DEAN'S ADVISORY COMMITTEE
STUDENT VENTURE GRANT APPLICATION

Please read all instructions and regulations on the reverse side of this sheet prior to the completion of this form. **The original plus 7 copies of your proposal are due in the Dean's Office on the 2nd Friday of the Block by 1:00 p.m.**

DATE SUBMITTED 13, October 2006

NAM _____ **SS** '07 **WORNER BOX** _____ **T** _____

ID # _____ **HOMETOWN (Not Address)** Spokane, WA

NAME _____ **CLASS** _____ **WORNER BOX** _____ **EXT.** _____

ID # _____ **HOMETOWN (Not Address)** _____

PROJECT TITLE Investigations and Education of the Deformation and Rheology of Rocks in the context of Volcanic Hazards.

BRIEF DESCRIPTION OF INTENDED USE OF FUNDS

To travel to University of B.C. in order to utilize an apparatus called the (VDR) to conduct research for my geology thesis and in turn, create educational lessons.

PROPOSED DATE/BLOCK OF USE Block 3, 2006

NAME OF FACULTY SPONSOR Christine Siddaway & Kris Stanec

HAVE YOU BEEN THE RECIPIENT OF A PREVIOUS VENTURE GRANT Yes (No)

IF SO, WHAT AMOUNT? ϕ **WHEN?** ϕ **REPORT SUBMITTED?** ϕ

TOTAL AMOUNT OF VENTURE FUNDS NOW REQUESTED $1000

ARE YOU SEEKING OTHER FUNDING FOR THIS PROPOSAL? Yes (No)

IF YES, WHAT IS THE SOURCE? _____

If this proposal is approved, I understand that it is my responsibility to notify the Dean's Office immediately if I do not pursue my project as proposed to the Dean's Advisory Committee. I further understand that all funds are to be used according to the proposal as submitted and approved by the Dean's Advisory Committee. Any changes to an approved project must be submitted to the Chair of the Committee for approval. **Please note: the IRS requires that we report Venture Funds as taxable income.**

SIGNATURE _____ **DATE** 10/12/06

**********DO NOT WRITE BELOW THIS LINE**********

DATE _____ **ACTION TAKEN** _____ **DATE** _____

BLOCKS TO BE USED _____ **REPORT SUBMITTED** _____

COMMENTS AND SUGGESTIONS:

VENTURE GRANT APPLICATION

Investigations and Education of the Deformation and Rheology of Rocks in the Context of Volcanic Hazards

---

I am proposing first, to research the mechanisms of deformation at the microscopic and atomic level in volcanic rocks for my senior distinctions thesis in geology. I will conduct lab experiments using a high-temperature experimental apparatus located in a volcanology lab at the University of British Columbia. In turn, I will also be integrating this research into an educational project. I will design and teach innovative and interactive lessons in order to educate students about the way the surface rocks behave in volcanically active and therefore hazardous areas. The liberal arts education I have received thus far at CC has allowed me discover two passions and academic interests: geology and education. I am requesting funds to support air travel, per diem costs, and research expenses associated with this project in order to have a capstone experience that, in many ways, serves as a culmination of my undergraduate experience. The success of my senior thesis and educational project hinge upon this research experience in the volcanology lab in Vancouver BC.

During my FYE Geology course, I remember standing in front of a brilliant metamorphic rock studying the wild designs while my professor, Christine Siddoway, told us this rock flowed like a liquid. This concept sparked my interest instantly. The perception that rocks are static, stable and non-changing is a common misconception. In fact, rocks are dynamically changing and deforming in diverse ways, especially in volcanically active areas. This fundamental earth process is dependant upon numerous variables encompassed by the study of Rheology. In 1920, the term Rheology was coined by Eugene Bingham and inspired by Heraclitus of Ephesus'

expression, *panta rei*, which means "everything flows". Rheology is the study of flow and deformation of matter under the influence of stress. For example, when laffy-taffy is pulled apart slowly and steadily, it will stretch into a thinner, longer rope. However, if it is pulled apart rapidly and abruptly, the chewy candy will tear. The taffy will deform and respond differently in response to the magnitude of applied, extensional stress. When talking about the deformation of rocks, stress is a force per unit of area, which is analogous to the extensional pulling apart of the laffy-taffy. Strain is the quantification of the change the laffy-taffy undergoes from a thick rectangle to a thinner rope. There are two main types of deformation: plastic and brittle. The laffy-taffy stretching is a perfect example of plastic deformation where the taffy remains cohesive. On the other hand, brittle deformation is like the way a granola bar crumbles while smashed in a backpack full of books. The result is a package of individual pieces of granola and total loss of cohesion of the original bar. Rocks too will deform and flow, under the right conditions. (Morrison, 2004). In order to actively study these processes, I will be manipulating the variables assisted with deformation including heat, pressure, presence of water and type of material being deformed.

My research will take me to the J.K. Russell Volcanology Laboratory in order to utilize the Volcanology Deformation Rig (VDR). Thanks to Steve Quane, a visiting professor here at CC and a research associate of the lab, I have special access to this deformation apparatus. In fact, the VDR was developed by Steve Quane and his esteemed colleagues to replicate the timescales, pressures and temperatures that induce deformation in volcanic rocks. This apparatus is able to deform materials at natural conditions that we cannot actively observe occurring in the field. The VDR is essential to my Geology research and educational project because it will allow

me to experimentally deform volcanic materials, observe and record the process with video and digital pictures and utilize the end products for thin section examination.

If funded, I plan to travel to Vancouver B.C. for Block III first visiting the Mt. Meager Volcanic Complex, a field site where I will collect various samples while gaining an understanding of the area. Next, I will perform numerous deformation experiments with the VDR under the guidance of Steve Quane, and his colleagues. I look forward to working with the pioneers in volcanic deformation research. Helen Lynn, a fellow geology student, will also experiment with volcanic deformation using the VDR for her senior thesis. We will both conduct separate experiments, however in order to be efficient with our time and money, we will be helping one another in the lab.

Helen will be focusing on the investigation of a component of rheology: the relationship between stress and strain and the implications for welding in volcanic rocks. For my Geology thesis, I will observe the processes occurring during deformation in the VDR. The end products of my experiments will be examined from a microstructural standpoint, identifying the mechanisms at work to achieve the changes in shape and texture. The two mechanisms that are assumed by geologists in this field are the loss of porosity and viscous deformation, which are analogous to the difference between the brittle breaking of the granola bar versus the laffy-taffy plastic deformation (Twiss & Moores, 1992).Determining the deformation mechanisms at the microscopic and atomic level will require the use of the Transmission Electron Microscope (TEM) in order to qualitatively and quantitatively study the rheology of volcanic rocks. My research will deepen the understanding of the rheological properties of volcanic rocks, and the relationships between deformation mechanisms at the atomic level and the implications for geologic hazards. Such knowledge, while important to the geologic community, should be

conveyed and taught to students in a creative, productive way. My research, results and interpretations of deformation mechanisms and rheology of volcanic rocks will be utilized and quite beneficial for the lessons I will create.

In block 6, I will be completing my Education Minor at CC by observing and teaching in a Geology classroom at Palmer High School. During this block, I will be designing adaptable, interactive lessons for high school and college level students with help from Tim Ferguson, Associate Director of the Education Program. Utilizing many different teaching strategies to convey my lessons, students will begin to understand the relationships and process involving rock deformation, rheology and volcanic hazards. These activities will be modeled after the hands-on/minds-on project based learning theory which will include the exploration of analogous materials like laffy-taffy and granola bars in conjunction with the videos, pictures, and deformation data from my research. With these tools, students will be able to explore concepts through multi-medium, not solely text book, while understanding the scientific process in terms of my active research and exploration of natural phenomenon. These lessons and tools, including a DVD of the video footage of my experiments, digital photographs and step by step experiments, will be made accessible to other teachers. The lessons will be incorporated as an additional chapter in my distinctions thesis that I will continue to write throughout the year, specifically 7th block under the advising of Steve Quane and Christine Siddoway, Associate Professor of Geology.

With these two projects, I will have the opportunity to capitalize on two of my passions in my undergraduate experience at CC, geology and education. Upon completion of this process, I will present my research, findings and future questions to the geology department and student majors during block 7 on Geology Day and at a GSA Cordilleran meeting in Bellingham,

Washington on May 4-6. After teaching at the high school level during 6th block, I will adapt and teach these lessons to Steve Quane's 8th block Volcanology students. I hope to inspire the younger generation of students to explore the field of geology and understand that science is about investigating questions regarding our natural world.

I am requesting $1,000 to help cover the cost of air-travel to and from Vancouver, BC and per diem expenses related to this research project. In effort to lower costs, lodging will generously be provided by Genevieve Robert, a graduate student who works in the J.K. Russell Volcanology Laboratory. A small amount of funds will contribute to Genevieve's apartment costs and utilities.

Estimated Budget

Item	Cost per day	Total estimated Cost
Airfare		550.00
Transportation (gas, public transportation etc.)	10.00/day for 22 days	220.00
Food	15.00/day for 24 days	360.00
Laboratory Supplies		90.00
Accommodations		100.00
Thin Sections	6 x $15.00	90.00
Total Cost of Trip		1410.00

Resources

Morrison, Faith A., "What is rheology anyway?" The Industrial Physicist, 10(2), April/May, 2004, pp 29-31.

Twiss, R.J. and Moores, E.M. 1992. Structural Geology. New York : W.H. Freeman, 532 pp.