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6W\OHV RI 6KDOOORZ *DV 0LJUDWLRQ DQ $FFXPXODWLRQ RQ WKH 1RUZHJLDQ &R 0DUJLQ

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6800$5<

:H KDYH DFTXLUHG 3 &DEOH GDWD IURP IRXU ORFDWLRQV ZLWK VKD FRQWLQHQWDO VKHOI 7ZR RI WKH DUHDV DUH FKDUDFWHUL]HG E\ D LQGLFDWLQJ IRFXVHG IOXLG IORZ WKURXJKRXW WKH 1HRJHQH 7KH ERWK D ULVN DQG D FKDQFH WR WKH RIIVKRUH LQGXVWU\ :KHQ DEX QDWXUDO JDV LV D YDOXDEOH UHVRXUFH :KHQ RFFXUULQJ LQ VPDO OHDG WR GLVDVWURXV EORZ RXWV VXFK DV WKH :HVW 9DQJXDUG DF &DEOH V\VWHP SURYLGH XV ZLWK WKH SRVVLELOLW\ WR PDS LQ GH DFFRPSDQ\LQJ PLJUDWLRQ VWUXFWXUHV 7KLV DOORZV EHWWHU XQ PLJUDWLRQ SURFHVVHV RQ WKH 1RUZHJLDQ FRQWLQHQWDO PDUJLQ

Introduction

The continental margin of Norway hosts numerous large deep-seated and shallow accumulations of gas. Fluids and gas are constantly migrating from these reservoirs to the sea bed. In some areas vertical pipes and pockmarks provide evidence of past episodes of gas migration while in other areas these structures are still active. Natural marine gas hydrates are present in the Storegga area off mid-Norway, off Svalbard and in the Barents Sea. The gas hydrates occur associated with shallow gas accumulation. Because gas hydrate formation reduces the permeability of the sediments they cause significant overpressures of the gas below. Both the shallow gas and gas hydrates represent potential hazards, and information on their distribution is crucial when designing and constructing sea bed installations or during drilling for deeper hydrocarbons.

Shallow gas and gas hydrates may also have a major impact on climate as large-scale methane release may accelerate global warming. Although at the moment the methane flux rates from sediments to the atmosphere are small compared to other sources of methane, there is strong evidence that there have been episodes in the geological past when large amounts of methane escaped from the sedimentary basins causing global warming. It is likely that small temperature variations that surpass a threshold can have large impact on the global climate.

Accumulations of shallow gas and gas hydrates can also be a potential energy resource. A number of countries such as Japan, India, Taiwan, Korea and Norway are actively researching the possibility to exploit gas hydrates and shallow gas reservoirs. The Peon gas discovery in the northern North Sea may contain commercial shallow gas accumulations. Intriguingly, it may also be possible to store large amounts of CO_2 in methane hydrate areas during the production of natural gas. A wide range of research projects are actively pursuing this scenario. In this context it is important to understand the gas migration mechanisms to be able to predict the consequence when exploiting gas from shallow reservoirs or storing CO_2 in shallow traps.

For an improved understanding of the gas migration processes it is important to map the distribution of free gas and gas hydrates with high spatial and vertical resolution. We have acquired several high-resolution 3D surveys on the Norwegian margins using the P-Cable technology (Figures 1 and 2). The 3D seismic cubes were acquired along the margin from the northern North Sea in the south to the western Svalbard margin in the north, in water depth varying from less than 300 meters to about 1300 meters. The survey areas reveal different styles of gas migration and illustrate the various gas storage and migration processes.

Data and Methods

The P-Cable technology provides an effective way of acquiring high-resolution 3D seismic data. The P-Cable system consists of a seismic cable that is towed perpendicular to a vessels steaming direction (Figure 2). The first P-Cable system, P-Cable1, is a 12 streamer analogue system that was developed by Volcanic Basin Petroleum Research (VBPR) and National Oceanography Center, Southampton (NOCS) in collaboration with University of Tromsø and industry partners. Seven cubes have been acquired using this system. The P-Cable2 was developed in 2006-2007 and is a digital system. The P-Cable2 has been used with up to 24 streamers and seven cubes have been acquired using this system. The P-

Results

References

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Figure 1:

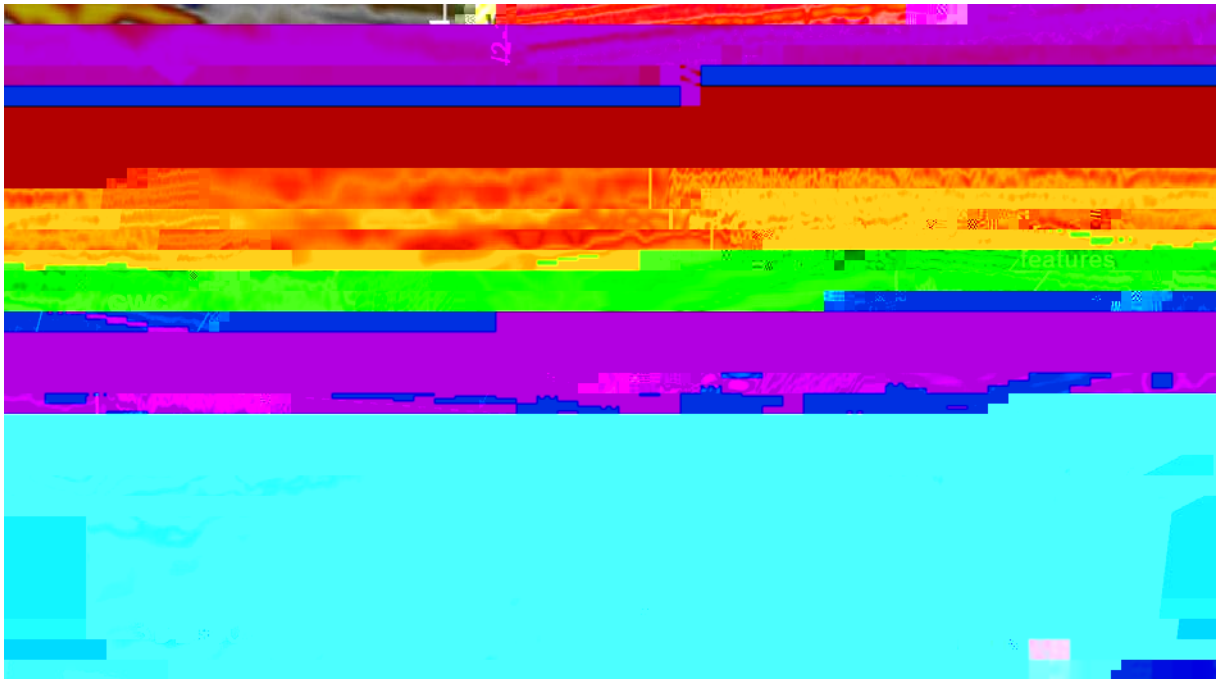

Figure 3: *Seismic example of the P-Cable (right) and conventional (left) 3D data of the Peon discovery. Image courtesy of Statoil.*

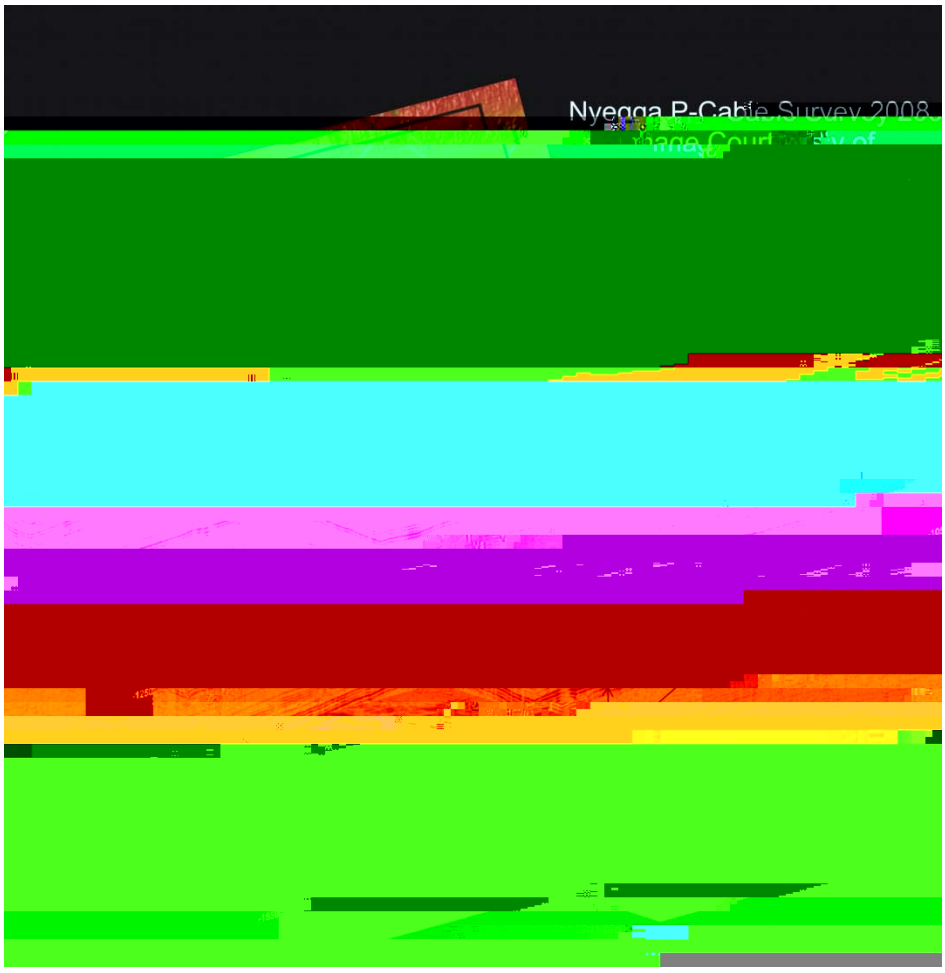

Figure 4: *Seismic example of the Nyegga cube showing free gas, pipe structures and pock marks.*