NEWCOMB GRANTS PROGRAM

2017-2018 APPLICATION FOR FACULTY

Fall deadline to submit: October 19, 2017.
Spring deadline to submit: March 1, 2018.

Name Nicole Gasparini Email ngaspari@tulane.edu

Department Earth and Environmental Sciences Rank Associate Professor

Campus address 101 Blessey Hall Phone 504-862-3197

Total amount requested $ 4,364.5

Have you previously received funding from NCI for this project? No

If yes, when? _____ Amount received $_____

Title of project How do rock properties control erosion rates and topography in the Guadalupe Mountains?

Description of project (50 words or less) The Guadalupe Mountains of New Mexico and Texas are made up of layered rocks. Rock properties appear to control whether topographic slopes are steep or shallow. Undergraduate and graduate students will collect data to understand the processes leading to differences in topography with rock properties.

In which category is the proposal? *Please select only one.*

X Research Grant _____ Teaching Grant

_____ Community Engagement _____ Special Initiative

Are you applying for funding for this project from another source? If yes, where? No

The proposal packet should include:

1. This form
2. Department chair approval form
3. Project description, including the project timetable (2-3 pages maximum)
4. Significance of the project to the Newcomb College Institute's mission, including a description of any undergraduate student involvement (student researchers, lecture presentation to students, research incorporated into class materials, etc.) (1-2 pages)
5. Budget worksheet (form available on NCI website)
6. CV of guest speaker/visiting scholar if applicable.

Application package should be emailed, preferably as one pdf document, to lwolford@tulane.edu.

After the project is completed, recipient of the grant must send a written report to Laura Wolford at lwolford@tulane.edu.

NEWCOMB
Newcomb College Institute of Tulane University

Educating undergraduate women for leadership in the 21st century

NEWCOMB GRANTS PROGRAM

DEPARTMENT CHAIR APPROVAL FORM

Due dates for applicants are October 19, 2017 and March 1, 2018.

Name of applicant Nicole Gasparini

Department Earth and Environmental Sciences

Chairperson Nancye Dawers Email ndawers@tulane.edu

Title of project How do rock properties control erosion rates and topography in the Guadalupe Mountains?

Brief description of project The Guadalupe Mountains of New Mexico and Texas are made up of layered rocks. Rock properties appear to control whether topographic slopes are steep or shallow. Undergraduate and graduate students will collect data to understand the processes leading to differences in topography with rock properties.

Indicate any difficulty which may be involved for the department (course release, hiring a replacement, etc.)

None.

Signature of applicant _____ Date 26 Feb 2018

Signature of department chair _____ Date 2/26/18

Chairperson should complete this form and return it to the faculty applicant.

How do rock properties control erosion rates and topography in the Guadalupe Mountains?

Nicole M. Gasparini, Associate Professor, Department of Earth and Environmental Sciences
Brent Goehring, Assistant Professor, Department of Earth and Environmental Sciences

This is a research proposal submitted to the Spring 2018 Newcomb Grants for Faculty Program.

Project Overview:

Motivation

The fact that rock strength affects topography is taught in almost all introductory geology courses, and this relationship is obvious in arid environments where rock is exposed on hillslopes. The rocks and slopes of the Grand Canyon serve as an accessible and classic example of the influence of rock strength on the resultant landscape form (Fig. 1). The observation that variations in rock color, broadly indicating difference in rock type, correlate with changes in slope is an indication of the influence of rock strength on the landscape. But what exactly are the properties of rock that control how steep a slope is? Where slopes are shallower, are they eroding faster? Or slower? Or at the same rate?

Figure 1. Cartoon of the stratigraphy of the Grand Canyon from http://www.bobspixels.com/kaibab.org/geology/gc_geol.htm. Note that harder rocks such as the Kaibab Limestone and Redwall Limestone form steep cliffs, while weaker rocks such as the Bright Angel Shale form shallower slopes.

We currently lack the process understanding to answer broad questions about how rock properties control landscape evolution. Our goal in this proposal is to collect data so that we can begin to answer these questions using the Guadalupe Mountains of New Mexico and Texas, USA, as a test bed. We will use results of the proposed work to support a later proposal to an external funding agency. We propose to use a technique to estimate erosion rates that is currently untested in carbonate rocks – a rock type that is prevalent in our field area and in many landscapes. Therefore, success of the method here could lead to many new research avenues for the PIs and others. Importantly, the seed data in this proposal will be integral to Samuel Anderson's MS project in the EENS department. The PIs on this proposal are his main advisor (Gasparini) and a committee member (Goehring). Anderson, Gasparini, and Goehring are committed to including female undergraduates in the project. We plan to include a female undergraduate at least in the field work and the laboratory work, and other research opportunities will grow from there. This may be two different undergraduates, or the same woman if she gets 'the research bug'. Finally, we are requesting funds to support one other field assistant, Sabrina Martinez. Martinez is also an EENS graduate student working with Gasparini. Although Martinez' project is not in the Guadalupes, she will greatly benefit from field and mentoring experiences. The presence of a more senior female scientist in the field will also be beneficial for the undergraduate whom we recruit.

Study Area and Proposed Work

The Guadalupe Mountains were chosen for a number of reasons. The environment is arid and rocks are generally well exposed. The field area has layered sandstone and carbonate rocks. Sandstones and carbonates represent two important classes of sedimentary rocks with fundamentally different mineralogies and structuring; we thus hypothesize that this will impact how these rocks weather and erode. We are also working with a colleague at the University of Texas, Joel Johnson, who has access to high-resolution digital topographic data for a large portion of the study site. Previous work by his MS student Emily Marino suggests that rock properties correlate with changes in channel steepness, or channel slope normalized by drainage area. Channel steepness is thought to increase with erosion rate and/or increase as rocks get stronger. Preliminary analysis done by Anderson supports these trends. As Figure 2 illustrates, channel steepness roughly changes where there is a change in mapped rock unit. However, the transition in steepness index does not always correlate exactly to mapped rock contacts. Some fundamental questions thus arise regarding the lack of correlation: Is this because the geologic map is not accurate at the level that we are looking, or are changes in steepness smoothed over contacts? Are rock properties not controlling channel steepness and erosion rates? We do not know the answers to these questions yet, but our goal is to better understand how rock properties affect erosion, and therefore better understand why channel steepness changes in the locations that it does. Here we describe field activities and laboratory work that will be supported by this project to help us better understand the patterns we see in the landscape and how they relate to rock properties.

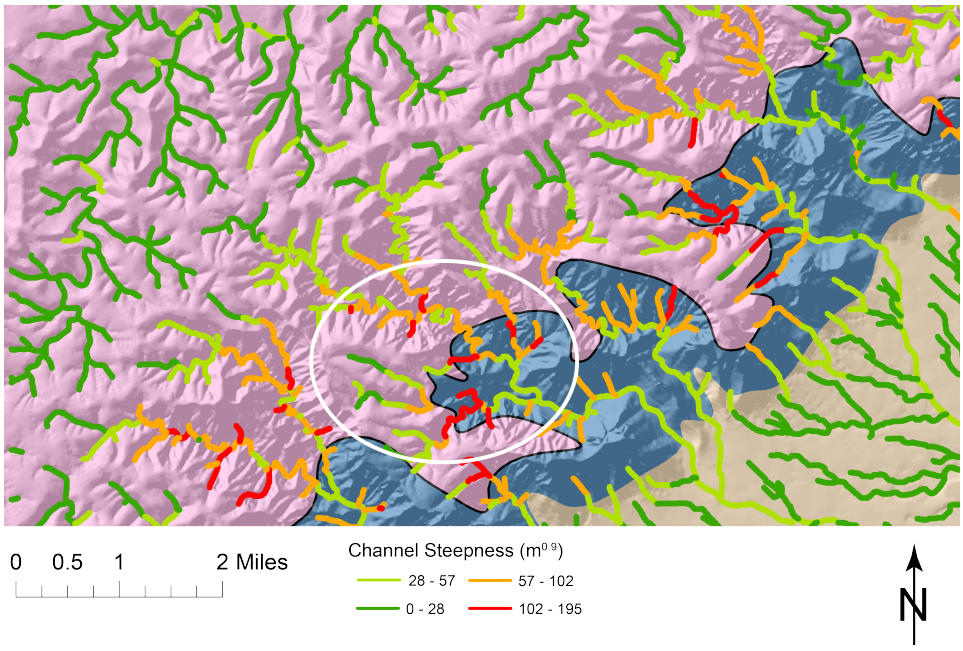

Figure 2. Map of a portion of the study area in the Guadalupe Mountains. The area shown is in New Mexico, just north of the Texas border. The land here is National Forest. The pink and blue shading are sandstone rocks and carbonate rocks, respectively. The river channels are colored by channel steepness, with red shades indicating the highest steepness values and light green the lowest. The white circled area highlights some of the ideas discussed in the text. Within the circle, the channel steepness in some channels increases where the channel flows from the weaker sandstone rocks (pink background) to the stronger carbonate rocks (blue background). However, in some locations, the channel steepness does not have a clear pattern at the contact (black line) between the two rock types.

Field work: Field work will take place over a three-week period during early summer 2018. In the field we intend to: 1) Collect rock strength data using a Schmidt hammer on exposed bedrock in river channels. (Gasparini owns a Schmidt hammer.) The Schmidt hammer is a very simple device that measures the in situ tensile strength of rocks. This will allow us to relate rock strength to both previously mapped rock units and to topographic metrics. 2) Map extent of sediment cover in the channels. Extensive sediment in the channels often comes from surrounding hillslopes. This sediment may change how the river channels erode and how steep they are, therefore river channels may not be controlled by the properties of the rock in their bed. 3) Measurement of fracture and bedding spacing. Rocks have planes of weakness and this should affect the nature of the processes that control river erosion and the steepness of the channel. We hypothesize that different rock types have different fracture and bedding spacing and that this changes the rock strength and erosion rates. 4) Collect four rock samples from four different locations in the channel to quantify local bedrock erosion rates. We will collect samples in two locations that have carbonate bedrock and two locations that have sandstone bedrock to quantify whether the two different rock types are eroding at different rates.

The field work requires extensive backcountry hiking, but otherwise is relatively straight forward. Gasparini will be going in the field over spring break 2018 with Anderson to train him on field techniques. Anderson has extensive experience in back country hiking and camping. He will be well-prepared to lead a successful trip with two assistants this summer.

Laboratory work: In the fall of 2018, Anderson and an undergraduate will prepare the rock samples in Goehring's laboratory. This involes both physical and chemical preparation of the samples to isolate the minerals of interest, quartz for the sandstone and calcite/argaonite for the carbonates. After pure mineral fractions are obtained, carbon isotopes will be extracted from the respective minerals in the Tulane Cosmogenic Nuclide Laboratory and sent for measurement elsewhere. The measurement of carbon isotopes in quartz is routine; however, measurements in carbonate for this purpose have been attempted only one time previously. Knowledge acquired during this work will benefit the proposed work and others in the geomorphic community.

Budget Overview:

We are requesting $4,364.50 to support the field campaign and sample processing.
Field costs: Lodging fees ($15/day * 21 days = $315), rental car ($1077), gas ($312.50), and food ($30/day * 21 days = $660). Total = **$2,364.50**.
Laboratory costs: Four samples at $500/sample = **$2000**.

How do rock properties control erosion rates and topography in the Guadalupe Mountains?

SIGNIFICANCE TO NEWCOMB'S MISSION

This project will significantly contribute to the education of undergraduate women. The proposed work will provide at least two unique research opportunities for an undergraduate female. The first is a three-week field experience in the Guadalupe Mountains. The second is learning techniques for mineral separation in the Tulane Cosmogenic Nuclide Laboratory. Whether one student participates in both parts of the projects, or we recruit two unique students will depend on the woman or women whom we recruit.

Many of our undergraduates go on to graduate school, and undergraduate research opportunities are essentially required for the best graduate programs. Research experiences not only prepare a student for graduate school, students gain mentors from these experiences. Research mentors will have a unique insight into a student's ability when it comes time for writing reference letters. Mentors also provide contacts that can be critical for graduate school admission.

Even if the undergraduate whom we recruit chooses to leave the sciences, she will still gain valuable skills from this experience. For both the field and lab parts of the project, we will carve out part of the project for the student to make her own. She will get credit for the work she does with us, and we will ask her to give a presentation at the end of her project. She will be encouraged to think independently on such tasks as finding the best ways to organize and present her data, rather than being told exactly how to do it. We will encourage the student to participate in the annual SSE Research Day.

Gasparini has a strong record of mentoring undergraduate students. In her ten years at Tulane, she has mentored 10 undergraduate research projects, and six of these undergraduates were female. Three of Gasparini's seven graduate students have been female. Sabrina Martinez, who is a current MS student in Gasparini's group will also participate in the field work. Although Martinez is not working on this project as part of her thesis, her thesis project does not have a field component. The field experience she gains from this project will be invaluable for her future. Martinez will also serve as a second female scientist role model and mentor for the undergraduates who participate in the field component of this project.

Although there are often more women than men in undergraduate Earth science classrooms, the gap closes or the numbers reverse in graduate school, and Earth science faculty remain dominantly male. Positive research experiences at the undergraduate level are one way to encourage women to move up the ladder, remain in the sciences, and change these trends.

Newcomb Grants Program Budget Proposal Worksheet

Please read and complete this worksheet carefully. Only fill-in the boxes that correspond with the projected costs of the project/proposal described in your application, and leave other line items blank. If you are quoting costs from a website, please name the website in the "Notes/Explanation" column.

YOUR NAME	Nicole Gasparini
PROJECT/PROPOSAL NAME	How do rock properties control erosion rates and topography in the Guadalupe Mountains?

TRANSPORTATION				**Estimated Costs**	**Notes/Explanation** Fill in cells with gray type
Destination 1	Guadalupe Mountains				
Projected travel dates	6/1/18	6/22/18			
Roundtrip fare					Website used for fare
Destination 2 (if applicable)					
Projected travel dates	FROM	TO			
Roundtrip fare					website used for fare
Taxis					
Mileage		0	0.565	$ -	# miles*.565=estimated cost
Rental Car				$1,077	Enterprise, Standard SUV for field work, mileage included
TRANSPORTATION TOTAL				$ 1,077.00	

HOTELS	Daily Rate	Number of nights		Total	**Hotel name and location**
If you are splitting the cost of lodging with another person, make the "Daily Rate" the cost you will actually pay, not the overall cost of the lodging/night.					
Hotel 1	$15		21.00	$ 315.00	Lodging is relatively cheap because we will stay at the
Hotel 2 (if applicable)				$ -	Park Service research station.
Hotel 3 (if applicable)				$ -	
HOTELS TOTAL				**$ 315.00**	

FOOD	Number of days	Estimated amount/day		**Notes and/or Explanation**
	22.00		$ 30.00	
FOOD TOTAL			**$ 660.00**	

CONFERENCE REGISTRATION FEE	**Quantity of Registrations**	**Fee**	**Conference**
		$ -	
CONFERENCE FEES TOTAL		$ -	

SUPPLIES AND OTHER EXPENSES

Personal items are not funded. Examples of personal items include immunizations,passport fees, and laptops. Supplies necessary for research become the property of the sponsoring

Item	**Price for item**	**Quantity**	**Total**	**Justification**
Gas	$2.50	125	$ 312.50	Assume: 2,500 miles. 20 miles/gallon = 125 gal. $2.5/gallon.
Sample processing costs	$500	4	$ 2,000.00	
			$ -	
			$ -	
			$ -	
			$ -	
			$ -	
			$ -	
			$ -	
			$ -	
SUPPLIES AND OTHER EXPENSES TOTAL			$ 2,312.50	

STUDENT ASSISTANTS

Students may be paid an hourly wage for assisting a faculty grant recipient with the faculty member's work. A student cannot be paid in a collaborative project. The acceptable hourly rate for students is $10.00 an hour ($10.42 with payroll taxes). A student being paid by the Newcomb Grants Program must be an woman-identified undergraduate. If possible, please provide the name and class year of student(s) you plan to hire.

Name and class year of student	**# of hours**	**Rate**	**Total**	**Justification/Notes**
		$10.42	$ -	
		$10.42	$ -	
		$10.42	$ -	
STUDENT ASSISTANTS TOTAL			$ -	

TOTAL PROJECT EXPENSES		**$ 4,364.50**	
OTHER SOURCES OF FUNDING			
Source	**Pending/Confirmed**	**Amount**	
TOTAL CONFIRMED FUNDING FROM OTHER SOURCES			CONFIRMED sources only. Please fill in this amount manually.
TOTAL AMOUNT REQUESTED FROM NEWCOMB COLLEGE INSTITUTE		**$ 4,364.50**	