NOTIFICATION OF PROPOSED RESEARCH CRUISE

PART A: GENERAL

1. NAME OF RESEARCH SHIP: **RRS James Clark Ross** — CRUISE NO.: **JR 269**

2. DATES OF CRUISE: From: 21 August 2011 To: 7 September 2011

3. OPERATING AUTHORITY:
British antarctic Survey, Highcross, Madingley Road, Cambridge CB3 0ET United Kingdom
TELEPHONE:
+ 1223 221497 **Contact Mr Chris Hindley – Ship Operations Manager**
TELEFAX:
+ 1223 362616
TELEX:
817725 BASCAMG

4. OWNER (if different from no. 3)
Natural Environment Research council, Polaris House,North Star Ave, swindon, SN2 1EU United Kingdom

5. PARTICULARS OF SHIP:

Name:	**RRS James Clark Ross on: 316163 imo: 8904496**
Nationality:	**Falkland Island (British)**
Overall length: (in metres)	**99.041 m**
Maximum draught: (in metres)	**Summary Draft 6.511 m**
Net tonnage:	**1719 tonnes**
Propulsion e.g. diesel/steam:	**Diesel Electric**
Call sign:	**ZDLP**
Registration port and number (if registered fishing vessel)	

6. CREW

Name of master: Captain Jerry Burgan

Number of crew: **28**

7. SCIENTIFIC PERSONNEL

Name and address of scientist in charge:
Professor Tim Minshull
National Oceanography Centre Southampton,
University of Southampton
European Way
Southampton
SO14 3ZH
United Kingdom

Tel/telex/fax no.:
Tel: + 44 2380596569
Fax: +44 2380593059
Email: tmin@noc.soton.ac.uk

No. of scientists: Maximum 26

8. GEOGRAPHICAL AREA IN WHICH SHIP WILL OPERATE (with reference to latitude and longitude)

Cruise JR269 will operate along the western shelf and slope off Prins Karls Forland – Kongsfjord, and Vestnesa Ridge, Svalbard. Scientific work will be focused in the region 6-11ºE, 78º15'-79º15'N.

9. BRIEF DESCRIPTION OF PURPOSE OF CRUISE

In 2008, hundreds of plumes of bubbles of methane gas were discovered rising from the seabed west of Spitsbergen, in the Arctic, in water depths at and shallower than the expected the upper limit of the methane hydrate stability zone (GHSZ). It is probable that these plumes come from methane released by the dissociation of methane hydrate beneath the seabed, caused by an increase in water temperature near the seabed of 1°C over the past 30 years, which has deepened the top of the GHSZ by 40 m. If so, this is

the first known occurrence of methane release from hydrate by ocean warming in modern times. The proposed research will employ very-high-resolution seismic imaging to identify gas hydrate and free gas in the sediments beneath the seabed, and to define in detail the sedimentary architecture and structures that control the routes taken by gas as it migrates to the seabed. These will be compared with the structures releasing gas into the water from a pockmark in deeper water. A test will also be carried out of refurbished electromagnetic sounding equipment.

10. DATES AND NAMES OF INTENDED PORTS OF CALL

Longyearbyen (Svalbard) – Between 21st and 23rd August 2011 (Taking ship over from another cruise)

11. ANY SPECIAL REQUIREMENTS AT PORTS OF CALL

None

NOTIFICATION OF PROPOSED RESEARCH CRUISE

1. PART B: DETAILS

1. NAME OF RESEARCH SHIP: **RRS James Clark Ross** — CRUISE NO.: **JR 269**

2. DATES OF CRUISE: From: 21 August 2011 To: 7 September 2011

3. a) PURPOSE OF RESEARCH

The fundamental hypothesis that will be examined by this work is that warming of the ocean can bring about release of methane sufficiently rapidly for it to have a significant effect on climate. Even though the change in temperature of sediment beneath the seabed and consequent dissociation of hydrate may take place over a few decades in the upper few tens of metres of the GHSZ, it could take much longer than this (hundreds of years) for the gas to migrate to the seabed, depending on where in the GHSZ the hydrate is located and on the permeability of the sediments and their depositional architecture and on structures within them that could act as high permeability conduits. Although, there is much observational evidence for the nature of seeps and vents at the seabed, and seismic images of medium-to-large-scale structures that underlie them, very little is known of the smaller structures that actually carry the gas to the seabed.

The overarching objective is to discover the ways in which free gas released by the dissociation of gas hydrate migrates to the seabed. There are three situations in which this gas migration occurs:

1) Where the gas hydrate stability zone (GHSZ) is removed entirely by a change in P-T conditions, such as increasing water temperature, and gas migration is controlled entirely by the stratigraphy and structures of the sediment that contained the hydrate or lies above the sediment that contained hydrate.
2) Where the GHSZ is thinned by a change in P-T conditions, but not removed entirely, and gas released from dissociation of hydrate at the base of the GHSZ migrates up slope beneath the GHSZ to escape to the seabed in the region landward of the GHSZ.
3) Where the GHSZ is thinned, but gas released from dissociation of hydrate at the base of the GHSZ migrates to the seabed in gas chimneys through the GHSZ that have their seabed expression in the form of large pockmarks.

Gas migrating from deeper beneath the GHSZ can also contribute to the gas migration in these three situations, in addition to the gas released from hydrate.

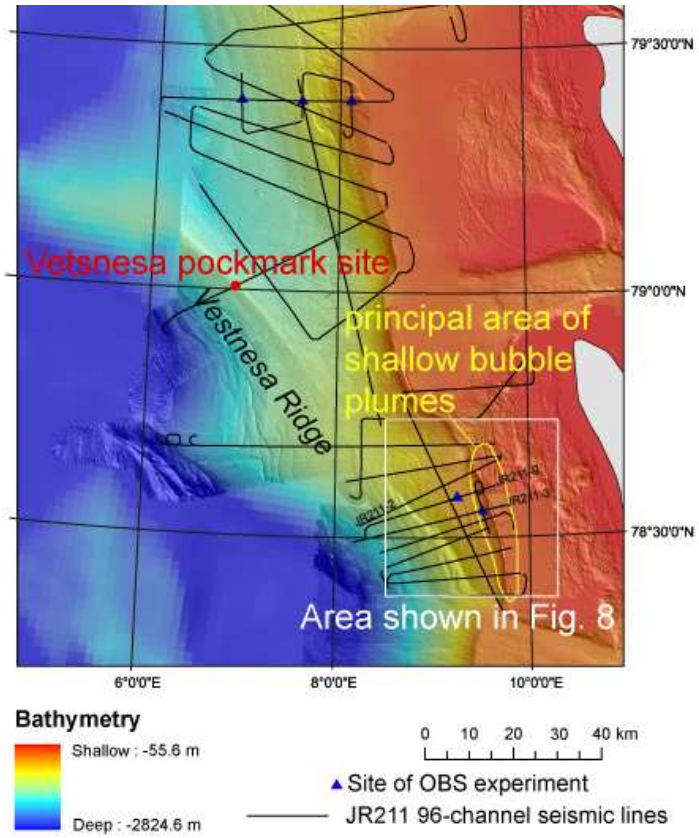
b) GENERAL OPERATIONAL METHODS (including full description of any fish gear, trawl type, mesh size, etc.)

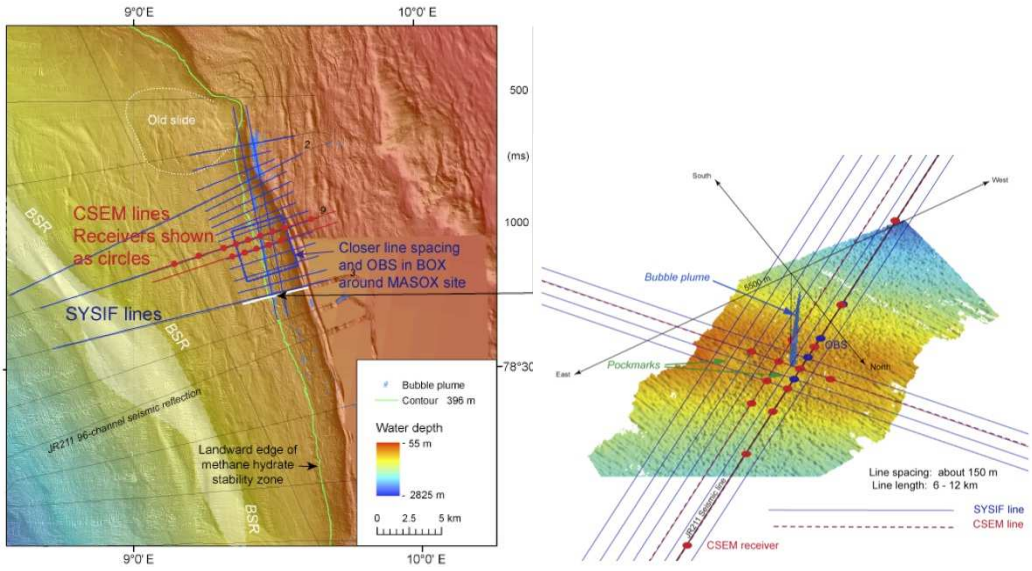
To achieve the primary objective we intend to define a) structural and sedimentary architecture of the edge of the GHSZ and the pockmark, b) sub-seabed distribution and amounts of hydrate and free gas (through electromagnetic work in a subsequent year), and c) migration pathways of free gas. These will be accomplished primarily by acquisition of new high-resolution seismic reflection data using a short streamer and mini-GI gun source, and very-high-resolution seismic reflection data with Ifremer's deep-tow seismic system, SYSIF. We will also deploy ocean bottom seismometers to record the airgun and SYSIF sources and thereby determine the seismic velocity structure of the shallow subsurface.

A series of other geophysical tools will also be used:

1. Swath bathymetry.
2. XBT probes to determine ocean temperature structure.
3. CTD probe to determine ocean temperature and salinity structure.
4. High-frequency echosounders to detect gas bubbles in the ocean.
5. A deep-towed controlled source electromagnetic source and two seabed receivers, to test operation of the refurbished source.

4. ATTACH CHART showing (on an appropriate scale) the geographical area of intended work, positions of intended stations, tracks of survey lines, positions of moored/seabed equipment, areas to be fished





Top panel shows seismic profiles acquired in 2008 and seafloor instrument sites in 2008. White box marks region of lower left panel and red dot shows centre of lower right map. Lower left panel: Blue lines illustrate types of SYSIF profile that will be acquired in the bubble plume area; conventional seismic reflection data will also be acquired along some of these profiles. The precise location of the profiles will be shifted a little to the south to focus around the final location of the MASOX site at 78º33.272'N, 9º28.699'E. Ocean bottom seismometers will be deployed on some of these lines (up to four instruments in total). Lower right panel: Blue lines mark types of SYSIF profile that will be acquired at the Vestnesa Ridge site and blue symbols mark possible ocean bottom seismometer locations (up to four at this site). Both lower panels: Red lines and symbols mark proposed electromagnetic profiles that will be acquired in a subsequent year; in 2011 a short test profile will be conducted in one of the survey areas using two seabed instruments.

5. a) TYPES OF SAMPLES REQUIRED (e.g., geological/water/plankton/fish/radionuclide)

The cruise will be entirely geophysical in nature and no sampling is planned.

b) METHODS OF OBTAINING SAMPLES (e.g., dredging/coring/drilling/fishing, etc. When using fishing gear, indicate fish stocks being worked, quantity of each species required, and quantity of fish to be retained on board).

Not applicable.

DETAILS OF MOORED EQUIPMENT

Dates Laying	Recovery	Description	Depth	Latitude	Longitude
25th August-7th September 2011	25th August-7th September 2011	Ocean bottom seismometers	300-1300 m	78º15'-79º15'N	6-10ºE
25th August-7th September 2011	25th August-7th September 2011	Ocean bottom electromagnetic receivers	300-1300 m	78º15'-79º15'N	6-10ºE

ANY HAZARDOUS MATERIALS (chemicals/explosives/gases/radioactives, etc.)
(Use separate sheet if necessary)

7.

a) Type and trade name — Tadiran or Electrochem

b) Chemical content (and formula) — Lithium batteries

c) IMO IMDG code (reference and UN no.)

d) Quantity and method of storage on board — A few tens of battery packs, stored in approved packaging.

e) If explosives give dates of detonation
- Method of detonation
- Position of detonation
- Position of detonation
- Frequency of detonation
- Depth of detonation
- Size of explosive charge in kg.

8. DETAIL AND REFERENCE OF

a) Any relevant previous/future cruises

- RRS *James Clark Ross* cruise 211, August-September 2008
- RRS *James Clark Ross* cruise 253, July-August 2011

b) Any previously published research data relating to the proposed cruise

Westbrook, G. K. et al. (2009). Escape of methane gas from the seabed along the West Spitsbergen continental margin. Geophys. Res. Lett., 36, L15608, doi:10.1029/2009GL039191.

9. NAMES AND ADDRESSES OF SCIENTISTS OF THE COASTAL STATE(S) IN WHOSE WATERS THE PROPOSED CRUISE TAKES PLACE WITH WHOM PREVIOUS CONTACT HAS BEEN MADE

Contact has been made with Prof. J. Mienert, Department of Geology, University of Tromsoe

10. STATE: Svalbard, Norway

a) Whether visits to the ship in port by scientists of the coastal state concerned will be acceptable

Yes

b) Participation of an observer from the coastal state for any part of the cruise together with the dates and the ports for embarkation and disembarkation

Professor Mienert has been invited to participate in the cruise or to send a representative. Embarkation would be around 23rd-25th August in Longyearbyen and disembarkation would be around 7th September in the UK.

c) When research data from the intended cruise are likely to be made available to the coastal state and by what means

A cruise report will be submitted to the relevant Norwegian agency within 12 months of the cruise. Data from the cruise will be provided to the relevant national Norwegian agency within two years of the cruise.

PART C. SCIENTIFIC EQUIPMENT

Complete the following table using a separate page for each coastal state

Coastal state: Svalbard, Norway

Port of call: Longyearbyen

Dates: Between 21st and 23rd August 2011

Indicate "YES" or "NO"

				DISTANCE FROM COAST		
List scientific work by function e.g.	Water column including sediment sampling of the seabed	Fisheries research within fishing limits	Research concerning the natural resources of the conti-nental shelf or its physical characteris-tics	Within 4 nm	Between 4-12 nm	Between 12-200 nm
Magnetometry						
Gravity						
Diving						
Seismics			Yes		Yes	Yes
Seabed sampling						
Bathymetry					Yes	Yes
Trawling						
Echo sounding					Yes	Yes
Water sampling						
U/W TV						
Moored instr.					Yes	Yes
Towed instr.					Yes	Yes

Note: The focus of our research is not natural resource exploration, but the methane and hydrate systems investigated may have resource potential.

6th January 2011

_____ Dated_____

C J H Hindley (On behalf of the Principal Scientist)

NB IF ANY DETAILS ARE MATERIALLY CHANGED REGARDING DATES/AREA OF OPERATION AFTER THIS FORM HAS BEEN SUBMITTED, THE COASTAL STATE AUTHORITIES MUST BE NOTIFIED IMMEDIATELY