

# Package ‘Bchron’

July 2, 2014

**Type** Package

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

**Version** 4.1.1

**Date** 2014-04-22

**Depends** inline

**Imports** hdrcode, utils, MASS, ellipse, coda, mclust

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## 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).

**License** GPL (>= 2)

**NeedsCompilation** yes

**Repository** CRAN

**Date/Publication** 2014-04-22 18:52:19

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Bchron-package	<i>Radiocarbon dating, age-depth modelling, relative sea level rate estimation, and non-parametric phase modelling</i>
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## 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 <a href="#">BchronCalibrate</a>
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 <a href="#">densityMclust</a> with the given number of mixture components
calAges	The calibrated ages from the <a href="#">BchronDensity</a> 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 <a href="#">BchronCalibrate</a>

**Author(s)**

Andrew Parnell <[andrew.parnell@ucd.ie](mailto: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 synchronicity 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 estimates 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 <a href="#">Bchronology</a>
RSLmean	A vector of RSL mean estimates of the same length as the number of predictPositions given to the <a href="#">Bchronology</a> function
RSLsd	A vector RSL standard deviations of the same length as the number of predictPositions given to the <a href="#">Bchronology</a> 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 <a href="#">Bchronology</a>
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

*Notern 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	<i>Marine 2013 calibration curve</i>
----------	--------------------------------------

---

**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	<i>Data for dummy calibration of normally distributed ages</i>
--------	--

---

**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, ...)
```

### Arguments

<code>x</code>	Output from <a href="#">BchronCalibrate</a>
<code>withPositions</code>	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
<code>...</code>	Other arguments to plot, see <a href="#">par</a> .

### Details

These plots are intended 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](mailto: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 <a href="#">BchronDensity</a>
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 <a href="#">par</a>

### Author(s)

Andrew Parnell <[andrew.parnell@ucd.ie](mailto:andrew.parnell@ucd.ie)>

### See Also

[Bchronology](#), [BchronRSL](#), [BchronDensity](#), [BchronDensityFast](#) for a faster approximate version of this function

### Examples

```
# Examples in \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 <a href="#">BchronDensityFast</a>
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 <a href="#">par</a>

**Details**

Creates a basic plot of output for a run of [BchronDensityFast](#)

**Author(s)**

Andrew Parnell <[andrew.parnell@ucd.ie](mailto:andrew.parnell@ucd.ie)>

**See Also**

[Bchronology](#), [BchronRSL](#), [BchronDensity](#), [BchronDensityFast](#) for a faster approximate version of this function

**Examples**

```
# Examples in \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 <a href="#">Bchronology</a>
...	Other graphical parameters as detailed in <a href="#">par</a>

**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 <a href="#">BchronRSL</a>
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 <a href="#">par</a>

**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**

<code>object</code>	Output from a run of <a href="#">Bchronology</a>
<code>newPositions</code>	A vector of new positions at which to find ages
<code>newPositionThicknesses</code>	A vector of thicknesses for the above positions. Must be the same length as <code>newPositions</code>
<code>maxExtrap</code>	The maximum new of extrapolation attempts. It might be worth increasing this if you are extrapolating a long way from the other dated positions
<code>...</code>	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](http://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 <a href="#">BchronCalibrate</a>
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 \link{BchronCalibrate}
```

---

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 <a href="#">Bchronology</a>
type	(optional) Type of output required. The default (quantiles) gives the quantiles of the ages for each depth in predictPositions from <a href="#">Bchronology</a> . 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)

Andrew Parnell <andrew.parnell@ucd.ie>

## 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 arguments to functions (not currently implemented)

### Author(s)

Andrew Parnell <andrew.parnell@ucd.ie>

### See Also

[BchronCalibrate](#), [Bchronology](#), [BchronRSL](#), [BchronDensity](#), [BchronDensityFast](#)

### Examples

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

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