Package 'TreeRingShape'

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Type Package

Title Recording Tree-Ring Shapes of Tree Disks with Manual Digitizing and Interpolating Model

Version 3.0.5

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Description Record all tree-ring Shapefile of tree disk with GIS soft 'Qgis' and interpolating model from high resolution tree disk image.

License GPL (>= 2)

Depends R (>= 3.6.2)

Imports methods, tibble, sf

Suggests testthat (>= 3.0.0), knitr, rmarkdown, waldo

VignetteBuilder knitr

Encoding UTF-8

LazyData true

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URL https://CRAN.R-project.org/package=TreeRingShape, https://github.com/ishidamgm/TreeRingShape, https://ishidamgm.github.io/TreeRingShape/, https://www.sanchikanri.com/treering/TreeRingShape.html

BugReports https://github.com/ishidamgm/TreeRingShape/issues

Config/testthat/edition 3

NeedsCompilation no

Repository CRAN

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Contents

area *Return a area from polygon xy coordinates*

Description

Return a area from polygon xy coordinates

Usage

```
area(xy)
```

Arguments

xy	a atrix or data frame of xy coordinates

Value

a vector of polygon area

Examples

```
xy<-data.frame(x=c(0,1,2,1),y=c(1,2,1,0))
plot(xy,type="b") ; polygon(xy)
area(xy)
```

circumference *Return circumference length of polygon line*

Description

Return circumference length of polygon line

Usage

```
circumference(l.)
```

Arguments

l.	data frame of line coordinates (x,y)

Value

a numeric of circumference length of polygon line

Examples

```
l. <- data.frame(x=c(0,0,1,1),y=c(0,1,1,0))
plot(l.,type="b") ; polygon(l.)
circumference(l.)
```

`classTreeRingShape-class` *class of TreeRingShape*

Description

class of TreeRingShape

Slots

`P_filename` character. file name of shape file (P) for tree ring points

`P_id.tag` character. column name of id in shape file (P), default is 'id'

`P_ring.tag` character. column name of ring no.(ordinaly year,outermost=0) in shape file (P), default is 'ring'

`P` data.frame. radial tree ring points (x,y,id,yr,r,deg)

`P00` numeric. x,y coordinates c(px00,py00) of tree ring center point, ordinarily a pith in a disk, a point of id==0 in P

`n_id` numeric. number of radial measurement points, length(unique(P$id))-1 (omit a original point id=0)

`YR_P` numeric. total number of tree rings, unique(P$ring)

`L_filename` character. file name of shape file (L) for tree ring lines

`L_ring.tag` character. column name of ring no.(ordinaly year,outermost=0) in shape file (L), default is 'ring'

`L` list. x,y coordinates of representative tree rings

`L_` data.frame. x,y coordinates of representative tree rings

`YR_L` numeric. cumulative tree rings number(year) from 0 (cambium layer) of L =dbf$ring, names(L)

`ln` numeric. total number of representative tree rings, length(L)

`L2_filename` character. file name of shape file (L2) for tree ring lines interpolated

`L2` list. x,y coordinates of representative + interpolated tree rings

`n_YR` numeric. total number of representative + interpolated tree rings = unique(P$yr), length(L2)

Examples

```
TR. <- new('classTreeRingShape')
TR.
slotNames(TR.)
str(TR.)
```

degree *Constant for conversion from degree to radian ####*

Description

Constant for conversion from degree to radian ####

Usage

```
degree
```

Format

An object of class `numeric` of length 1.

DiskInfo *Return information for tree disk analysed from TreeRingShape class*

Description

Return information for tree disk analysed from TreeRingShape class

Usage

```
DiskInfo(TR., dpi = 1200)
```

Arguments

`TR.`	class of TreeRingShape
`dpi`	Resolution of tree disk image

Value

data frame of information for tree disk analysed

See Also

`TreeRingShape`

dst — *Return a vector of distances from original a point (0,0) from a matrix or data frame of xy coordinates*

Description

Return a vector of distances from original a point (0,0) from a matrix or data frame of xy coordinates

Usage

```
dst(xy)
```

Arguments

xy	a matrix or data frame of xy coordinates

Value

a vector of distances from original a point

Examples

```
plot(TR@L[[1]])
plot(dst(TR@L[[1]]))
```

dstpp — *Return vector for distance between adjacent two points*

Description

Return vector for distance between adjacent two points

Usage

```
dstpp(x, y)
```

Arguments

x	vector of x coordinates
y	vector of y coordinates

Value

vector for distance between adjacent two points

Examples

```
l.<-TR@L[[1]]
plot(l.)
x<-l.[,1] ;y<-l.[,2]
dstpp(x,y)
```

`Ldeg360` *Return a vector of center angle 0 to 360(degree) for x y coordinate vector*

Description

Return a vector of center angle 0 to 360(degree) for x y coordinate vector

Usage

```
Ldeg360(x, y)
```

Arguments

x	a vector of x coordinates
y	a vector of y coordinates

Value

a vector of center angle 0 to 360(degree) for x y coordinate vector

Examples

```
xy <-TR@L[[1]]
plot(Ldeg360(xy[,1],xy[2]))
```

`Llist2dataframe` *Convert from a list of tree rings polygons (L) to data frame to a data frame with no.,year,x,y,r(radius),radian(center angle),degree. The data frame is sorted by degree(0 to 360).*

Description

Convert from a list of tree rings polygons (L) to data frame to a data frame with no.,year,x,y,r(radius),radian(center angle),degree. The data frame is sorted by degree(0 to 360).

Usage

```
Llist2dataframe(L)
```

Arguments

L	list of tree ring lines

Value

data frame

Examples

```
L_ <- Llist2dataframe(TR@L)
head(L_) ; tail(L_)
```

Lmove *Move the tree rings coordinates based on P00 (x,y movement coordinates).*

Description

Move the tree rings coordinates based on P00 (x,y movement coordinates).

Usage

```
Lmove(L, P00 = P00)
```

Arguments

L	a list of tree rings(x,y coordinates).
P00	x, y coordinates of a center point (usually a pith).

Value

moved L to center point 0,0

Examples

```
Lplot(TR@L)
sapply(Lmove(TR@L,c(3000,-3000)),lines,col="blue")
```

Lplot *Plot a graphics of tree rings*

Description

Plot a graphics of tree rings

Usage

```
Lplot(L, rn = 1:length(L), col = "red", ...)
```

Arguments

L	a list of tree rings polygon coordinates (X,Y)
rn	vector of ring number of list (L), default 1:length(L)
col	color of plot
...	other parameters to be passed through to plotting functions

Value

No return value, only draw tree ring plot.

Examples

```
Lplot(TR@L,main=TR@L_filename)
Lplot(TR@L,rn=1:20,col='blue',main=TR@L_filename)
```

Lplot2 *Draw a graphics of tree rings by 1 ring (3*3 in a screen)*

Description

Draw a graphics of tree rings by 1 ring (3*3 in a screen)

Usage

```
Lplot2(L, i.ring = 1:length(L), nrow = 3, ncol = 3, ask = "FALSE", ...)
```

Arguments

L	a list of tree rings polygon coordinates (X,Y)
i.ring	integer vector, tree ring number for drawing
nrow	par(mfrow=c(nrow,ncol))
ncol	par(mfrow=c(nrow,ncol))
ask	logical; if TRUE, the user is asked before each plot
...	other parameters to be passed through to plotting functions.

Value

No return value, only draw tree ring plot.

Examples

```
Lplot2(TR@L,i.ring=1:9, nrow=1,ncol=1,type='b')
Lplot2(TR@L,type='b')
```

`Lrad.plot` *Check center angle of points to input order*

Description

Check center angle of points to input order

Usage

```
Lrad.plot(L, i.ring = 1:4, nrow = 2, ncol = 2)
```

Arguments

`L`	list of tree rings
`i.ring`	integer vector, tree ring number for drawing
`nrow`	par(mfrow=c(nrow,ncol))
`ncol`	par(mfrow=c(nrow,ncol))

Value

No return value, only draw tree ring plot.

Examples

```
slotNames(TR)
Lplot(TR@L)
str(TR@L)
Lrad.plot(TR@L,11:19)
```

Lrn — *Return a ring number of tree ring polygons list (L) from year*

Description

Return a ring number of tree ring polygons list (L) from year

Usage

```
Lrn(L, yr)
```

Arguments

L	tree ring polygons list (L)
yr	years (or rings)

Value

a ring number of tree ring polygons list (L)

Examples

```
Lrn(TR@L,168)  # 168 is the formation year (from outermost) of the tree ring
```

Lsort — *Sort x,y coordinates of a tree ring line with center angle of each point*

Description

Sort x,y coordinates of a tree ring line with center angle of each point

Usage

```
Lsort(l.)
```

Arguments

l.	x,y coordinates matrix (ncol=2) or data.frame of an tree ring.

Value

ordered with center angle of each point

Examples

```
i<-seq(0,2*pi,0.1)
l.<-data.frame(x=sin(i),y=cos(i))
l.[10,]<-l.[20,]
plot(l.,type="b")
plot(Lsort(l.),type="b")
```

`Lsort_all` *Sort x,y coordinates of tree ring lines with center angle of each point apply Lsort to list of tree ring lines*

Description

Sort x,y coordinates of tree ring lines with center angle of each point apply Lsort to list of tree ring lines

Usage

```
Lsort_all(L)
```

Arguments

`L`	a list of tree ring lines (x,y)

Value

a list of tree ring lines (x,y) ordered with center angle of each point

Examples

```
str(Lsort_all(TR@L))
```

`new_classTreeRingShape` *Initial setting of a new classTreeRingShape (TR)*

Description

Initial setting of a new classTreeRingShape (TR)

Usage

```
new_classTreeRingShape(
  P_filename,
  L_filename,
  L2_filename,
  P_id.tag = "id",
  P_ring.tag = "ring",
  L_ring.tag = "ring"
)
```

Arguments

P_filename	file name of shape file (P) for tree ring points
L_filename	file name of shape file (L) for tree ring lines
L2_filename	file name of shape file (L2) for tree ring lines interpolated
P_id.tag	column name of id in shape file (P), default is 'id'
P_ring.tag	column name of ring no.(ordinaly year,outermost=0) in shape file (L), default is 'ring'
L_ring.tag	column name of ring no.(ordinaly year,outermost=0) in shape file (L), default is 'ring'

Value

generated new object from classTreeRingShape

Examples

```
TR_<-new_classTreeRingShape(
P_filename='Abies_277_h400_TreeRing_Points.shp',
L_filename='Abies_277_h400_TreeRing_Representative.shp',
L2_filename='Abies_277_h400_TreeRing.shp',
P_id.tag='id',
P_ring.tag='ring',
L_ring.tag='ring')

 TR_
 slotNames(TR_)
 str(TR_)
```

nstP — *Return a vector of row numbers of points that have nearest center angle*

Description

Return a vector of row numbers of points that have nearest center angle

Usage

```
nstP(z1, z2)
```

Arguments

z1	a data frame or a matrix of xy coordinates of a tree ring (usualy inner ring)
z2	a data frame or a matrix of xy coordinates of a tree ring (usualy outer ring)

Value

a vector of row numbers of z2, the length is nrow(z1)

Examples

```
L_out<-TR@L[[1]];L_in<-TR@L[[30]]
np<-nstP(L_out,L_in)
plot(L_out,col="red"); points(L_in)
segments(L_out[,1],L_out[,2],L_in[np,1],L_in[np,2],col="blue")
```

plot_TreeRing — *Draw a plot of tree rings This function draws Tree rings of a disk from x, y list(x,y) with name of year.*

Description

Draw a plot of tree rings This function draws Tree rings of a disk from x, y list(x,y) with name of year.

Usage

```
plot_TreeRing(L, year = 0, ...)
```

Arguments

L	list(x,y) of Tree ring coordinates with name of year
year	name of column of Tree ring year (0(cambium),1,2,....,n(pith))
...	other parameters to be passed through to plotting functions

Value

No return value, only draw tree ring plot.

Examples

```
names(TR@L)
plot_TreeRing(TR@L)
plot_TreeRing(TR@L,year=10,type='l',col='blue')
```

`plot_TreeRings_df` *Plot tree rings from data fame This function draws Tree rings of a disk from data frame(x,y,year).*

Description

Plot tree rings from data fame This function draws Tree rings of a disk from data frame(x,y,year).

Usage

```
plot_TreeRings_df(df, year_label = "yr")
```

Arguments

`df`	name of a data frame
`year_label`	name of column of Tree ring year (0(cambium),1,2,....,n(pith))

Value

No return value, only draw tree ring plot.

See Also

`Llist2dataframe` for the data frame

Examples

```
TR@L_ <- Llist2dataframe(TR@L)     # data frame of tree rings
names(TR@L_)
plot_TreeRings_df(TR@L_)
```

plot_TreeRing_df *plot_TreeRing_df Draw a Tree ring of a disk from data frame(x,y,year)*

Description

plot_TreeRing_df Draw a Tree ring of a disk from data frame(x,y,year)

Usage

```
plot_TreeRing_df(df, year = 0, year_label = "yr")
```

Arguments

df	name of a data frame
year	integer vector of years to draw tree rings
year_label	name of column of Tree ring year (0(cambium),1,2,....,n(pith))

Value

No return value, only draw tree ring plot.

Examples

```
TR@L_ <- Llist2dataframe(TR@L)     # data frame of tree rings
plot_TreeRing_df(TR@L_, year =1)
```

plot_year_RingArea *Plot and return data frame of year_disk area and year_Tree ring area*

Description

Plot and return data frame of year_disk area and year_Tree ring area

Usage

```
plot_year_RingArea(L2, yr_end = 2018)
```

Arguments

L2	list of tree rings
yr_end	outermost year of tree ring

Value

list of Year_DiskArea and Year_TreeRingArea

See Also

TreeRingsInterpolation

---

rdst *Return relative distance between two representative tree rings*

Description

Return relative distance between two representative tree rings

Usage

```
rdst(L, P, yr)
```

Arguments

L	list of x,y coordinates of representative tree rings (TR@L)
P	data.frame (x,y,id,yr,r,deg) of radial tree ring points (TR@P)
yr	year

Value

a data frame with relative distance and center angle

Examples

```
rdst.<-rdst(TR@L,TR@P,73)
plot(rdst.)
spline<-smooth.spline(rdst.$rad,rdst.$rdst, spar =0.0002)
lines(predict(spline,seq(-pi,pi,0.01)),col="red")
```

---

rdst_MerginePlus *Return relative distance between two representative tree rings*

Description

Return relative distance between two representative tree rings

Usage

```
rdst_MerginePlus(L, P, yr)
```

Arguments

L	is a list of tree rings(x,y coordinates).
P	data.frame (x,y,id,yr,r,deg) of radial tree ring points (TR@P)
yr	integer of year

Value

a data frame with relative distance and center angle(degree) with mergine (-90 - 0 - 360 - 90)

Examples

```
year.<-73
rdst.<-rdst_MerginePlus(TR@L,TR@P,year.)
plot(rdst.,xlim=c(-200,200),main=year.)
spline<-smooth.spline(rdst.$deg,rdst.$rdst, spar =0.0002)
lines(predict(spline,seq(-202,220,1)),col="red")
```

ReadShapefile_P00 *Return x,y coordinates of a tree ring center point (P00) from shape file of tree ring points*

Description

Return x,y coordinates of a tree ring center point (P00) from shape file of tree ring points

Usage

```
ReadShapefile_P00(
  filename = "Abies_277_h400_TreeRing_Points.shp",
  id.tag = "id",
  ring.tag = "ring"
)
```

Arguments

filename	a shape file name of Tree ring points
id.tag	string, column name of id (attribute table)
ring.tag	string, column name of ring years (0 is cambium layer)

Value

numeric : x,y coordinates of a tree ring center point (P00)

Examples

```
.dir <- system.file("shp",package = "TreeRingShape")
.file <- "Abies_277_h400_TreeRing_Points.shp"
filename <- paste(.dir,.file,sep="/")
ReadShapefile_P00(filename)
```

ReadShapefile_TreeRingPoints

Read a shape file of Tree Ring Points (P : radial input and correction points)

Description

Read a shape file of Tree Ring Points (P : radial input and correction points)

Usage

```
ReadShapefile_TreeRingPoints(
  filename = "Abies_277_h400_TreeRing_Points.shp",
  id.tag = "id",
  ring.tag = "ring"
)
```

Arguments

filename	a file name of Tree ring points (shape file)
id.tag	string, column name of id (attribute table)
ring.tag	string, column name of ring years (0 is cambium layer)

Value

a data frame of TreeRingPoints (radial input and correction points)

Examples

```
.dir <- system.file("shp",package = "TreeRingShape")
.file <- "Abies_277_h400_TreeRing_Points.shp"
filename <- paste(.dir,.file,sep="/")
sf.P<-sf::st_read(filename)
plot(sf.P)
ReadShapefile_TreeRingPoints(filename,id.tag='id',ring.tag='ring')
```

ReadShapefile_TreeRings

Read Shapefile_TreeRings

Description

Read Shapefile_TreeRings

Usage

```
ReadShapefile_TreeRings(
  filename = "Abies_277_h400_TreeRing_Representative.shp",
  ring.tag = "ring"
)
```

Arguments

filename	a file name(path) of shape file written to disk.
ring.tag	string, column name of ring years (0 is cambium layer)

Value

a list of tree ring lines

Examples

```
.dir <- system.file("shp",package = "TreeRingShape")
.file <- "Abies_277_h400_TreeRing_Representative.shp"
filename <- paste(.dir,.file,sep="/")
sf.L<-sf::st_read(filename)
plot(sf.L)
Lplot(ReadShapefile_TreeRings(filename))
```

---

seq_deg *Return a vector of sequence of angles between start and end angle 0 to pi -pi to 0*

Description

Return a vector of sequence of angles between start and end angle 0 to pi -pi to 0

Usage

```
seq_deg(deg1, deg2, deg.by = 1)
```

Arguments

deg1	start angle
deg2	end angle
deg.by	step of sequence

Value

vector of sequence of angles between start and end angle

Examples

```
seq_deg(170,-170,.5)
```

TR *A sample object of class TreeRingShape*

Description

The data set contains tree ring shape data for Abies_277_h400 sampled from Tateyama, central Japan. Its disk image and shape files can be download from https://www.sanchikanri.com/treering/Abies_277_h400.zip It's intended to demonstrate the structure and use of 'TreeRingShape' class objects within the package.

Usage

```
TR
```

Format

An object of class `classTreeRingShape` of length 1.

Examples

```
# Access basic information about the TreeRingShape object
slotNames(TR)
str(TR)
# Plot the tree ring shape data
Lplot(TR@L)
```

TreeRingIndex *Calculate tree ring index from chronosequence data (year,growth)*

Description

Calculate tree ring index from chronosequence data (year,growth)

Usage

```
TreeRingIndex(ya, spar = 0.8)
```

Arguments

ya	data frame of chronosequence data (year,growth)
spar	smoothing parameter of spline curve

Value

list spline ; fitting parameter of Spline curve , idx ; data.frame(year,TreeRingIndex)

References

Cook, E., & Peters, K. (1981). The smoothing spline, a new approach to standardising forest interior tree-ring.Trre-ring Bulletin, 41, 45–53.

See Also

TreeRingsInterpolation

`TreeRingShape` *Construct a object (TR) of classTreeRingShape*

Description

Construct a object (TR) of classTreeRingShape

Usage

```
TreeRingShape(
  P_filename,
  L_filename,
  L2_filename,
  P_id.tag = "id",
  P_ring.tag = "ring",
  L_ring.tag = "ring"
)
```

Arguments

`P_filename`	file name of shape file (P) for tree ring points (without extention)
`L_filename`	file name of shape file (L) for tree ring lines (without extention)
`L2_filename`	file name of shape file (L2) for tree ring lines interpolated (without extention)
`P_id.tag`	column name of id in shape file (P), default is 'id'
`P_ring.tag`	column name of ring no.(ordinaly year,outermost=0) in shape file (L), default is 'ring'
`L_ring.tag`	column name of ring no.(ordinaly year,outermost=0) in shape file (L), default is 'ring'

Value

generated new object from classTreeRingShape

Examples

```
test_TreeRingShape <- function(){
oldwd <- getwd()
on.exit(setwd(oldwd))
setwd(system.file("shp",package = "TreeRingShape"))

TR.<-TreeRingShape(
P_filename='Abies_277_h400_TreeRing_Points.shp',
L_filename='Abies_277_h400_TreeRing_Representative.shp',
L2_filename='Abies_277_h400_TreeRing.shp',
P_id.tag='id',P_ring.tag='ring',
L_ring.tag='ring')

 slotNames(TR.)
 str(TR.)
 Lplot(TR.@L2)
 return(TR.)
}

 TR. <- test_TreeRingShape()
 DiskInfo(TR.)
```

TreeRingsInterpolation

Interpolates tree ring between representative (manual input) tree rings with tree ring points

---

Description

Interpolates tree ring between representative (manual input) tree rings with tree ring points

Usage

```
TreeRingsInterpolation(TR)
```

Arguments

TR	object of classTreeRingShape (without tree ring interpolated)

Value

TR object of classTreeRingShape (with tree ring interpolated)

Examples

```
# tree ring interpolation (add TR@L2 to classTreeRingShape )
TR@L2   ### empty
TR <- TreeRingsInterpolation(TR)
TR@L2  ###  entered
ya <- plot_year_RingArea(TR@L2, 2018)$Year_TreeRingArea
# Figure of relationships year and tree ring area
plot(ya,type='b')
tri. <- TreeRingIndex(ya)
lines(tri.$spline,col='red',lw=2)
# Figure of relationships year and tree ring index
plot(tri.$idx,type='b')
abline(h=1,col='red')
```

`TreeRingsLines` *Read representative tree ring lines from shape files*

Description

Read representative tree ring lines from shape files

Usage

```
TreeRingsLines(TR)
```

Arguments

`TR`	a tree ring class (classTreeRingShape)

Value

TR (TreeRing class TR@L<-L ; TR@L_<-L_ ; TR@YR_L <-YR_L ; TR@ln <- ln)

Examples

```
 #  didectory of tree ring shapefiles
 .dir <- system.file("shp",package = "TreeRingShape")

# path of  P_filename
.file <- "Abies_277_h400_TreeRing_Points.shp"
 TR_@P_filename <- paste(.dir,.file,sep="/")

  TreeRingsPoints(TR_)@P

# path of L_file name
.file <- "Abies_277_h400_TreeRing_Representative.shp"
L_filename <- paste(.dir,.file,sep="/")
 TreeRingsPoints(TR_)@L
```

```
Lplot(TR@L)
```

`TreeRingsPoints` *Read TreeRingsPoints shape file, check and save parameters*

Description

Read TreeRingsPoints shape file, check and save parameters

Usage

```
TreeRingsPoints(TR)
```

Arguments

`TR`	a tree ring class (classTreeRingShape)

Value

a list of (P,P00,YR_P,n_id,YR_P,n_YR)

Examples

```
 #  didectory of tree ring shapefiles
 .dir <- system.file("shp",package = "TreeRingShape")

# path of  P_filename
.file <- "Abies_277_h400_TreeRing_Points.shp"
 TR_@P_filename <- paste(.dir,.file,sep="/")

  TreeRingsPoints(TR_)@P
```

`TR_` *A sample object of class TreeRingShape, shapefile paths and column names only.*

Description

The full data set contains tree ring shape data for Abies_277_h400 sampled from Tateyama, central Japan. Its disk image and shape files can be download from https://www.sanchikanri.com/treering/Abies_277_h400.zip

Usage

```
TR_
```

Format

An object of class classTreeRingShape of length 1.

Examples

```
# Access basic information about the TreeRingShape object
TR_<-new_classTreeRingShape(
P_filename='Abies_277_h400_TreeRing_Points.shp',
L_filename='Abies_277_h400_TreeRing_Representative.shp',
L2_filename='Abies_277_h400_TreeRing.shp',
P_id.tag='id',
P_ring.tag='ring',
L_ring.tag='ring')
slotNames(TR_)
str(TR_)
```

WriteShapefile_TreeRings

Write a shapefile of interpolated tree rings

Description

Write a shapefile of interpolated tree rings

Usage

```
WriteShapefile_TreeRings(L2, filename = "test.shp")
```

Arguments

L2	is as list of Tree ring polygons (X, Y)
filename	is a shape file(path) name written to disk.

Value

No return value, called for side effects.

Examples

```
#'
WriteShapefile_TreeRings (TR@L, tempfile("TreeRingShape_test",fileext = ".shp"))
dir(tempdir())
```

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