Revision of the Geology Curriculum for Mining Engineering Undergraduates

BACKGROUND

Overview
Mining Engineering undergraduates currently take 10 credits of geology coursework as part of the ABET accredited bachelor’s degree. The students have been struggling to connect geological concepts to mining-specific applications, and key topics such as mining geology and mineral exploration have not been historically taught. The goal of this revision is to divide the junior-level credit hours evenly between two courses, redistribute the content, and focus specifically on geological concepts that are directly to mining in order to maximize the utility of the allotted credit hours. In addition, the pedagogy will emphasize constructive learning to improve the student experience.

Previous Courses in the Curriculum
GEOL 101 (4 credits): Earth and Environmental Systems
  Introductory physical geology with laboratory
GEOL 310 (4 credits): Earth Materials and Resources, with laboratory
  Mineralogy
  Petrology
  Ore deposits
GEOL 311 (2 credits): Structural Geology for Mining Engineers, with laboratory
  Regional scale structural geology; brittle and ductile zone
  Significant repetition in other required courses (e.g. Rock Mechanics)

WHAT IS CHANGING

New Courses in This Revision
GEOL 101 (4 credits): Retain as currently taught

MNGN XXI (3 credits): Mining Geology I, with laboratory
  Mineralogy
  Petrology
  Structural geology (eliminating repetition with other MNGN classes)
MNGN XX2 (3 credits): Mining Geology II, with laboratory
  Ore deposits, taught directly through case studies
  Mineral exploration
  Mining geology

INTENDED OUTCOMES

Learning Outcomes: Mining Geology I
1. Describe the physical and chemical characteristics of an individual rock or soil type (6 weeks)
2. Collect and analyze field data to provide evidence for how rocks and minerals are formed (2 weeks)
3. Develop a descriptive model using diagrams and data to predict or explain tectonic motion on a local and regional scale, using the concepts of plate tectonics, paleogeography, stress, strain and deformation mechanisms (3.5 weeks)
4. Compare how water interacts with the different rock and soil types in #1 in terms of quantity, quality, and physical behavior (1.5 weeks)
5. Propose a geological site investigation based on geological data and an engineering project plan (1.5 weeks)
6. Analyze data to provide evidence for how site’s geology controls the environmental issues (1.5 weeks)

Learning Outcomes: Mining Geology II
1. Predict the physical characteristics of an ore deposit based on a geological deposit model, and identify how these characteristics impact mining activities for major deposit types (6 weeks)
2. Propose a mineral exploration program based on site and deposit type characteristics (4 weeks)
3. Predict the geometallurgy of an ore deposit using the geological deposit model (1 week)
4. Predict the environmental issues at a site based on an understanding of the geological characteristics of the ore deposit style (1 week)
5. Construct a geological model of a given ore deposit based on exploration data and the deposit style (4 weeks)

Example Assessments:

Formative Assessment for Mining Geology II, Learning Outcome #3
“Categorizing Grid.” Students organize geometallurgical characteristics (ore and alteration mineralogy, rock properties), comminution and mineral processing techniques according to ore deposit styles.

Summative Assessment for Mining Geology II, Learning Outcome #4
“Analytic Memo” exercise: Predict whether the Pebble deposit is acid generating based on your knowledge of porphyry deposits. Calculate the acid generating and neutralizing potential for the Pebble ore body using their environmental baseline data. Write a memo to the Environmental Protection Agency recommending whether you think the site should be developed and if so, how.

Elizabeth Holley is an Assistant Professor in the Department of Mining Engineering. Professor Holley’s research interests include: Mineral exploration vectors, genetic models, and geological controls on production. She is currently teaching Mining Engineering Design and Mining Graduate Seminar.

June 2016 Cohort