Geochemistry --- Thursday, 6 June 2019

Hf-Nd isotopes *(due Wednesday 12 June 5 PM)*

Objective

Exploring Lu-Hf and Sm-Nd isotopes in dating and tracing Earth differentiation

1. Calculate the $^{176}Hf/^{177}Hf$ ratio of the Earth at 3.2 Ga given Initial CHUR $^{176}Hf/^{177}Hf$ =0.279794, present day $^{176}Lu/^{177}Hf$ =0.0336, $^{176}Hf/^{177}Hf$ =0.282785, and λ for $^{176}Lu=1.867 \times 10^{-11}$ $year^{-1}$. Calculate its ε_{Hf} value relative to the CHUR value at that time.

2. Calculate the present-day $^{176}Hf/^{177}Hf$ and $^{143}Nd/^{144}Nd$ ratios of the Depleted Mantle assuming it has ε_{Hf} and ε_{Nd} values of +20 and +10 , respectively. Assuming they were derived from a primitive mantle (chondritic) source 2 billion years ago, then calculate its present day $^{176}Lu/^{177}Hf$ and $^{147}Sm/^{144}Nd$ values.

3. Plot the evolution lines for CHUR and the Depleted Mantle in epsilon vs. age (time) space for the last 4.5 Ga and sketch a likely chondrite-normalized REE (and Hf) pattern for the Depleted Mantle.