

AUSTRAL SUMMER INSTITUTE V

A cooperative program
UNIVERSIDAD DE CONCEPCIÓN - WOODS HOLE OCEANOGRAPHIC INSTITUTION
FUNDACIÓN ANDES

Topics in MARINE GEOLOGY AND GEOPHYSICS

3-28 January 2005

ESTACIÓN DE BIOLOGÍA MARINA - DICHATO
DEPARTAMENTO DE OCEANOGRAFÍA
UNIVERSIDAD DE CONCEPCIÓN

Module I: 3-7 January 2005 ANTARCTIC MARINE GEOLOGY

Dr. John Anderson
Rice University

PALEOCEANOGRAPHY AND CLIMATE DEVELOPMENT OF THE POLAR REGIONS

Dr. James Kennett
University of California Santa Barbara

Module III: 17-21 January 2005 LANDSCAPE AND SEASCAPE EVOLUTION

Dr. Neal Driscoll
Scripps Institution of Oceanography

MID-OCEAN RIDGES

Dr. Daniel Fornari
Woods Hole Oceanographic Institution

Module II: 10-14 January 2005 PALEOMAGNETISM; CYCLOSTRATIGRAPHY

Dr. Ulrich Bleil
Bremen University

MARINE RADIOGENIC ISOTOPE RECORDS

Dr. Bernhard Peucker-Ehrenbrink
Woods Hole Oceanographic Institution

Module IV: 24-28 January 2005 MACROEVOLUTION OF MARINE PROTISTS

Dr. Richard Norris
Scripps Institution of Oceanography

MARINE SEISMOLOGY

Dr. Emilio Vera
Universidad de Chile

The final date for faxed and e-mail applications is 4 October 2004
Applications sent by air mail should be postmarked no later than 4 October 2004.
Courses are open to advanced undergraduate and graduate students,
professionals, and academics

COORDINATORS

Dr. Carina Lange
Dr. Silvio Pantoja
Departamento de Oceanografía
Universidad de Concepción

SPONSORING INSTITUTIONS

Universidad de Concepción
Woods Hole Oceanographic Institution
Fundación Andes
Centro de Investigación Oceanográfica en el
Pacífico Sur-Oriental (COPAS)

INFORMATION AND APPLICATIONS

Danielle Barriga
Depto. de Oceanografía
Edificio Oceanografía, 3er piso
Universidad de Concepción
Casilla 160-C
Concepción, Chile
E-mail: asi@udec.cl
Tel.: (56) (41) 79 5120
Fax: (56) (41) 79 5120
www.udec.cl/udecwhoi

Coordinador General del Programa:
Dr. Víctor Ariel Gallardo - Universidad de Concepción



Universidad de Concepción





AUSTRAL SUMMER INSTITUTE – V
Topics in MARINE GEOLOGY AND GEOPHYSICS
3-28 January 2005

**Universidad de Concepción (UDEC) – Woods Hole Oceanographic Institution (WHOI) –
Fundación Andes (FA) Cooperative Program
2004-2005**

I. Introduction

The Fifth Austral Summer Institute (ASI-V), **Topics in Marine Geology and Geophysics**, was held at the Marine Biology Station of the Oceanography Department, Universidad de Concepción, in Dichato, from 3-28 January 2005. ASI-V was developed as part of the UDEC-WHOI-FA cooperative project.

The objective of ASI-V was to reinforce advanced multidisciplinary formation and research in the Southeast Pacific. Graduate and advanced undergraduate students in the areas of Marine Sciences and Oceanography, academics, post-doctorates, and professionals interested in the areas of Marine Geology and Geophysics were all invited to apply.

II. Announcements and Applications

Publicity for ASI-V included national and international mailings (letter of invitation and/or poster), e-mails (letter of invitation and/or request to post ASI-V information), and a Web page.

Applicants were required to fill out an application form, write a letter of intent, and provide a brief CV. Applicants totaled 37 and were Chilean (28), Colombian (3), Peruvian (3), Brazilian (1), Swedish (1), and Nicaraguan (1). By country of residence, the applicants were from Chile (32), Colombia (1), Peru (2), Brazil (1), and Sweden (1).

III. Participants and Lecturers

All 37 of the applicants were accepted. Unfortunately, four of these did not participate because we were unable to secure additional funding to cover travel expenses of foreign participants.

Twenty-four participants took part in ASI-V. They were Chilean (21), Colombian (2), and Peruvian (1), all residing in Chile. The participant roster is included at the end of this report. Eight instructors participated in ASI-V.

- Dr. John Anderson, Rice University, Antarctic Marine Geology, 3-7 January 2005
- Dr. James Kennett, University of California Santa Barbara, Paleooceanography and Climate Development of the Polar Regions, 3-7 January 2005
- Dr. Ulrich Bleil, Bremen University, Paleomagnetism; Cyclostratigraphy, 10-14 January 2005
- Dr. Bernhard Peucker-Ehrenbrink, Woods Hole Oceanographic Institute, Marine Radiogenic Isotope Records, 10-14 January 2005
- Dr. Neal Driscoll, Scripps Institution of Oceanography, Landscape and Seascape Evolution, 17-21 January 2005
- Dr. Daniel Fornari, Woods Hole Oceanographic Institute, Mid-Ocean Ridges, 17-21 January 2005
- Dr. Richard Norris, Scripps Institution of Oceanography, Macroevolution of Marine Protists, 24-28 January 2005
- Dr. Emilio Vera, Universidad de Chile, Marine Seismology, 24-28 January 2005

IV. Course contents

“Antarctic Marine Geology”

This course will include an overview of the Antarctic environment, its lithosphere, cryosphere, atmosphere and hydrosphere. We will then discuss the geological evolution of the continent and continental margin. The second half of the course will focus on marine sedimentology, continental margin evolution and climatic and ice sheet evolution.

“Paleooceanography and Climate Development of the Polar Regions”

The Earth's climate during the last half million years is known to be highly unstable and sensitive, and prone to abrupt change. Geological records from ice cores and marine sediments from Antarctica and the Northern Hemisphere have demonstrated a remarkable propensity during glacial states for jumps in temperature of up to ~10oC within a single human life span, with more persistent warm periods (interglacials) every 100,000 years. Both the abrupt and major interglacial warming during this period required a trigger to initiate the change and strong reinforcing feedback mechanisms, but their cause remains enigmatic. Explaining abrupt global warming events and associated climate behavior presents an urgent challenge to earth scientists, especially within the context of modern atmospheric increases in greenhouse gases and contemporaneous global warming.

The entire global system is presently marked by the largest sea level and temperature changes known for at least the last 14 million years. This course will deal with Antarctica's critical role in global climatic evolution including recent abrupt warming. Steady isolation of Antarctica through millions of years of plate tectonic development towards the modern (late Quaternary) Earth System state has led to this influence. Antarctica's modern role in this global climate behavior is through rapid feed-back mechanisms involving changes in sea ice distribution, oceanic-mediated carbon dioxide drawdown from the atmosphere, and intermediate water temperatures. Warming of Antarctic intermediate waters during times of low sea level (glacial periods) may have had a significant role in triggering abrupt warming through destabilization of the methane hydrate

reservoir on continental margins and resulting massive emissions of methane (a highly potent greenhouse gas) to the atmosphere. We now need to understand the likely response of this reservoir to the super-interglacial temperatures expected later this century.

Through a sequence of lectures, laboratories, discussion and exercises this course will examine modern features of Antarctica and the Southern Ocean; proxies used for measuring paleoceanographic change; the climatic development of Antarctica on different time scales; the problem of explaining much of Quaternary climatic behavior; the potential role of methane hydrates in climate change; and the role of Antarctica in abrupt climate change.

“Paleomagnetism; Cyclostratigraphy”

The series of lectures begin with a state-of-the-art summary of paleomagnetic investigations, addressing all aspects from sampling and measuring techniques to data evaluation and interpretation. Followed by an in depth discussion of magnetic mineral inventories in marine sediments, the effectively climate controlled temporal variability of their concentration, composition and magnetic characteristics is explored in its perspectives to develop cyclostratigraphic routines and to apply modern environmental magnetisms analytical methods.

“Marine Radiogenic Isotope Records”

This course introduces students to the fundamentals of isotope chemistry (nucleosynthesis, radioactive decay, mass spectrometry, two-component mixing, isotope fractionation) applied to radiogenic marine isotope records. Temporal variations in the interaction of the hydrologic cycle with the continental crust and hydrothermal circulation of seawater through oceanic crust have shaped the chemical and isotopic evolution of seawater. The marine strontium, osmium, and neodymium isotope records will be used to illustrate these interactions. Specifically, case studies of the modern ocean, the Eocene-Oligocene transition, and the Cretaceous-Tertiary boundary will be used to elucidate the impact various surficial processes have on the isotope chemistry of seawater.

The course will offer a combination of lectures, discussions, and classroom exercises aimed at familiarizing students with the fundamental concepts of marine radiogenic isotope records.

“Landscape and Seascape Evolution”

Landscapes and seascapes record the complex interplay between erosion and deposition. Deposition and erosion are caused by a number of different processes acting separately and in concert (e.g. tectonic deformation, precipitation, landslides, glaciers, volcanism).

Understanding how these processes shape and sculpt the landscape/seascape and are recorded in the stratigraphic record is the overarching goal of this course. We will investigate a number of examples from the mountain tops to the deep sea that will illustrate how tectonic and sedimentary processes affect landscape and seascape development and evolution.

“Mid-Ocean Ridges”

This course covers the history of mid-ocean ridge research and technologies used to map and image the global ridge system. This includes sea surface systems (multibeam bathymetry, magnetic, and gravity data), deep towed systems (sidescan sonar and camera systems or ROVs), near bottom magnetometer; near bottom gravimeter, autonomous underwater vehicles (AUVs) and near-bottom mapping, submersible (submarine and ROV) observations and measurements, teleseismic earthquakes from land-based seismometers, ocean bottom seismometers, passive and active experiments, hydrophones (in the water column), seismic reflection studies, potential field measurements (near bottom compliance and magnetics).

The course also includes mid-ocean ridge morphology and segmentation, which involves mid-ocean ridge spreading segments (and segments as volcanoes), characteristics of individual spreading segments, segments as volcanoes (analogies in Hawaii and Iceland), along axis high near the segment center, along axis variation in crustal thickness, models for magma supply to segments, transforms, nontransform offsets, a hierarchy of offsets, morphology vs. spreading rate, crustal structure, ophiolites, seismic layers, and rock layers.

Some examples of recent MOR morphological, structural, and petrological field studies to be presented are the Mid-Atlantic Ridge, Kane to Lucky Strike, the Southern EPR, the Chile Ridge, back arc spreading centers, Lau Basin. Finally, the East Pacific Rise will be examined as a case study using a Geographic Information System (GIS) Database.

“Macroevolution of Marine Protists”

This course is intended to provide an overview of the microfossil record in the oceans and the evolutionary history of the shelled plankton. I have three goals: (1) to introduce you to the major microfossil groups in terms of their taxonomy, biology, and fossil record, (2) discuss the paleoceanographic and pleoclimatic significance of microfossils and give a general overview of Mesozoic and Cenozoic paleoceanography, and (3) provide some practical experience with microfossil identification and occurrence in the laboratory and field. This last goal is really a key one, so the lectures are all geared to lead into the laboratory sessions as much as possible. I expect you to do the laboratories in groups and to talk to each other and me a lot. I have also provided a number of readings to introduce the various topics covered in the course. These readings are not at all comprehensive but they are intended to provide enough background information to stimulate discussion during the lectures and laboratories.

ASI-V PROGRAM

Professor	Topics	Week
<p>Dr. John Anderson (Rice University)</p> <p>Dr. James Kennett (University of California at Santa Barbara)</p>	<p><i>ANTARCTIC MARINE GEOLOGY</i></p> <p><i>PALEOCEANOGRAPHY AND CLIMATE DEVELOPMENT OF THE POLAR REGIONS</i></p>	<p>Module I: January 3-7</p>
<p>Dr. Ulrich Bleil (Bremen University)</p> <p>Dr. Bernhard Peucker-Ehrenbrink (Woods Hole Oceanographic Institution)</p>	<p><i>PALEOMAGNETISM; CYCLOSTRATIGRAPHY</i></p> <p><i>MARINE RADIOGENIC ISOTOPE RECORDS</i></p>	<p>Module II: January 10-14</p>
<p>Dr. Neal Driscoll (Scripps Institution of Oceanography)</p> <p>Dr. Daniel Fornari (Woods Hole Oceanographic Institution)</p>	<p><i>LANDSCAPE AND SEASCAPE EVOLUTION</i></p> <p><i>MID-OCEAN RIDGES</i></p>	<p>Module III: January 17-21</p>
<p>Dr. Richard Norris (Scripps Institution of Oceanography)</p> <p>Dr. Emilio Vera (Universidad de Chile)</p>	<p><i>MACROEVOLUTION OF MARINE PROTISTS</i></p> <p><i>MARINE SEISMOLOGY</i></p>	<p>Module IV: January 24-28</p>

Participant		Mod I	Mod II	Mod III	Mod IV	Nat./Univ.
Aguilar, Germán	Geaguilar@udec.cl	X	X	X	X	UdeC
Becerra, Carolina	Cabecerr@cec.uchile.cl		X	X	X	UdeChile
Cisternas, Carolina	Carocist@udec.cl	X	X	X	X	UdeC
Collado, Silvana	Scollado@profc.udec.cl				X	UCV
Contardo, Ximena	Xcontardo@ucn.cl		X			UCN
Cordova, Ma. Loreto	Marcordo@ing.uchile.cl	X	X	X		UdeChile
Flores, Valentina	Vflores@ing.uchile.cl	X	X	X		UdeChile
Gamarra, Alex	Agamarra@udec.cl	X				Peru/UdeC
Giesecke, Ricardo	Cgiesecke@udec.cl	X				UdeC
Giglio, Susana	Sgiglio@udec.cl	X				UdeC
González, Juan	Jgonzale@operamail.com				X	UCV
Hidalgo, Ma. Carolina	Mcarolinahidalgo@hotmail.com	X		X	X	UdeC
Lhose, Paulina	Plm002@ucn.cl	X	X	X	X	UCN
Marchant, Margarita	Mmarchan@udec.cl	X				UdeC
Muñoz, Praxedes	Praxedes@ucn.cl		X	X		Ucoq
Nilsson, Jenny	Jennyn@misu.su.se	X	X	X		Sweden
Núñez, Samuel	Snunez@udec.cl	X	X			Colombia/ UdeC
Ortiz, Sara	Shoa@shoa.cl			X		SHOA
Ramírez, Elisa	Eramirez@cicese.mx				X	Chile
Rebolledo, Lorena	Lrebolle@udec.cl	X			X	UdeC
Rodrigo, Cristian	Roderick_cmp@yahoo.com			X		SHOA
Sánchez, Gloria	Glsanchez@udec.cl				X	Colombia/ UdeC
Soto, Jaime	Jsoto@udec.cl	X	X			UdeC
Tapía, Raúl	Rtapia@udec.cl	X			X	UdeC