Package 'rgplates'

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Type Package

Title R Interface for the GPlates Web Service and Desktop Application

Version 0.2.0

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Description Query functions to the GPlates <https://www.gplates.org/> Desktop Application and the GPlates Web Service <https://gws.gplates.org/> allow users to reconstruct past positions of geographic entities based on user-selected rotation models without leaving the R running environment. The online method (GPlates Web Service) makes the rotation of static plates, coastlines, and a low number of geographic coordinates available using nothing but an internet connection. The offline method requires an external installation of the GPlates Desktop Application, but allows the efficient batch rotation of thousands of coordinates, Simple Features (sf) and Spatial (sp) objects with custom reconstruction trees and partitioning polygons. Examples of such plate tectonic models are accessible via the chronosphere-portal <https://cran.r-project.org/package=chronosphere>. This R extension is developed under the umbrella of the DFG (Deutsche Forschungsgemeinschaft) Research Unit TERSANE2 (For 2332, TEmperature Related Stressors in ANcient Extinctions).

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BugReports https://github.com/adamkocsis/rgplates/issues

Encoding UTF-8

Depends R (>= 3.5.0), sf

Imports methods, utils

NeedsCompilation no

RoxygenNote 7.2.1

Suggests knitr, rmarkdown, chronosphere, geojsonsf, sp

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R topics documented:

`platemodel-class` *Class of objects representing plate tectonic models*

Description

Meta-object containing paths to a unique plate tectonic model

Usage

```
## S4 method for signature 'platemodel'
initialize(.Object, path = NULL, rotation = NULL, polygons = NULL)
```

Arguments

`.Object`	Constructor argument (not needed).
`path`	(`character`) Path to a .mod unique plate model object.
`rotation`	(`character`) If `path` is `NULL`, the path to the rotation file-part of the model.
`polygons`	(`character`) If `path` is `NULL`, the path to the plate polygon file-part of the model.

Value

A `platemodel` class object.

Examples

```
# path to provided archive
archive <- file.path(
  system.file("extdata", package="rgplates"),
  "paleomap_model_v19o_r1c.zip")
# extract to temporary directory
unzip(archive, exdir=tempdir())
# path to the combined model/rotation file
path <- file.path(tempdir(),
  "paleomap_model_v19o_r1c/paleomap_model_v19o_r1c.mod")
# register in R - to be used in reconstruct()
model <- platemodel(path)
```

reconstruct *Reconstruct geographic features*

Description

Reconstruct the geographic locations from present day coordinates and spatial objects back to their paleo-positions. Each location will be assigned a plate id and moved back in time using the chosen reconstruction model. #' The function implements two reconstruction submodules, which are selected with the `model` argument:

Usage

```
reconstruct(x, ...)

## S4 method for signature 'matrix'
reconstruct(
  x,
  age,
  model = "PALEOMAP",
  listout = TRUE,
  verbose = FALSE,
  enumerate = TRUE,
  chunk = 200,
  reverse = FALSE,
  path.gplates = NULL,
  cleanup = TRUE,
  dir = NULL,
  plateperiod = FALSE
)

## S4 method for signature 'data.frame'
reconstruct(x, ...)

## S4 method for signature 'numeric'
reconstruct(x, ...)

## S4 method for signature 'character'
reconstruct(
  x,
  age,
  model = "PALEOMAP",
  listout = TRUE,
  verbose = FALSE,
  path.gplates = NULL,
  cleanup = TRUE,
  dir = NULL,
  plateperiod = FALSE
```

```
)

## S4 method for signature 'Spatial'
reconstruct(
  x,
  age,
  model,
  listout = TRUE,
  verbose = FALSE,
  path.gplates = NULL,
  cleanup = TRUE,
  dir = NULL,
  plateperiod = FALSE
)

## S4 method for signature 'sf'
reconstruct(
  x,
  age,
  model,
  listout = TRUE,
  verbose = FALSE,
  path.gplates = NULL,
  cleanup = TRUE,
  dir = NULL,
  plateperiod = FALSE,
  gmeta = FALSE
)
```

Arguments

x	are the features to be reconstructed. Can be a vector with longitude and latitude representing a single point or a matrix/dataframe with the first column as longitude and second column as latitude, or a `SpatialPolygonsDataFrame` class object. The character strings `"plates"` and `"coastlines"` return static plates and rotated present-day coastlines, respectively.
...	arguments passed to class-specific methods.
age	(`numeric`)is the age in Ma at which the points will be reconstructed
model	(`character` or `platemodel`) The reconstruction model. The class of this argument selects the submodule used for reconstruction, a `character` value will invoke the remote reconstruction submodule and will submit `x` to the GPlates Web Service. A `platemodel` class object will call the local-reconstruction submodule. The default is `"PALEOMAP"`. See details for available models.
listout	(`logical`)If multiple ages are given, the output can be returned as a `list` if `listout = TRUE`.
verbose	(`logical`) Should call URLs (remote submodule) or console feedback (local-submodule) be printed?

enumerate	(logical) Should be all coordinate/age combinations be enumerated and reconstructed (set to TRUE by default)? FALSE is applicable only if the number of rows in x is equal to the number elementes in age. Then a point will be reconstructed to the age that has the same index in age as the row of the coordinates in x. List output is not available in this case.
chunk	(numeric) Argument of the remote reconstruction submodule. Single integer, the number of coordinates that will be queried from the GPlates in a single go.
reverse	(logical) Argument of the remote reconstruction submodule. The flag to control the direction of reconstruction. If reverse = TRUE, the function will calculate the present-day coordinates of the given paleo-coordinates.
path.gplates	(character) Argument of the local reconstruction submodule. In case the GPlates executable file is not found at the coded default location, the full path to the executable (gplates-<ver>.exe on Windows) can be entered here.
cleanup	(logical) Argument of the local reconstruction submodule. Should the temporary files be deleted immediately after reconstructions?
dir	(character) Argument of the local reconstruction submodule. Directory where the temporary files of the reconstruction are stored (defaults to a temporary directory created by R). Remember to toggle cleanup if you want to see the files.
plateperiod	(logical) Argument of the local reconstuction submodule. Should the durations of the plates be forced on the partitioned feature? If these are set to TRUE and the plate duration estimates are long, then you might lose some data.
gmeta	(logical) Argument of the local reconstruction submodule, in the case, when sf objects are supplied. Should the metadata produced by GPlates be included in the output object?

Details

If model is a character entry, then the reconstruct() function uses the GPlates Web Service (https://gws.gplates.org/, remote reconstruction submodule). The available reconstruction models for this submodule are:

- "SETON2012" (Seton et al., 2012) for coastlines and plate polygons.
- "MULLER2016" (Muller et al., 2016) for coastlines and plate polygons.
- "GOLONKA" (Wright et al. 2013) for coastlines only.
- "PALEOMAP" (Scotese and Wright, 2018) for coastlines and plate polygons.
- "MATTHEWS2016" (Matthews et al., 2016) for coastlines and plate polygons.

If model is a platemodel class object, then the function will try to use the GPLates desktop application (https://www.gplates.org/) to reconstruct the coordinates (local reconstruction submodule). Plate models are available in chronosphere with the fetch function. See datasets for the available models. The function will try to find the main GPlates executable in its default installation directory. If this does not succeed, use path.gplates to enter the full path to the GPlates executable as a character string.

Value

A numeric matrix if x is a numeric, matrix or data.frame, or Spatial* class objects, depending on input. NULL in case no model is specified.

References

Matthews, K. J., Maloney, K. T., Zahirovic, S., Williams, S. E., Seton, M., & Müller, R. D. (2016). Global plate boundary evolution and kinematics since the late Paleozoic. Global and Planetary Change, 146, 226–250. https://doi.org/10.1016/j.gloplacha.2016.10.002

Müller, R. D., Seton, M., Zahirovic, S., Williams, S. E., Matthews, K. J., Wright, N. M., ... Cannon, J. (2016). Ocean Basin Evolution and Global-Scale Plate Reorganization Events Since Pangea Breakup. Annual Review of Earth and Planetary Sciences, 44(1), 107–138. https://doi.org/10.1146/annurev-earth-060115-012211

Scotese, C., & Wright, N. M. (2018). PALEOMAP Paleodigital Elevation Models (PaleoDEMS) for the Phanerozoic PALEOMAP Project. Retrieved from https://www.earthbyte.org/paleodem-resource-scotese-and-wright-2018/

Seton, M., Müller, R. D., Zahirovic, S., Gaina, C., Torsvik, T., Shephard, G., ... Chandler, M. (2012). Global continental and ocean basin reconstructions since 200Ma. Earth-Science Reviews, 113(3–4), 212–270. https://doi.org/10.1016/j.earscirev.2012.03.002

Wright, N., Zahirovic, S., Müller, R. D., & Seton, M. (2013). Towards community-driven paleogeographic reconstructions: integrating open-access paleogeographic and paleobiology data with plate tectonics. Biogeosciences, 10(3), 1529–1541. https://doi.org/10.5194/bg-10-1529-2013

Examples

```
# With the web service
# simple matrices
# replace model with desired choice
reconstruct(matrix(c(95, 54), nrow=1), 140, model=NULL)

# points reconstruction
xy <-cbind(long=c(95,142), lat=c(54, -33))
reconstruct(xy, 140, model=NULL)
```

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Description

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Details

This is still the Beta version. As is R, this is free software and comes with ABSOLUTELY NO WARRANTY. Nevertheless, notes about found bugs and suggestions are more than welcome.

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