

Offshore Special Area of Conservation: Braemar Pockmarks

SAC Selection Assessment



© John Hartley*

Version 4.0 (1st July 2008)

* Cover photo illustrates carbonate cemented rock slab with wolf-fish, Buccinid egg mass and epifauna including the anemone *Bolocera tuediae*

Introduction

This document provides detailed information about the Braemar Pockmarks site and evaluates its interest features according to the Habitats Directive selection criteria and guiding principles.

The advice contained within this document is produced to fulfil requirements of JNCC under Part 2 of the Offshore Marine Conservation (Natural Habitats, & c.) Regulations 2007, relating to the conservation of natural habitat types and habitats of species through identification of Special Areas of Conservation (SACs) in UK offshore waters. Under these Regulations, JNCC has an obligation to provide certain advice to Defra to enable the Secretary of State to fulfil his obligations under the Regulations, and to Competent Authorities to enable them to fulfil their obligations under the Regulations.

This document includes information required under Regulation 7 of the Offshore Marine Conservation (Natural Habitats, & c.) Regulations 2007 to enable the Secretary of State to transmit to the European Commission the list of sites eligible for designation as Special Areas of Conservation (SACs). JNCC have been asked by Defra to provide this information to Government.

Sites eligible for designation as offshore marine SACs are selected on the basis of the criteria set out in Annex III (Stage 1) to the Habitats Directive and relevant scientific information. Sites are considered only if they host a Habitats Directive Annex I habitat or Annex II species. Moreover, sites for Annex II species must contain a clearly identifiable area representing physical and biological factors essential to these species' life and reproduction to be eligible. Socio-economic factors are not taken into account in the identification of sites to be proposed to the European Commission¹.

In addition to information on the Annex I habitats and/or Annex II species hosted within the site, this document contains i) a chart of the site, ii) its name, location and extent, and iii) the data resulting from application of the criteria specified in Annex III (Stage 1) to the Habitats Directive. This is in line with legal requirements outlined under Regulation 7. JNCC has adhered to the format established by the Commission for providing site information. This format is set out in the 'Natura 2000 Standard data form' (CEC, 1995) (prepared by the European Topic Centre for Biodiversity and Nature Conservation on behalf of the European Commission to collect standardised information on SACs throughout Europe).

¹ Following European Court of Justice 'First Corporate Shipping' judgement [C-371/98](#) (7 November 2000)

Document version control

| Version and issue date | Amendments made | Issued to and date |
|---|---|--|
| BraemarPockmarks_Selection Assessment_4.0.doc (1 st July 2008) | - Post consultation modifications, including site boundary amendment | Secretary of State (July 2008) |
| BraemarPockmarks_Selection Assessment_3.1.doc (13th November 2007) | - Draft SAC changed to possible SAC | Public consultation (December 2007) |
| BraemarPockmarks_Selection Assessment_3.0.doc (25th May 2007) | - New introductory text, revised site summary and map layout, heading & text amendments - Additional guiding principles for site selection incorporated under Global Assessment - Conservation Objectives and Advice on Operations moved to separate document | JNCC Committee (June 07) and UK Marine Biodiversity Policy Steering Group (September 07) |
| BraemarPockmarksDossier_2.0_Draft.doc (26 th August 2006) | - Draft Conservation Objectives and (revised) Advice on Operations added. - Map layout revised | Defra, Devolved Administrations, and other Govt. departments (25 th September 2006) |
| Braemar Pockmarks selection assessment and provisional management action statements: JNCC 05 P10 (September 2005) | | JNCC Committee (September 2005), Defra (Dec 2005) |

Further information

This document is available as a pdf file on JNCC's website for download if required (www.jncc.gov.uk)

Please return comments or queries to:

Charlotte Johnston
Joint Nature Conservation Committee
Monkstone House
Peterborough
Cambs
PE1 1JY

Email: offshore@jncc.gov.uk

Tel: +44 (0)1733 866905

Fax: +44 (0)1733 555948

Website: www.jncc.gov.uk

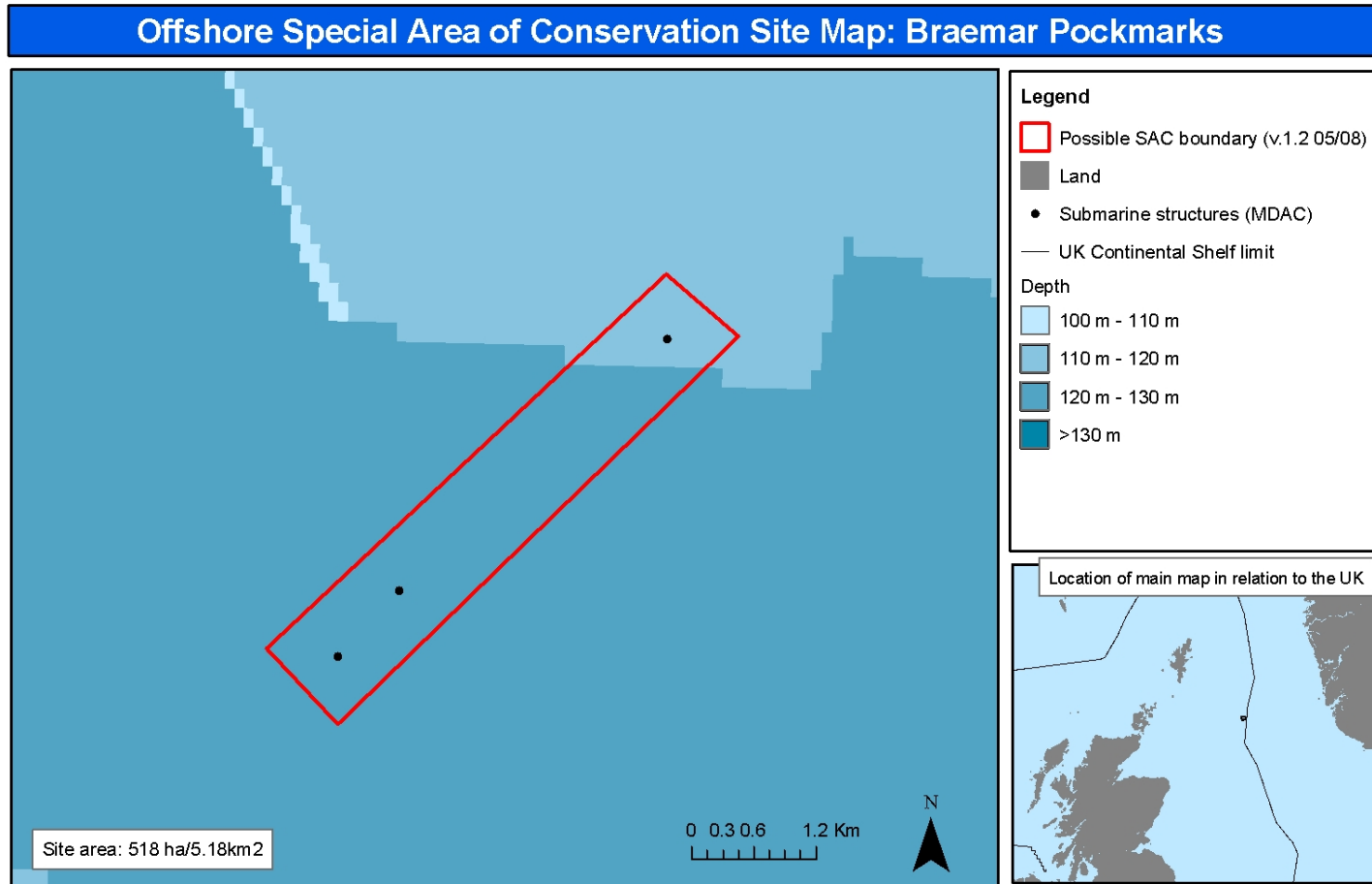
Braemar Pockmarks: SAC Selection Assessment

| | |
|--|--|
| 1. Site name Braemar Pockmarks | 2. Site centre location 58°59'12", 1°28'34" (Datum: WGS 1984) |
| 3. Site surface area 518 ha/5.18km ² (Datum: WGS 1984 UTM Zone 31 North, calculated in ArcGIS) | 4. Biogeographic region Atlantic |

5. Interest feature(s) under the EU Habitats Directive

1180 Submarine structures made by leaking gases

6. Map of site



Boundary coordinates:

1) 58°58'23", 1°26'15" 2) 59°0'23", 1°30'12" 3) 59°0'4", 1°30'57" 4) 58°57'60", 1°26'60"

Map version number 1.5 (22/05/08)

Site map projected in UTM (Zone 31N, WGS84 datum). Seabed habitat derived from BGS 1:250,000 seabed sediment maps © NERC and SeaZone bathymetry.

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7. Site summary

The Braemar pockmarks are a series of crater-like depressions on the sea floor, two of which contain the Annex I habitat “Submarine structures made by leaking gases”. In this location, large blocks, pavements slabs and smaller fragments of methane derived authigenic carbonate have been deposited through a process of precipitation during the oxidation of methane gas. These carbonate structures provide a habitat for marine fauna usually associated with rocky reef, and very specific chemosynthetic organisms which feed off both methane (seeping from beneath the sea floor) and its by-product, hydrogen sulphide (Judd, 2001). Larger blocks of carbonate also provide shelter for fish species such as wolf-fish and cod. Close by the two pockmarks containing blocks of carbonate, to the south west, there is another block of carbonate which is not associated with a pockmark (Hartley, 2005).

The site’s name originates from its proximity to the Braemar oil field in the northern North Sea, approximately 240 km east of the Orkney Islands. The pockmarks at the site are shallow, ovoid, seabed depressions, several metres across, which were probably formed by the venting of biogenic/petrogenic fluids or gases into the water column (Hovland & Judd, 1988). The water depth at the site is approximately 120 m.

The Braemar Pockmarks occur in the Northern North Sea Regional Sea (JNCC, 2004a; Defra 2004). There are currently no Special Areas of Conservation in the Northern North Sea for which ‘Submarine structures made by leaking gases’ are a qualifying interest feature of the site. However one other area has been recommend to Defra by JNCC for this feature in this region and is shown below with its characteristic features.

| Possible SAC | Notable characteristics of interest feature (Dando et al, 1991) |
|------------------|---|
| Scanner Pockmark | The carbonate blocks lie in the base of the Scanner pockmark and are colonised by fauna more typically associated with rocky reef. These submarine structures made by leaking gases are notably colonised by large numbers of anemones (<i>Urticina feline</i> and <i>Metridium senile</i>) and squat lobsters. Also present is the gutless nematode <i>Astomonema southwardorum</i> which may have a symbiotic relationship with chemosynthetic bacteria. Fish (hagfish, fourbeard rockling, haddock, wolf-fish and small redfish) also appear to be using the pockmark depressions and the carbonate structures for shelter |

In character, the interest features of the Braemar Pockmarks site are similar to those found at the Scanner Pockmark site; however, the carbonate structures at Braemar are more abundant and diverse in form than that of the Scanner site, and appear to be characterised by slightly different species assemblages.

8. Site boundary

The proposed boundary for the Braemar pockmarks site has been defined using JNCC's marine SAC boundary definition guidelines (JNCC, 2004b) and information provided during public consultation on this site in 2007-2008. The proposed boundary is a simple polygon enclosing the minimum area necessary to ensure protection of the Annex I habitat. Coordinate points have been positioned as close to the edge of the interest feature as possible, rather than being located at the nearest whole degree or minute point. As bottom trawling is a significant threat to the interest feature, the proposed boundary includes a margin to ensure its protection. The maximum depth of water around the feature is 125 m; therefore, assuming a ratio of 3:1 fishing warp length to depth, the proposed boundary is defined to include a margin of 375 m from the submarine structures and adjacent area of carbonate rock. The location of the Annex I habitat is drawn from data provided courtesy of Marathon Oil Ltd (Hartley, 2005). The presence of carbonate structures formed from leaking gases was confirmed by survey using an ROV (remote operated vehicle).

Note that the boundary proposed is for the SAC. Any future management measures which may be required under the Offshore Marine Conservation (Natural Habitats, & c.) Regulations will be determined by Competent Authorities in consultation with JNCC, and may have different boundaries to the SAC site boundary.

9. Assessment of interest feature(s) against selection criteria

9.1 Submarine structures made by leaking gases

Annex III selection criteria (Stage 1A):

a) *Representativity*

The Braemar Pockmarks site occurs in the Northern North Sea Regional Sea, and represents a range of different sizes and forms of Annex I 'submarine structures made by leaking gases' in this area. The faunal communities are representative of those present on submarine structures made by leaking gases, consisting of anemones and hydroids, as well as organisms dependent on chemosynthesis (Hartley, 2005). However the site has been subject to some damage from bottom trawling (John Hartley, pers. comm., 2005); therefore the grade for the feature is B: good representativity.

b) *Area of habitat*

An evaluation of the area the submarine structures made by leaking gases at this site in relation to the total area covered by this interest feature in UK waters is not possible, since all occurrences of this habitat are not known. However, evidence from known occurrences of the habitat shows that the extent at each occurrence is very small (2,500 m² at the most). The grades for this criterion are Grade A (site contains '15-100%' of total resource of Annex I habitat), Grade B (site contains '2-15%' of total resource of Annex I habitat) and Grade C (site contains '0-2%' of total resource of Annex I habitat) (CEC, 1995). It is likely that the Annex I habitat at the Braemar pockmarks site comprises between 15 and 100% of the total extent of submarine structures made by leaking gases; therefore, the grade for this criterion is A.

c) *Conservation of structure and functions*

Degree of conservation of structure

The biological and physical structure of the interest feature at the Braemar pockmarks site are known to have been partially impacted by bottom trawling (John Hartley, pers. comm., 2005). VMS data (2005-2007) provided by the Scottish Fishermen's Federation in 2008 has also confirmed that this area is likely to be subject to demersal fishing activities. Trawling has dispersed, fragmented and possibly buried some of the carbonate formations, and may also have modified the structure of the encircling pockmarks (John Hartley, pers. comm., 2005). However, much of the interest feature is still intact. The grade is II: structure well conserved.

Degree of conservation of functions

The prospects of this feature in terms of maintaining its structure in the future (taking into account unfavourable influences and reasonable conservation effort) are good. Regulations are in place to regulate oil and gas activity in and around SACs in the UK Continental Shelf Designated Area, and a mechanism is available through the European Commission's Common Fisheries Policy regulations to modify fishing activity in the area if this is deemed to be necessary. The laying of submarine cables and pipelines would also require regulatory consent at this site. The feature is distant from terrestrial sources of pollution. The grade is I: excellent prospects.

Restoration possibilities

Restoration methods in the offshore area focus on the removal of impacts which should allow recovery where the habitat has not been removed. Restoration of the biological communities at the Braemar pockmarks site may be possible where the submarine structures have not been destroyed. However where damage has occurred, the restoration potential is unknown. This is because the methane derived authigenic carbonate is accreted naturally (and over long time periods) and further accretion is dependent on sufficient gas seepage as well as the presence of specific chemosynthetic micro-organisms. There is anecdotal evidence to suggest that the submarine structures are sustained by shallow biogenic gas seepage (John Hartley, pers. comm., 2005); however, if deeper petrogenic gas supports the structures, there is potential for a reduction in seepage if the underlying reservoir is depleted through commercial activities (Oil and Gas UK, 2008). Therefore, the grade is III: restoration difficult or impossible.

Overall grade

Due to the second sub-criterion of this criterion being graded I: excellent prospects, the overall grade is A: excellent conservation (regardless of the other two sub-criteria).

d) *Global assessment*

There are currently no other SACs with this habitat as a qualifying feature in UK waters; as such, this site makes a particularly important contribution to

maintaining this Annex I habitat at favourable conservation status within its natural range. The total extent of ‘Submarine structures made by leaking gases’ in the UK is unknown, though present information suggests that this habitat probably covers less than 1,000 ha. As such, this habitat may be considered rare.

The suggested grades for Stage 1A criteria a)-c) are B, A and A respectively. Given these evaluations, and taking into account the rarity of this habitat in UK waters, the Global Assessment grade is A (‘excellent conservation value’).

Summary of scores for Stage 1a criteria

| Area of habitat | Representativity (a) | Relative surface (b) | Structure and function (c) | Global assessment (d) |
|------------------------|-----------------------------|-----------------------------|-----------------------------------|------------------------------|
| Braemar Pockmarks | B | A | A | A |

10. Sites to which this site is related

None

11. Supporting scientific documentation

The Braemar pockmarks were discovered initially during the rig site surveys for Marathon Oil Ltd as part of the Braemar field development. Further investigation was then undertaken in 2001 during pipeline route surveys for the Braemar development. Stills camera photography, grab sampling and sidescan sonar provided samples during these surveys. Subsequently, in 2003, a Technip Ltd ROV survey acquired video footage, further photographs and grab samples of the fauna associated with the carbonate formations. This work has recently been summarised in a report produced by Hartley Anderson Ltd (Hartley, 2005).

12. Site overview and conservation interest

The following information has been taken principally from the Hartley Anderson Ltd report (Hartley, 2005).

The Braemar pockmarks cover a range of sizes from those with diameters between 5 and 10m and a maximum depth of 0.5m; to larger (less prevalent) pockmarks with a diameter of between 50m and 130m a maximum depth of approximately 5m (Hartley, 2005). Their presence in this area is particularly of note as it occurs outside the region identified by BGS of known pockmark occurrence in the North Sea (reported in Johnston *et al.*, 2002). Only a proportion of the pockmarks at this site have been examined in detail for presence of ‘Submarine structures made by leaking gases’. These are listed below (with their associated features) and displayed in Figure 1 (Hartley, 2005):

- Pockmark A – Substantial carbonate rock formation and evidence of fluid/gas expulsion found, together with presence of chemosynthetic biota.
- Pockmark B – Limited evidence of carbonate rock seen but shell gravel suggests fluid/gas expulsion.
- Pockmark C - Substantial carbonate rock formation and evidence of fluid/gas expulsion.
- “Clay outcrop” (Subsequently discovered not to be a clay outcrop). Evidence of carbonate rock presence.

The drop camera and video footage showed well developed carbonate cemented rocks (known as ‘Methane Derived Authigenic Carbonate’ or MDAC) in various forms: as large rocks, pavements, slabs and smaller fragments (Hartley, 2005). The vast majority of these submarine structures made by leaking gases were present in discrete

pockmarks. However, their presence (together with much shell hash) on the feature initially interpreted as a clay outcrop, suggests that in some instances they may form outside defined pockmarks, resulting in discrete areas of different seafloor texture (Hartley, 2005). The presence of shell hash (including alongside large carbonate cemented rocks) suggests continuing periodic expulsion of fluid or gas resulting in a winnowing away of finer sediments (Hartley, 2005).

As well as providing a potentially favourable, sheltered habitat for a variety of marine organisms, pockmarks which have active gas seeps and associated structures may be of ecological significance because i) of the utilisation of methane and its by-product, hydrogen sulphide, by chemosynthesisers; and ii) MDAC provides a hard substrate suitable for colonisation by certain benthic organisms (Judd, 2001).

Based on multivariate analyses of data from remotely collected grab samples, the fauna inside and outside the pockmarks was found to be essentially similar (Hartley, 2005). However, ROV observations indicate that Braemar's carbonate-cemented structures show evidence of chemosynthesis (indicated by the presence of bacterial mats) along with higher densities of certain species (e.g. the pogonophoran worm *Siboglinum fiordicum*) which has been found to contain endosymbiotic chemosynthetic bacteria (Southward *et al.*, 1981 and Flügel and Langhof, 1983 cited in Judd and Hovland, 2007). The presence of *Siboglinum fiordicum* in high densities in one replicate sample from Pockmark C was particularly notable. This suggests that targeted sampling (for example using ROV) in areas of bacterial mats and coarse winnowed sediments is likely to reveal further rarely recorded species and potentially others dependent on chemosynthesis (Hartley, 2005).

The hard carbonate substratum also seems to provide a habitat and distributional stepping stones for a variety of species (based on ROV observations). The structures have attracted a range of fish species (cod, haddock, wolf-fish and conger eel) presumably through the provision of food and shelter (see Plate 3). In addition, the frequent occurrence of egg masses of Buccinid gastropods on the carbonate-cemented rocks was noted during the survey (Plate 2) (Hartley, 2005).

There are no data currently available on fish and mobile epifaunal species at a suitable scale specifically within the proposed site boundary. However, general information on the interest of the area in relation to fish, with a bias towards commercially exploited species (as it is for these that data have been collected) can be gleaned from sources such as Fisheries Sensitivity Maps in British Waters' (Coull *et al.*, 1998 and Fisheries research scientists in both England and Scotland. According to these sources, the Braemar Pockmarks site lies on the edge of the recognised spawning area for saithe, but this species is widely distributed and eggs and larvae are pelagic (Coull *et al.*, 1998). The site also lies on the eastern boundary of the recognised Norway lobster (*Nephrops norvegicus*) distribution but catches indicate that numbers would be low here (Coull *et al.*, 1998). Finally, although the site falls within the recognised haddock nursery area (for juveniles), this species is widely distributed throughout the northern North Sea (the same applies to Norway pout) (Coull *et al.*, 1998). In general, the spawning and nursery sensitivities for these species are not unique to the proposed site, and are not rigidly fixed. (Nick Bailey, pers. comm., January 2006).

Figure 1: Seabed features and sampling locations around the Braemar Field (compilation from various sources) (Hartley, 2005)

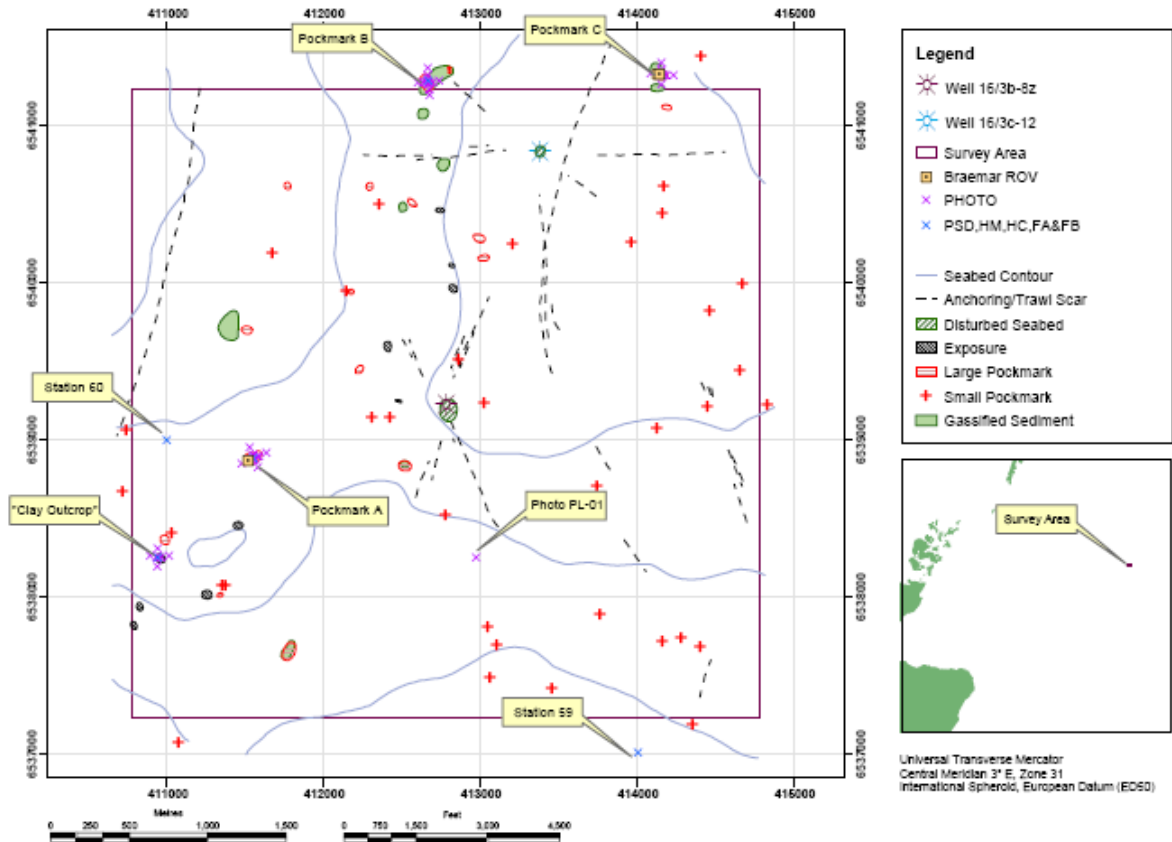


Plate 1: (Pockmark A) Carbonate cemented rock slab with wolf-fish, Buccinid egg mass and epifauna including *Bolocera tuediae*.



Plate 2: (Pockmark A) Mixed seabed with buried carbonate cemented rock, shell gravel and muddy sand. Visible fauna includes *Bolocera tuediae*, Buccinid egg masses and juvenile gadoid fish.



Plate 3: (Pockmark A) Carbonate cemented rock pavement and shell gravel with cod, Buccinid egg masses and epifauna (sponges and the anemone *Bolocera tuediae*).

References

COMMISSION OF THE EUROPEAN COMMUNITY (CEC). 1995. *Natura 2000 Standard Data Form: Explanatory Notes*. Brussels: European Commission DG Environment.

COULL, K.A., JOHNSTONE, R., & ROGERS, S.I. 1998. *Fisheries Sensitivity Maps in British Waters* [online]. UK: UKOOA Ltd. Available from:

www.ukooa.co.uk/issues/fisheries/v0000513.htm [Accessed March 2007].

DANDO, P.R., AUSTEN, M.C., BURKE, R.J., KENDALL, M.A., KENNICUTT, M.C., JUDD, A.G., MOORE, D.C., O' HARA, S.C.M., SCHMALJOHANN, R. & SOUTHWARD, A.J. 1991. Ecology of a North Sea Pockmark with an active methane seep. *Marine Ecology Progress Series*, **70**, 49-63.

DANDO, P.R. 2001. A review of pockmarks in the UK part of the North Sea, with particular respect to their biology. *Technical report produced for Strategic Environmental Assessment – SEA2*. UK: Department of Trade and Industry.

DEFRA. 2004. *Review of Marine Nature Conservation*. Working Group Report to Government [online]. London: Defra. Available from:

<http://www.defra.gov.uk/marine/pdf/biodiversity/rmnc-report-0704.pdf> [Accessed March 2007].

GRAHAM, C., CAMPBELL, E., CAVILL, J., GILLESPIE, E. & WILLIAMS, R. 2001. *JNCC Marine Habitats GIS Version 3: its structure and content*. British Geological Survey Commissioned Report, CR/01/238. UK: British Geological Survey.

HARTLEY, J.P. 2005 *Seabed Investigations of Pockmark Features in UKCS Block 16/3*. Report to Joint Nature Conservation Committee. Aberdeenshire: Hartley Anderson Limited.

HOPKINS, J.J. & BUCK, A.L. 1995 The Habitats Directive Atlantic Biogeographical Region, Report of Atlantic Biogeographical Workshop, Edinburgh, Scotland, 13th-14th October 1994. *JNCC Report*, No. 247 [online]. Available from: www.jncc.gov.uk/page-2352 [Accessed March 2007].

HOVLAND, M. & JUDD, A.G. 1988. *Seabed Pockmarks and Seepages: Impact on Geology, Biology and the Marine Environment*. London: Graham & Trotman,

JNCC. 2004a. *The Irish Sea Pilot Final Report*. Report to Defra by The Joint Nature Conservation Committee [online]. Peterborough: JNCC. Available from:

<http://www.jncc.gov.uk/page-2767#download> [Accessed March 2007]

JNCC. 2004b. *UK Guidance on defining boundaries for marine SACs for Annex I habitat sites fully detached from the coast* [online]. Peterborough: JNCC. Available from:

<http://www.jncc.gov.uk/pdf/SACHabBoundaryGuidanceFinal.pdf> [Accessed March 2007]

JOHNSTON, C.M., TURNBULL, C.G. & TASKER, M.L. 2002. Natura 2000 in UK offshore waters: advice to support the implementation of the EC Habitats and Birds Directive in UK offshore waters. *JNCC Scientific Report* No. 325 [online]. Peterborough: Joint Nature Conservation Committee. Available from: <http://www.jncc.gov.uk/PDF/JNCC325-full.pdf> [Accessed March 2007].

JUDD, A.G. 2001. Pockmarks in the UK Sector of the North Sea. *Technical report (TR_002) produced for Strategic Environmental Assessment - SEA2*. UK: Department of Trade and Industry.

JUDD, A.G. & HOVLAND, M. (2007) *Seabed fluid flow: the impact on geology, biology and the marine environment*. Cambridge: Cambridge University Press.

MCLEOD, C.R., YEO, M., BROWN, A.E., BURN, A.J., HOPKINS, J.J., & WAY, S.F. (eds.) 2005. *The Habitats Directive: selection of Special Areas of Conservation in the UK*. 2nd edn [online]. Peterborough: Joint Nature Conservation Committee. Available from:

www.jncc.gov.uk/SACselection

OIL AND GAS UK (2008) *Response to the 2007/08 public consultation on the selection of Special Areas of Conservation in UK Offshore Waters..* Response available from JNCC on request.

SCOTTISH FISHERMEN'S FEDERATION (2008) *Response to the 2007/08 public consultation on the selection of Special Areas of Conservation in UK Offshore Waters.* Response available from JNCC on request.