Error Propagation for Trace Element Ratios

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Error Propagation for Trace Element Ratios

Often, uncertainty is only plotted on element-element bivariate diagrams. Including error bars on bivariates that have an element-element ratio on one of the axes requires error propagation through the ratio calculation.

Example: You want to include error bars on your plot of La/Sm

```r
errorMat <- matrix(nrow = 1, ncol = 3)
errorMat[,1] <- 0.0126
errorMat[,2] <- 0.0124
rownames(errorMat) <- "oneSig"
colnames(errorMat) <- c("La", "Sm", "LaSm")

data <- matrix(nrow = 1, ncol = 2)
data[,1] <- 12
data[,2] <- 2.63
rownames(data) <- "sample"
colnames(data) <- c("La", "Sm")
```

Simple function for propagating error through calculation of an element-element ratio.

```r
error_prop <- function(x, y, delta_x, delta_y) {
  # Inputs:
    ##  x = concentration of numerator element in your sample
    ##  y = concentration of denominator element in your sample
    ##  delta_x = one sigma uncertainty of numerator element
    ##  delta_y = one sigma uncertainty of denominator element
  # Outputs:
    ##  delta_z = one sigma uncertainty of trace element ratio

    delta_z = (x/y) * sqrt(((delta_x/x)^2) + ((delta_y/y)^2))

  return(delta_z)
}
```

```r
errorMat["oneSig", "LaSm"] <- error_prop(x = data[1,"La"],
                                         y = data[1,"Sm"],
                                         delta_x = errorMat["oneSig", "La"],
                                         delta_y = errorMat["oneSig", "Sm"])
print(errorMat)
```

```
##            La     Sm      LaSm
## oneSig 0.0126 0.0124 0.02203954
```