

NOTIFICATION OF PROPOSED RESEARCH CRUISE

PART A: GENERAL

1. NAME OF SHIP: **F.S. "ALKOR"** Cruise No. **AL374**
2. DATES OF CRUISE: 29 May - 11 June 2011 FROM: Kiel (Germany) TO: Kiel
3. OPERATING AUTHORITY: Leibniz-Institut für Meereswissenschaften, IFM-GEOMAR
 Wischhofstraße 1-3
 24148 KIEL, Germany
 Phone: +49-431-600 2132
 Fax : +49-431-600-2680, e-mail: klackschewitz@ifm-geomar.de
4. OWNER: (if different from para 3)
5. PARTICULARS OF SHIP:
- | | |
|---|----------------------------------|
| <u>NAME</u> | ALKOR |
| <u>Nationality</u> | German |
| <u>OVERALL LENGTH</u> | 55,20 m |
| <u>MAXIMAL DRAUGHT</u> | 3,95 m |
| <u>NETTONAGE</u> | 1000 |
| <u>PROPULSION</u> | Diesel Electric |
| <u>CALL SIGN</u> | DBND |
| <u>PHONE INMARSAT</u> | +870 764 54 99 82 |
| <u>FAX INMARSAT</u> | +870 764 54 99 84 |
| <u>REGISTERED PORT & NUMBER</u>
(if registered fishing vessel) | Kiel, Germany |
| <u>IMO No.</u> | 8905880 |
| <u>MMSI</u> | 211 216 570 |
| <u>E-Mail</u> | bruecke@alkor.briese-research.de |
6. CREW: NAME OF MASTER: Walter Baschek
NUMBER OF CREW: 11
7. SCIENTIFIC PERSONNEL:
NAME & ADDRESS OF SCIENTIST IN CHARGE
 Dr. Peter Linke, Leibniz-Institut für Meereswissenschaften, IFM-GEOMAR
 Wischhofstr. 1-3, 24148 Kiel, Germany
TEL./TELEFAX No. +49-431-600-2115, Fax: 49-431-600-2928
e-mail: plinke@ifm-geomar.de
NUMBER OF SCIENTISTS: 12
8. GEOGRAPHICAL AREA IN WHICH SHIP WILL OPERATE (with reference in latitude and longitude):
 General working area: North Sea; Northern-limit: 59°N, Eastern-limit: 8°, Southern-limit: 53.5, Western-limit: 0°; for details (see attached map).
9. BRIEF DESCRIPTION OF PURPOSE OF CRUISE:
 This cruise will be the first cruise conducted in the framework of the EU project ECO2 (funded through the EU call "Ocean of Tomorrow"), which sets out to assess the risks and long-term impacts associated with the storage of CO₂ below the seabed. Carbon Capture and Storage (CCS) is regarded as a key technology for the reduction of CO₂ emissions from power plants and other industrial sources at the European and international level. The EU decided to support a selected portfolio of demonstration projects to promote, at industrial scale, the implementation of CCS in Europe. Several of these projects aim to store CO₂ below the seabed. However, little is known about the short-term and long-term impacts of CO₂ storage on marine ecosystems even though CO₂ has been stored in the North Sea (Sleipner) for more than 14 years and for 1 year in the Barents Sea (Snøhvit). In this regard, ECO2 will assess the likelihood and impact of leakage on marine ecosystems, apply novel monitoring techniques to detect and quantify the fluxes of formation fluids, natural gas, and CO₂ from storage sites, and, finally, develop a best practice guide for the management of sub-seabed CO₂ storage sites considering the precautionary principle and estimate the costs of monitoring and remediation.
 Although the main research focus is the southern German EEZ work permission is also requested for the EEZ of Norway (limits see below). Station work there will be focused on the Sleipner area and the area of the Tommeliten. The latter will be used as a reference site and has been intensively studied by our institution during previous research cruises with the German RV Heincke (HE207), the German RV ALKOR (AL259, 267, 290) and the Irish RV CELTIC EXPLORER (CE0913), and by other workers (Judd and Hovland, 2007 and literature cited therein).
10. DATES AND NAMES OF INTENDED PORTS OF CALL: none
11. ANY SPECIAL REQUIREMENTS AT PORTS OF CALL: none

NOTIFICATION OF PROPOSED RESEARCH CRUISE**PART B: GENERAL**1. NAME OF RESEARCH SHIP FS ALKOR2. DATES OF CRUISE 29 May - 11 June 2011 FROM Kiel (Germany) TO Kiel (Germany)3. a) PURPOSE OF RESEARCH

On cruise AL374 we wish to investigate the Sleipner CO₂ storage site operated by Statoil and the natural shallow water CO₂ seep offshore Juist Island (Fig. 1). We intend to quantify fluxes of key chemical parameters and potentially toxic metals and study the mechanisms determining the migration of CO₂, CH₄, and formation waters through the sedimentary overburden by a variety of novel monitoring techniques. Included in the study are investigations of seawater chemistry together with the near-field dispersion processes as key input parameters for our environmental studies and numerical model simulations. We will also carry out the assessment of the distribution of sensitive megafauna and will use fingerprinting of microbial community diversity as a key indicator of environmental impacts.

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

The water column and seafloor in the vicinity of gas plumes at active pockmarks and gassy sediments will be monitored with multi beam echo-sounding and TV-cameras mounted to a towed frame (video sledge), respectively. Surficial sediment samples will be taken with multiple corer, grabs and vibro corer in the vicinity of pockmarks. Water samples will be obtained from Rosette water sampler profiles. A bottom lander (GasQuant) will be deployed (only during the cruise) to quantify gas fluxes from sediment into the water column (and atmosphere). **No** fishing gear will be used.

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

Focus of our activities in the Norwegian EEZ will be old well locations at Sleipner (15/9-11, 15/9-16, and 16/7-2; Chadwick et al. 2004). Tommeliten is considered as a reference area (mean decimal position: 56°29.88'N., 02°59.80'E). Work permission is requested within a radius of at least 5 nautical miles around the mean position. Further details are presented on the attached map.

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

Water/gas
surface sediment

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, quantity of fish to be retained on board)

CTD/ Rosette water sampler (water, dissolved gases), pumping system
Ocean Floor Observation System (OFOS video sled)
Multiple Corer (<0.5m sediment cores)
Vibro Corer (<6m sediment cores)
Box Grab (<0.5m sediment)

6. DETAILS OF MOORING EQUIPMENT: no mooringsDATES

<u>Laying</u>	<u>Recovery</u>	<u>Description</u>	<u>Depth</u>	<u>Latitude</u>	<u>Longitude</u>
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7. ANY HAZARDOUS MATERIAL (Chemicals, explosives, gases, radioactive, etc): none
(use separate sheet if necessary)

- (a) TYPE and TRADE NAME
- (b) CHEMICAL CONTENT (& FORMULA)
- (c) IMO IMDG CODE Reference and UN No.
- (d) QUANTITY & METHODS OF STOWAGE ON BOARD
- (e) IF EXPLOSIVES give date(s) of detonation
 - Method of detonation
 - Position of detonation
 - Frequency of detonation
 - Depth of detonation
 - Size of explosive charge in Kg

8. DETAIL & REFERENCE OF:

(a) ANY RELEVANT PREVIOUS / FUTURE CRUISES:

Detailed surveys of North Sea pockmarks and seepages have been undertaken during cruises with the vessels Skandi Ocean in 1983, Lador in 1985 (Hovland & Judd 1988), Challenger in 1991 (Dando et al. 1994) and a number of cruises of the Geological and the Hydrographic Services Norway during 1991 and 1995 (e.g. Rise et al., 1999). Cruise ALKOR 259 & 290 lead by IFM-GEOMAR and other German research cruises were conducted in the Tommeliten area (R/V Heincke HE-169, and HE-180) as well as cruise CE0913 with the Irish RV CELTIC EXPLORER (Linke et al. 2010, McGinnis et al., 2010). In 2012, another cruise with RV CELTIC EXPLORER is planned.

(b) ANY PREVIOUSLY PUBLISHED RESEARCH DATA RELATED TO THE PROPOSED CRUISE:

- Chadwick, RA, P Zweigel, U Gregersen, GA Kirby, S Holloway, PN Johannessen (2004) Geological reservoir characterization of a CO₂ storgae site: The Utsira Sand, Sleipner, northern North Sea. *Energy* 29: 1371-1381.
- Hovland M & A Judd (1988) Seabed Pockmarks and Seepages. Graham and Trotman, London, 293 pages.
- Hovland M (1992) Pockmarks and gas-charged sediments in the eastern Skagerrak. *Continental Shelf Res.*, 12: 1111-1119.
- Iversen N & BB Jørgensen (1985) Anaerobic methane oxidation rates at sulphate-methane transition in marine sediments from Kattgat and Skagerrak. *Limnologia Oceanografica* 30: 944-955.
- Judd A., Hovland M. (2007) Seabed Fluid Flow – The Impact on Geology, Biology, and the Marine Environment. Cambridge University Press, Cambridge, UK, 475 pages.
- Linke, P., Schmidt, M., and CE0913 cruise participants (2010). RV Celtic Explorer Fahrtbericht / Cruise Report CE0913 – Fluid and gas seepage in the North Sea, IFM-GEOMAR report No. 36, pp. 82.
- Niemann H, Elvert M, Hovland M, Orcutt B, Judd A, Suck I, Gutt J, Joye S, Damm E, Finster K, Boetius A, (2005). Methane emission and consumption at a North Sea gas seep (Tommeliten area). *Biogeosciences*, 2, 335–351.
- McGinnis, D.F., M. Schmidt, S. Themann, T.S. DelSontro, L. Rovelli, P. Linke (2010), Natural carbon dioxide seeps in the Southern German North Sea, *JGR – Oceans*, accepted for publication.
- Rise L et al (1999) Sea-bed pockmarks related to fluid migration from Mesozoic bedrock strata in the Skagerrak offshore of Norway. *Marine and Petroleum Geology* 16: 619-631.
- Schneider v Deimling J, Greinert J, Chapman NR, Rabbel W, Linke P (2010) Acoustic imaging of natural gas seepage in the North Sea: Sensing bubbles under control of variable currents. *Limnology and Oceanography: Methods* 8: 155-171.
- Wegener G, Shovitri M, Knittel K, Niemann H, Hovland M, and Boetius A (2008) Biogeochemical processes and microbial diversity of the Gullfaks and Tommeliten methane seeps (Northern North Sea). *Biogeosciences* 5, 1127–1144.

9. NAMES AND ADDRESS OF SCIENTIST WITH WHOM PREVIOUS CONTACT HAS BEEN MADE:

Dr. Martin Hovland, Statoil ASA, Forusbeen 50, N-4035 Stavanger, Norway

10. STATE

- (a) WHETHER VISITS TO THE SHIP IN PORT BY SCIENTISTS OF THE COASTAL STATE WILL BE ACCEPTABLE
YES/NO: yes
- (b) PARTICIPATION OF AN OBSERVER FROM THE COASTAL STATE FOR ANY PART OF THE CRUISE TOGETHER WITH THE DATES AND PORTS FOR EMBARKATION / DISEMBARKATION :
yes, 29.05.2011 Kiel / 11.06.2011 Kiel, onboard working applicability has to be discussed
- (c) WHEN RESEARCH DATA FROM THE INTENDED CRUISE IS LIKELY TO BE MADE AVAILABLE TO THE COASTAL STATE:
2011: cruise summary report
2012-2013: cruise report, scientific literature, images on request

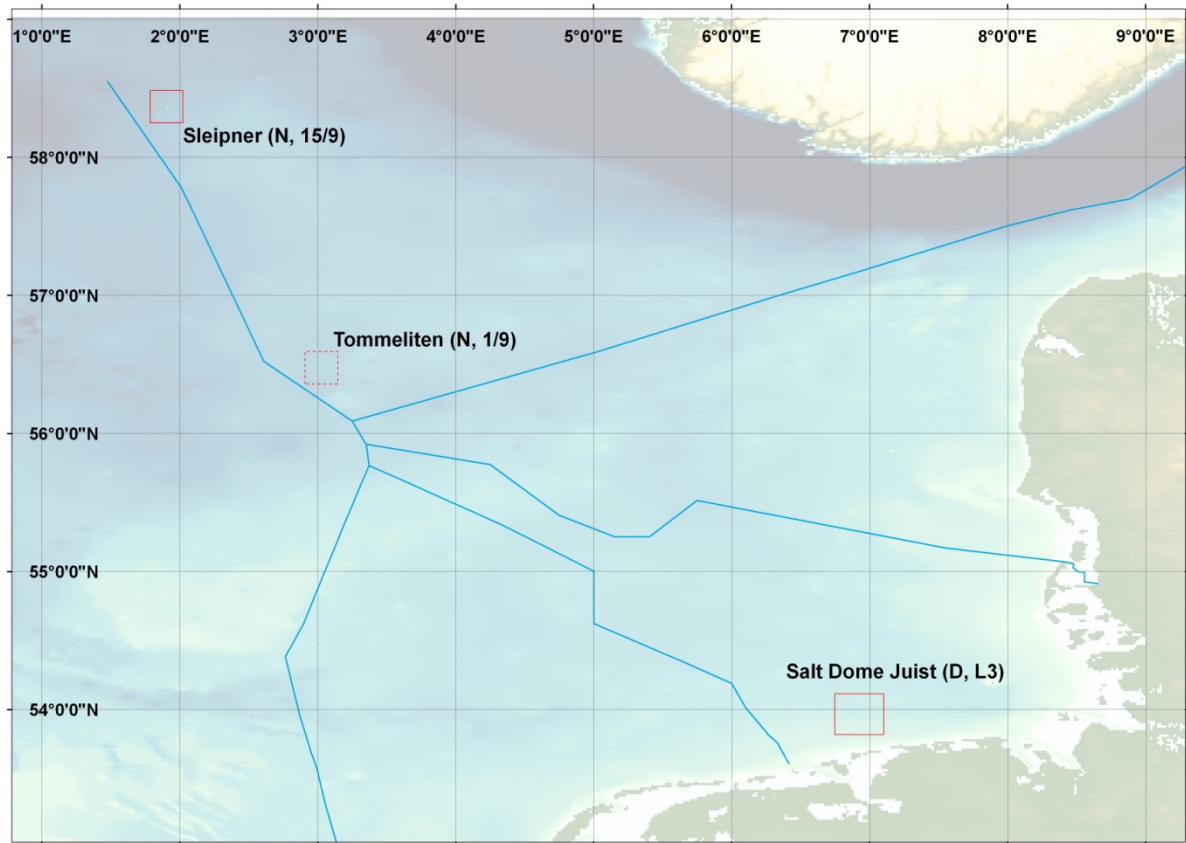
PART C: SCIENTIFIC EQUIPMENT**COASTAL STATE: Norway****PORT CALL: none****DATES: 29. May - 11. June 2011****11. COMPLETE THE FOLLOWING TABLE****- separate page for each coastal state (indicate 'YES' or 'NO')**

LIST SCIENTIFIC WORK BY FUNCTION, eg: MAGNETOMETRY GRAVITY OLVING SEISMICS BATHYMETRY SEABED SAMPLING ECHO SOUNDING WATER SAMPLING U/W T.V. MOORED INSTRUMENTS TOWED INSTRUMENTS	WATER COLUMN INCLUDING SEDIMENT SAMPLING OF THE SEABED	FISHERY RESEARCH WITHIN FISHING LIMITS	RESEARCH CONCERNING THE NATURAL RESOURCES OF THE CONTINENTAL SHELF OR ITS PHYSICAL CHARACTERISTICS	DISTANCE FROM COAST		
				WITHIN 4 NM	BETWEEN 4 -12 NM	Between 12-200 nm
Single beam echo-sounding (12kHz)	No	No	Yes	No	No	Yes
Multibeam echosounding 100/400kHz	No	No	Yes	No	No	Yes
Video-Observation System (bottom photography)	No	No	Yes	No	No	Yes
CTD/Rosette water sampler	Yes	No	Yes	No	No	Yes
Multiple corer	Yes	No	Yes	No	No	Yes
Box grab	Yes	No	Yes	No	No	Yes
Vibro corer	Yes	No	Yes	No	No	Yes
GasQuant-Lander (multi beam 8-100kHz)	No	No	Yes	No	No	Yes


Dated: 15.01.2010

(Principal Scientist)

N.B. IF ANY DETAILS ARE MATERIALLY CHANGED REGARDING DATES / AREA OF OPERATION AFTER THIS FORM HAS BEEN SUBMITTED THE COASTAL STATE'S AUTHORITIES MUST BE NOTIFIED IMMEDIATELY.



INTENDED WORKING AREAS DURING CRUISE ALKOR 374: Requested working area in the Norwegian EEZ are the Sleipner and the Tommeliten areas. Tommeliten is a methane seep, which could be explored as a reference site.

Coordinates of the old wells (Sleipner, N):

15/9-11: 58°24.012'N / 1°53.604'E
15/9-16: 58°22.128'N / 1°52.623'E
15/7-02: 58°28.401'N / 2°01.952'E

Coordinates of requested working area (Tommeliten, N):

56°18'N 2°48'E
56°18'N 3°15'E
56°33.6'N 3°15'E
56°33.6'N 2°48'E