From: _____
To: bcasey@williams.edu; nrenaud@williams.edu;
Subject: On-Campus Winter Study 99
Date: Wednesday, September 29, 2010 10:20:43 AM

STUDENT NAME:

CLASS YEAR: 2013

STUDENT ID:

EMAIL:

TYPE OF 99: program

SUBJECT: GEOS

TITLE OF 99: Bering Sea Paleoceanography: How Oxygen Isotope Ratios in Benthic Foraminifera Relate to Changes in Glaciation

SPONSOR EMAIL:

GROUP PROJECT: no

STUDENTS IN GROUP:

DESCRIPTION: The goal of this project is to establish the chronology for a deep-sea sediment core collected from the Bering Sea. This research is the first part of a larger project on the timing of past glaciations and changes in Earth's orbit. We chose samples at 0.75-meter intervals from the 150-m-long core to be age markers for the rest of the samples. We will measure the 18O/16O in the shells of benthic foraminifera with an isotope-ratio mass spectrometer at Oregon State University and compare results to published records in order to date the rest of the site's samples.

INTELLECTUAL CONTENT: Orbital changes affect the timing of Pleistocene glacial cycles, but which orbital parameter is the most important in initiating and terminating glaciations is debated (Raymo et al., 2006; Huybers, 2006). Knowing the sediment age is crucial to our understanding of the role of these cycles in climate records reconstructed from the sediment. By looking at the oxygen isotope ratios of ocean-dwelling species, we can date the sediment. Oxygen-16 tends to evaporate from the ocean preferentially and therefore freezes in polar ice in greater quantity, increasing the 18O/16O in the ocean as ice sheets grow during glaciations (Emiliani, 1955). Therefore, benthic foraminifera living in the ocean in different glaciation eras develop their

carbonate shells with different ratios of oxygen isotopes that can be dated based on where in the sediment column the foraminifera were found. We will date our samples by matching our benthic δ18O results to a world average record created by Lisiecki and Raymo (2005), then apply those ages to the rest of the samples from site U1389 based on depth. I am interested in this project because it will offer me hands-on, cutting edge learning that I would not be able to get in a class.

ANALYSIS: I plan to prepare samples of subseafloor sediment from the Bering Sea for analysis. Sediment from these areas contains calcium carbonate shells of certain species of single-celled organisms called benthic foraminifera. I will prepare these samples by removing all the small particles of silt and clay from the samples, pick out the shells, and for a week during Winter Study take them to Oregon State University in Portland to be analyzed in their Finnegan isotope-ratio mass-spectrometer. This will give us an idea of the age of much of the column of sediment at site U1345.

READING LIST: Readings completed:

Cesare Emiliani (1955) Pleistocene Temperatures, Journal of Geology, 63(6): 538-578.

Lisiecki, L.E., Raymo, M.E. (2005), A Plio-Pleistocene Stack of 57 Globally Distributed Benthic δ18O Records, Paleoceanography, vol. 20, PA1003, doi:10.1029/2004PA001071.

Raymo et al., (2006) Plio-Pleistocene Ice Volume, Antarctic Climate, and the Global δ18O Record, Science, vol. 313, 492, doi:10.1126/science.1123296.

Huybers, P., (2006) Early Pleistocene Glacial Cycles and the Integrated Summer Insolation Forcing, Science, vol. 313, pp. 492-495, doi:10.1126/science.1125249.

Expedition 323 Scientists, 2009. Bering Sea paleoceanography: Pliocene-Pleistocene paleoceanography and climate history of the Bering Sea, IODP Prel. Rept., 323: Tokyo (Integrated Ocean Drilling Program Management International, Inc.). doi:10.2204/iodp.pr.323.2010.

CONSULTATION:
PRIOR EXPERIENCE: I took Oceanography (GEOS 104) in spring 2010.
I worked on this project for Prof. Mea Cook as a student research assistant from July 5 to August 20, 2010, and I am continuing to work on this project in Prof. Cook's lab this fall.

EVALUATION: I will write the ten-page-minimum paper as is required by the WSC.\nnSTRUCTURE: Pre-WSP: All fall I will be working in the lab preparing the

samples in question, as a continuation of the work I did for Prof. Cook in the summer.
WSP:
Week 1: Prepare samples for analysis.
Week 2: Prepare samples for analysis and transport.
Week 3: Travel to Oregon State University and analyze our samples in their Isotope Ratio Mass-Spectrometer, then come back to Williamstown.
Week 4: Collect our data and produce a 10-page paper based on my findings.

RESOURCES: I will be working in Bronfman 160 and shouldn\'t need any other resources, as they are already available in the lab.

EXPENSES: (Flight and Accommodations prices researched on Kayak.com)

Round Trip Economy Airfare—$345, Albany, NY to Portland, OR leaving January 23, returning January 29.

Rental Car—$224, Kia Rio, 7 days ($32 per day, appx. 200 miles to and from PDX, appx. 20 miles around town).

Hotel Room, Albany, OR: $623 total ($89/night)

Food Cost per day: $20 (total $140)

Total: $1332