The abanico plot

visualising chronometric data with individual standard errors

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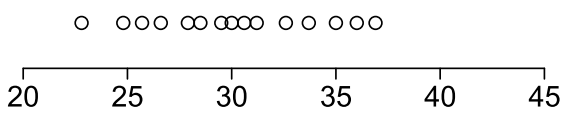
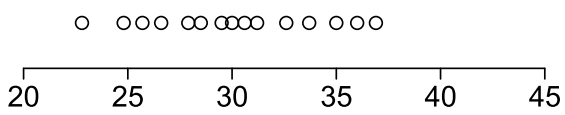
2 - IRAMAT-CRP2A, Université Bordeaux Montaigne
3 - Institute for Geography, University of Cologne
4 - Helmholtz-Zentrum Dresden-Rossendorf, Helmholtz Institute Freiberg for Resource Technology, Remote Sensing Group
5 - Geographical Institute, Geomorphology, University of Bayreuth

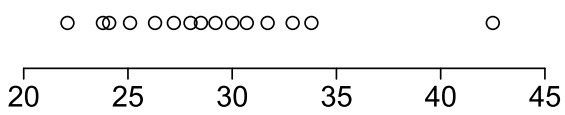
The relevance of errors And the need to explicitly show them

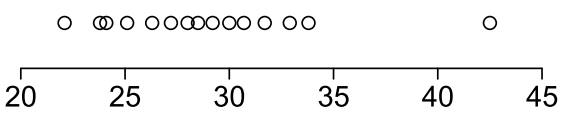
homogeneous distribution?





homogeneous distribution with an outlier?





Graphs courtesy of Rex Galbraith

The relevance of errors And the need to explicitly show them

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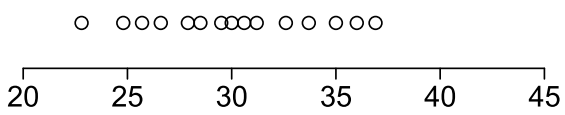
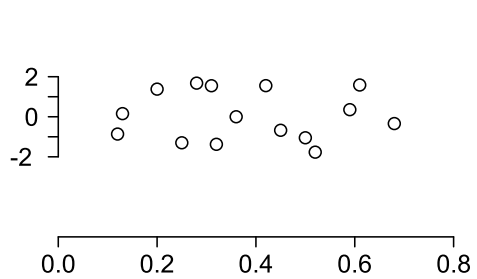
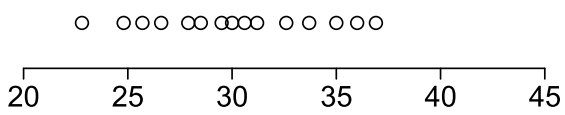
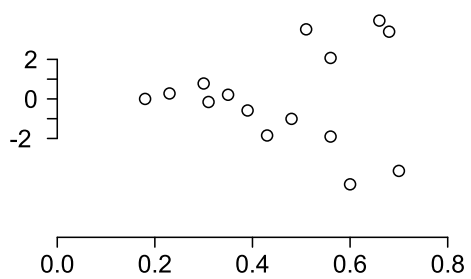




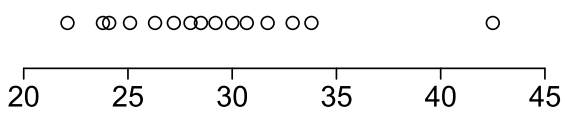
Yes, of course

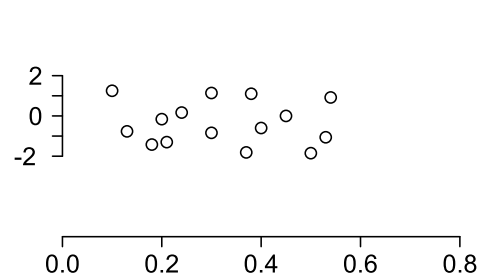




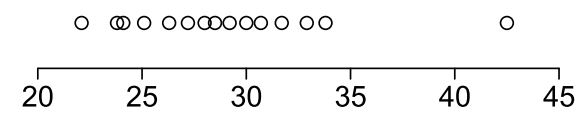
No,two populations

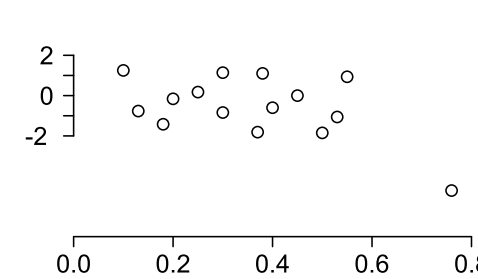
homogeneous distribution with an outlier?





No, just homogeneity



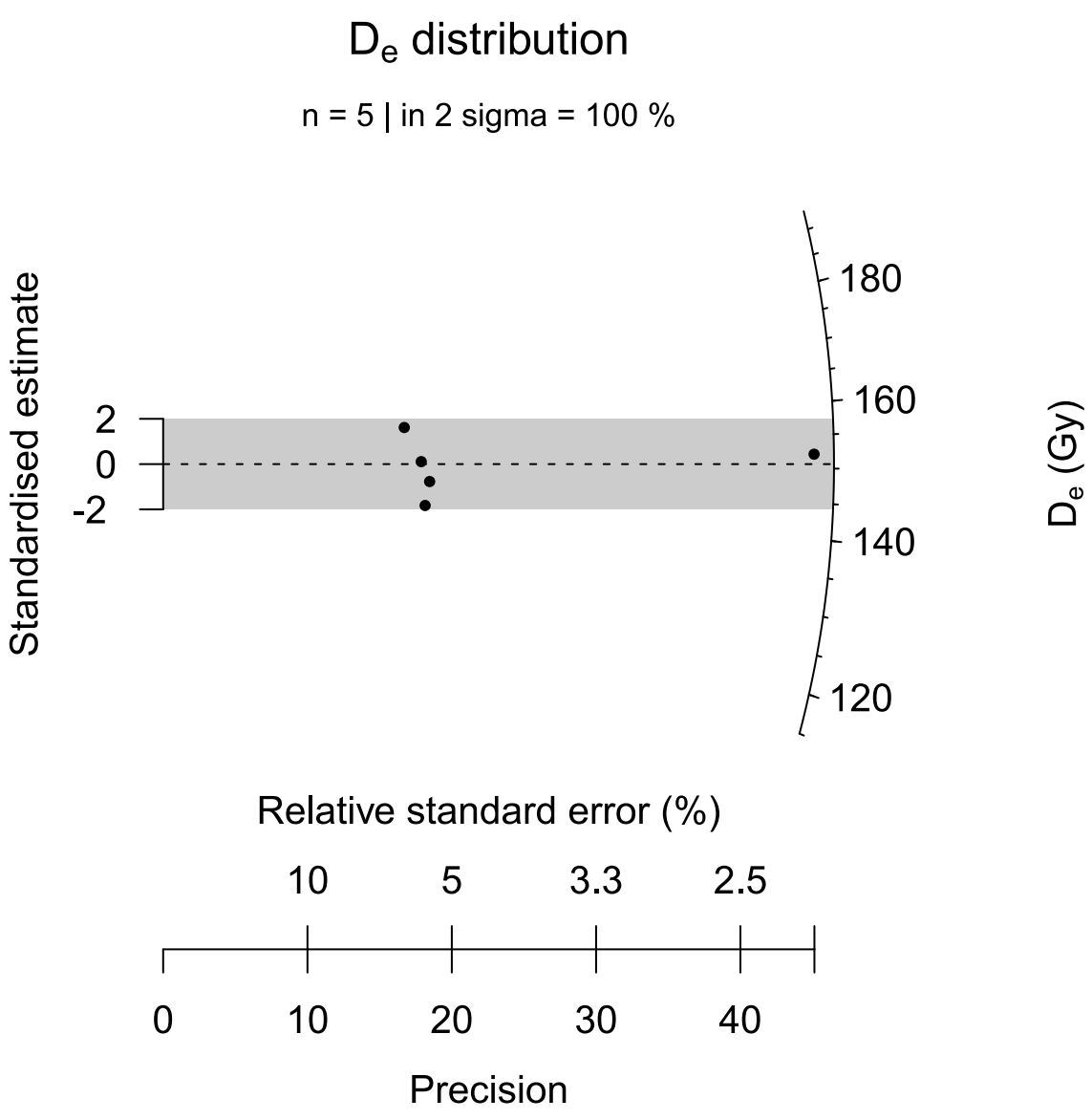


Yes, but not the obvious

Graphs courtesy of Rex Galbraith

What the radial plot does really well

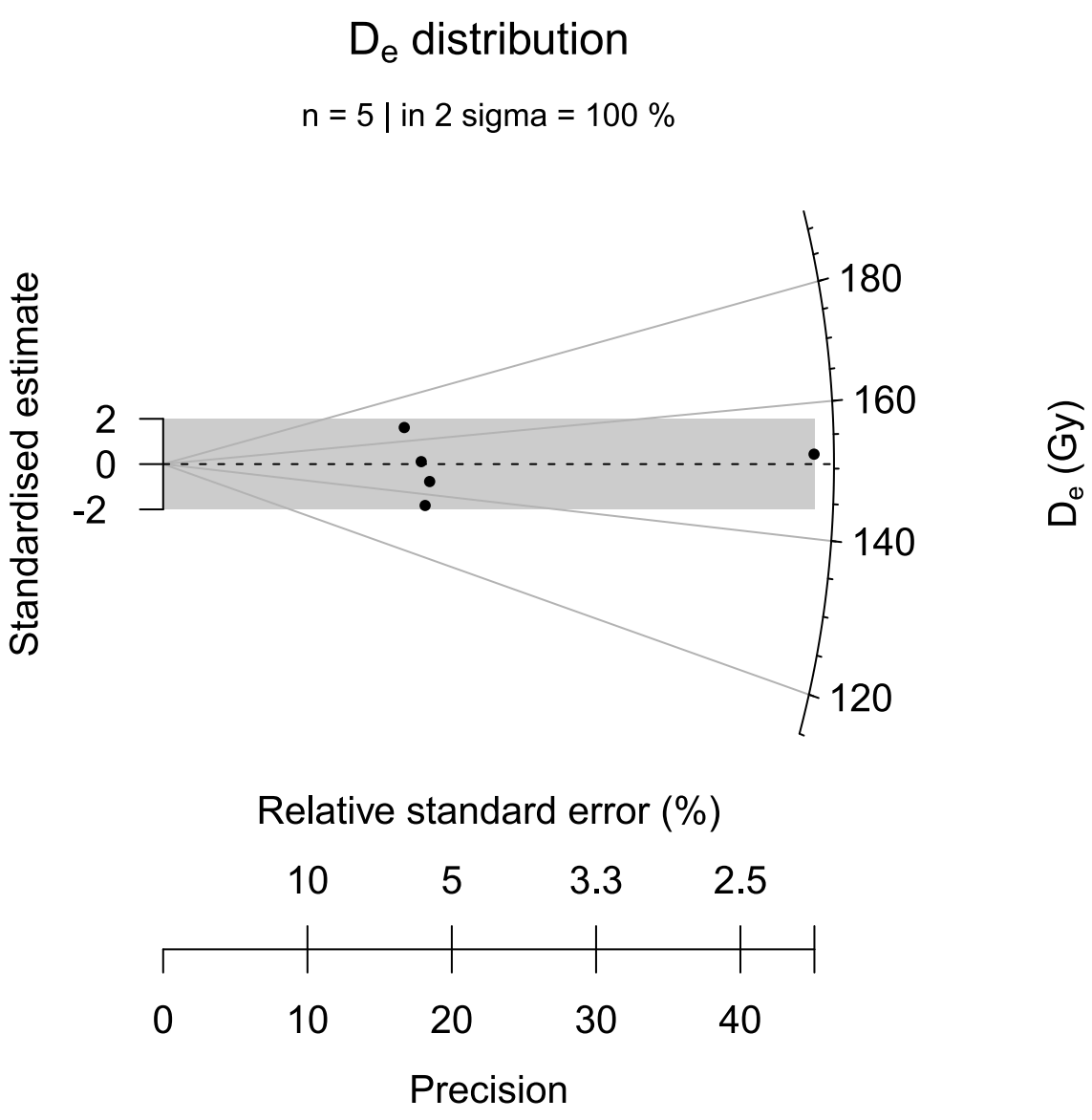
And what is does not so well




```
plot_RadialPlot(data = data.frame(z, s),
                plot.ratio = 0.15, pch = 20, grid.col = "none")
```

What the radial plot does really well

And what is does not so well

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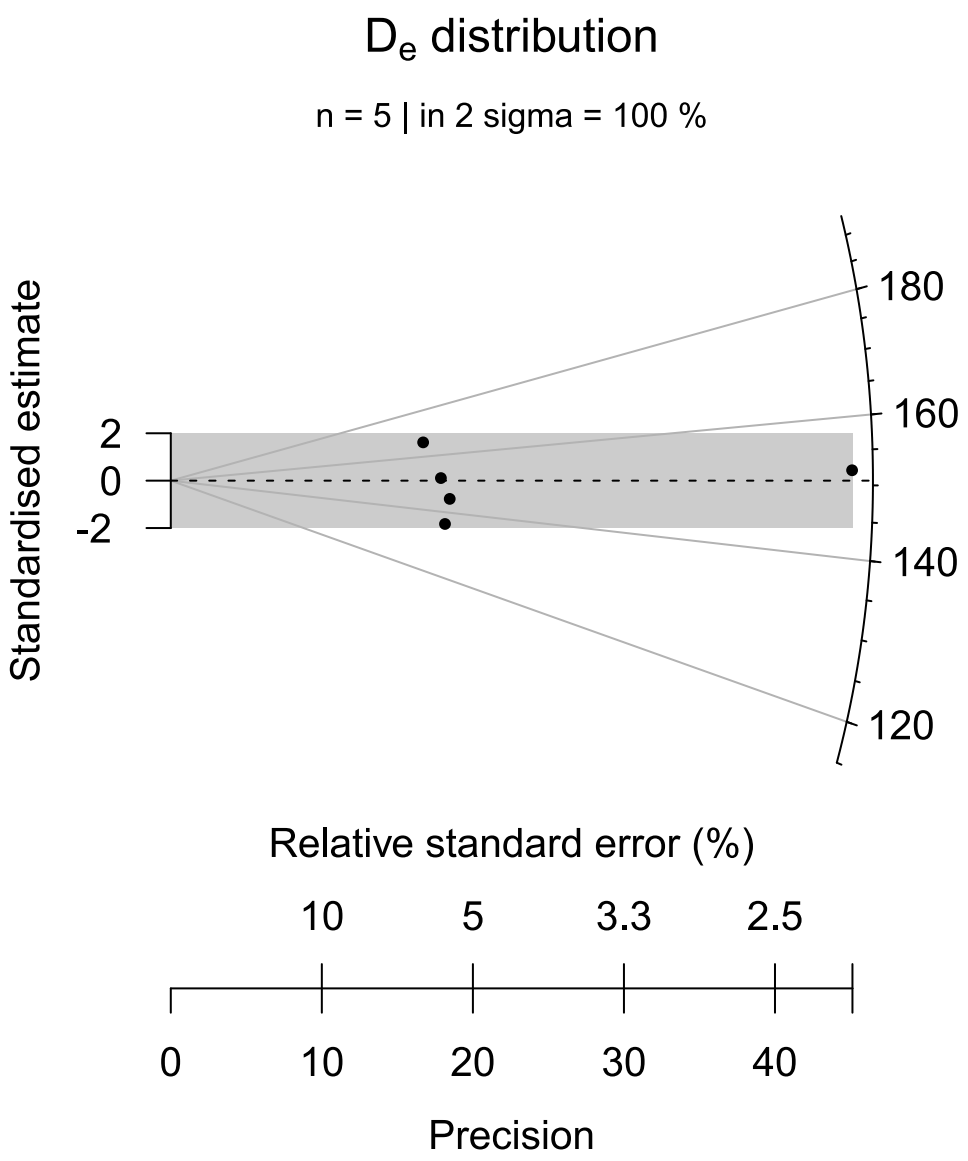
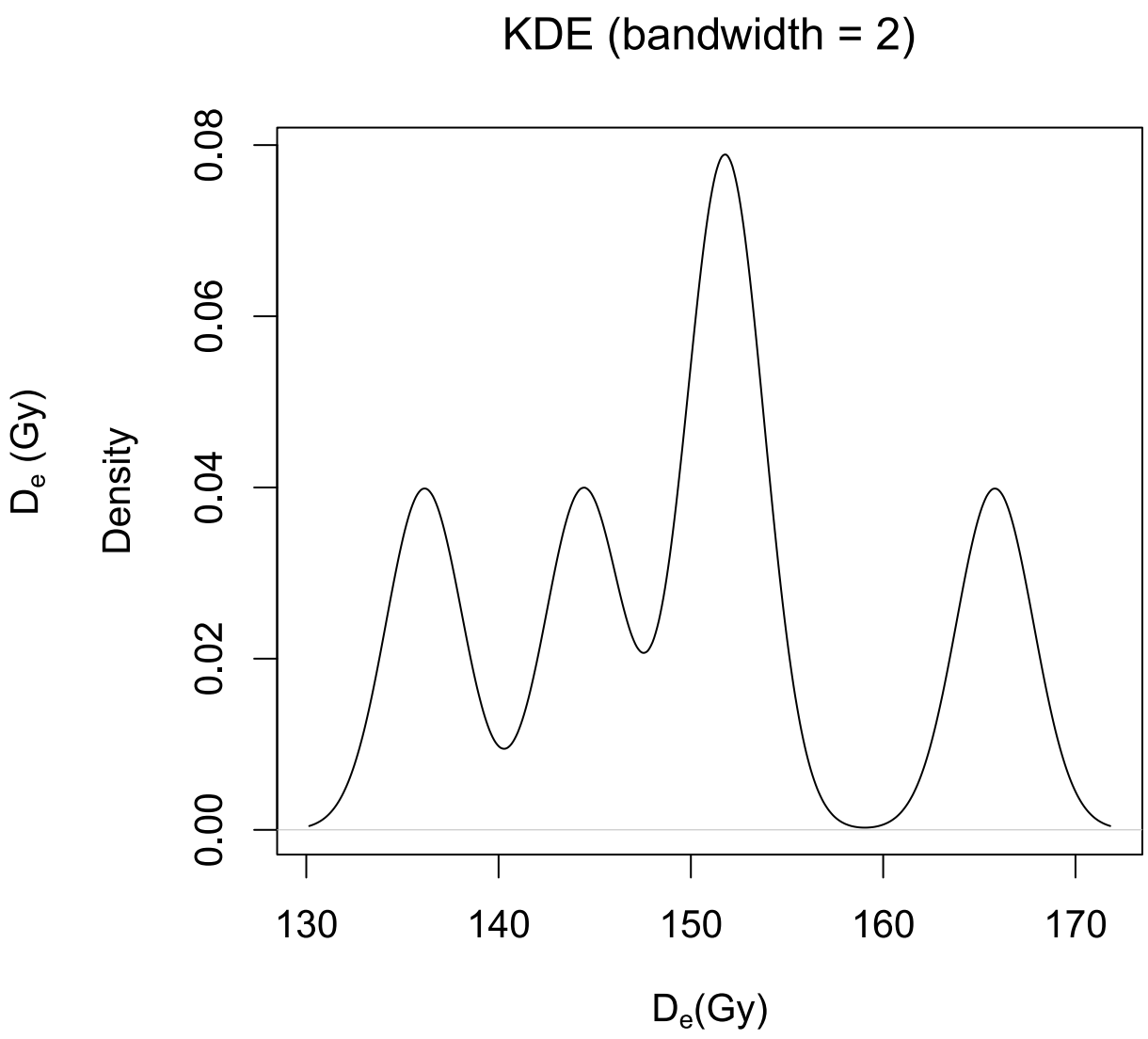
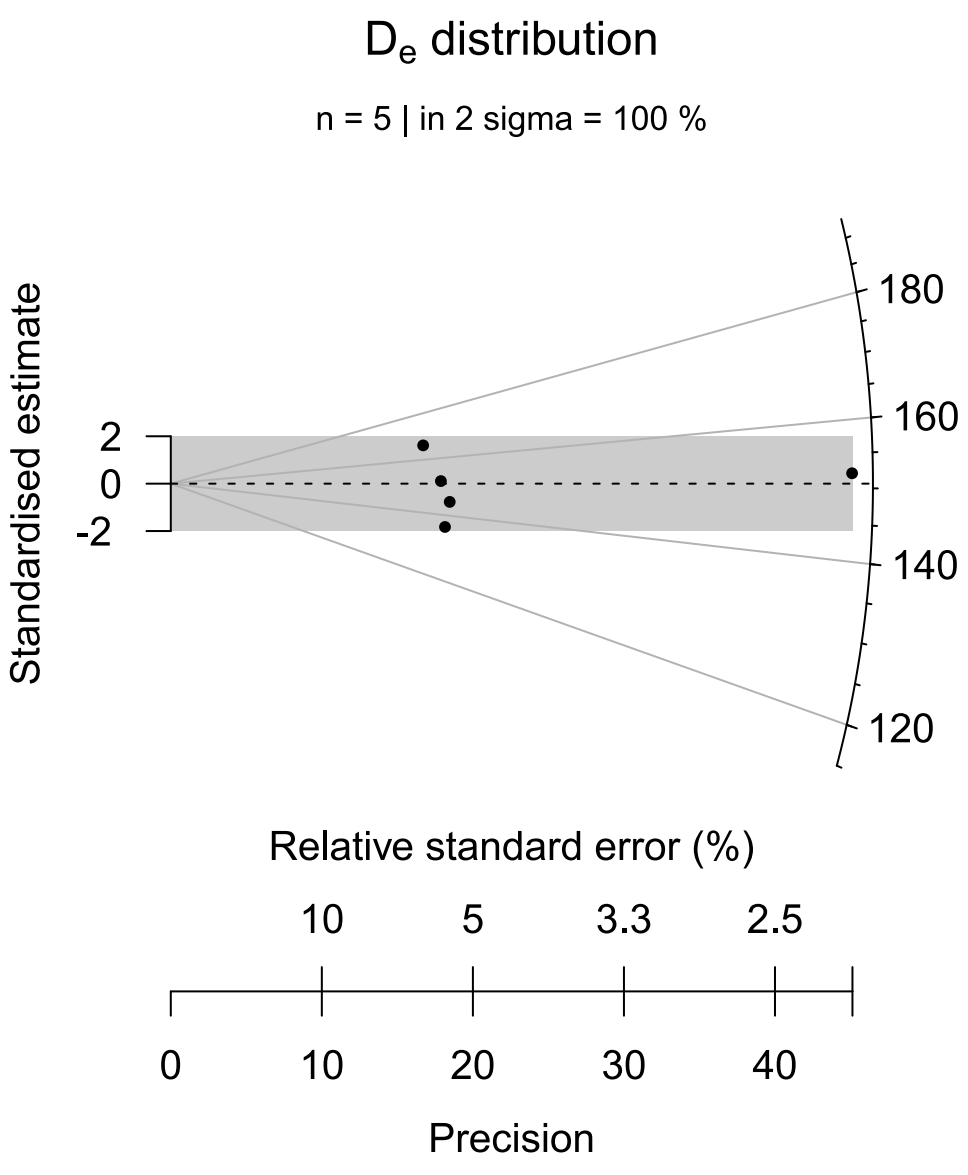


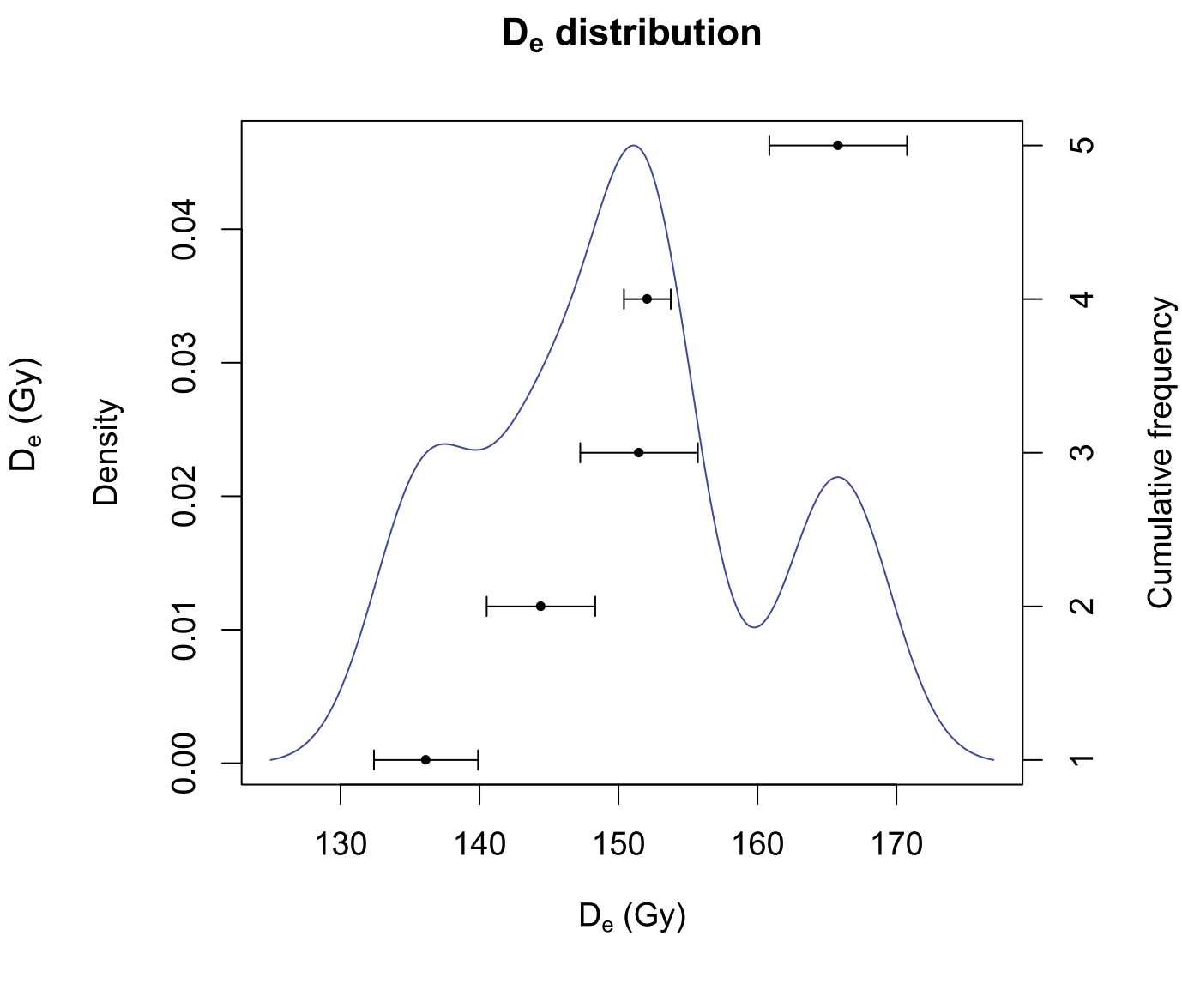



```
plot(density(x = z, bw = 2), xlab = expression(paste(D[e], "(Gy)")),
     main = "KDE (bandwidth = 2)")
```

What the radial plot does really well

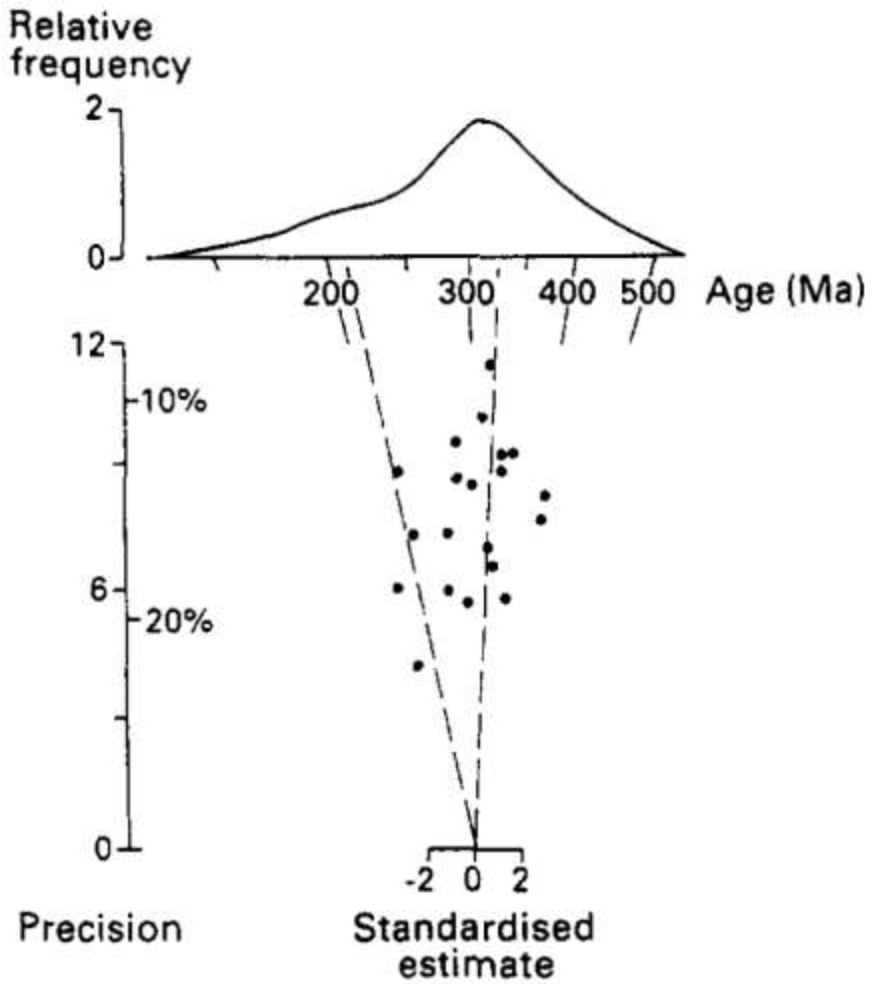
And what is does not so well



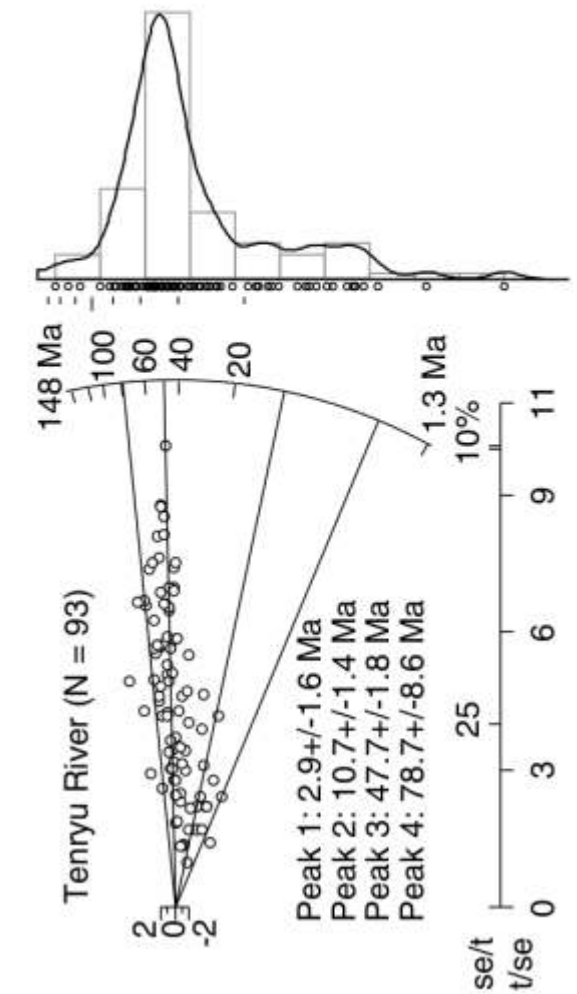



```
plot_KDE(data = data.frame(z, s))
```

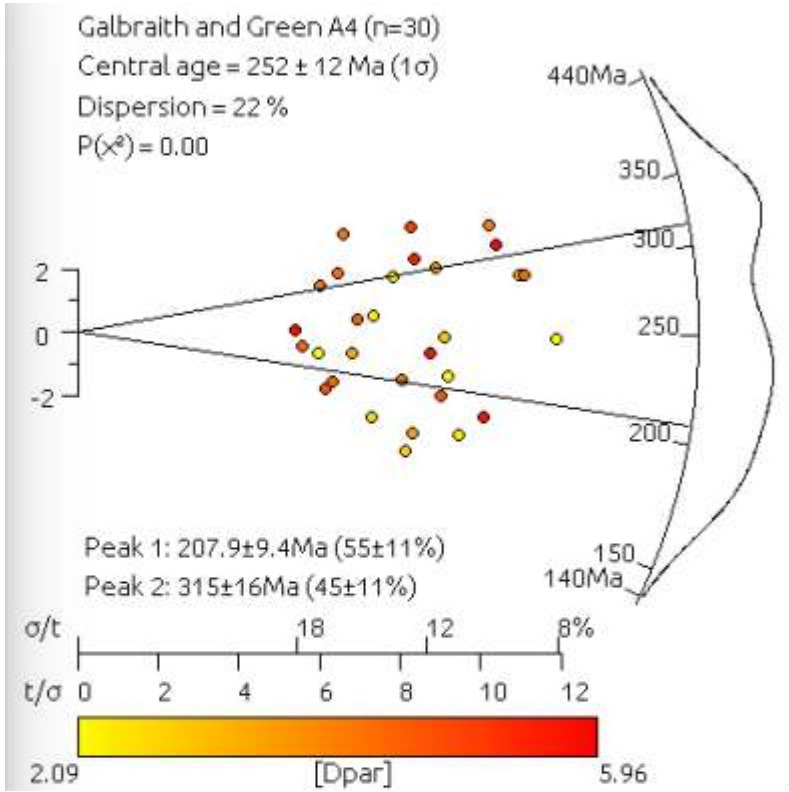
A glimpse back and aside Alternative ways to merge two plots



Galbraith & Green (1990)

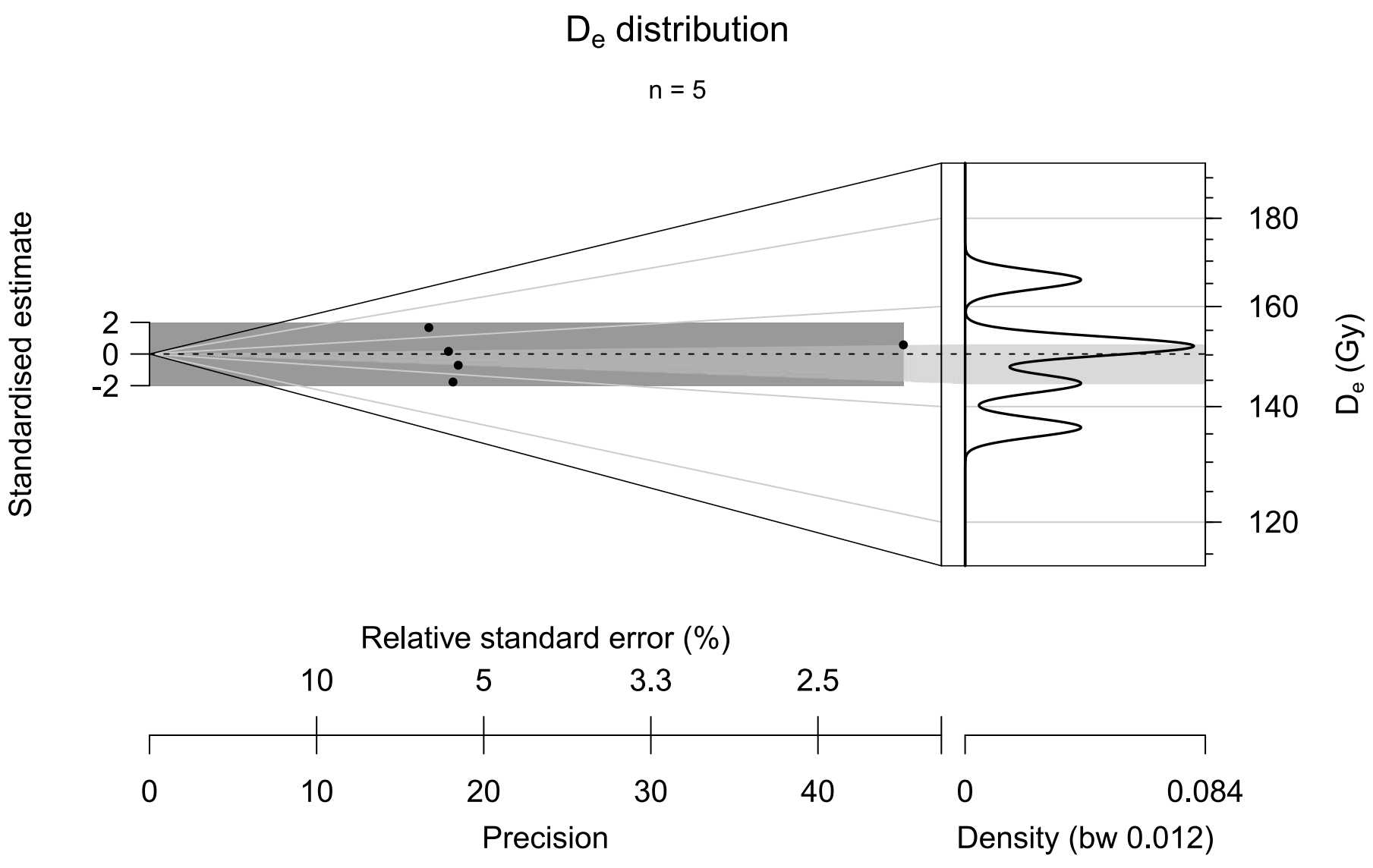


Clift et al. (2013)



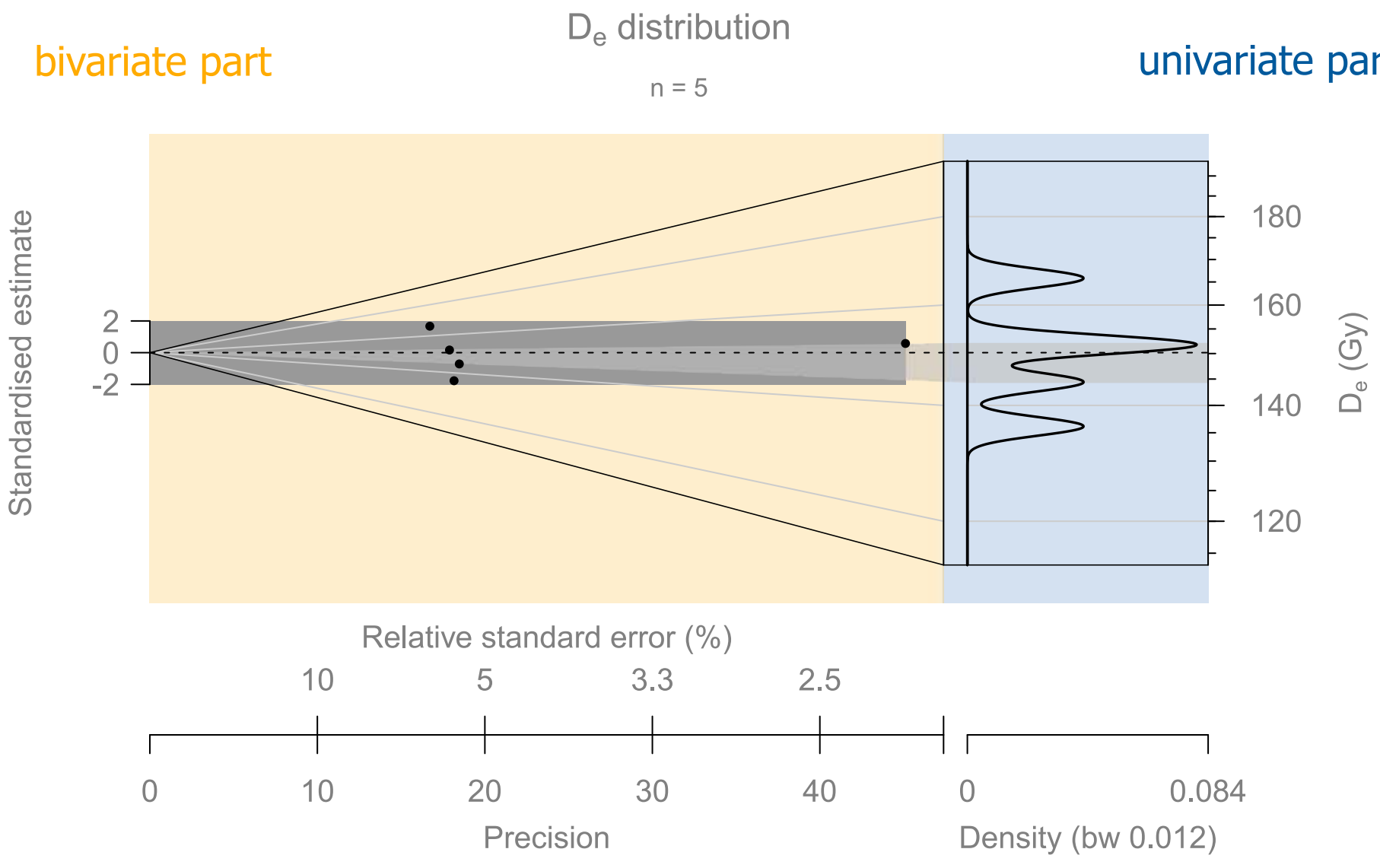
Vermeesch et al. (2009)*

A step beyond The structure of the abanico plot




```
plot_AbanicoPlot(data = data.frame(z, s))
```

A step beyond The structure of the abanico plot

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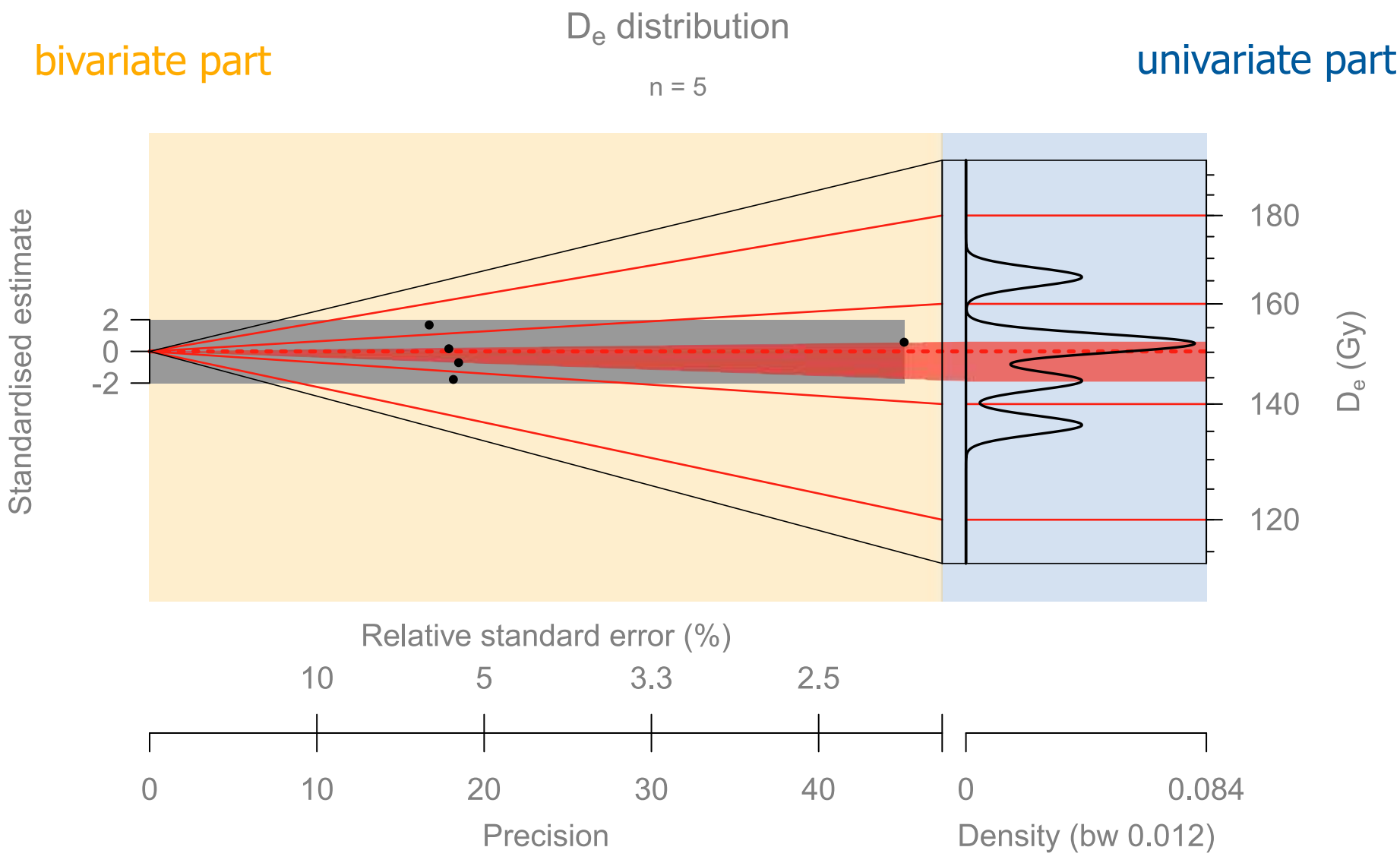
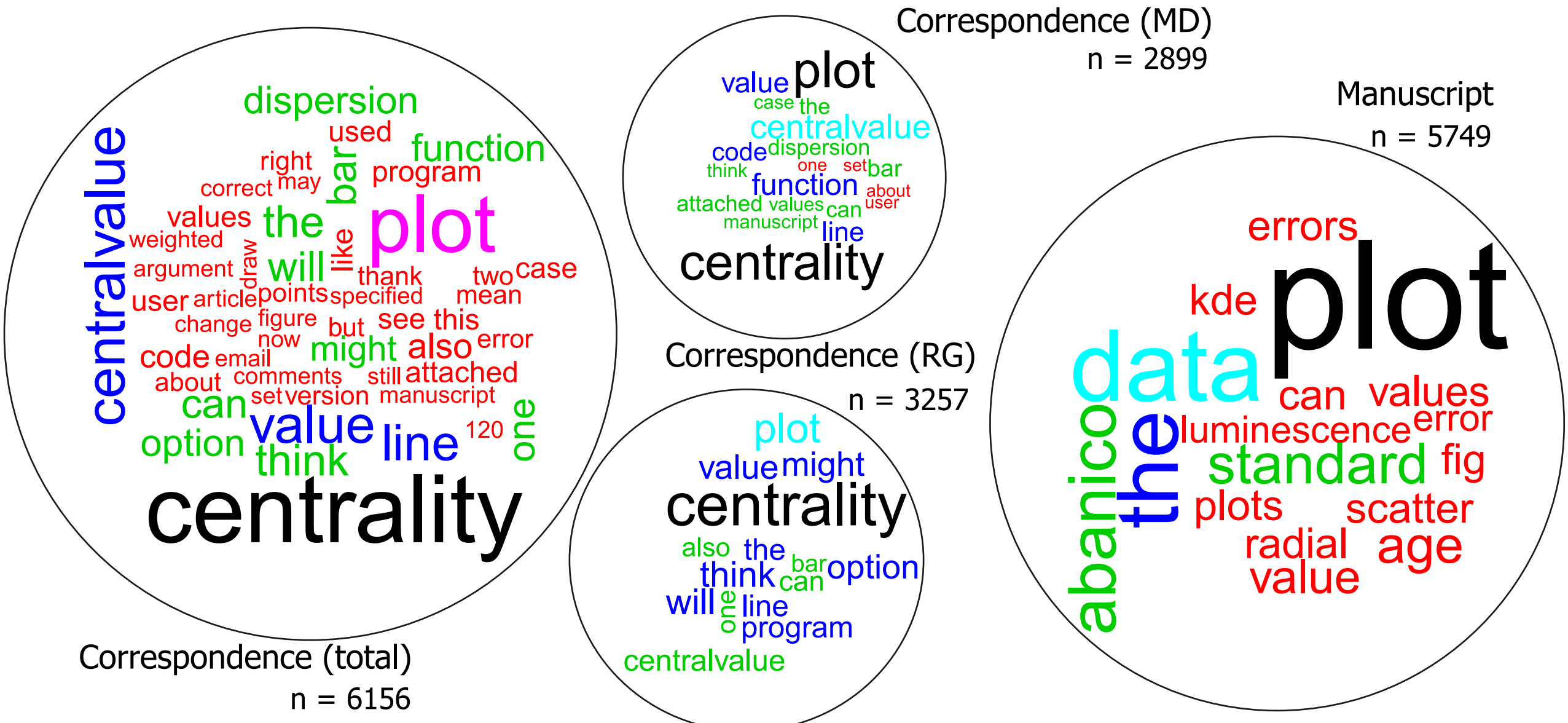


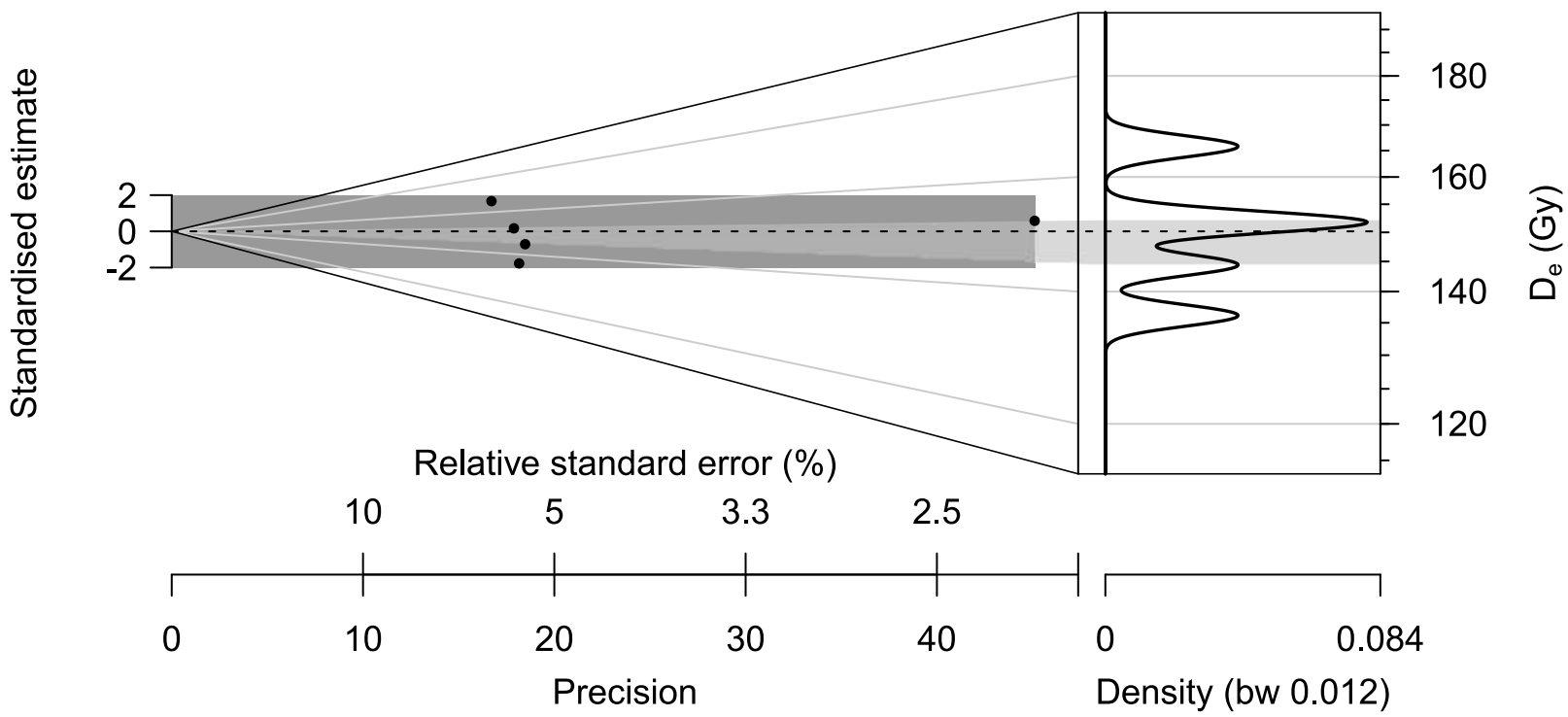

```
plot_AbanicoPlot(data = data.frame(z, s))
```

A summary The most important keywords during preparation of the article




```
wordcloud(words = md, colors = 1:7)
wordcloud(words = rg, colors = 1:7)
wordcloud(words = c(md, rg), colors = 1:7)
wordcloud(words = ms, colors = 1:7)
```

The geometric foundations Just four equations to construct the plot

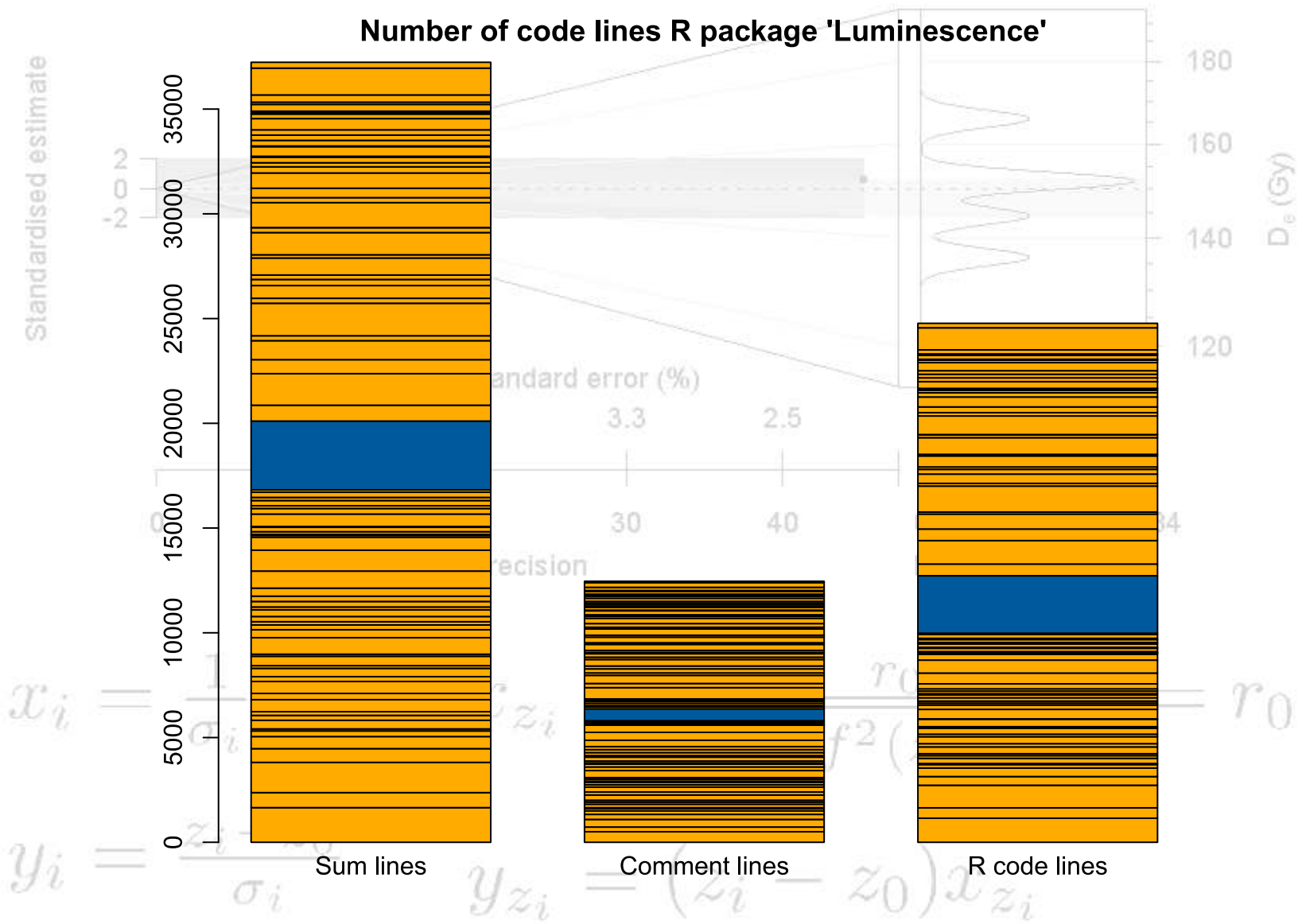


$$x_i = \frac{1}{\sigma_i} \qquad x_{z_i} = \frac{r_0}{\sqrt{1+f^2(z_i-z_0)^2}} = r_0$$

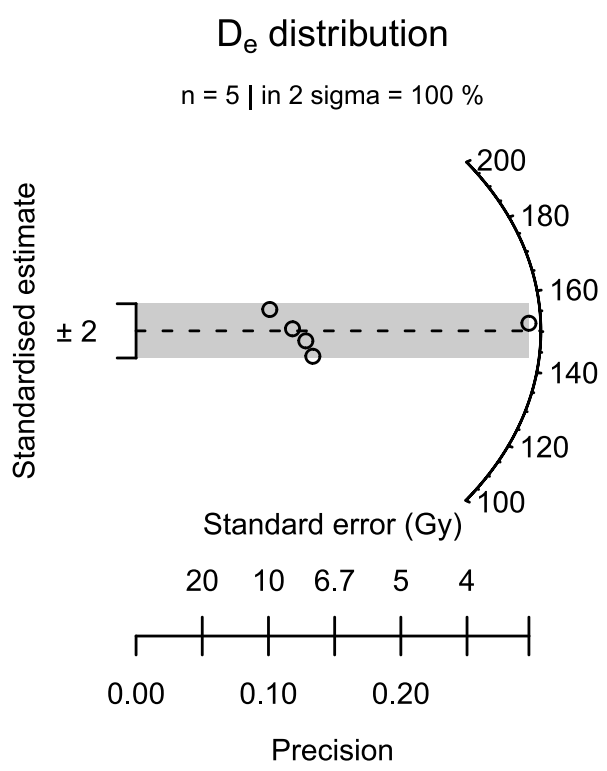
$$y_i = \frac{z_i - z_0}{\sigma_i} \qquad y_{z_i} = (z_i - z_0)x_{z_i}$$

```
plot_AbanicoPlot(data = data.frame(z, s), main = "", mtext = "")
```

The geometric foundations Just four equations to construct the plot



The geometric foundations From radial to abanico plot



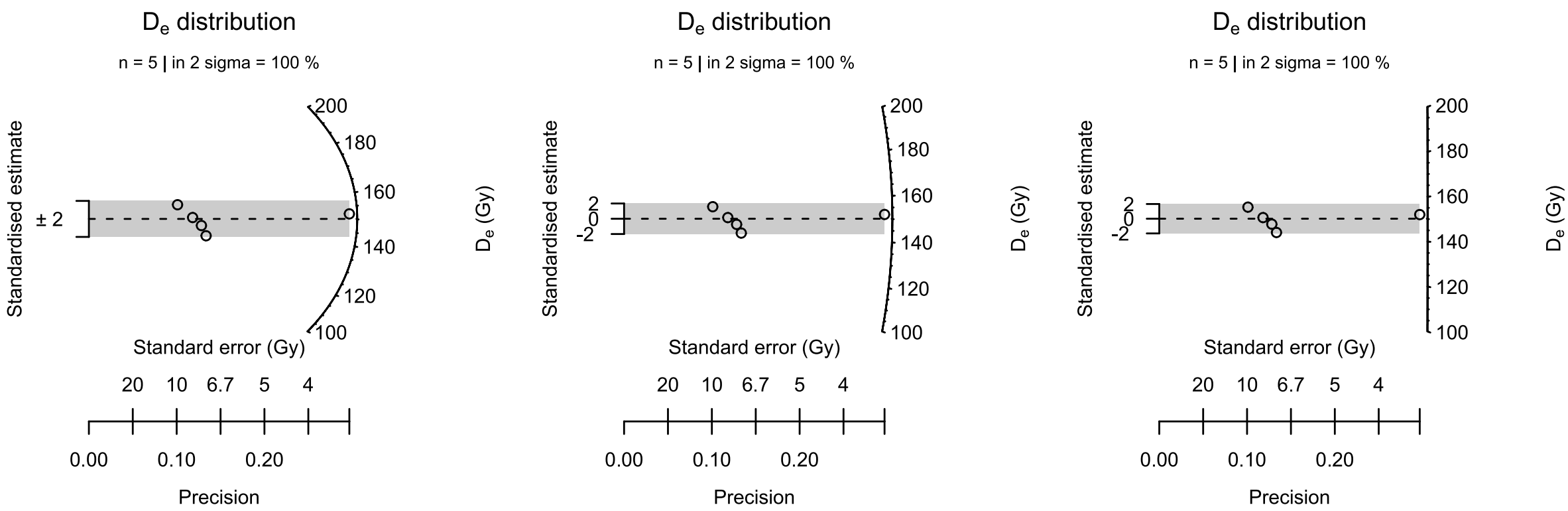
$$x_i = \frac{1}{\sigma_i} \qquad x_{z_i} = \frac{r_0}{\sqrt{1+f^2(z_i-z_0)^2}} = r_0$$

$$y_i = \frac{z_i - z_0}{\sigma_i} \qquad y_{z_i} = (z_i - z_0)x_{z_i}$$

Galbraith (1988)

```
plot_RadialPlot(data = data.frame(z, s), plot.ratio = 0.25)
```

The geometric foundations From radial to abanico plot



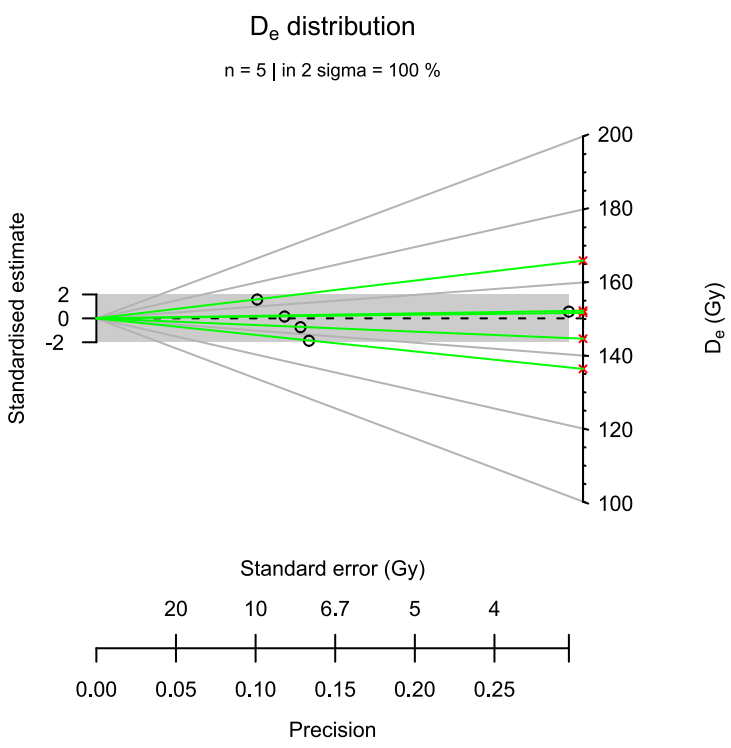
$$x_i = \frac{1}{\sigma_i} \qquad x_{z_i} = \frac{r_0}{\sqrt{1+f^2(z_i-z_0)^2}} = r_0$$

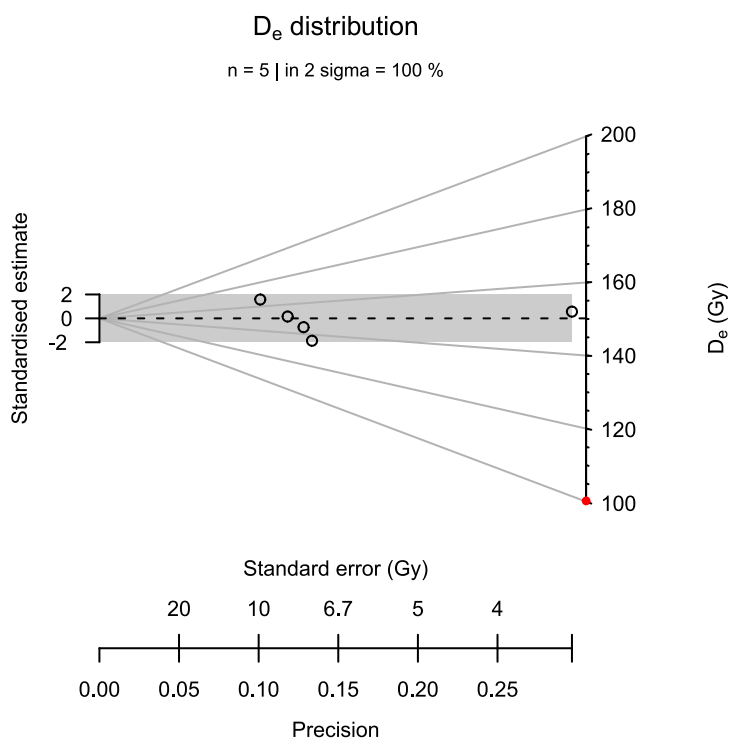
$$y_i = \frac{z_i - z_0}{\sigma_i} \qquad y_{z_i} = (z_i - z_0)x_{z_i}$$

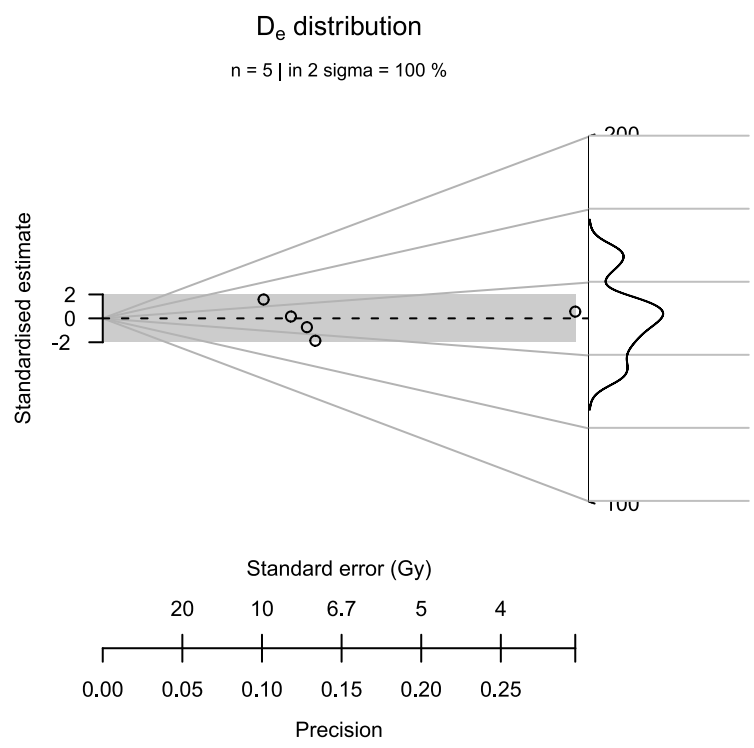
Galbraith (1988)

```
plot_RadialPlot(data = data.frame(z, s), plot.ratio = 0.25)
plot_RadialPlot(data = data.frame(z, s), plot.ratio = 0.1)
plot_RadialPlot(data = data.frame(z, s), plot.ratio = 0.01)
```

The geometric foundations From radial to abanico plot







$$x_i = \frac{1}{\sigma_i}$$

$$y_i = \frac{z_i - z_0}{\sigma_i}$$

Galbraith (1988)

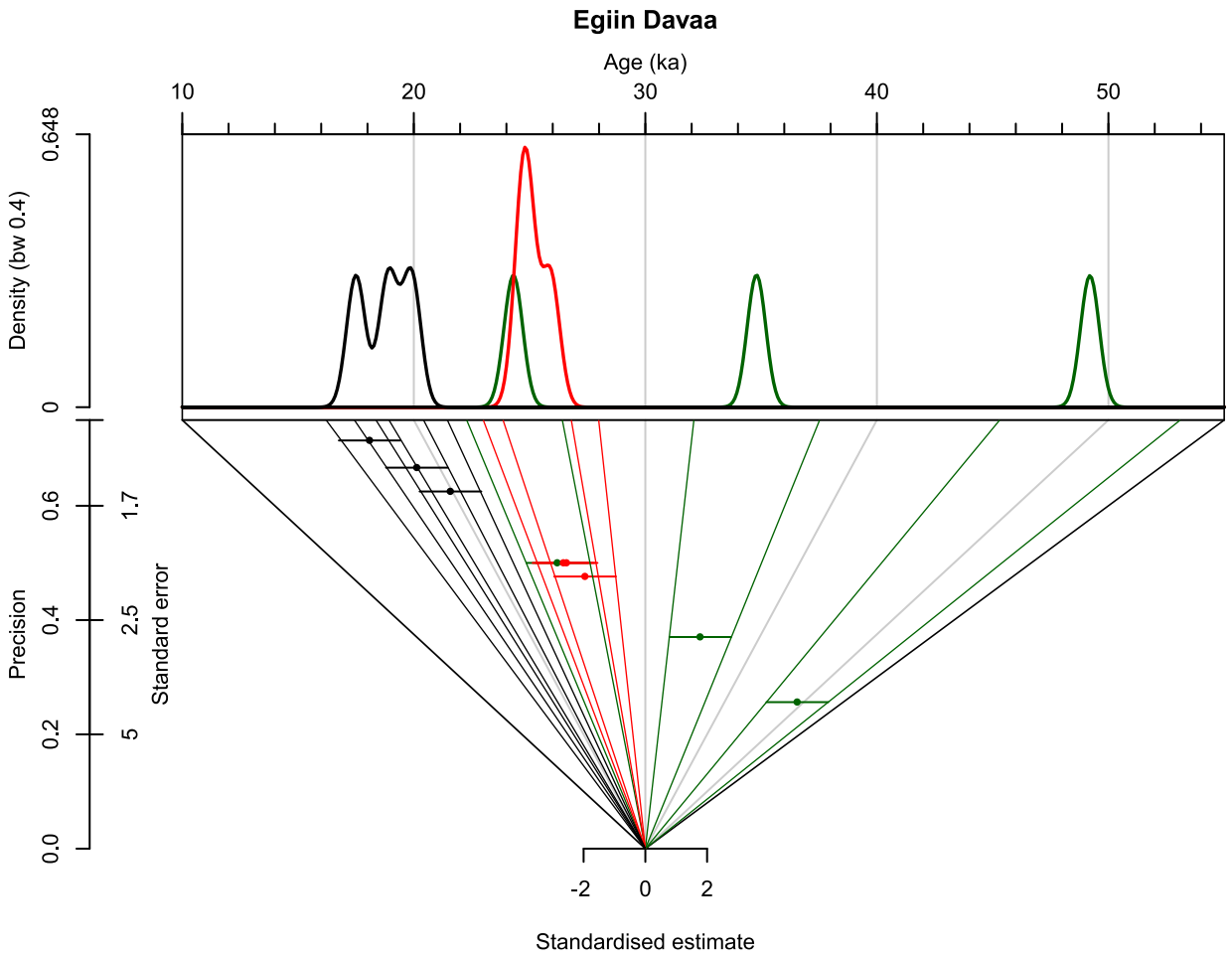
$$x_{z_i} = \frac{r_0}{\sqrt{1+f^2(z_i-z_0)^2}} = r_0$$

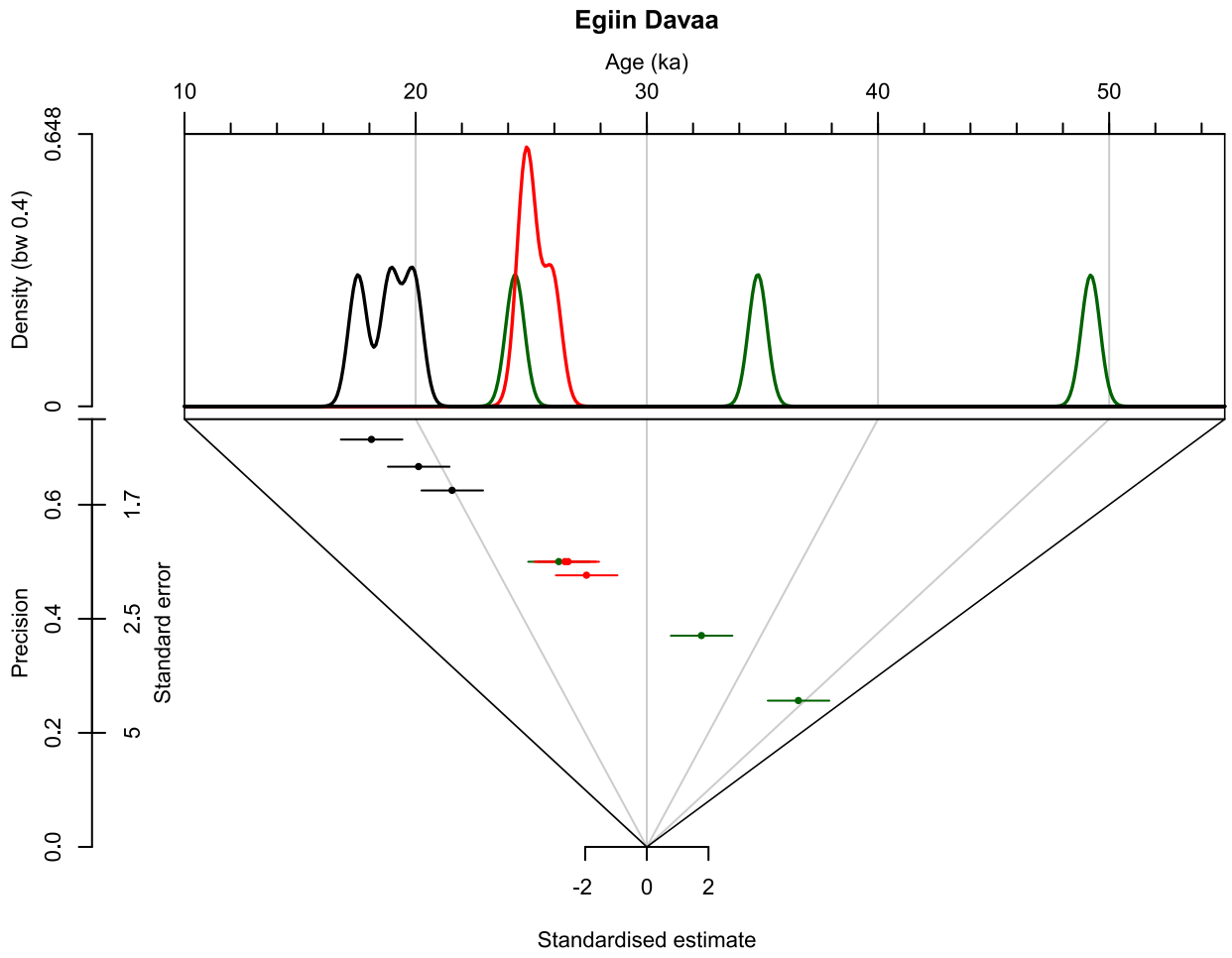
$$y_{z_i} = (z_i - z_0)x_{z_i}$$

Galbraith (1990)

```
plot_RadialPlot(data = data.frame(z, s), plot.ratio = 0)
```

Cosmogenic nuclides

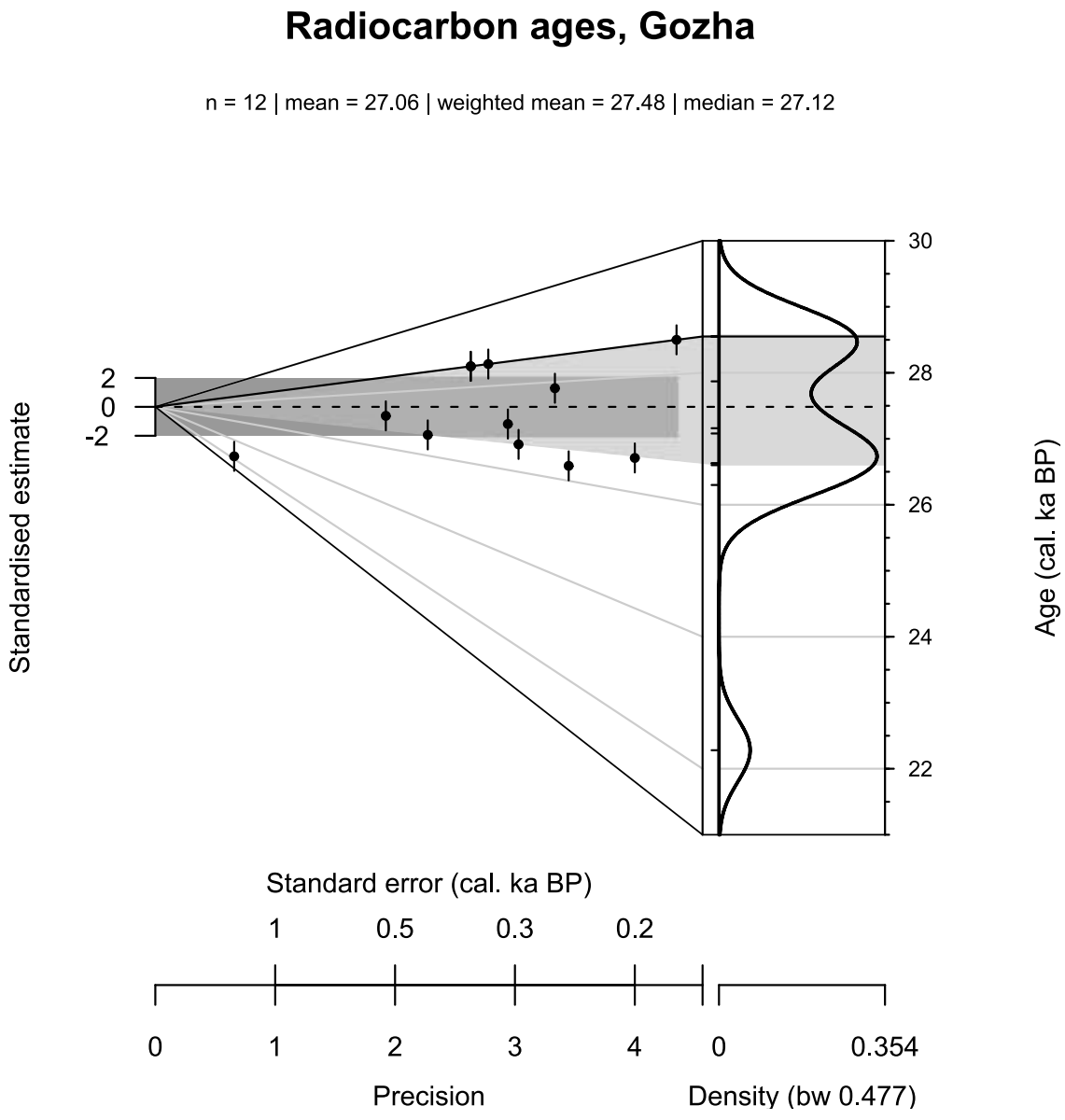


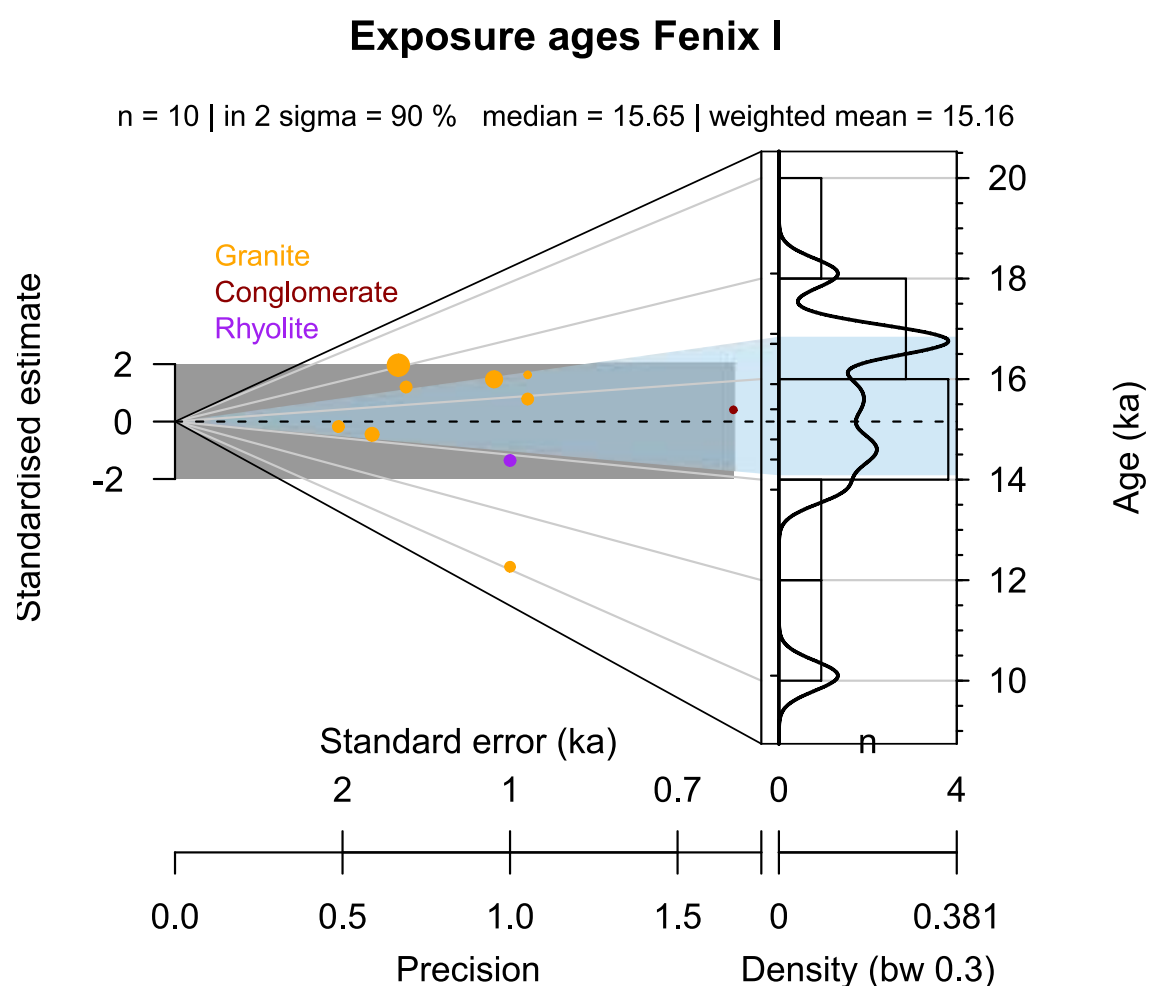


Data courtesy of Steffen Pötsch

```
plot_AbanicoPlot(data = data.frame(z, s), ...)
```

Cosmogenic nuclides





Plots from Dietze et al. (accepted), data from Rinterknecht et al. (2006) and Douglass et al. (2006).

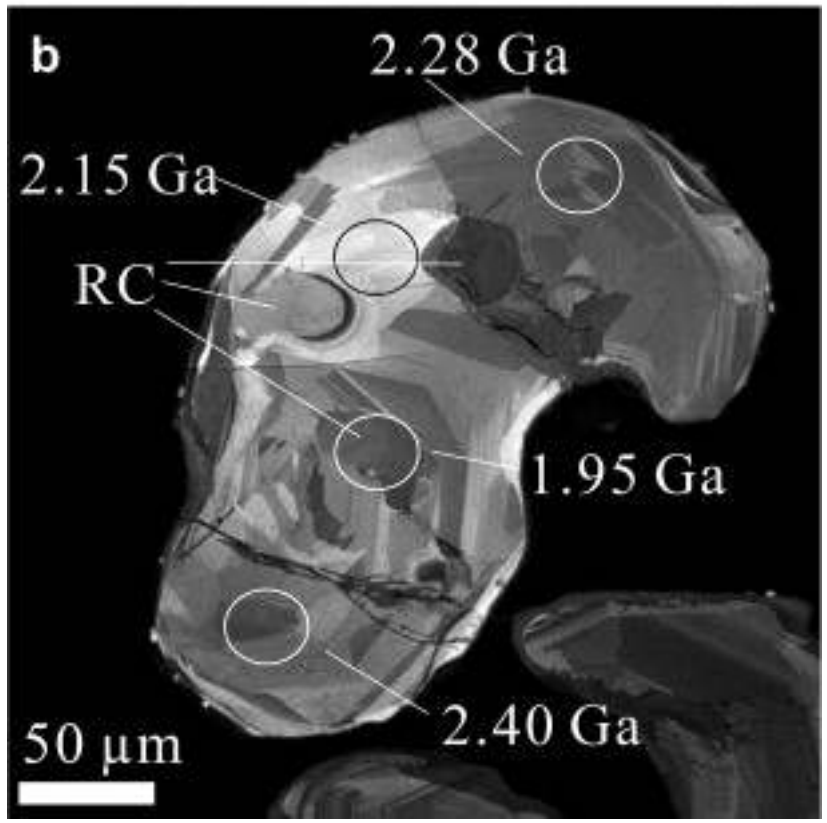
```
plot_AbanicoPlot(data = data.frame(z, s), ...)
```

Fission track ages

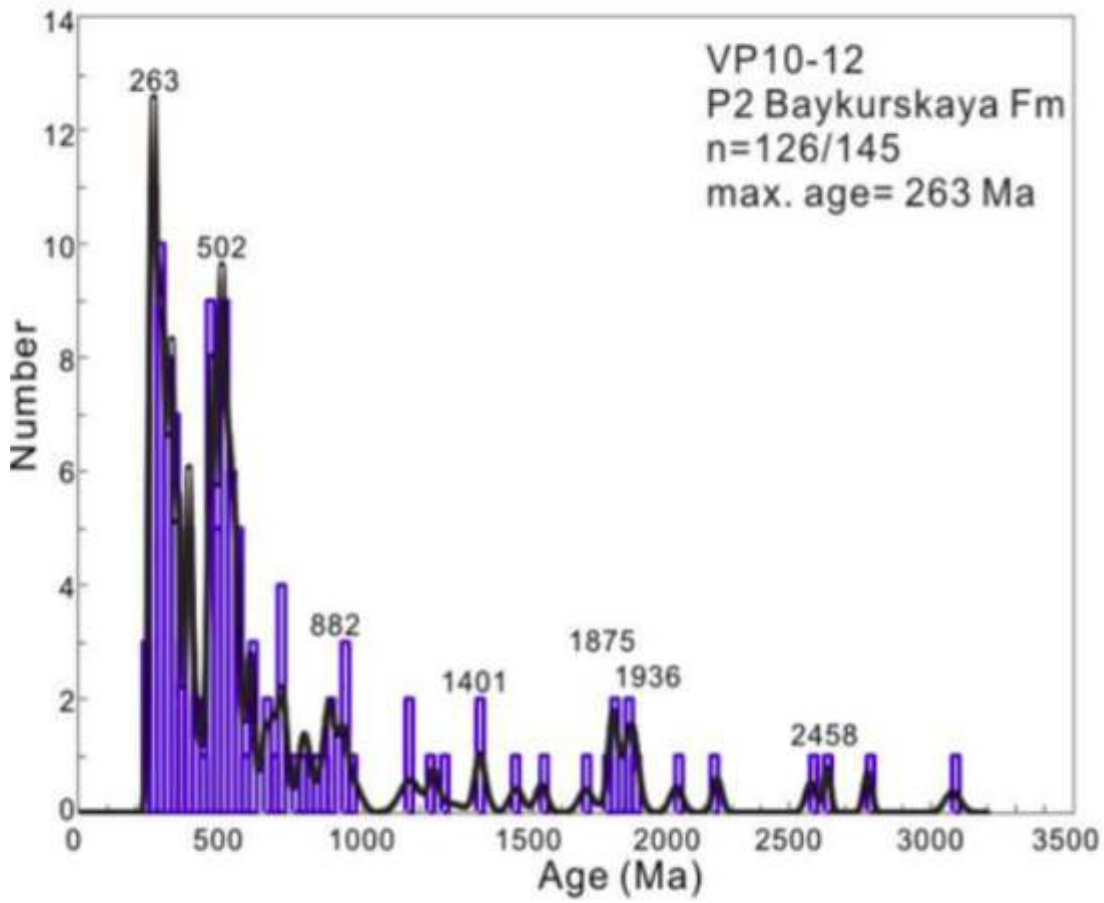
Plot from Dietze et al. (accepted), data from Kirstein et al. (2009)

```
plot_AbanicoPlot(data = data.frame(z, s), ...)
```

Beyond OSL/FT/CN...

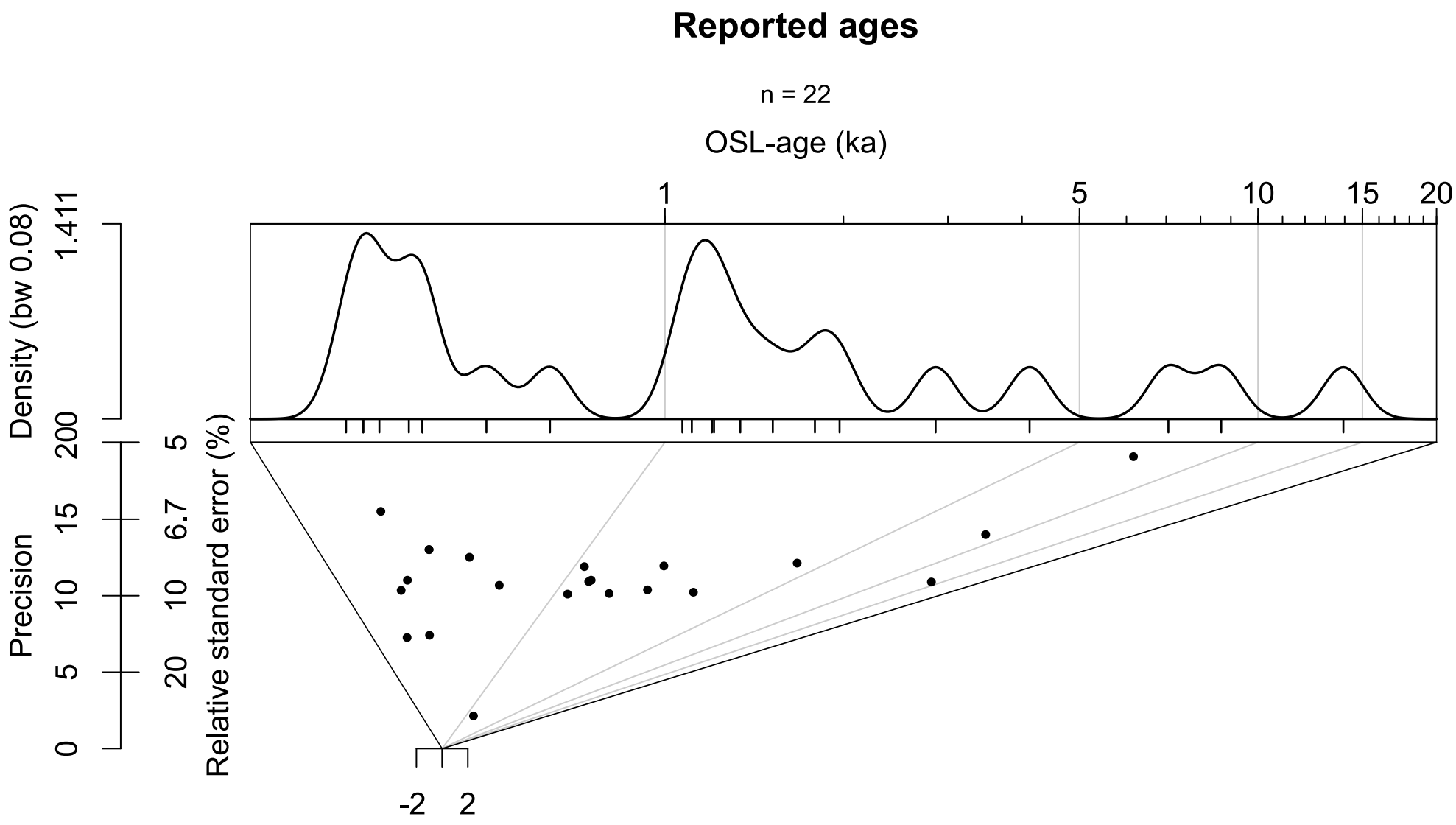


From Kröner et al. (2014)



From somewhere out of the internet...

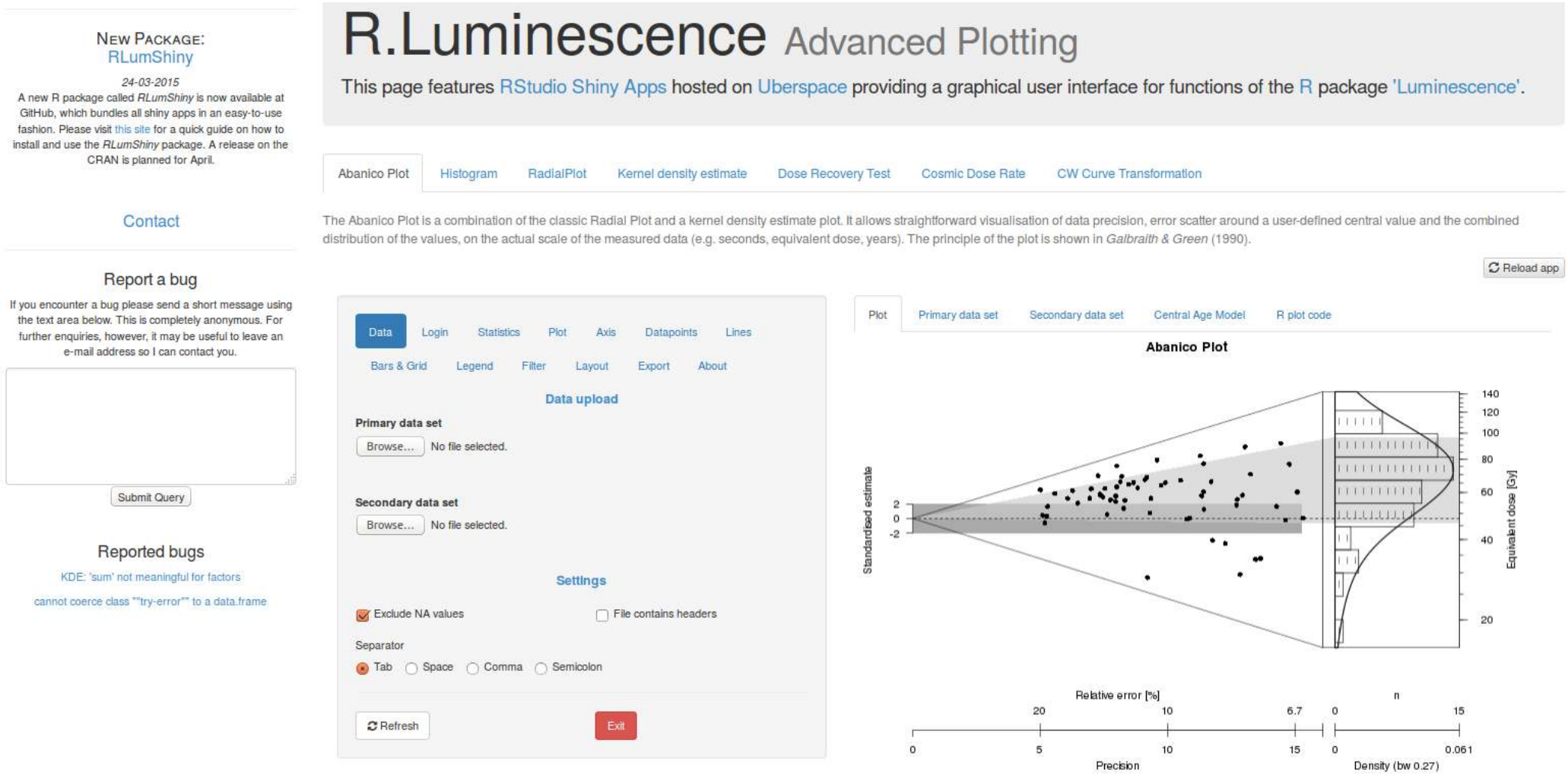
An alternative to probability density functions of pooled ages?



Data from Stauch et al. (2014)

```
plot_AbanicoPlot(data = data.frame(z, s), ...)
```

A summary The most important keywords during preparation of the article



http://zerk.canopus.uberspace.de/R.Lum/

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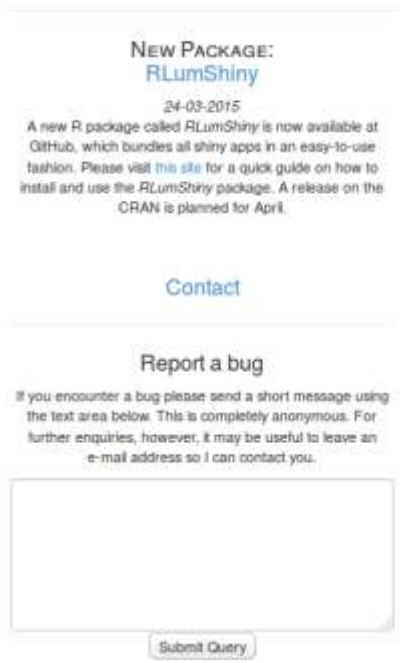
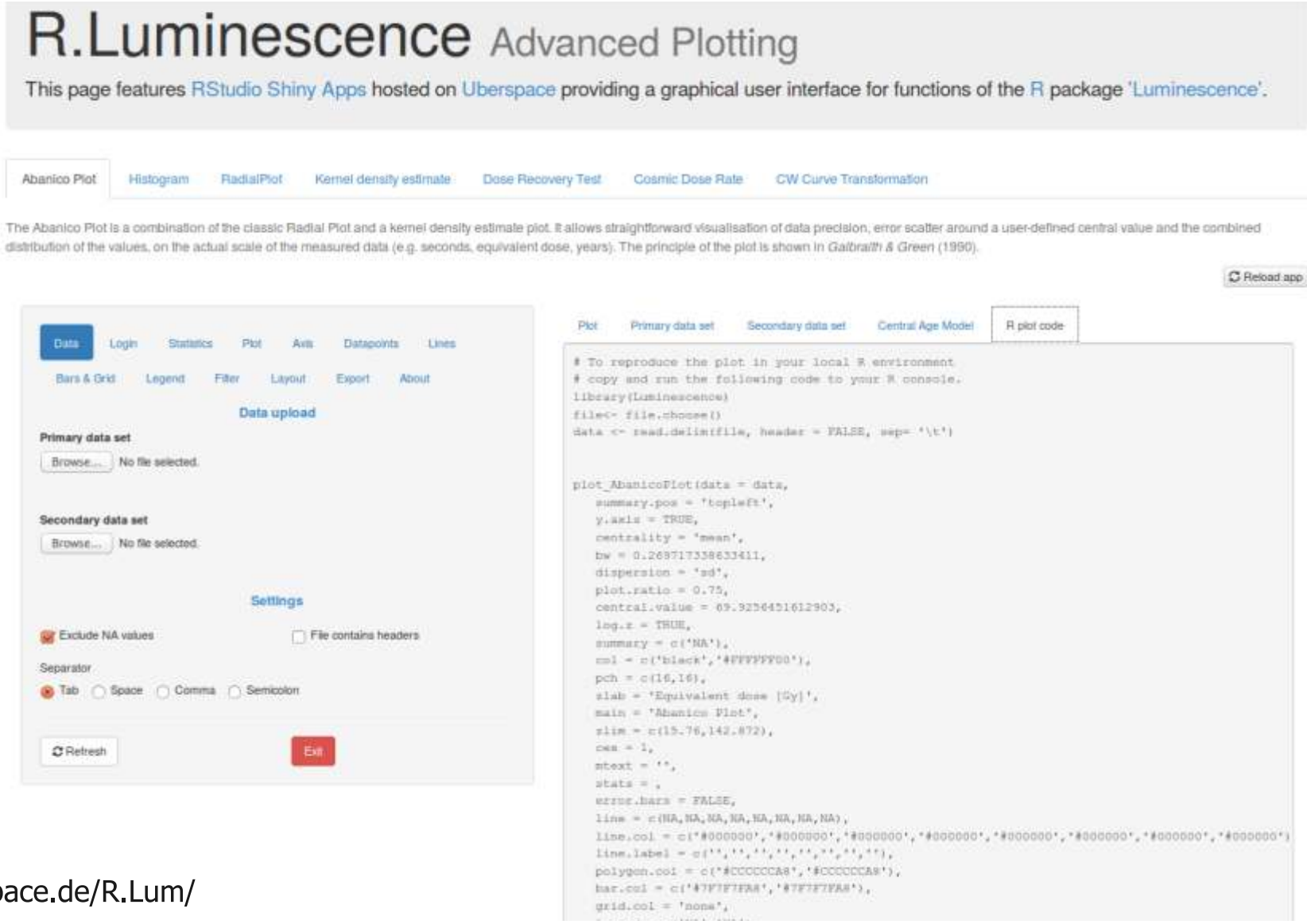
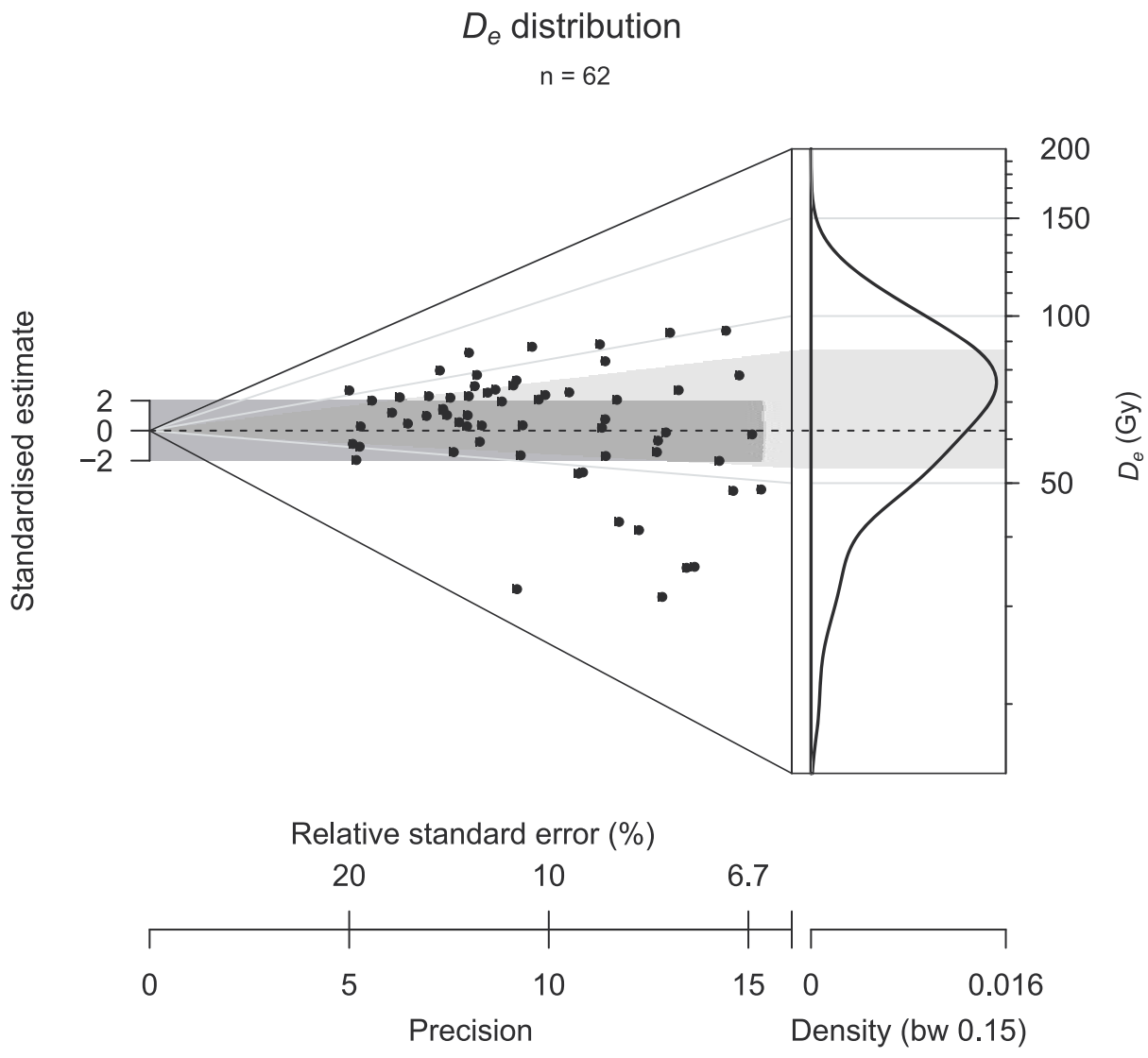


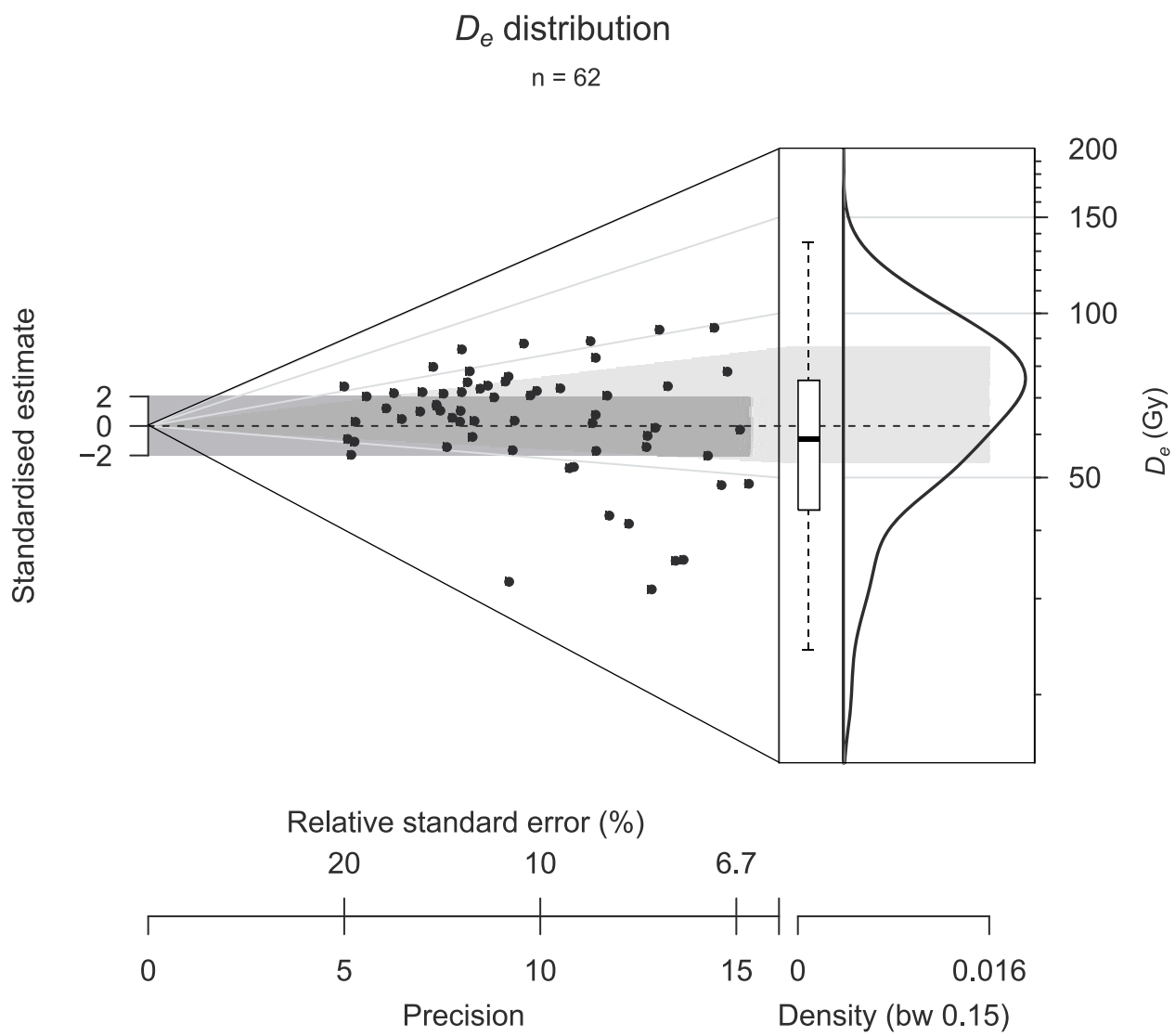


http://zerk.canopus.uberspace.de/R.Lum/

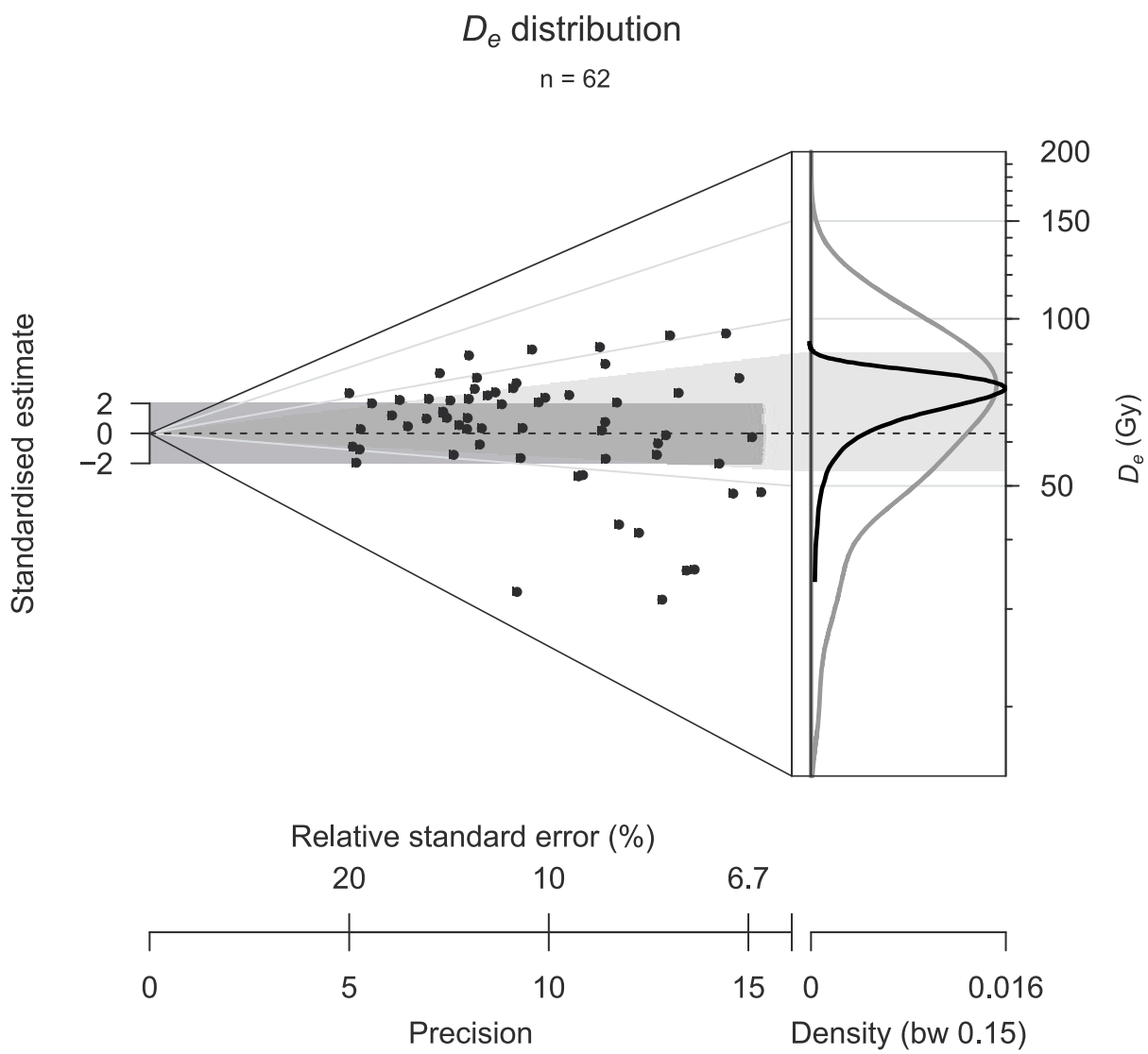
Where to go next Some future improvements, tweaks, generalisations



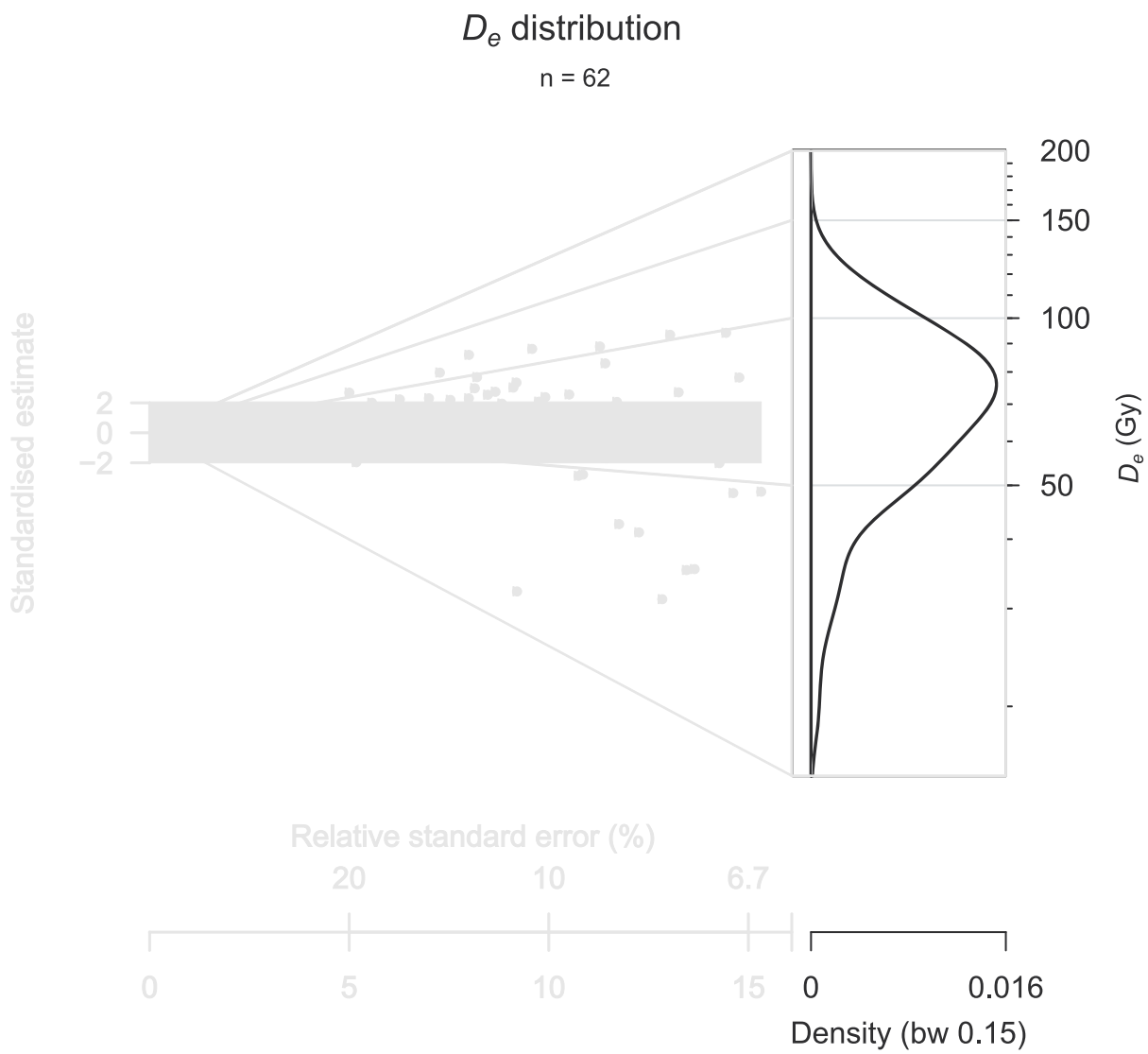
Where to go next Some future improvements, tweaks, generalisations



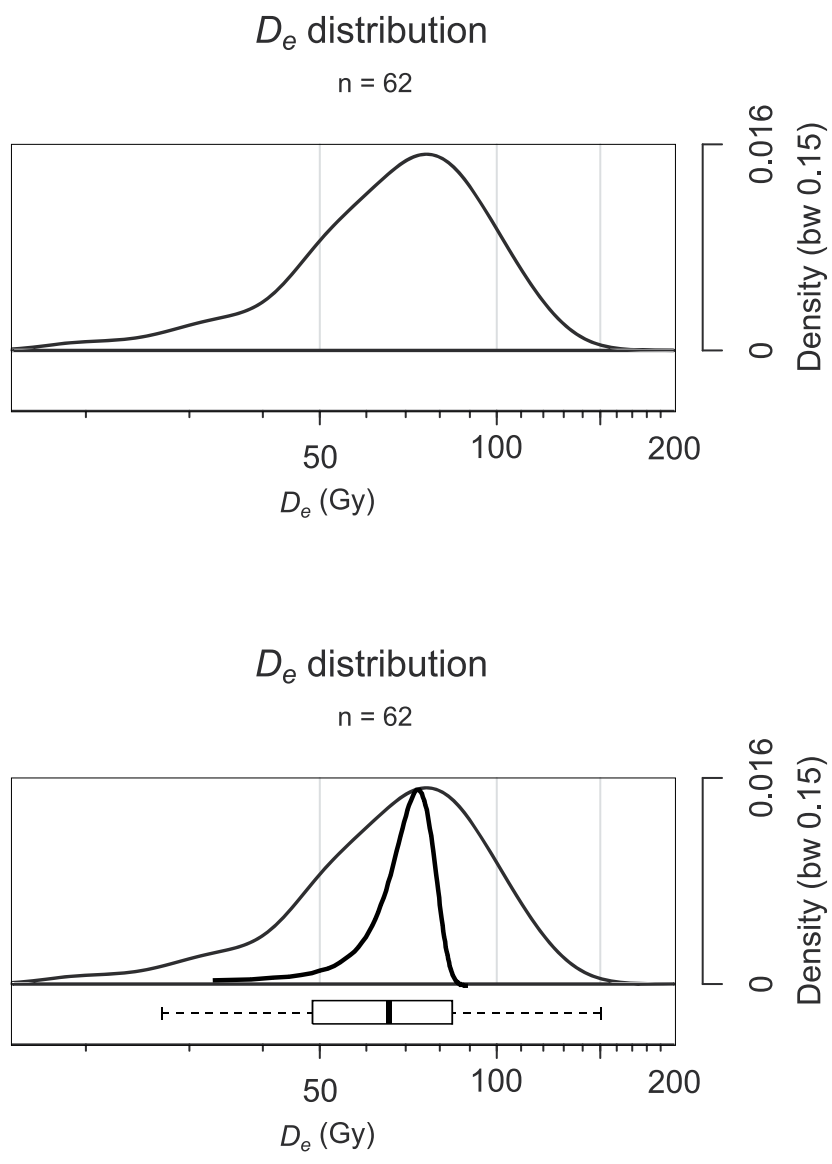
Where to go next Some future improvements, tweaks, generalisations



Where to go next Some future improvements, tweaks, generalisations



Where to go next Some future improvements, tweaks, generalisations



Where to go next ...

Let the users decide...

...implying they get involved!

Thank you!