Amino Acids in Serpentinization Fluids from the Atlantis Massif. Nick Camper[1], Susan Q. Lang[1], IODP Expedition 357 Science Party
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Introduction: Amino acids are powerful biomarkers and can also potentially be produced abiotically in locations where water-rock serpentinization reactions occur. The International Ocean Discovery Program Expedition 357 drilled multiple boreholes into the Atlantis Massif with the goal of investigating the connection between serpentinization, subseafloor life, and carbon cycling. Fluids flushed from the boreholes were collected and should reflect a mixture of seawater and subseafloor materials. Water column samples were also collected above drill sites before drilling, from the plume of the near-by Lost City Hydrothermal Field, and from background seawater. Analysis of the fluid samples is currently underway to determine the concentrations of total hydrolysable amino acids and muramic acid, as well as the D/L ratio of amino acids. During primary production microorganisms will produce high concentrations of amino acids that have low D/L ratios. Muramic acid is produced by bacteria as part of their cell walls while elevated concentrations of cysteine can reflect activity by methanogens and sulfate reducing bacteria. During heterotrophy, concentrations of free and hydrolyzed amino acids as well as D/L ratios change in predictable ways. For example, during microbial degradation aspartic acid and glutamic acid degrade into the non-protein amino acids β-alanine and γ-aminobutyric acid. Low D/L ratios are indicative of a freshly produced biotic origin of the amino acids, whereas higher D/L ratios may indicate either heterotrophic reworking or an abiotic input. The amino acid data will be compared to other fluid geochemical data to identify the important factors in driving patterns in abundances. Ultimately, the concentrations and D/L ratios will be used to determine the sources of amino acids and to identify locations of an active subseafloor biosphere.