensity for a slower exact version of this function

Examples

```
## Not run: # Read in some data from Sluggan Moss
data(Sluggan)

# Run the model
SlugDensFast = BchronDensityFast(ages=Sluggan$ages,ageSds=Sluggan$ageSds,
calCurves=Sluggan$calCurves)

# plot it
plot(SlugDensFast)
## End(Not run)
```

Bchronology *Runs the Compound Poisson-Gamma chronology model of Haslett and Parnell (2008)*

Description

Fits a non-parametric chronology model to age/position data according to the Compound Poisson-Gamma model defined by Haslett and Parnell (2008). This version uses a slightly modified Markov chain Monte Carlo fitting algorithm which aims to converge quicker and requires fewer iterations. It also a slightly modified procedure for identifying outliers

Usage

```
Bchronology(ages, ageSds, positions, positionThicknesses = rep(0, length(ages)),
calCurves = rep("intcal13", length(ages)), ids = NULL,
outlierProbs = rep(0.01, length(ages)), predictPositions = seq(min(positions),
max(positions), length = 100), pathToCalCurves = system.file('data',
package = "Bchron"), iterations = 10000, burn = 2000, thin = 8,
extractDate = 1950 - as.numeric(format(Sys.time(), "%Y")), maxExtrap = 500,
thetaMhSd = 0.5, muMhSd = 0.1, psiMhSd = 0.1, ageScaleVal = 1000,
positionScaleVal = 100)
```

Arguments

ages	A vector of ages (most likely 14C)
ageSds	A vector of 1-sigma values for the ages given above
positions	Position values (e.g. depths) for each age
positionThicknesses	(optional) Thickness values for each of the positions. By default set to zero
calCurves	A vector of values containing either 'intcal13', 'shcal13', 'marine13', or 'normal'. Should be the same length the number of ages supplied. Non-standard calibration curves can be used provided they are supplied in the same format as those previously mentioned and are placed in the same directory. Normal indicates a normally-distributed (non-14C) age.
ids	(optional) ID names for each age
outlierProbs	(optional) A vector of prior outlier probabilities, one for each age. Defaults to 0.01
predictPositions	(optional) A vector of positions (e.g. depths) at which predicted age values are required. Defaults to a sequence of length 100 from the top position to the bottom position
pathToCalCurves	(optional) File path to where the calibration curves are located. Defaults to the system directory where the 3 standard calibration curves are stored.
iterations	(optional) The number of iterations to run the procedure for
burn	(optional) The number of starting iterations to discard
thin	(optional) The step size for every iteration to keep beyond the burnin
extractDate	(optional) The top age of the core. Used for extrapolation purposes so that no extrapolated ages go beyond the top age of the core. Defaults to the current year
maxExtrap	(optional) The maximum number of extrapolations to perform before giving up. Useful for when large amounts of extrapolation are required, i.e. some of the predictPositions are a long way from the dated positions
thetaMhSd	(optional) The Metropolis-Hastings standard deviation for the age parameters
muMhSd	(optional) The Metropolis-Hastings standard deviation for the Compound Poisson-Gamma mean
psiMhSd	(optional) The Metropolis-Hastings standard deviation for the Compound Poisson-Gamma scale
ageScaleVal	(optional) A scale value for the ages. Bchronology works best when the ages are scaled to be approximately between 0 and 100. The default value is thus 1000 for ages given in years.
positionScaleVal	(optional) A scale value for the positions. Bchronology works best when the positions are scaled to be approximately between 0 and 100. The default value is thus 100 for positions given in cm.

Details

The Bchronology function fits a compound Poisson-Gamma distribution to the increments between the dated levels. This involves a stochastic linear interpolation step where the age gaps are Gamma distributed, and the position gaps are Exponential. Radiocarbon and non-radiocarbon dates (including outliers) are updated within the function also by MCMC.

Value

A list of class BchronologyRun which include elements:

`theta`	The posterior estimated values of the ages
`phi`	The posterior estimated outlier values (1=outlier, 2=not outlier). The means of this parameter give the posterior estimated outlier probabilities
`mu`	The posterior values of the Compound Poisson-Gamma mean
`psi`	The posterior values of the Compound Poisson-Gamma scale
`thetaPredict`	The posterior estimated ages for each of the values in predictPosition
`predictPositions`	The positions at which estimated ages were required
`calAges`	The calibrated ages as output from `BchronCalibrate`

Author(s)

Andrew Parnell <andrew.parnell@ucd.ie>

References

Haslett, J., and Parnell, A. C. (2008). A simple monotone process with application to radiocarbon-dated depth chronologies. Journal of the Royal Statistical Society, Series C, 57, 399-418.

Parnell, A. C., Haslett, J., Allen, J. R. M., Buck, C. E., and Huntley, B. (2008). A flexible approach to assessing synchroneity of past events using Bayesian reconstructions of sedimentation history. Quaternary Science Reviews, 27(19-20), 1872-1885.

See Also

`BchronCalibrate`, `BchronRSL`, `BchronDensity`, `BchronDensityFast`

Examples

```
## Not run:
# Data from Glendalough
data(Glendalough)

# Run in Bchronology - all but first age uses intcal13
GlenOut = Bchronology(ages=Glendalough$ages,ageSds=Glendalough$ageSds,
calCurves=Glendalough$calCurves,positions=Glendalough$position,
positionThicknesses=Glendalough$thickness,ids=Glendalough$id,
predictPositions=seq(0,1500,by=10))
```

```
# Summarise it a few different ways
summary(GlenOut) # Default is for quantiles of ages at predictPosition values
summary(GlenOut, type='convergence') # Check model convergence
summary(GlenOut, type='outliers') # Look at outlier probabilities

# Predict for some new positions
predictAges = predict(GlenOut, newPositions = c(150,725,1500), newPositionThicknesses=c(5,0,20))

# Plot the output
plot(GlenOut,main="Glendalough",xlab='Age (cal years BP)',ylab='Depth (cm)',las=1)
## End(Not run)
```

BchronRSL *Relative sea level rate (RSL) estimation*

Description

This function takes output from a Bchronology run, some RSL mean and standard deviations, and fits an errors-in-variables polynomial regression model which takes account of the age uncertainty. It then esimates rates and accelerations in RSL with appropriate uncertainty quantification

Usage

```
BchronRSL(BchronologyRun, RSLmean, RSLsd, degree = 1, iterations = 10000,
burn = 2000, thin = 8)
```

Arguments

BchronologyRun	Output from a run of Bchronology
RSLmean	A vector of RSL mean estimates of the same length as the number of predictPositions given to the Bchronology function
RSLsd	A vector RSL standard deviations of the same length as the number of predictPositions given to the Bchronology function
degree	(optional) The degree of the polynomial regression: linear=1 (default), quadratic=2, etc. Supports up to degree 5, though this will depend on the data given
iterations	(optional) The number of MCMC iterations to run
burn	(optional) The number of starting iterations to discard
thin	(optional) The step size of iterations to discard

Details

This function fits an errors-in-variables regression model to relative sea level (RSL) data. An errors-in-variables regression model allows for uncertainty in the explanatory variable, here the age of sea level data point. The algorithm is more fully defined in the reference below

Value

An object of class BchronRSLRun with elements

BchronologyRun	The output from the run of Bchronology
samples	The posterior samples of the regression parameters
degree	The degree of the polynomial regression
RSLmean	The RSL mean values given to the function
RSLsd	The RSL standard deviations as given to the function
const	The mean of the predicted age values. Used to standardise the design matrix and avoid computational issues

Author(s)

Andrew Parnell <andrew.parnell@ucd.ie>

References

Andrew C. Parnell and W. Roland Gehrels (2013) 'Using chronological models in late holocene sea level reconstructions from salt marsh sediments' In: I. Shennan, B.P. Horton, and A.J. Long (eds). Handbook of Sea Level Research. Chichester: Wiley

See Also

BchronCalibrate, Bchronology, BchronDensity, BchronDensityFast

Examples

```
## Not run: # Load in data
data(TestChronData)
data(TestRSLData)

# Run through Bchronology
RSLrun = Bchronology(ages=TestChronData$ages,ageSds=TestChronData$ageSds,
positions=TestChronData$position,positionThicknesses=TestChronData$thickness,
ids=TestChronData$id,calCurves=TestChronData$calCurves,
predictPositions=TestRSLData$Depth)

# Now run through BchronRSL
RSLrun2 = BchronRSL(RSLrun,RSLmean=TestRSLData$RSL,RSLsd=TestRSLData$Sigma,degree=3)

# Summarise it
summary(RSLrun2)

# Plot it
plot(RSLrun2)
## End(Not run)
```

Glendalough *Glendalough data*

Description

Chronology data for Glendalough data set

Usage

```
data(Glendalough)
```

Format

A data frame with 6 observations on the following 6 variables.

`id` ID of each age

`ages` Age in (14C) years BP

`ageSds` Age standard deviations

`position` Depths in cm

`thickness` Thicknesses in cm

`calCurves` Calibration curve for each age

Details

This Glendalough data has be used with `Bchronology` or `BchronDensity`

References

Haslett, J., Whiley, M., Bhattacharya, S., Mitchell, F. J. G., Allen, J. R. M., Huntley, B., \& Salter-Townshend, M. (2006). Bayesian palaeoclimate reconstruction. Journal of the Royal Statistical Society, Series A, 169, 395-438.

intcal13 *Nothern hemisphere 2013 calibration curve*

Description

Northern hemisphere 2013 calibration curve

Usage

```
data(intcal13)
```

Format

A data frame with 5141 observations on 5 variables.

Details

For full details and reference see http://www.radiocarbon.org/IntCal13.htm. For usage details see BchronCalibrate

---

`marine13` *Marine 2013 calibration curve*

Description

Marine 2013 calibration curve

Usage

```
data(marine13)
```

Format

A data frame with 4801 observations on 5 variables.

Details

For full details and reference see http://www.radiocarbon.org/IntCal13.htm. For usage details see BchronCalibrate

---

`normal` *Data for dummy calibration of normally distributed ages*

Description

Data for dummy calibration of normally distributed ages

Usage

```
data(normal)
```

Format

A data frame with 2 observations on 3 variables.

Details

This is dummy data so that BchronCalibrate can calibrate normally distributed dates.

plot.BchronCalibratedDates *Plot calibrated dates from a BchronCalibrate run*

Description

Plots calibrated radiocarbon dates from a BchronCalibrate run. Has options to plot on a position (usually depth) scale if supplied with the original run

Usage

```
## S3 method for class 'BchronCalibratedDates'
plot(x,
withPositions = FALSE,
xlab='Age (cal years BP)',
ylab=ifelse(withPositions,'Position','Density'),
pause=FALSE,
...)
```

Arguments

x	Output from BchronCalibrate
withPositions	Whether to plot with positions (i.e. using the position values as the y axis). Default is FALSE in which case it will produce a sequence of plots, one for each calibrated age
xlab	An x-axis label for the plot
ylab	A y-axis label for the plot
pause	Whether to pause between plots or go ahead and create them all
...	Other arguments to plot, see par.

Details

These plots are intented to be pretty basic and used simply for quick information. Users are encouraged to learn the R plotting features to produce publication quality graphics

Author(s)

Andrew Parnell <andrew.parnell@ucd.ie>

References

Forthcoming!

See Also

BchronCalibrate, Bchronology, BchronRSL, BchronDensity, BchronDensityFast

Examples

```
# Examples in \code{\link{BchronCalibrate}}
```

`plot.BchronDensityRun` *Plot output from BchronDensity*

Description

A plot of the output from `BchronDensity`

Usage

```
## S3 method for class 'BchronDensityRun'
plot(x, plotDates = TRUE, plotSum = FALSE, ...)
```

Arguments

`x`	Output from `BchronDensity`
`plotDates`	(optional) Whether to plot the individual calibrated dates (default TRUE)
`plotSum`	(optional) Whether to plot the sum of the probability distributions (default FALSE)
`...`	(optional) Other graphical commands. See `par`

Author(s)

Andrew Parnell <andrew.parnell@ucd.ie>

See Also

`Bchronology`, `BchronRSL`, `BchronDensity`, `BchronDensityFast` for a faster approximate version of this function

Examples

```
# Examples in \code{\link{BchronDensity}}
```

`plot.BchronDensityRunFast` *Plot run from BchronDensityFast*

Description

Plots output from `BchronDensityFast`

Usage

```
## S3 method for class 'BchronDensityRunFast'
plot(x, plotDates = TRUE, plotSum = FALSE, ...)
```

Arguments

`x`	Output from `BchronDensityFast`
`plotDates`	(optional) Whether to include individual age pdfs (default TRUE)
`plotSum`	(optional) Whether to include sum of age pdfs (default FALSE)
`...`	Other graphical parameters, see `par`

Details

Creates a basic plot of output for a run of `BchronDensityFast`

Author(s)

Andrew Parnell <andrew.parnell@ucd.ie>

See Also

`Bchronology`, `BchronRSL`, `BchronDensity`, `BchronDensityFast` for a faster approximate version of this function

Examples

```
# Examples in \code{\link{BchronDensityFast}}
```

plot.BchronologyRun *Plot output from Bchronology*

Description

Plots output from a run of Bchronology

Usage

```
## S3 method for class 'BchronologyRun'
plot(x, ...)
```

Arguments

x	The object created by Bchronology
...	Other graphical parameters as detailed in par

Details

Creates a simple plot of the chronology output. More detailed plots can be created by manipulating the Bchronology object as required

Author(s)

Andrew Parnell <andrew.parnell@ucd.ie>

See Also

BchronCalibrate, Bchronology BchronRSL, BchronDensity, BchronDensityFast

Examples

```
# Examples in main function \code{\link{Bchronology}}
```

plot.BchronRSLRun *Plot output from BchronRSL*

Description

Plot output from the BchronRSL function

Usage

```
## S3 method for class 'BchronRSLRun'
plot(x, xlab = "Age (cal BP)", ylab = "Depth (m)", ...)
```

Arguments

x	An object created by BchronRSL
xlab	(optional) Label for the x-axis of the plot
ylab	(optional) Label for the y-axis of the plot
...	Other arguments to plot, see par

Author(s)

Andrew Parnell <andrew.parnell@ucd.ie

See Also

BchronCalibrate, Bchronology, BchronRSL, BchronDensity, BchronDensityFast

Examples

```
# Examples in \code{\link{BchronRSL}}
```

---

predict.BchronologyRun

Predict ages of other positions for a BchronologyRun object

Description

This function will predict the ages of new positions (usually depths) based on a previous run of the function Bchronology. It will also allow for thickness uncertainties to be included in the resulting ages, for example when the age of a particular event is desired

Usage

```
## S3 method for class 'BchronologyRun'
predict(object, newPositions, newPositionThicknesses = NULL, maxExtrap = 500, ...)
```

Arguments

object	Output from a run of Bchronology
newPositions	A vector of new positions at which to find ages
newPositionThicknesses	A vector of thicknesses for the above positions. Must be the same length as newPositions
maxExtrap	The maximum new of extrapolation attempts. It might be worth increasing this if you are extrapolating a long way from the other dated positions
...	Other arguments to predict (not currently supported)

Author(s)

Andrew Parnell <andrew.parnell@ucd.ie

See Also

BchronCalibrate, Bchronology BchronRSL, BchronDensity, BchronDensityFast

Examples

```
# Examples in main function \code{\link{Bchronology}}
```

---

shcal13 *Southern hemisphere 2013 calibration curve*

Description

Southern hemisphere 2013 calibration curve

Usage

```
data(shcal13)
```

Format

A data frame with 5141 observations on 5 variables.

Details

For full details and reference see http://www.radiocarbon.org/IntCal13.htm. For usage details see BchronCalibrate

---

Sluggan *Sluggan Moss data*

Description

Chronology data for Sluggan Moss data set

Usage

```
data(Sluggan)
```

Format

A data frame with 31 observations on the following 6 variables.

`id` ID of each age

`ages` Age in (14C) years BP

`ageSds` Age standard deviations

`position` Depths in cm

`thickness` Thicknesses in cm

`calCurves` Calibration curve for each age

Details

This Sluggan Moss data can be downloaded from the European Pollen Database: www.europeanpollendatabase.net. For usage see Bchronology or BchronDensity

References

Smith, A. G., \& Goddard, I. C. (1991). A 12,500 year record of vegetational history at Sluggan Bog, Co. Antrim, N. Ireland (incorporating a pollen zone scheme for the non-specialist). New Phytologist, 118, 167-187.

---

summary.BchronCalibratedDates

Summarise a BchronCalibrate object

Description

Produces summary output from a BchronCalibrate run, including the highest density regions for the calibrated ages for given probability levels

Usage

```
## S3 method for class 'BchronCalibratedDates'
summary(object, prob = c(50, 95, 99), ..., digits = max(3, getOption("digits") - 3))
```

Arguments

`object`	The output of a run of BchronCalibrate
`prob`	A vector of percentage values (between 0 and 100) at which the highest density regions for each age are calculated
`...`	Further arguments (not currently supported)
`digits`	Significant digits to display (not currently supported)

Author(s)

Andrew Parnell <andrew.parnell@ucd.ie>

References

Forthcoming!

See Also

BchronCalibrate, Bchronology, BchronRSL, BchronDensity, BchronDensityFast

Examples

```
# Examples in \code{\link{BchronCalibrate}}
```

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summary.BchronologyRun

Summarise a Bchronology object

Description

Summarise a Bchronology object

Usage

```
## S3 method for class 'BchronologyRun'
summary(object, type=c('quantiles','outliers','convergence'),
probs = c(0.025, 0.1, 0.5, 0.9, 0.975), ..., digits = max(3, getOption("digits") - 3))
```

Arguments

object	Output from a run of Bchronology
type	(optional) Type of output required. The default (quantiles) gives the quantiles of the ages for each depth in predictPositions from Bchronology. The other options provide outlier probabilities or convergence diagnostics.
probs	(optional) Probabilities (between 0 and 1) at which to summarise the predicted chronologies
...	Other arguments (not currently supported)
digits	Number of digits to report values (not currently supported)

Author(s)

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See Also

BchronCalibrate, Bchronology BchronRSL, BchronDensity, BchronDensityFast

Examples

```
# Examples in main function \code{\link{Bchronology}}
```

summary.BchronRSLRun *Summarise a BchronRSL run*

Description

Summarise a BchronRSL run

Usage

```
## S3 method for class 'BchronRSLRun'
summary(object, ...)
```

Arguments

object	The output from a run of BchronRSL
...	(optional) Other arugments to functions (not currently implemeted)

Author(s)

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See Also

BchronCalibrate, Bchronology, BchronRSL, BchronDensity, BchronDensityFast

Examples

```
# Examples in \code{\link{BchronRSL}}
```

TestChronData *Example chronology file for use with the BchronRSL function.*

Description

Some example chronology data for use with the BchronRSL function

Usage

```
data(Glendalough)
```

Format

A data frame with 27 observations on the following 6 variables.

`id` ID names

`ages` Ages in years BP

`ageSds` Ages standard deviations in years BP

`position` Depths in cm

`thickness` Thicknesses in cm

`calCurves` Calibration curve for each age

References

Andrew C. Parnell and W. Roland Gehrels (2013) 'Using chronological models in late holocene sea level reconstructions from salt marsh sediments' In: I. Shennan, B.P. Horton, and A.J. Long (eds). Handbook of Sea Level Research. Chichester: Wiley

Examples

```
data(TestChronData)
# See \code{\link{BchronRSL}}
```

`TestRSLData` *Relative sea level data*

Description

A set of relative sea level data for use with `BchronRSL`

Usage

```
data(Glendalough)
```

Format

A data frame with 24 observations on the following 3 variables.

`Depth` Depth in cm

`RSL` Relative sea level in m

`Sigma` Standard deviation of RSL measurement

References

Andrew C. Parnell and W. Roland Gehrels (2013) 'Using chronological models in late holocene sea level reconstructions from salt marsh sediments' In: I. Shennan, B.P. Horton, and A.J. Long (eds). Handbook of Sea Level Research. Chichester: Wiley

Examples

```
data(TestChronData)
# See \code{\link{BchronRSL}}
```

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