

Proposal Title: **Increasing Student Engagement in Introductory Labs Through Active Learning**

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Budget Request: \$2,000

Courses Targeted: GEOL 1404: Introductory Physical Geology Laboratories
Average Enrollment per semester: 160

Executive Summary:

This proposal requests funding to purchase new equipment for use in introductory physical geology laboratory courses. The department is undertaking a total revamp of the introductory physical geology laboratory courses with a renewed focus on active learning processes. I have applied for faculty developmental leave to facilitate the redevelopment of the physical geology labs and a rewrite of the physical geology laboratory manual. We envision that the newly redesigned laboratories would facilitate more cooperative learning and problem solving using 'real' data generated by the students.

Proposal Summary:

As part of the laboratory manual rewrite, we are designing more active learning laboratory exercises. These new laboratories will require new (and updated) materials and equipment to be successful.

Physical geology laboratories are incorporated into the GEOL 1404: Physical Geology course. Physical Geology serves as one of the department's core course offerings. The course is taken by a diverse population of students who are not typically STEM majors (with the exception of geology and environmental science majors). Typical majors include business, education, criminal justice, psychology, and even art/theater.

As such, the physical geology laboratories give a unique opportunity to educate non-scientists in the process of doing science – as opposed to observing science.

This proposal is focused on funding durable equipment for two of the proposed new laboratories: Isostasy and Plate Tectonics

Isostasy Lab – Isostasy is the concept that a state of gravitational equilibrium exists between the Earth's two crustal types and the underlying mantle asthenosphere. This concept explains fundamental features about the planet's surface such as differing topographic heights, the difference in elevation of oceanic basins and continents, and crustal flexure due to loading.

In the isostasy laboratory, the students will generate data using wooden blocks of different densities to determine their buoyancies (Archimedes Principle). Students will also determine densities by measuring the volume of the wooden blocks and massing the blocks on a mass balance. Data from the two principles will be compared to 'ground-truth' the validity of the technique. Students will then use the

Archimedes principle to determine the mass of irregular objects (in this case samples of basalt and granite to represent the two types of crust on the planet). Data will then be compared to real world measurements.

Materials needed: Mass Balances, graduated cylinders, wooden blocks, tubs

Plate Tectonics Lab – Plate tectonics is the way that our planet works. One of the manifestations of plate tectonic processes are deformed rocks, which may be folded and faulted. Students often have a basic concept of folds and faults but do not necessarily understand the mechanics of deformation. Simple analogue models can be of great utility in facilitating student understanding.

In the Plate Tectonics lab, the students will use simple squeeze boxes to simulate folding and faulting of rock layers. Students will use layers of media to model rock layers and then to model compression (Figure 1) and tension (Figure 2) of the layers. Students will investigate topics like strain rate dependence, effect of anisotropy of materials, effect of layer thickness, etc. Data generated can be used to generate graphs or numerical models of faulting and folding.

Materials Needed: Squeeze boxes*, media
*(alternately material to make the squeeze boxes)



Figure 1. Simple squeeze box showing folding and faulting of media.



Figure 2. Simple squeeze box showing extensional faulting of media.

Proposed Budget:

Budget:

	Quantity	Price	Total
Mass balance	3	\$398.00	\$1,194.00
Oak 4x4x8'	2	\$40.00	\$80.00
Balsa 4x4x1'	4	\$15.00	\$60.00
Squeeze Box Materials			
Glass/Plexiglass Plates	20	\$15.00	\$300.00
No. 1 grade 2x6x8'	7	\$9.00	\$63.00
screw hardware	10	\$20.00	\$200.00
Miscellaneous			\$103.00
		TOTAL	\$2,000.00

Budget Justification:

Materials for the squeeze boxes are requested to produce ten squeeze boxes. Average enrollment per lab is twenty students. This would yield a 2:1 student to squeeze box ratio. I will make the squeeze boxes. Commercial squeeze boxes of the type I will make sell for approximately \$115 each. I believe I can make comparable boxes for one third the price.

Mass balances are not something we can fabricate in-house. Oak and Balsa would be for the wooden block models used in the laboratory.