Geophysical Research Abstracts
Vol. 13, EGU2011-13002, 2011
EGU General Assembly 2011

Use of laser spectroscopy to measure the $^{13}C/^{12}C$ and $^{18}O/^{16}O$ compositions of carbonate minerals

Shaun Barker (1), Gregory Dipple (1), Feng Dong (2), and Douglas Baer (2)

(1) Mineral Deposit Research Unit, Department of Earth and Ocean Sciences, University of British Columbia, Vancouver, BC V6T1Z4, Canada, (2) Los Gatos Research, Inc. 67 East Evelyn Avenue, Suite 3, Mountain View, CA 94041-1529

The stable carbon and oxygen isotope composition of carbonate minerals are utilized throughout the earth and environmental sciences for various purposes. Here, we demonstrate the first application of a prototype instrument, based on a cavity enhanced laser absorption technique (off-axis integrated cavity output laser spectroscopy or OA-ICOS), to measure the carbon and oxygen isotope composition of CO_2 gas evolved from the acidification of carbonate minerals. The isotopic specific measurements of $\delta^{13}C$ and $\delta^{18}O$ were recorded from absorption spectra of $^{12}C^{16}O^{16}O$, $^{13}C^{16}O^{16}O$ and $^{12}C^{16}O^{18}O$ in the near-infrared wavelength region. The instrument was calibrated using $CaCO_3$ minerals with known $\delta^{13}C$ and $\delta^{18}O$ compositions, which had been previously calibrated by isotope ratio mass spectrometry relative to the international isotopic standards NBS-18 and NBS-19. Individual analyses are demonstrated to have internal precision of better than 0.15 ‰ for $\delta^{13}C$ and 0.6 ‰ for $\delta^{18}O$. Analysis of 4 carbonate standards of known isotopic composition over 2 months, determined using the original instrumental calibration, indicates that analyses are accurate, with accuracy of better than 0.6 ‰ for $\delta^{18}O$ and better than 0.5 ‰ for $\delta^{13}C$. In comparison to CF-IRMS, OA-ICOS (cavity enhanced laser absorption) offers an extremely cost-effective, low power, and robust technique for quickly measuring the stable isotopic composition of carbonate minerals. The instrument requires very few consumables, can be operated by non-expert users, and can be easily deployed into field-based research environments.