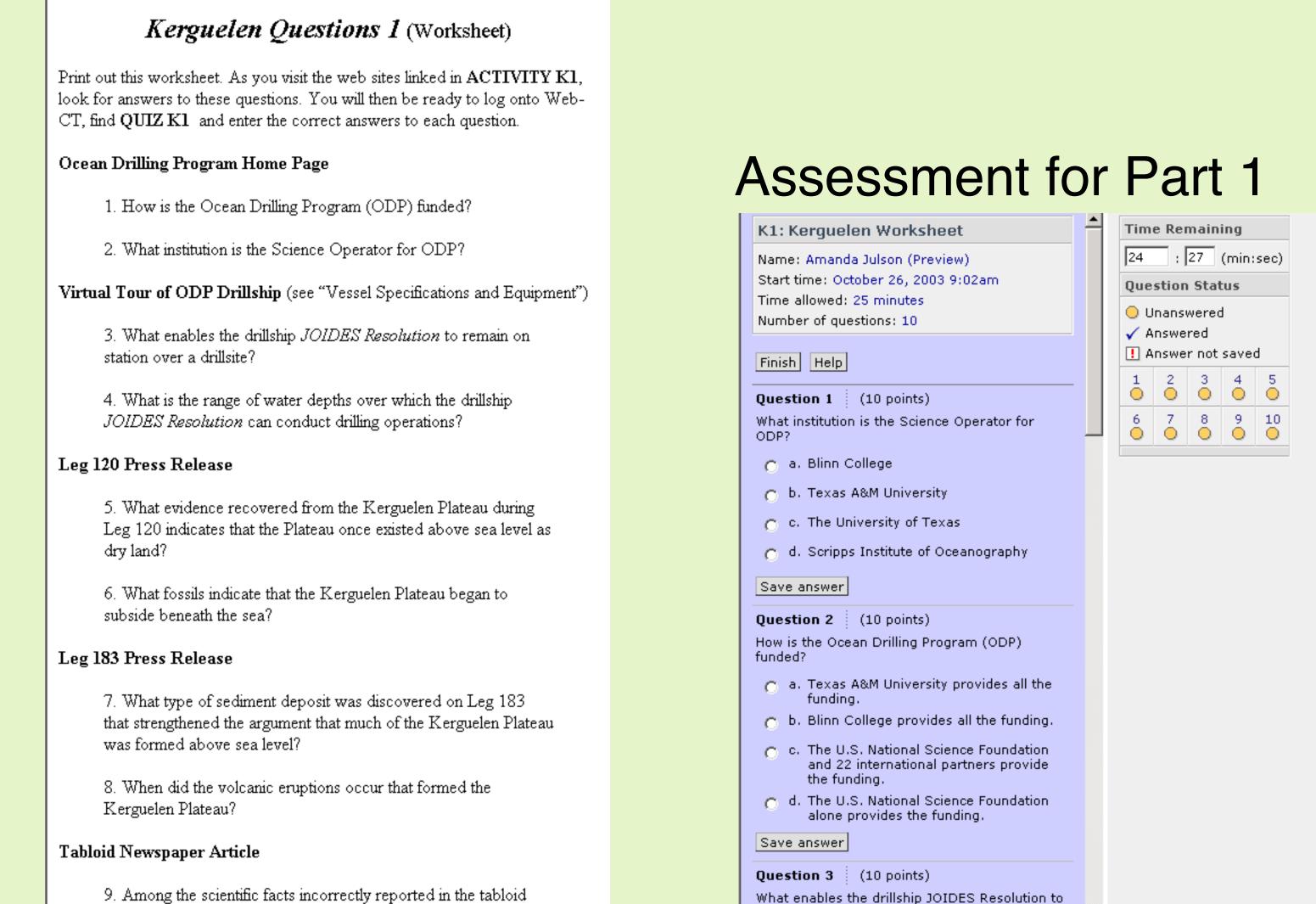
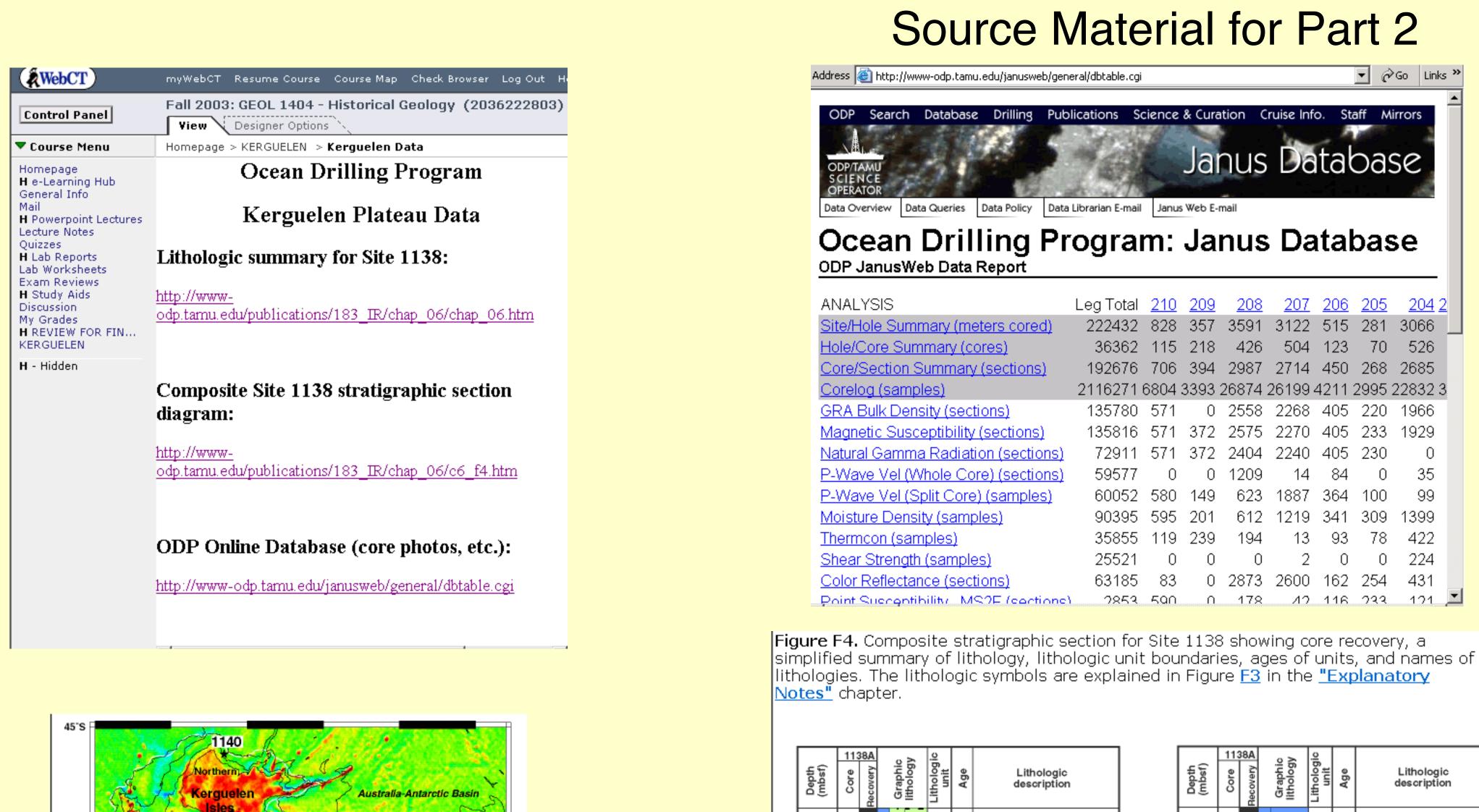
FROM ODP TO CPR: USING OCEAN DRILLING PROGRAM DATA IN CALIBRATED PEER REVIEW ASSIGNMENTS

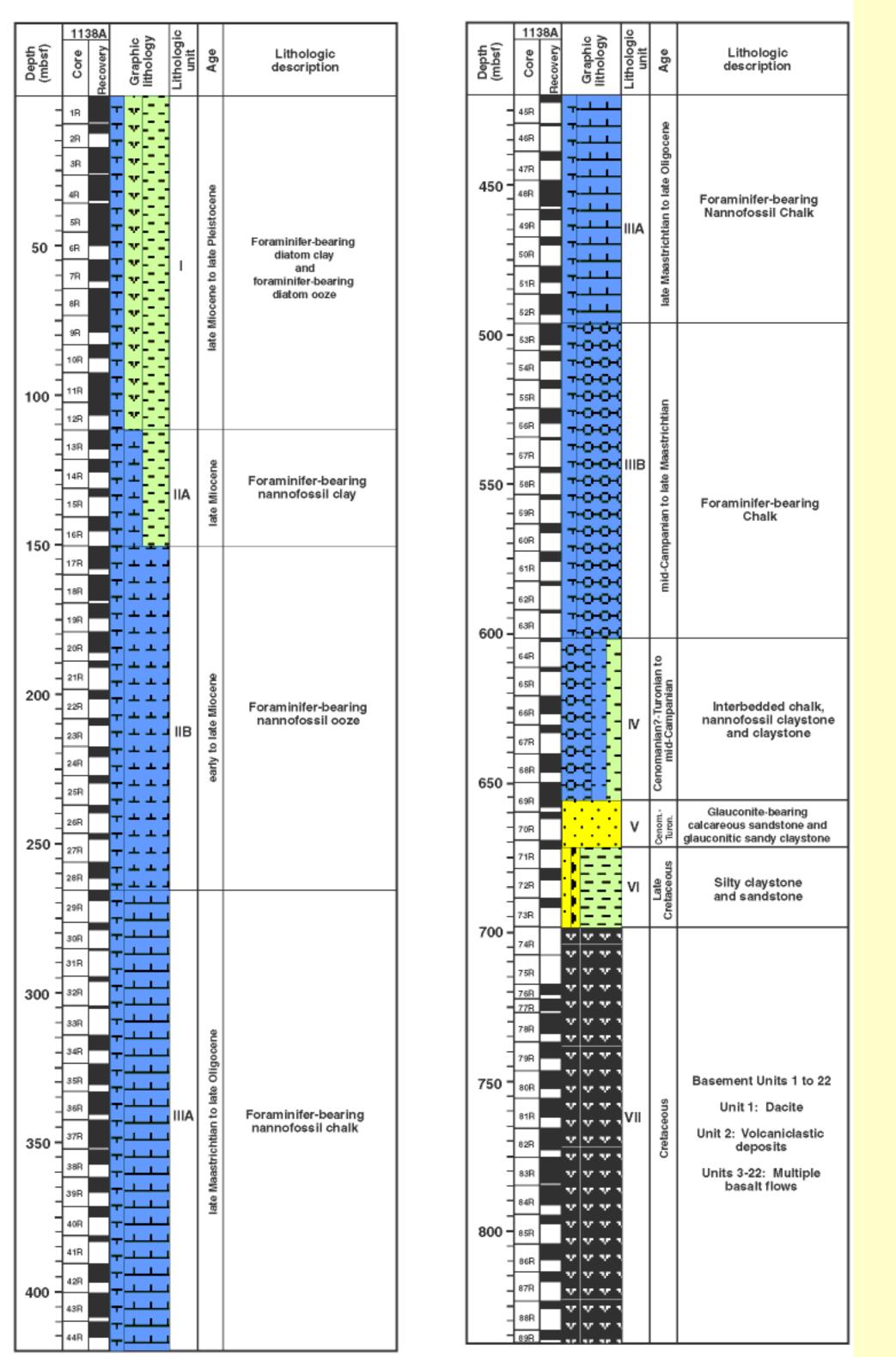
Source Material for Part 1 myWebCT Resume Course Course Map Check Browser Log Out Help Fall 2003: GEOL 1404 - Historical Geology (2036222803) instructions and due dates for the parts of ou oing activity on the KerguelenPlateau are nized here. You can also access the items on tl Veekly Activities page, the Lab Worksheets page, nd the Quiz page. All paths lead to Kerguelen! 👚 H REVIEW FOR F Address 🎒 http://www-odp.tamu.edu/public/pressrel_html/leg120b.htm COLLEGE STATION,TX -- Scientists now have a 97-million-year geologic record to determine the origin and evolution of the Kerguelen Plateau, one of the world's largest underwater structures. The giant structure lies in the remote subantarctic region of the Indian Ocean. At 2500 kilometers (150) miles) in length, its size and shape resemble Arg Address 🥘 http://www-odp.tamu.edu/public/pressrel_html/leg183.ht are the only above-water expressions of the sub drilling vessel *JOIDES Resolution*, their home plateau with two primary objectives in min to obtain, by deep-ocean drilling, cores of sedir to recover cores of crustal rocks to learn how t The results reveal a fascinating history of a regio Ancient Volcanic Cataclysms in the Indian Ocean Kerguelen Plateau and Broken Ridge reveal solid Earth dynamics and environmental consequences of massive volcanism Today, scientists from the Ocean Drilling Program (ODP) completed an expedition to one of the most remote places on Earth, the Kerguelen Plateau. This plateau is located in the southern Indian Ocean, is one-third the size of the United States, and is described as a large igneous province (LIP). LIPs are areas where magma wells up from deep beneath Earth's surface and forms molten rock. The major objectives of the expedition were to determine through drilling: when volcanism was active; how much of the plateau From the National Examiner, August 2, 1988: formed above sea level and how long portions of the feature remained above sea level; and if continental fragments form part of the plateau. The scientists met these objectives, and future shore-based research Sting minister is always on ca will be devoted to the recovered samples. Using evidence from fossils as well as terrestrial plant remains, the scientific team constrained the time period during which the Kerguelen LIP formed. They found that the southern Kerguelen Plateau, only hundreds of kilometers from Antarctica, formed approximately 110 million years ago. To the north, the çentral Kerguelen Plateau and the once-contiguous Broken Ridge formed between 85 and 95 million 🔃 _ trying to save its

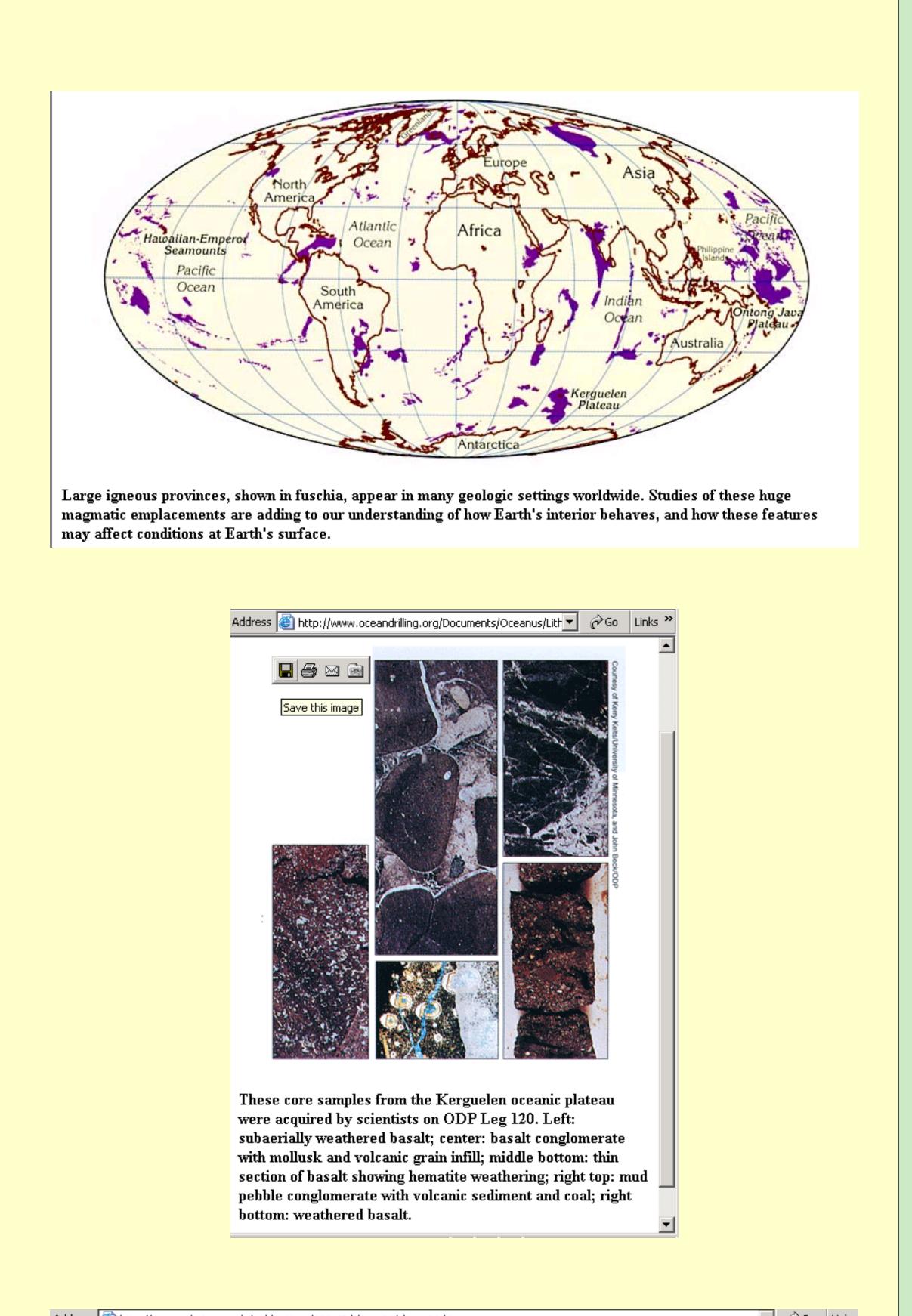
Assignment for Part 1

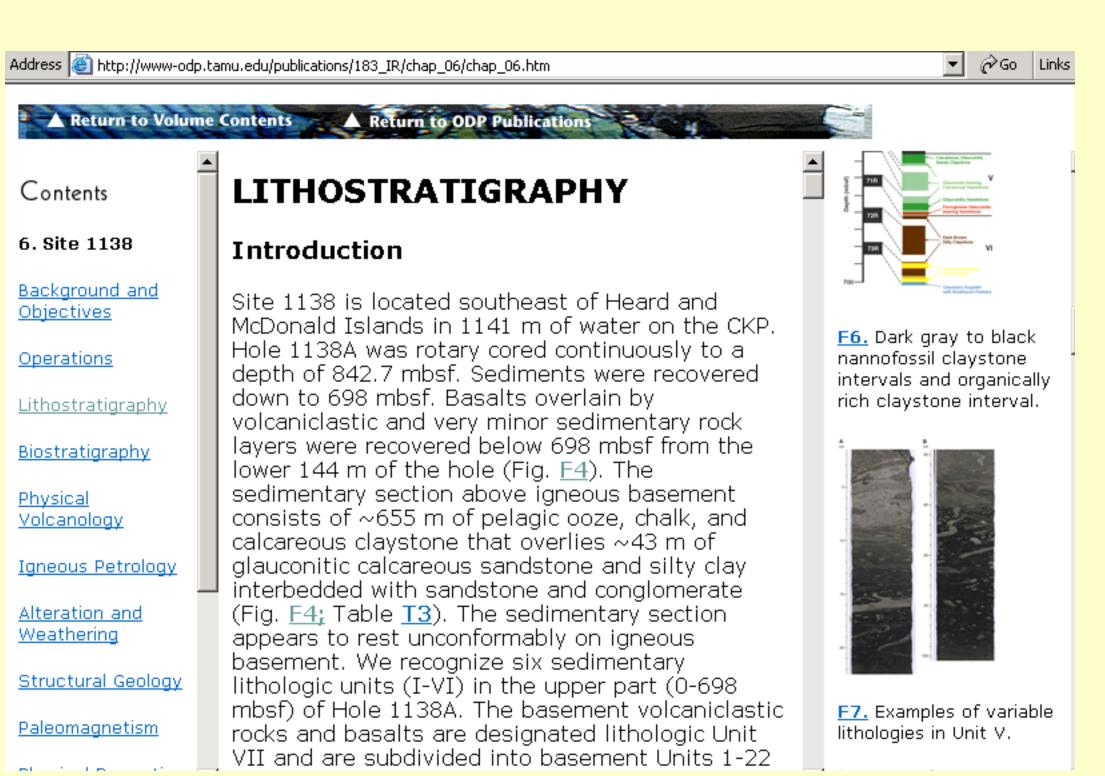


Elizabeth Heise and Amanda Palmer-Julson University of Texas at Brownsville and Blinn College









Kerguelen Lab Project II

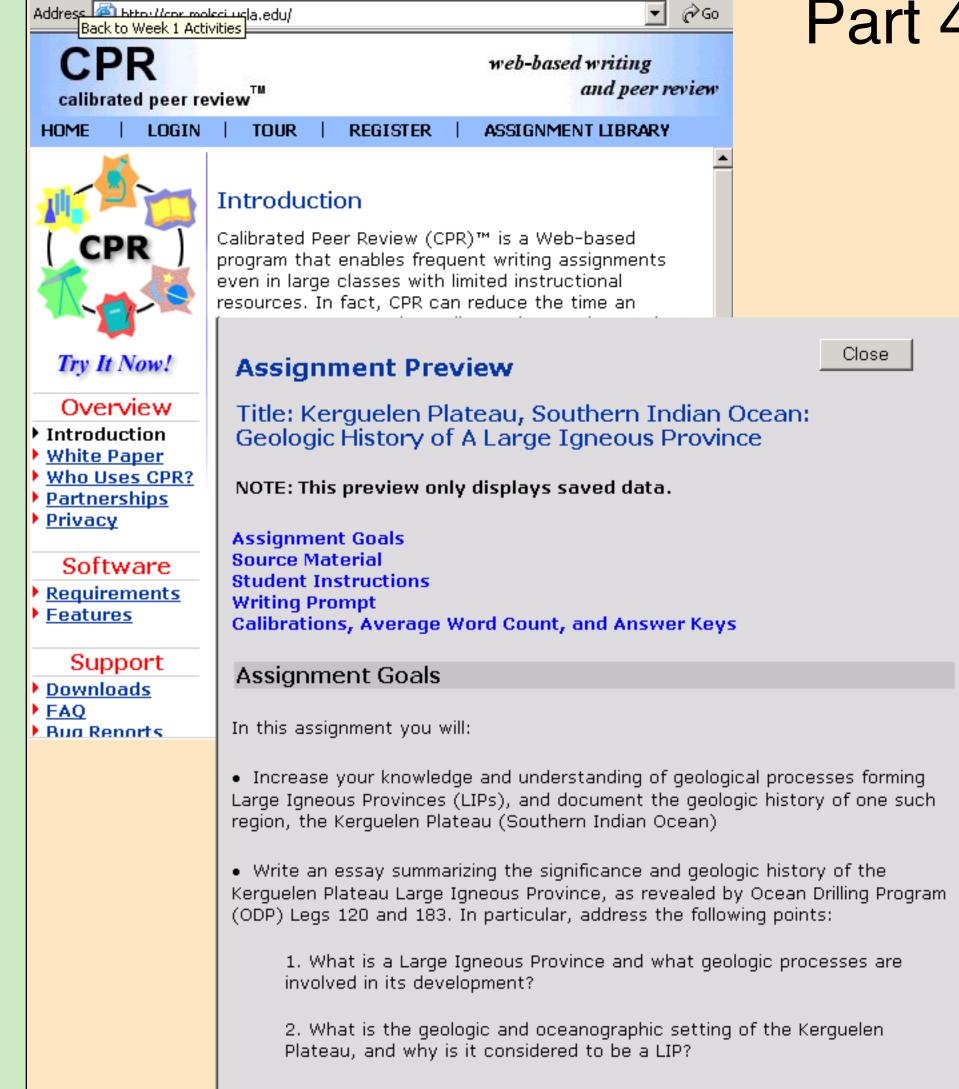
Based on the readings previously discussed and drilling data analyzed in class by group members, answer the following questions. Be sure to record your answers as you will need them for the upcoming writing assignment.

L. Summarize results from drilling basement (igneous) rocks on Legs 120 and 183 (in particular, Site 1138), and discuss how these results address questions regarding the nature and origin of the Kerguelen Plateau. What kind of crust predominates at Kerguelen Plateau - continental or oceanic? Explain (mention the kinds of rocks that indicate this).

b. What evidence for the presence of continental crust have been found by drilling

indicating late Cenozoic glaciationton?

Part 4 - CPR Writing Assignment



A virtual tour of the drillship is at

Overviews of the major results of Legs 120 and 183 are found in the ODP press

Virtual Tour of ODP Drillship

releases from each leg at:

ODP Leg 120 Press Release

ODP Leg 183 Press Release

Global Map of Large Igneous Provinces

ODP Site Location Map - Kerguelen Plateau

"The Life Cycle of Mantle Plumes

from Leq 183 is found at:

Leg 183 Scientific Results

Leg 183 Inital Reports

Hole 1138A, Core 28R

Hole 1138A, Core 37R

Hole 1138A, Core 53R

Hole 1138A, Core 69R

Hole 1138A, Core 72R

Hole 1138A, Core 83R

Hole 1138A, Core 70R and 71R

Hole 1138A, Core 73R (upper part)

Hole 1138A, Core 73R (lower part)

Site 1138 Composite Stratigraphic Section

A global map of Large Igneous Provinces is found at:

A location map of ODP drill sites on the Kerquelen Plateau is found at:

Summary articles on results from ODP drilling on the Kerquelen Plateau are

"The Lost World: Environmental Effects During Formation of a Giant Volcanic

Much more detailed information on shipboard results and shorebased studies

ODP Online Database (core photos, etc.): <u>ODP Online Database (JANUS)</u>

Cores illustrating the Kerguelen Plateau stratigraphic sequence: Hole 1138A, Core

"LIP Reading: Understanding the Kerguelen Plateau and Broken Ridge"

The composite stratigraphic sections for Site 1138 is found at:

2. Discussion of what constitutes a Large Igneous Province and the geologic processes involved in its development 3. How do results from Legs 120 and 183 (especially Site 1138) address questions regarding the nature and origin of the Kerguelen Plateau? o What is the source of the magma in a LIP? 4. How do results from Legs 120 and 183 (especially Site 1138) documen o How long does it take for a LIP to develop? the Mesozoic and Cenozoic geologic history of the Kerguelen Plateau? o Are LIPs restricted to either a continental or an oceanic setting?

Writing Prompt

Source Material o In what way are LIPs thought to be associated with mantle plumes? This assignment explores the significance and geologic history of the Kerguelen o Why are LIPs geologically important? Plateau Large Igneous Province, as revealed by Ocean Drilling Program (ODP) 3. Description of the geologic and oceanographic setting of the Kerguelen Plateau, and why is it considered to be a LIP. Background information about the Ocean Drilling Program (ODP) can be found o Where is the Kerguelen Plateau located? Ocean Drilling Program home pag o How large is the Kerguelen Plateau (compared to a familiar region)?

> o Describe the bathymetry (water depths) on the Plateau. o How was the Kerguelen hotspot involved in formation of the Plateau? o How do the igneous processes that formed the Kerguelen Plateau compare with those observed at modern active hot spots?

o What are some examples of LIPs around the world?

your word processor)! Also be sure to insert paragraph breaks using the prope

REMEMBER that these items will appear as a checklist for reviewing essays

1. Topic sentence(s) to introduce essay.

4. Summary of results from drilling basement (igneous) rocks on Legs 120 and 183 (especially Site 1138), and how these results address questions regarding the nature and origin of the Kerguelen Plateau.

 What kind of crust predominates at Kerguelen Plateau - continental or oceanic (what type of basement rock is present)? o What evidence for the presence of continental crust has been found by drilling on the Plateau?

o From what specific continents would this crustal material have come? o What was the character of the final phase of volcanism associated with the formation of the Plateau?

o What is the age and rock type found in the igneous basement at Site

o What was the eruptive setting for this rock (compared to sea level)? 5. Summary of the sedimentary depositional sequence found on Legs 120

Mesozoic and Cenozoic geologic history of the Kerguelen Plateau What sedimentological and/or paleontological evidence has been found indicating that the Plateau was an emergent land mass early in

and 183 (especially Site 1138) and how these results document the

o What sedimentological and/or paleontological evidence has been

o What sedimentological and/or paleontological evidence has bee found indicating that the Plateau later sank to pelagic depths? What sedimentological and/or paleontological evidence has been found indicating mid-Cenozoic climatic change?

found indicating late Cenozoic glaciation?

and paste your text into CPR's text box. Refer to the HTML Tutor link in th "Source Material Resources" section to learn the basic HTML codes that you will need to format your text (i.e., line returns, paragraph breaks

What sedimentological and/or paleontological evidence has been.

ALWAYS check your formatting by using the "Preview Text" button. This will show you exactly how your text will appear to reviewers.

Sample Student Essay

Submitted: 10/20/2003 3:29:17 PM Word Count: 628

Through the research of the Ocean Drilling Program headed by Texas A&M University, scientists and geologists have made considerable steps toward the understanding of Large Igneous Provinces. Drilling of the LIPs igneous basement by the sea vessel JOIDES Resolution, we gain a new perspective on the creation of these mysterious structures. Each core sample contains a detailed history of how the rocks originated and under what conditions. Unraveling these distinct rock records will either, confirm or dismiss previous hypotheses as well as create new ones. Eventually, this information could answer some of the largest questions that have baffled scientists for decades. Large Igneous Provinces are formed when extraordinary amounts of mantle-derived magma well up beneath the earth's crust, usually occurring in 1 to 10 million year episodes. This has been associated with possible decompression melting of an ascending hot mantle plume. The explosive volcanism involved injects harmful materials such as carbon dioxide and sulfur, into the earth's atmosphere causing substantial and perhaps catastrophic short and long term environmental effects. Two of the largest LIPs include the Ontong Java Plateau and the Kerguelen Plateau.

The 110 million year old Kerguelen Plateau is located in the remote sub-Antarctic region of the southern Indian Ocean. Its size resembles that of Argentina, spanning an enormous 1.78 million square miles. Lying 1 to 2.5 km below sea level, scientists were limited to studying the only above-water expressions, Tiny Kerguelen, Heard, and MacDonald islands. However, thanks to the ODP, they have found new and remarkable evidence of a history unlike any other earthly structure. Rather than one single massive volcanic event, several episodes of effusive volcanism over a prolonged period of time made up the LIPs crust. The uppermost crust contains a hybrid of oceanic and continental rock. Though dominated by basaltic rock, Gneiss, a continental rock, was found as clasts within a conglomerate. Fragments of East Gondawanan continental lithosphere was found, originating from India, Antarctica, and Australia, and is associated with the surfacing of the mantle plume. Toward the end of its construction, explosive volcanism of silica-rich magma was dispersed. This explosive volcanism is a likely factor in mass extinctions and global climate change. Subsequent research revealed that hot spots in the past operated much differently than the modern day hot spots we are familiar with. The prolonged duration, the spatial extent, and the timing of magmatism involved is uncharacteristic of those seen today.

Drilling at sites 120, 183, and 1138 revealed that the now underwater structure actually took shape above sea level. Basaltic crustal rocks which were erupted as the plateau began to form were found to have been created near sea level. Further evidence was found in sediments, which were shown to have accumulated on land, such as a marsh or a flood plain. Furthermore, fossils of wood, spores, pollen and a seed were recovered indicating a once warm, habitable environment. Eventually, tectonic plates carried the landmass away from its originating hot spot, the crust began to cool, slowly contracting and gradually subsiding below sea level. Layers of marine limestone containing fragments of fossilized bryozoans, clams, sponges, sea urchins, and a tooth are evidence of a gradual subsidence to marine depths. The limestone was determined to have been created during the Late Cretaceous Period indicating a subsiding period from 66 to 97 million years ago. Further subsiding to pelagic depths occurred, where for the next 65 million years, beds of fine grained chalk composed of microscopic skeletons of single-celled marine plants and animals accumulated. Today, its

the climate began a slow cooling process. By the Late Cenozoic, changes in the sediment composition reveal glaciation that spanned for millions of years.

subsidence resembles that of normal oceanic lithosphere. During the mid-Cenozoic, some 36 million years ago, an abrupt change in diatoms typical of temperate regions indicates that



Abstract:

FROM ODP TO CPR: USING OCEAN DRILLING PROGRAM DATA IN CALIBRATED PEER REVIEW ASSIGNMENTS

that has been drilled since 1997. Each of these sites were designed to address specific questions in geology

A Sunken Land Brought to Light

Fact vs. Fiction

schedule for the project is as follows:

A virtual tour of the drillship is at

Virtual Tour of ODP Drillship

ODP Leg 120 Press Release

ODP Leg 183 Press Release

Tabloid Newspaper Article

Complete Kerguelen Questions 1 Kerguelen Worksheet

Assigned Reading:

• Examine the global map of Large Igneous Provinces found at:

Rocks recovered from Kerguelen Plateau on Leg 120

ODP Site Location Map - Kerguelen Plateau

Reading C: "The Life Cycle of Mantle Plumes"

worksheet) must be completed by 11:55 p.m. Sept. 14.

Site 1138 Composite Stratigraphic Section

(Oct. 13) Deadline for CPR essay sumbission (11:55 p.m.)

(Oct. 20) Deadline for CPR calibrations and reviews (11:55 p.m.)

Igneous Province at http://cpr.molsci.ucla.edu/

1138, found at:

(Oct. 1 and 2) In-Class ACTIVITY K4: Kerguelen Lab Project II

Click here for directions to completing a Calibrated Peer Review assignment.

A location map of ODP drill sites on the Kerguelen Plateau is found at:

Reading A: "LIP Reading: Understanding the Kerguelen Plateau and Broken Ridge"

Complete Kerguelen Worksheet 2A or Kerguelen Worksheet 2B or Kerguelen Worksheet 2C

Global Map of Large Igneous Provinces

• Examine the core photos found at:

(Sept. 3 and 4) In-Class ACTIVITY K1: Introduction to Kerguelen Project

• Background information about the Ocean Drilling Program (ODP) can be found at:

• A 1988 tabloid newspaper article inspired by the Leg 120 press release is found here:

parts of the structure above sea level are tiny volcanic islands.

subsequently sank to its current submerged state.

HEISE, Elizabeth A., Department of Chemistry and Environmental Science, The University of Texas at Brownsville, 80 Fort Brown, Brownsville, TX 78520, eheise @uclalumni.net and PALMER-JULSON, Amanda, Natural Sciences, Blinn College, P.O. Box 6030, Bryan, TX 77805

Foundation, with substantial contributions from its international partners. The Joint Oceanographic Institutions manages the program. Texas A & M Uni

Our assignment involves reconstructing the geologic history of a Large Igneous Province, the Kerguelen Plateau, Southern Indian Ocean (Legs 120 and

UCLA, and is maintained on their servers. It is currently supported by the University of California, and is shared at no cost to colleges and university

essays, and self-assessment. CPR thus follows the model of actual scientific writing: anonymous peer review. Furthermore, it addresses a problem fac

scoring. Their overall assignment grade combines the scores for the student's essay with the results of their calibrations, their assessment of pee

ing college faculty across the nation: how to assess critical thinking and technical writing skills without requiring additional grading resources

183). Students are shown how to approach the data on ODP's site and then write a geologic history based on those data.

versity is responsible for science operations, and

Lamont-Doherty Earth Observatory of Columbia University is responsible for logging service

Much of ODP's data are accessible on ODP's webpage (http://www-odp.tamu.edu). There include detailed descriptions of every site and every core

nstructional tool (http://cpr.molsci.ucla.edu). CPR was recently developed under an NSF systemic reform initiative in Chemistry (DUE 95-55-605) a

Lost Atlantis (In the Indian Ocean)?

The Tale of Kerguelen Plateau

In 1988 an international team of scientists aboard the Ocean Drilling Program's (ODP) drillship JOIDES Resolution braved the stormy waters of the southern Indian Ocean to conduct the first scientific drilling on the Kerguelen Plateau. Located in one of the most remote

places on Earth, the Kerguelen Plateau is an upraised region of the seafloor approximately the size and shape of Argentina. The only

Prior to the drilling operation, survey cruises had indicated layers of sediment draping a large sunken rock platform. Scientists

hypothesized that large-scale volcanic eruptions had been responsible for building the plateau to above-sea-level heights, but it

The initial nine-week expedition recovered cores of rock and sediment that confirmed pre-cruise speculation regarding the Plateau's

origin and history. Massive outpourings of lava during the rime of the dinosaurs built an initially barren landmass, which later evolved

into a lush, primeval forest that underwent a long period of slow subsidence before reaching its present depth hundreds to thousands of

Following standard post-cruise procedures a press release detailing results of the drilling was made available to news agencies worldwide However, as often happens in the reporting of scientific discoveries, mistakes and misunderstandings crept in. A few months after the

cruise, an ODP employee was browsing the supermarket tabloids while waiting in the checkout line. He was startled to find an article

The purpose of this month-long project is to acquaint you with the nature of scientific research by exploring the details of an actual investigation. First, you'll learn about the Ocean Drilling Program and its mission, and read for yourself the official press release -- and the tabloid report that followed. Then you'll look at the fundamental scientific problems that the 1988 drilling cruise (and subsequent

scientists were able to reconstruct a plausible sequence of events likely to have occurred during the geologic history of the Kerguelen

In the course of this project there will be assigned readings, in-class discussions, lab projects and a culminating written assignment. A

• Overviews of the major results of Kerguelen Plateau drilling cruises (Legs 120 and 183) are found in the ODP press releases from

Assessment: Web-CT Quiz K1 by (based on the answers to questions on the worksheet) must be completed by 11:55 p.m. Sept. 7

• Read the article on results from ODP drilling on the Kerguelen Plateau as assigned in class (it will be ONE of these three):

Assessment: Web-CT Quiz K2A by or Web-CT Quiz K2B by or Web-CT Quiz K2C by (based on the answers to questions on the

(Sept. 15 and 16) In-Class ACTIVITY K3: Kerguelen Lab Project I Based on the articles read in Activity K2 by group members,

Based on the data analyzed in class by group members, answer the questions on the lab worksheet. Be sure to record complete answers

Begin Calibrated Peer Review (CPR) Writing assignment, Kerguelen Plateau, Southern Indian Ocean: Geologic History of A Large

as you will need them for the upcoming writing assignment. Data for analysis in class include the composite stratigraphic sections for Site

answer the questions on the lab worksheet. Be sure to record complete answers as you will need them for the upcoming writing

Reading B: "The Lost World: Environmental Effects During Formation of a Giant Volcanic Province"

(Sept. 10 and 11) In-Class ACTIVITY K2: What Is Scientific Ocean Drilling and What Does It Tell You? (Discussion of previous

expeditions) were designed to address. Finally you will examine some of the actual data collected during the cruise and learn how

announcing that scientific drilling had recovered proof that the lost continent of Atlantis had finally been found... and it was the

article, what is wrong with the statement regarding dinosaurs?

10. What did the tabloid article succeed in reporting accurately

when compared with the official ODP Leg 120 Press Release?

K1: Kerguelen Worksheet	Time Remaining
anda Julson (Preview) October 26, 2003 9:02am	24 : 27 (min:sec
Illowed: 25 minutes er of questions: 10	Unanswered ✓ Answered
sh Help	! Answer not saved
uestion 1 (10 points) hat institution is the Science Operator for DP?	1 2 3 4 5 6 7 8 9 10
👝 a. Blinn College	
5 b. Texas A&M University	
C c. The University of Texas	
C d. Scripps Institute of Oceanography	
Save answer	
Question 2 (10 points)	
How is the Ocean Drilling Program (ODP) funded?	
 a. Texas A&M University provides all the funding. 	
C b. Blinn College provides all the funding.	
 c. The U.S. National Science Foundation and 22 international partners provide the funding. 	
d. The U.S. National Science Foundation alone provides the funding.	
Save answer	
Question 3 (10 points)	
What enables the drillship JOIDES Resolution to remain on station over a drillsite?	
C a. The heave compensator.	
C b. The ship's dynamic positioning	

Assignment for Part 2

Kerguelen Questions 2A (Worksheet)								
Print out this worksheet. As you visit the web sites linked in ACTIVITY K2, look for answers to these questions. ONLY USE THIS WORKSHEET IF YOU WERE ASSIGNED READING A ("LIP READING: UNDERSTANDING THE KERGUELEN PLATEAU AND BROKEN RIDGE").								
You will then be ready to log onto Web-CT, find QUIZ K2A and enter the correct answers to each question.								
1. What does the word "contiguous" mean (Hint: it is in the dictionary)?								

Site Map for 183

Address 🙆 http://www.joiscience.org/greatesthits2/pdfs/hotspots.pdf 🔻 🎓 Go Links 🤏

LIP Reading: Understanding the Kerguelen Plateau and Broken Ridge

› - | AA AA B•| • • | III | 4 • • | • • |

2. With what other undersea structure did Kerguelen Plateau once form a contiguous plateau one third the size of Australia?

3. What was the type of rock recovered at an ODP drill site on the Kerguelen Plateau in 1999 that provided the first unequivocal evidence of continental crust from the plateau? 4. What type of rock dominates the uppermost crust of Kerguelen Plateau? 5. What radiometric age dating technique was used to determine the age of

rocks from Kerguelen Plateau? 6. In most models for the eruption of continental flood basalts and oceanic plateaus, which part of the mantle plume would be expected to cause more voluminous output of magma? 7. In what ways did magmatic activity at Kerguelen Plateau prove to be more complex than anticipated?

10. What was the phrase or concept in this article that you found most difficult to

understand (you will not get credit for answering "the whole thing").

8. Most basaltic magma that erupts on Earth comes from a source in Earth's asthenosphere. How is the source of mantle plumes thought to differ? 9. From the figure and accompanying caption, when was the peak (greatest rate) of magma output at Kerguelen Plateau?

Assessment for Part 2

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△ CLOSE

≇ WebCT	Quiz - Microsoft Internet Exp	lorer					_
K2A: K	Kerguelen Worksheet	1	Tim	e Rei	main	ing	
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Questic			6	7	8	9	10
	es the word "contiguous" me large	aı					
_	Next or adjacent to.						

Finish Help Question 1 What does the 👝 a. large o b. Next 👝 c. underwater 👝 d. polar Save answer Question 2 (10 points) With what other undersea structu form a contiguous plateau one

👝 a. Broken Ridge 👝 b. Australia 🦰 c. Hawaii 👝 d. Africa

Kerguelen Lab Project I Based on the articles read by group members, answer the

questions assigned to your lab table. Each group will present its answers to the class. Be sure to record this information as it is presented as you will need it for the upcoming writing assignment KEEP THIS PAGE!

Part 3 - In Class Activities

<u>Biostratigraphy</u>

processes involved in its development. Give examples from the articles and note the source of information (Reading A, B or C). a. What is the source of the magma in a LIP?

b. How long does it take for a LIP to develop? c. Are LIPs restricted to either a continental or an oceanic setting? d. What are some examples of LIPs?

e. In what way are LIPs thought to be associated with mantle plumes? f. Why are LIPs important?

2. Describe the geologic and oceanographic setting of the Kerguelen Plateau and why is it considered to be a LIP. Give examples from the articles and note the source of information (Reading A, B or C).

a. Where is the Kerguelen Plateau? b. How large is the Kerguelen Plateau (compared to a familiar region)? c. Describe the bathymetry (water depths) on the Plateau.

d. How was the Kerguelen hotspot involved in formation of the Plateau? e. How do the igneous processes that formed the Kerguelen Plateau compare with those observed at modern active hot spots?

Mesozoic and Cenozoic geologic history of the Kerguelen Plateau. a. What sedimentological and/or paleontological evidence has been found indicating that the Plateau was an emergent land mass early in its history? b. What sedimentological and/or paleontological evidence has been found indicating that the Plateau subsequently sank to shallow marine depths? c. What sedimentological and/or paleontological evidence has been found indicating that the Plateau later sank to pelagic depths? d. What sedimentological and/or paleontological evidence has been found indicating mid-Cenozoic climatic change?

c. With what specific continents would this material be associated? d. What was the character of the final phase of volcanism associated with the formation of the Plateau? (This is looking for an igneous rock composition term). e. What is the age and composition of the igneous basement at Site 1138? f. What was the eruptive setting for this basement (compared to sea level)? 2. Summarize the sedimentary depositional sequence found on Legs 120 and 183 (especially Site 1138) and discuss how these results document the

e. What sedimentological and/or paleontological evidence has been found