

Teaching Stable Isotope Geochemistry in an Undergraduate Petrology or Geochemistry Course.

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Goal: To introduce students to the use of stable isotope geochemistry in petrology, and to provide a framework and lesson plan to assist instructors.

Rationale: Stable isotope geochemistry has become commonplace in petrologic literature and stable isotope data strongly influence interpretations of many petrologic processes. In spite of this, undergraduate petrology textbooks tend to present limited background on stable isotope fundamentals and applications. In addition, stable isotopes provide an opportunity for quantitative problem solving that is mathematically within reach of students and involves a variety of chemical and geological processes.

Time Required: This lesson is designed for two 75-minute class meetings with homework reading and problem assignments to be completed before class. If only one class time is available, Part 1 can stand alone with an abbreviated version of the Part 1 Classroom Activity, followed by presentation of the Alta aureole isotope data and class discussion.

Lesson Plan Overview: This lesson plan consists of three parts. These can be incorporated into a petrology course, partly or entirely, depending on time and desired depth of coverage. The materials include the following:

Part 1 Reading Assignment (for students) to introduce the main concepts of stable isotope geochemistry.

Part 1 Problem Assignments (for students) designed to reinforce the concepts introduced. This assignment is embedded in the reading assignment.

Part 1 Classroom Activities (for instructor) includes suggested questions for in-class discussion after students have completed the reading assignment with problems.

Part 2 Reading Assignment (for students) covers specifics of coupled C-O isotopic trends due to volatilization (Batch and Rayleigh models), and fluid infiltration “exchange fronts.”

Part 2 Problems (for students) designed to reinforce the concepts covered in reading. These problems are less structured than Part 1.

Part 3 Reading Assignment (for students) introduces the Alta contact aureole, stable isotope data from the aureole, and a fluid infiltration interpretation.

Part 3 Problems (for students) designed to reinforce the concepts covered in reading. These problems are fairly open-ended.

Answer Sheets for all Problems (for instructor). Spreadsheets of “raw data” (for the students) and “complete data” (for instructors, with all plots included) are included and can also be found at <http://www.mtholyoke.edu/courses/sdunn/geol201/index.html>