Tracking Student Progress With a Mineralogy/Petrology Concept Inventory

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Purpose

- Measure the progression of student abilities through core introductory geology courses into upper level geology courses

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Motivation

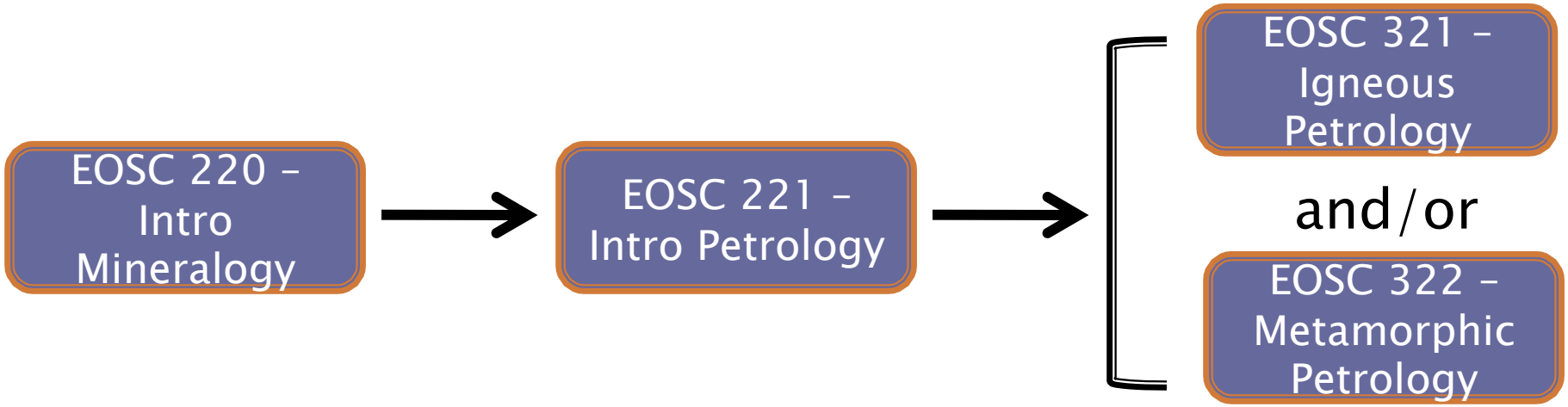
- Instructors of upper level courses have noted pre-requisite skills that are lacking
- Upper level students have noted that core concepts and skills are not always clear to them

Assessment Development

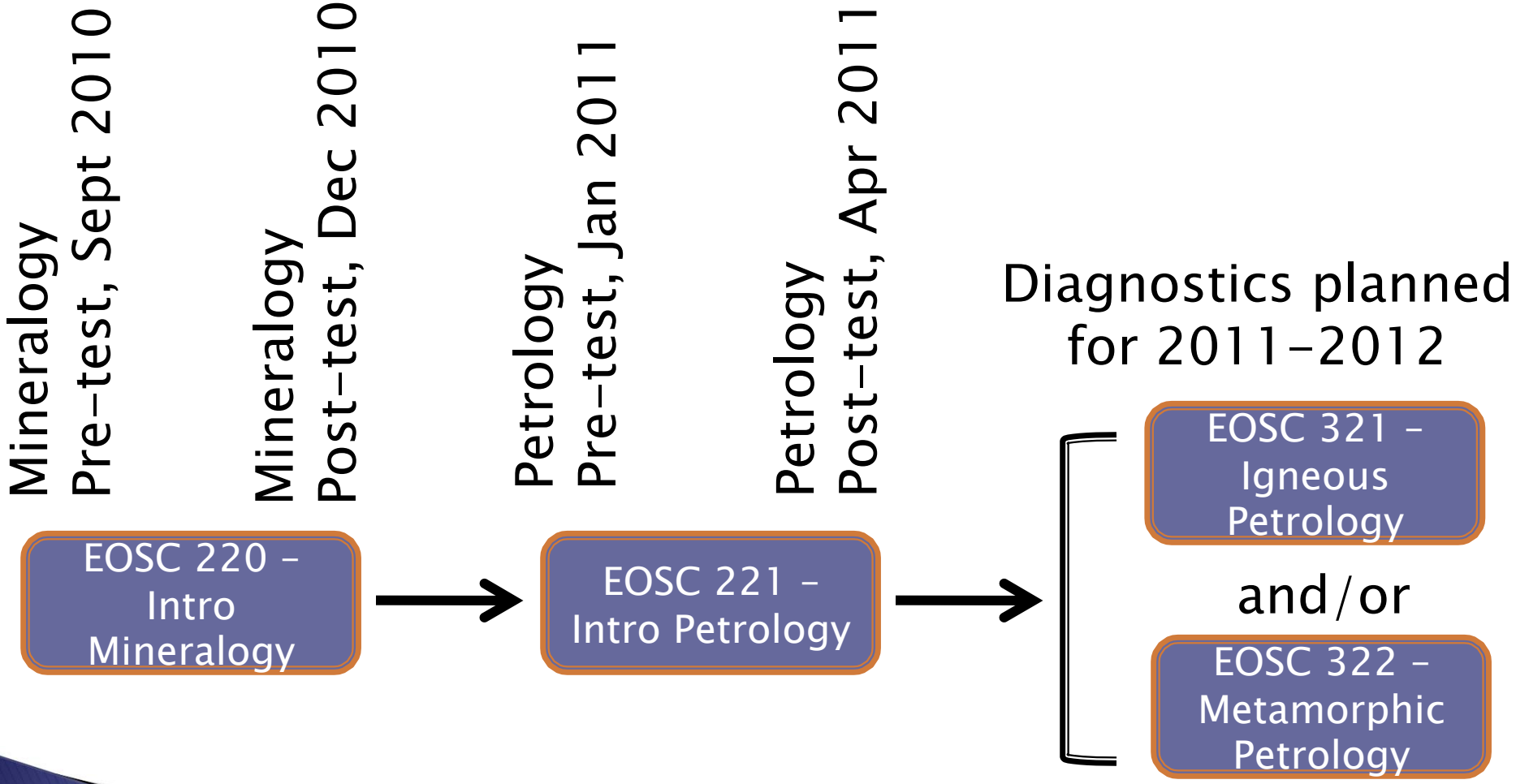
- Identify learning goals that instructors rated both crucial & consistently difficult for students
- Create test questions to assess these particular goals
- Improve questions based on faculty comments
- Validate the tests through one-on-one interviews to ensure students understand and interpret questions as intended
- Administer the tests (Sept. 2010-April 2011 complete, continue next year)

Course Sequence

- First introductory geology courses for majors in 2nd year (Mineralogy & Petrology)
- Specific upper level Petrology courses in 3rd year (Igneous Petrology & Metamorphic Petrology)



Assessment Sequence



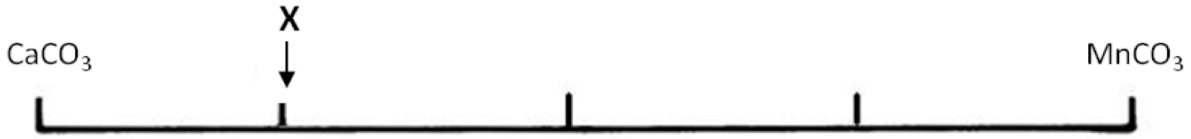
Results – General

- Small learning gain in Mineralogy (53% to 67% average score)
- Similar learning gain in Petrology, with a lower pre- and post-average score (42% to 58%)
- Good retention over the Winter Break (similar scores on all questions that were asked on the Mineralogy Post and Petrology Pre)

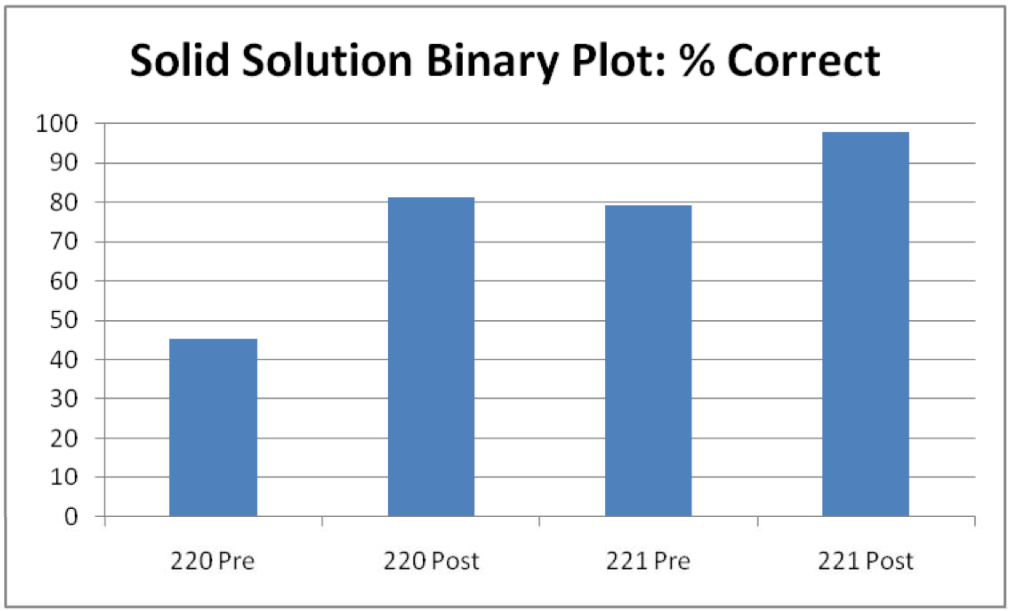
Results – Binary Plots

- Proficiency increases throughout the year, ending with 98% correct

Calcite ($CaCO_3$) and rhodochrosite ($MnCO_3$) form a complete solid solution series, which means that Mn can substitute for Ca in the chemical structure in any proportion and vice versa. What is the % Ca of mineral 'X' on this line?

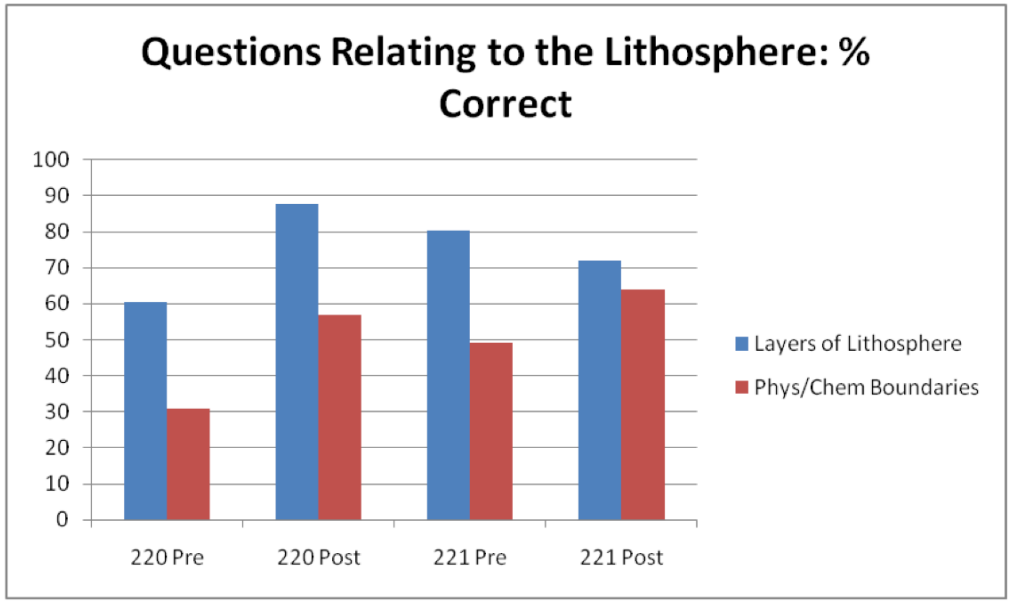


a) 20%
b) 25%
c) 50%
d) 75%
e) 80%



Results – Lithospheric Concepts

- Identification gets **WORSE** and recognition of physical/chemical boundaries gets **BETTER**
- Overall scores on both are poor, and are considered to be fundamental concepts by instructors



Layers of Lithosphere: Which part of the Earth is referred to as the lithosphere?

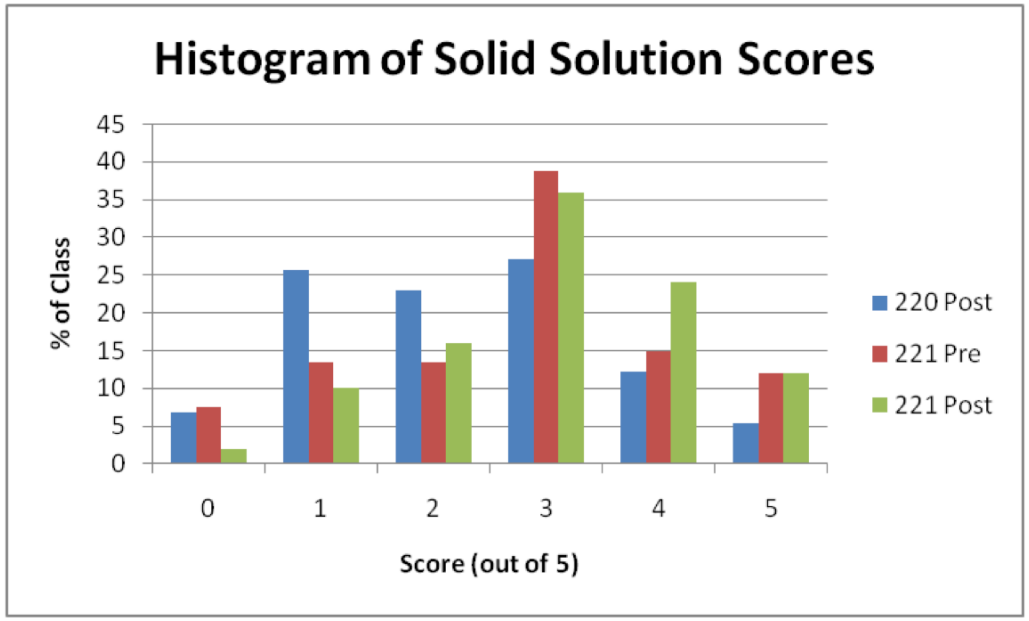
a) Lower mantle and core
b) Upper mantle
c) Crust and upper mantle
d) Crust
e) Lower mantle

Phys/Chem Boundaries: Which two adjacent layers on/in Earth are physically different in their material properties but chemically are **THE SAME**?

a) Atmosphere/crust
b) Atmosphere/lithosphere
c) Crust/upper mantle
d) Upper mantle/lower mantle
e) Lower mantle/outer core

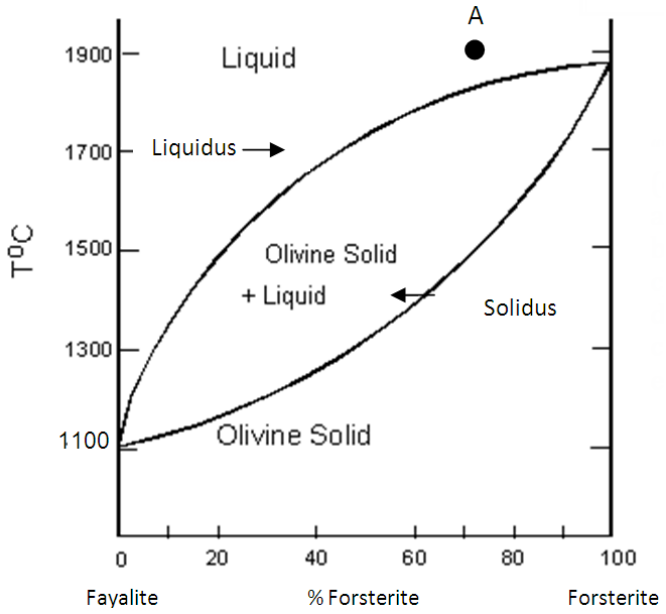
Results – Solid Solution Diagrams

- Students are not yet proficient, but average scores do improve throughout the year



Answer **ALL** of the questions a through e relating to the diagram below. The following questions **ALL** refer to a cooling system (decreasing temperature) beginning at point A.

a) What is the % **Forsterite** of the liquid at point A?
b) At what **temperature** do the first crystals form?
c) What % **Forsterite** are the first crystals?
d) At what **temperature** has the liquid completely crystallized?
e) What % **Forsterite** is the last drop of liquid?



Conclusions

- Strong improvements on some key concepts
- Persistent low scores on other key concepts
- Valuable insights for instructors to help inform future course plans
- Still much to learn!

Future Assessment Plans

- Revise tests for 2011-2012
- Implementation for 2011-2012:
  - Pre- & Post- tests for 220 & 221
  - Diagnostics for 321 & 322