LDRIMS Rb-Sr Geochronometry

F. S. ANDERSON[1]* AND K. NOWICKI[1]

[1]Southwest Research Institute, 1050 Walnut, Suite 300, Boulder, CO 80302 USA
(*correspondence: anderson@boulder.swri.edu)

We are developing a portable laser desorption resonance ionization mass spectrometer (LDRIMS) for determining the radiometric age of rocks using ^{87}Rb-^{87}Sr, as well as constraining lithologic evolution and measuring chemical composition.

Our current prototype can measure the strontium isotope ratio of lab standards with 10 ppm net Sr to a precision of ±0.1% (1σ), with a sensitivity of $1{:}10^{10}$ in less than 15 minutes. The speed of the LDRIMS measurement allows thousands of samples to be measured in significantly shorter periods of time than traditional methods, with little or no sample preparation. Models of the age error for ±0.1% (1σ) accuracy based on previous measurements of the SNC meteorites show that for ALH84001 and Zagami dates with analytical uncertainties less than ±50 Ma are possible (Fig. 1). We are currently working on measuring Rb simultaneously (Fig. 2).

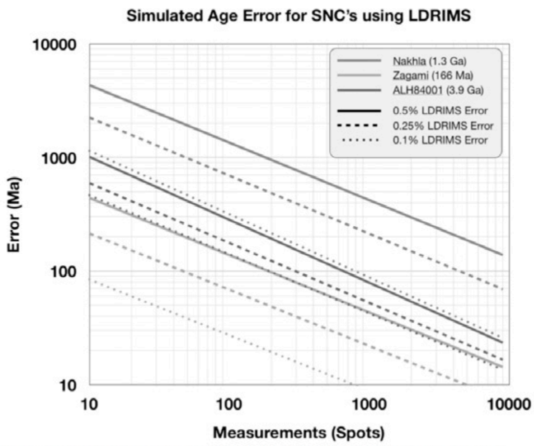

Figure 1: Modeled errors for 3 SNCs show that for precision of ±0.1% and 1000 spots, dates with error <±50 Ma are possible.

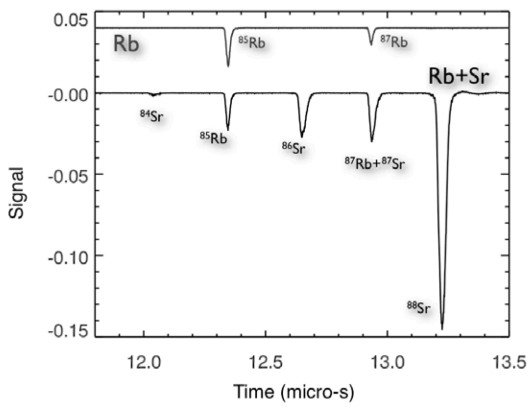

Figure 2: Measurement of Rb and Sr in a sample using LDRIMS.

The bipolar seesaw versus the winds

R.F. ANDERSON

Lamont-Doherty Earth Observatory, Palisades, NY, 10964 USA (boba@ldeo.columbia.edu)

Ice cores, marine and terrestrial records indicate a phased relationship between the two polar hemispheres during millennial-scale climate variability. Cold stadial conditions in the Northern Hemisphere (NH) are accompanied by warming in Antarctica and by rising atmospheric carbon dioxide concentrations. When conditions warm abruptly in the north, Antarctica begins to cool.

These relationships are generally attributed to the oceanic bipolar seesaw, whereby warming and cooling in both polar hemispheres is attributed to varying heat transport by Atlantic Meridional Overturning Circulation (AMOC).

Evidence for varying AMOC is robust and there is now consensus that it had a powerful impact on NH climate. However, can it account for observed changes in the Southern Hemisphere (SH)? Or is it necessary to invoke a greater role for atmospheric circulation?

Evidence for changes in atmospheric circulation during stadials is widespread throughout the NH and in the tropics. During each major stadial, the Asian monsoon weakened and the Intertropical Convergence Zone shifted southward.

Some models suggest little change in atmospheric circulation south of the tropics during NH stadials. However, we propose that the oceanic bipolar seesaw alone is not sufficient to explain the observed variability of the mid and high latitudes of the SH. In addition to the regular rise in atmospheric CO_2 during stadials, which can be linked to wind-driven upweing in the Southern Ocean, changes in the position of the Subtropical Front, varying leakage of Agulhas Current water into the Atlantic Ocean, increasing sea surface temperatures far in excess of those predicted by models, and rapid retreat of mid-latitude SH mountain glaciers during NH stadials all indicate a significant role for SH winds.