Tutorial on Data and databases: Wednesday, July 10, 2013
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The exercise is designed to introduce you to post-download events of a geochemical database. [There is a separate phenomena associated with accessing a db, and selecting a dataset. You'll have to consider that as a separate problem, which we are prepared to help you at another time.] I will provide example databases.

The initial paper "assigned" for reading is Ahrens (1954) (see the wiki page for the reference and pdf). The paper informs us that many elements have abundances that follow a log-normal distribution.

Goals:
MORB database
- evaluate the relative element variation in MORBs
- are there chemical systematics in the relative variation
- what are the best estimates of K, Th and U content of MORB?

Deep Crustal database
- evaluate the relative element variation in these samples
- are there chemical systematics in the relative variation
- what is the best estimate of K, Th and U content of the deep crust?

List of to do:
1 Calculate the follow in the MORB database
average [=average(capture your array of data)]
standard deviation [=stdev(capture your array of data)]
count [=count(capture your array of data)]
standard error of the mean
[=stdev(capture you array of data)/sqrt(count([=average(capture you array of data))]
median [=median(capture your array of data)]

log-normal data
- you need to generate a separate column of data for the log value of a sample's element concentration. So go to the far right of your data set and type
= ln(element concentration), then fill right, then fill down
average [=average(capture your array of data)]
standard deviation [=stdev(capture you array of data)]
- now calculate the new average value and the "+ limit" and "– limit"
= exp(average(capture your data array))
= exp("ln_average" + "ln_stdev")-average
= average-exp("ln_average" - "ln_stdev")

FIRST ORDER QUESTIONS:

What is the average compositional of the continental crust?
Middle crust?
Lower crust?
Continental Lithospheric Mantle?

What Average value?

Why do we need an average compositional model?
How do we benefit from these statistical treatments?

What is the composition of the continental crust?
How do we calculate this composition?
What are the uncertainties of this composition?

observations of data

Global MORB data

An important question is wha

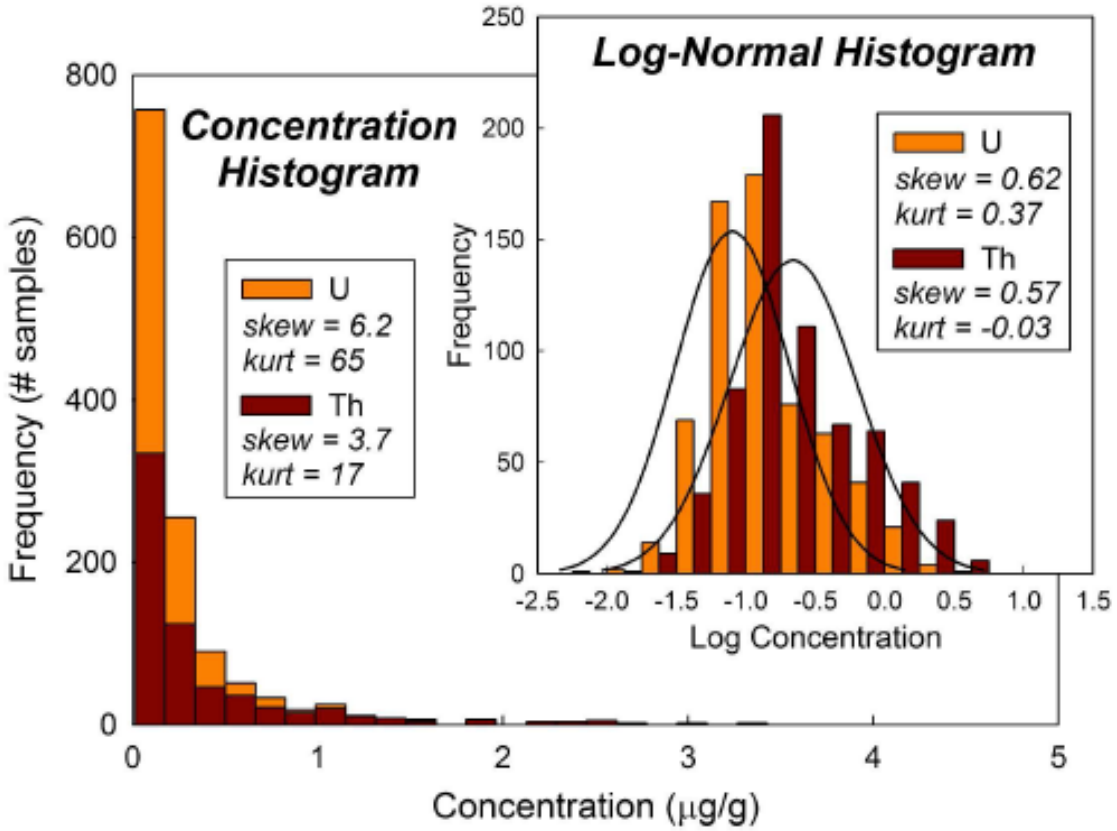


Figure 2 from Arevalo and McDonough

Examples of frequency distributions of highly incompatible trace element abundances in global MORB. Both Th and U are highly incompatible during mantle melting and thus are characterized by skewed distributions; however, taking the logarithm of the sample abundances of these elements normalizes the data into distributions with a more Gaussian geometry (Ahrens, 1954).

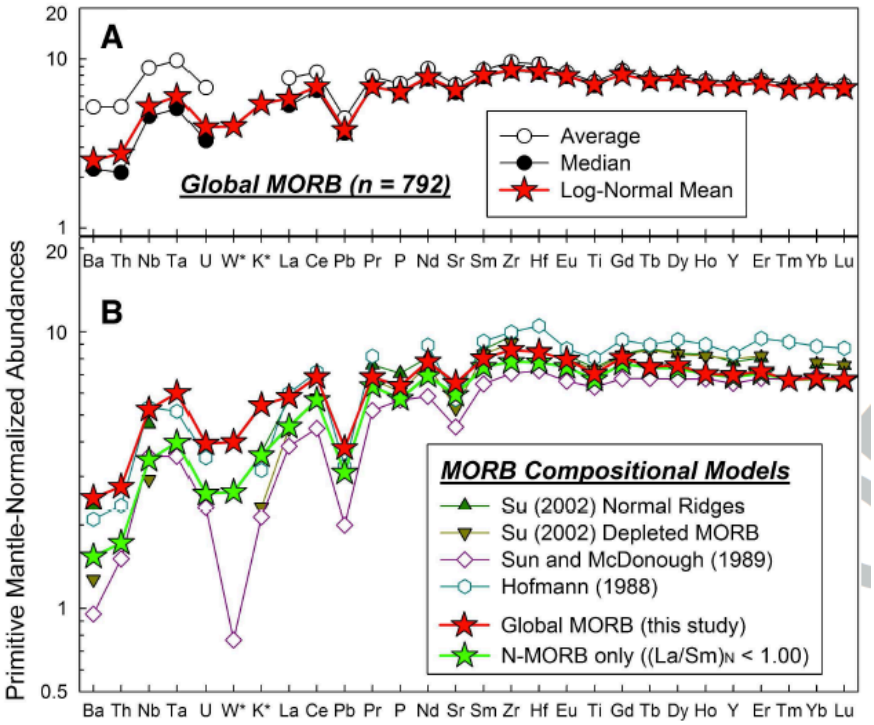
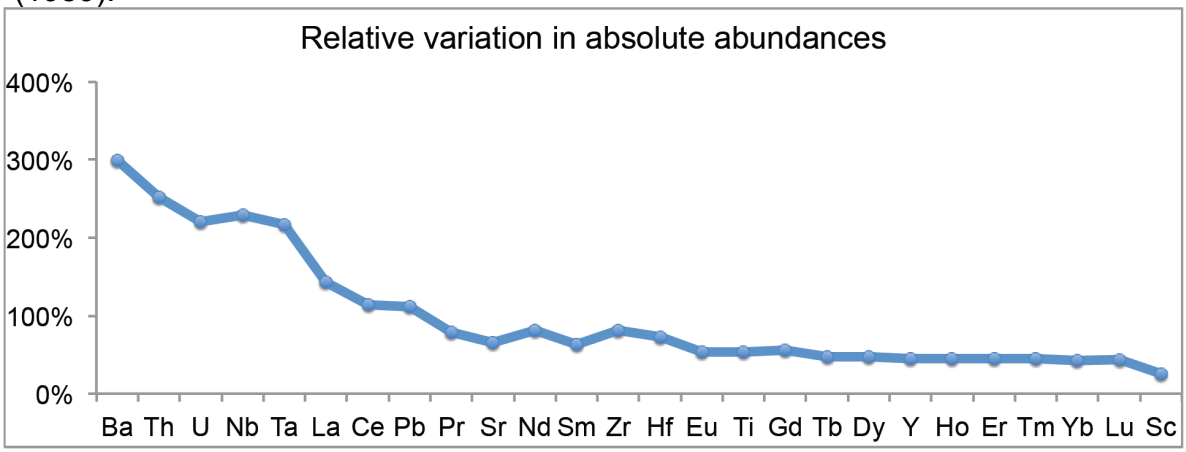


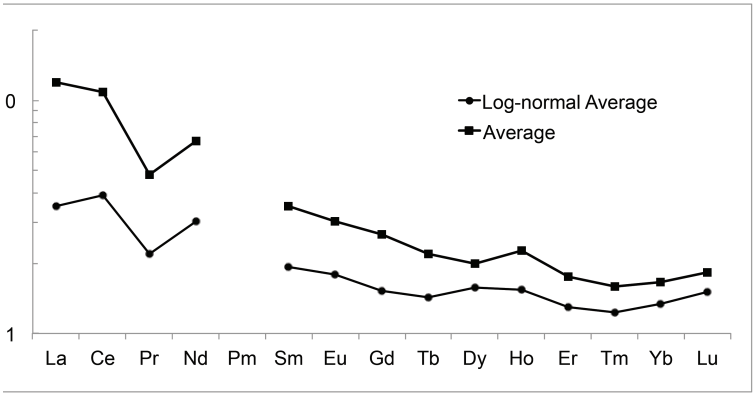
Figure 3 from Arevalo and McDonough

Primitive-mantle normalized abundances of trace elements in various compositional models of MORB chemistry. **The elements along the abscissa are ordered by relative incompatibilities observed in MORB**, as determined in previous studies (e.g., Hofmann, 1988; Sun and McDonough, 1989) and here. (A) The log-normal mean abundances of trace elements in our global MORB data set mimic the median rather than the statistical average due to the skewed frequency distributions of highly incompatible elements observed in terrestrial samples (see Fig. 2). (B) Global MORB represent a more incompatible element enriched composition compared to N-MORB and previous models of MORB composition, though the abundances of the less incompatible heavy REE merge with the values observed in N-MORB and predicted by Sun and McDonough (1989).



Relative variation in the absolute concentration of an element in MORBs (Arevalo and McDonough (2010) Global MORB data array.

Continental Lithospheric mantle?
Data from spinel-peridotite xenoliths



The above and below figures were generated from the databases we have here. My recommendation is that we should use the log-normal value to characterize element abundances in a deep Earth regions.

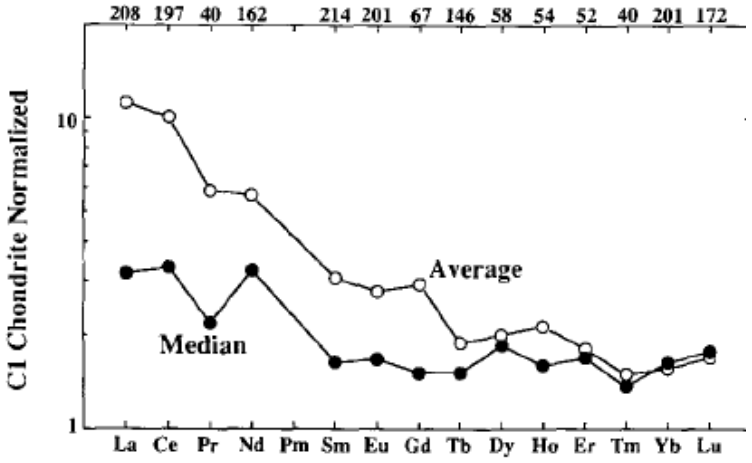


Fig. 2. C1 chondrite normalized diagram of the REE for tl
average and median spinel peridotite. Normalizing values fro
[24]. Numbers along the top of the figure refer to the numb
of data entries for each element which went into the avera
REE pattern.