

**Amended Application for Port Call Clearance  
and Consent to Conduct Marine Scientific Research  
in Areas Under National Jurisdiction of**  

<b>ICELAND</b>
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**(name of coastal state)**

Date: 5 December 2006

**1. General Information**

<b>1.1 Cruise name and/or #:</b>	Research Vessel R/V Knorr
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<b>1.2 Sponsoring institution:</b>	
<b>Name:</b>	Woods Hole Oceanographic Institution
<b>Address:</b>	Woods Hole, MA 02543 USA
<b>Name of Director:</b>	Dr. James Luyten, Acting Director

<b>1.3 Scientist in charge of the project (include CV and passport photo):</b>	
<b>Name:</b>	Richard Hey
<b>Address:</b>	HIGP/SOEST/Univ. of Hawaii, Honolulu, HI, 96822
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<b>Fax:</b>	808-956-3189
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**BIOGRAPHICAL SKETCH**

**Richard N. Hey**

Hawaii Institute of Geophysics and Planetology  
School of Ocean and Earth Science and Technology  
University of Hawaii at Manoa  
2525 Correa Road  
Honolulu, HI 96822

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Birth: June 2, 1947, Tennessee

**PROFESSIONAL PREPARATION:**

California Institute of Technology, B.S., Geology, 1969  
Princeton University, Ph.D., Geology and Geophysics, 1975

**APPOINTMENTS:**

- 8/86 - present Geophysicist, School of Ocean and Earth Science and Technology, University of Hawaii, Honolulu, Hawaii
- 1/81 - 7/86 Assistant to Associate Research Geophysicist, Scripps Institution of Oceanography, University of California, San Diego
- 6/75 - 12/80 Assistant to Full Research Geophysicist, Hawaii Institute of Geophysics and Research Corporation, University of Hawaii
- 1/74 - 6/75 Research Associate, Geophysics Laboratory, University of Texas Marine Science Institute
- 1970 - 1973 Teaching Assistant, Princeton University
- 1969 - 1974 Research Assistant, Princeton University

## **PROFESSIONAL SOCIETIES:**

American Geophysical Union (Fellow)  
Geological Society of America (Fellow)  
American Association for the Advancement of Science

## **PUBLICATIONS**

### **Five Publications Most Closely Related to the Proposed Project:**

Hey, R.N., Tectonic evolution of the Cocos-Nazca spreading center, *Geol. Soc. Am. Bull.*, 88, 1404-1420, 1977.

Hey, R.N., F.K. Duennebie, and W.J. Morgan, Propagating rifts on mid-ocean ridges, *J. Geophys. Res.*, 85, 3647-3658, 1980.

Hey, R.N., Evidence for spreading center jumps from fine-scale bathymetry and magnetic anomalies near the Galapagos Islands, *Geology*, 7, 504-506, 1979.

Hey, R.N. and D.S. Wilson, Propagating rift explanation for the tectonic evolution of the Northeast Pacific - The pseudomovie, *Earth Planet. Sci. Lett.*, 58, 167-188, 1982.

Wilson, D.S. and R.N. Hey, History of rift propagation and magnetization intensity for the Cocos-Nazca spreading center, *J. Geophys. Res.*, 100, 10041-10056, 1995.

### **Five Other Significant Publications:**

Hey, R.N., A new class of pseudofaults and their bearing on plate tectonics: A propagating rift model, *Earth Planet. Sci. Lett.*, 37, 321-325, 1977.

Hey, R.N. and P.R. Vogt, Spreading center jumps and sub-axial asthenosphere flow near the Galapagos hotspot, *Tectonophysics*, 37, 41-52, 1977.

Hey, R.N., D.F. Naar, M.C. Kleinrock, W.J. Phipps Morgan, E. Morales, and J.G. Schilling, Microplate tectonics along a superfast seafloor spreading system near Easter Island, *Nature*, 317, 320-325, 1985.

Hey, R.N., J.M. Sinton, and F.K. Duennebie, Propagating rifts and spreading centers, in *Decade of North American Geology: The Eastern Pacific Ocean and Hawaii*, Geological Society of America, 161-176, 1989.

Hey, R.N., P.D. Johnson, F. Martinez, J. Korenaga, M.L. Somers, Q.J. Huggett, T.P. LeBas, R.I. Rusby, and D.F. Naar, Plate boundary reorganization at a large-offset, rapidly propagating rift, *Nature*, 378, 167-170, 1995.

## **SYNERGISTIC ACTIVITIES:**

Results from my previous research have been integrated into plate tectonic theory and, in addition to the scientific literature, appear in textbooks and encyclopedias that will be used to educate future generations of students. These results are used in my courses, including innovative curricular materials such as the computer graphics animation movies we developed to show plate tectonic evolution as propagating rifts change oceanic ridge/transform geometry, one of which is included on my website. I've been Chief or co-Chief Scientist on 20 oceanographic expeditions which have trained ~ 55 women and ~ 15

minority students, including undergrads, grads, and postdocs, in marine geological and geophysical data collection and analytical techniques. There have been 31 minority and 15 women co-authors on the papers presenting this research. Two state of the art analytical techniques were developed in my lab, PRMap, which is used to model seafloor propagator wakes, and Magbath, which has been used by many scientists to model seafloor magnetic anomalies taking topography into account. I've also served as Associate Editor of Marine Geophysical Researches from 1986 to the present.

**COLLABORATORS & OTHER AFFILIATIONS:**

**Collaborators:**

**J. Karson, E. Klein, J. Gee, K. Gillis, R. Varga, R. Detrick, A. Hoskuldsson, F. Martinez, S. Diniega, D.F. Naar, J. Francheteau, R. Armijo, M. Constantin, J.P. Cogne, J. Girardeau, R. Hekinian, R. Searle, P.D. Johnson, D.R. Pardee, A. Gascho, E. Baker, J. Lupton, R.A. Feely, J.J. Gharib, G.J. Massoth, J.A. Resing, F.J. Sansone, M. Kleinrock, D. Bohnenstiehl, S.L. Walker, J.H. Steele, S.A. Thorpe, K.K. Turekian.**

**Graduate Advisors:**

W.J. Morgan (Princeton), K.S. Deffeyes (Princeton), T.H. Jordan (USC)

**Graduate Advisees Past 5 Years:**

D.R. Pardee, A. Gascho

**Total Number of Grad Students Advised: 23**

**Total Number of Postdocs Sponsored: 1**



**Richard N. Hey**

<b>1.4 Scientist(s) from coastal state involved in the planning of the project:</b>	
<b>Name(s):</b>	Ármann Höskuldsson
<b>Address:</b>	Institute of Earth Sciences, University of Iceland, Sturlugata 7, 101 Reykjavík, Iceland

<b>1.5 Submitting officer:</b>	
<b>Name and address:</b>	Elizabeth Caporelli, Marine Operations Coordinator Woods Hole Oceanographic Institution 38 Water Street, Mail Stop # 37 Woods Hole, MA 02543 USA
<b>Nationality:</b>	USA
<b>Telephone:</b>	508-289-2277
<b>Fax:</b>	508-457-2185
<b>Email:</b>	ecaporelli@whoi.edu

## **2. Description of Project (Attach additional pages as necessary)**

**2.1 Nature and objectives of the project:** The Reykjanes Ridge is one of the most striking parts of the mid-ocean ridge system on global maps of gravity and bathymetry because of the V-shaped diachronous ridges pointing away from Iceland. It is probably the most anomalous slow spreading ridge, showing the morphology and topography of a fast spreading ridge, presumably because of extra magma supply from the Iceland hotspot. It shows the strongest influence of a hotspot on any mid-ocean ridge and thus is probably the type example of this important effect. It is also the type example of an obliquely spreading ridge, trending ~30° oblique to present plate motion. Despite the importance of understanding this major feature, there is a significant data gap along arguably the most important segment of this ridge, the part extending from the Iceland margin to the northern boundary of extensive multibeam bathymetry, sidescan, seismic reflection and magnetics surveys which constrain the Reykjanes Ridge evolution south of 62°N. The off-axis area north of this has never been systematically surveyed to collect the marine geophysical data necessary to investigate whether there is a pattern of oceanic ridge jumps that relates in some way to the known rift relocations observed on Iceland. It is important to do this to test between competing hypotheses for the major V-shaped patterns of bathymetry and gravity. Although various “pulsing plume” hypotheses to explain this pattern have long been favored, recently an alternative “rift relocation” hypothesis has been proposed. This hypothesis predicts a strong correlation between ridge jumps and the V-shaped diachronous ridges that our proposed geophysical survey will test. Our goal is a seamless history of the plate boundary geometry both at sea and on land during the past 18 Ma. We regard this as an essential step toward the full understanding of Iceland and the geodynamic influence of the hotspot or mantle plume on the mid-ocean ridge system.

**2.2 Relevant previous or future research cruises:** In 2003 we conducted a seagoing investigation of the northernmost part of the Reykjanes Ridge near the south coast of Iceland, using the EM300 multibeam system on the research vessel *Árni Fridriksson*. The study revealed two overlapping axial volcanic ridges extending from the tip of the Reykjanes peninsula southward along the Reykjanes Ridge.

**2.3 Previously published research data relating to the project:** So far two posters at the 2003 AGU Fall meeting have presented the results, with one more submitted for the 2006 AGU Fall meeting, and one paper by Höskuldsson et al. in press.

### 3. Methods and Means to be Used

<b>3.1 Particulars of vessel:</b>	
<b>Name:</b>	Research Vessel Knorr
<b>Nationality (Flag state):</b>	USA
<b>Owner:</b>	United States
<b>Operator:</b>	Woods Hole Oceanographic Institution
<b>Overall length (meters):</b>	85 meters
<b>Maximum draught (meters):</b>	5.1 meters
<b>Displacement/Gross tonnage:</b>	2,518 T
<b>Propulsion:</b>	Diesel Electric
<b>Cruising &amp; Maximum speed:</b>	12 knots/15 knots
<b>Call sign:</b>	KCEJ
<b>Method and capability of communication (including emergency frequencies):</b>	INMARSAT Satellite Telephone Iridium Satellite telephone VHF Channel 13 and 16 Single Side Band 2182 kHz
<b>Name of master:</b>	Captain Kent Sheasley
<b>Number of crew:</b>	23
<b>Number of scientists on board:</b>	34

**3.2 Aircraft or other craft to be used in the project:**  
none

#### 3.3 Particulars of methods and scientific instruments

<b>Types of samples and data</b>	<b>Methods to be used</b>	<b>Instruments to be used</b>
Gravity, magnetics, and bathymetry data, and bathythermograph data	Gravimeter, Magnetometer, and SeaBeam multibeam, Expendable bathythermograph	Gravimeter, Magnetometer, Multibeam, 3.5 kHz and 12 kHz transducers, XBTs
Sediments	Coring	Gravity Core

**3.4 Indicate whether harmful substances will be used:**  
no

**3.5 Indicate whether drilling will be carried out:**  
No

**3.6 Indicate whether explosives will be used:**  
no

#### 4. Installations and Equipment

Details of installations and equipment (dates of laying, servicing, recovery; exact locations and depth):

none

#### 5. Geographical Areas

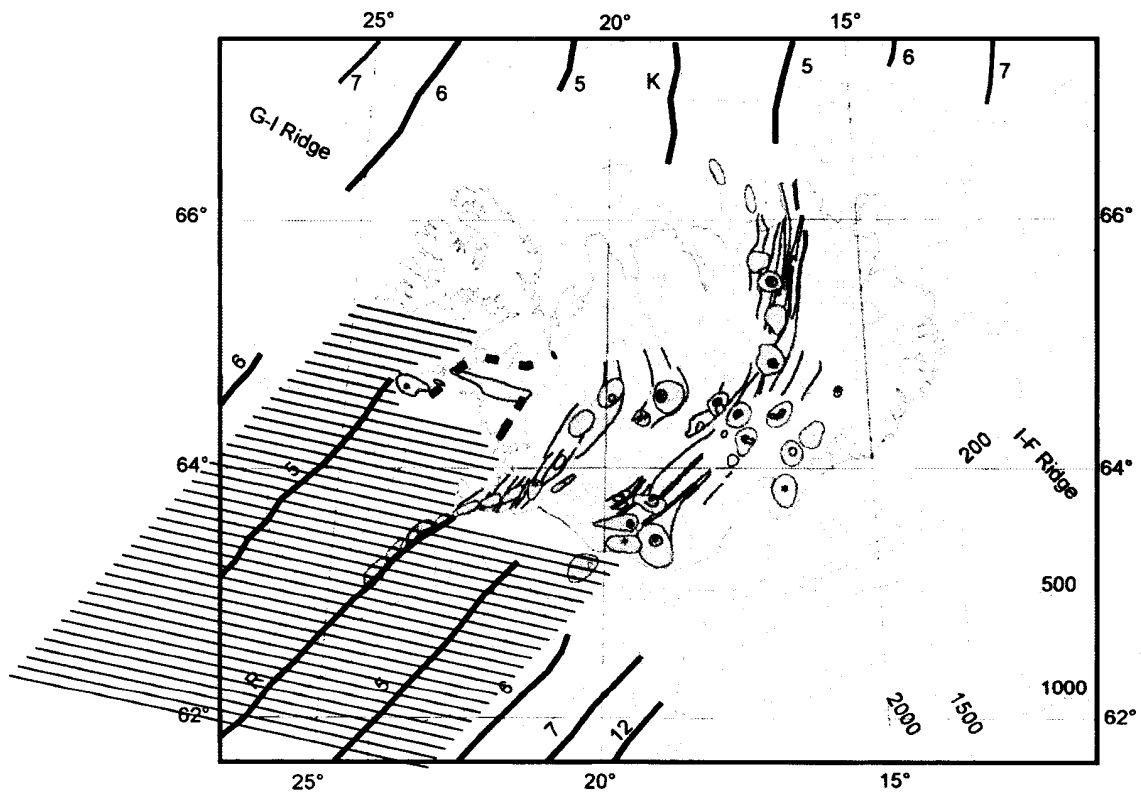
5.1 Indicate geographical areas in which the project is to be conducted (with reference in latitude and longitude):

62-65N, 20-30W (See Chart below)

Core Sites: (See Chart on following page)

- 1) 63° 19'N, 20° 20'W
- 2) 63° 22'N, 20° 14'W
- 3) 63° 14'N, 20° 27'W

5.2 Attach chart(s) at an appropriate scale (1 page, high-resolution) showing the geographical areas of the intended work and, as far as practicable, the positions of intended stations, the tracks of survey lines, and the locations of installations and equipment.



**CORE SITES:**



**6. Dates**

**6.1 Expected dates of first entry into and final departure from the research area of the research vessel:**

Entry: 15 June 2007, Departure 15 July 2007

**6.2 Indicated if multiple entry is expected:**

no

**7. Port Calls**

**7.1 Dates and names of intended ports of call in:**

Arrive: Reykjavik, Iceland 11 June 2007  
Depart: Reykjavik, Iceland 15 June 2007  
Arrive: Reykjavik, Iceland 15 July 2007  
Depart: Reykjavik, Iceland 17 July 2007

**7.2 Any special logistical requirements at ports of call:**

none

<b>7.3 Name/Address/Telephone of shipping agent (if available):</b>
<p><b>Iceland</b></p> <p>EIMSKIP Port Agency Services  Posthusstraeti 2  101 Reykjavik  ICELAND</p> <p>Contact: Arnar Jonsson  tel. 354 525 7273  fax: 354 525 7279  cell: 354 825 7273  email: <a href="mailto:pas@eimskip.is">pas@eimskip.is</a></p>

## **8. Participation:**

<b>8.1 Extent to which coastal state will be enabled to participate or to be represented in the research project:</b>
<p>Co-PI (Ármann Höskuldsson from Institute of Earth Sciences, University of Iceland) is Icelandic, and we hope several Icelandic students and scientists will participate on the expedition.</p>

<b>8.2 Proposed dates and ports for embarkation/disembarkation:</b>
<p>Embark: Reykjavik, Iceland 15 June 2007  Disembark: Reykjavik, Iceland 15 July 2007</p>

## **9. Access to data, samples and research results**

<b>9.1 Expected dates of submission to coastal state of preliminary reports, which should include the expected dates of submission of the final results: mid-August, 2007</b>
<p>No more than 30 days from the end date of the cruise.</p>

<b>9.2 Proposed means for access by coastal state to data and samples:</b>
<p>Co-PI (Ármann Höskuldsson) will have copies of all data, and additional copies will be provided as requested</p>

<b>9.3 Proposed means to provide coastal state with assessment of data, samples and research results or provide assistance in their assessment or interpretation:</b>
<p>Through collaborative research</p>

<b>9.4 Proposed means of making results internationally available:</b>
<p>Through publications and websites</p>