

Gas found in glacial, shallow sands

Hydro has announced a most remarkable gas discovery that the company just recently made in the North Sea. Possibly more than 30 billion m³ of gas has been discovered only 160 meters below seabed, and the reservoir consists of glacial sandstones capped by glacial moraines.

Halfdan Carstens

Hydro has made a large gas discovery in exploration well 35/2-1 in the northern part of the North Sea offshore Norway, and the operator already now says that the chances for a commercial development are good.

Unofficial press reports claim the recoverable reserves may amount to 30 billion m³ (ca. 1 Tcf) or the equivalent of almost 200 million barrels of oil. Norsk Hydro does not to confirm this estimate, but the Minister of Energy and Petroleum, Torhild Widvey, did in fact use this figure when talking to the press. It is also known that the discovery covers a large area.

Relevant for the reserve estimate in this discovery is how much the gas is compressed compared to a reservoir at a deeper level with abnormal formation pressures. "If we assume that this young Pliocene reservoir has hydrostatic pressure, older reservoirs buried to several thousand metres will – given the same reservoir volume – have up to 10 times more gas in place," says Professor Jon Kleppe at the Department of Petroleum Engineering and Applied Geophysics, the Norwegian Uni-

versity of Science and Technology (NTNU), Trondheim. "A sizable discovery at such shallow depths with normal pressure thus requires a lot more area and volume than a deeper discovery," he adds.

This discovery on the Peon prospect is highly unusual in two different ways. Firstly, the reservoir is only 160 meter below the seabed. With a total depth of 687 meters and it is therefore the shallowest exploration well ever drilled in the Norwegian offshore sector. With water depth of 384 meters the sedimentary succession drilled was only 303 meter. Secondly, the reservoir consists of glacial sandstones deposited in the Pliocene while glacial moraines constitute cap rock. This discovery therefore adds another play model to the Northern North Sea fairway that very few – if anyone outside Norsk Hydro – have thought about.

"This discovery represents a new milestone in the exploration history of the North Sea," says Exploration Manager Tom Bugge in the small, independent oil company Petra. For several years he was engaged in the IKU's Shallow Drilling Project and has thereby gained considerable knowledge about the upper layers of the continental shelf.

"The gas discovery is within sedimentary layers that have been mapped as representing potential drilling hazards because of shallow, gascharged sands," says Reidulv Bøe, Team Leader in the Norwegian Geological Survey for Marine Geology. "They have never been looked upon as potential reservoirs," he adds.

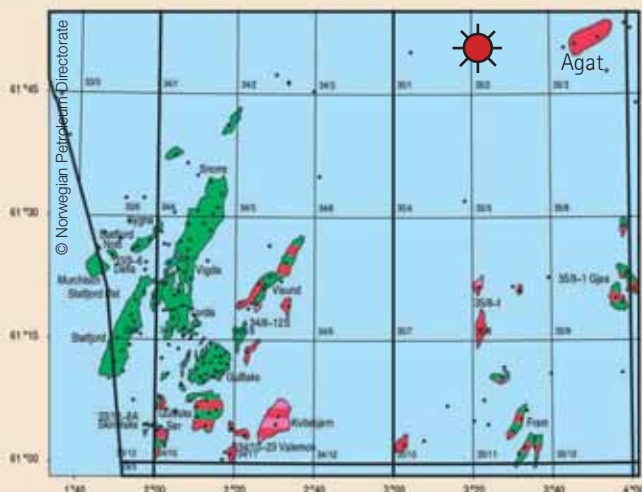
The prograding wedge of sediments below the unconformity seen on the seismic line is derived from the Norwegian mainland after the onset of the Pliocene/Pleistocene glacial period approximately 2.7 million years ago.

The pronounced unconformity represents an erosional surface formed by glaciers during one of the latest glacial advances and is probably less than 1 million years old. As has happened several times in the geological evolution of the North Sea, gneisses and granites in the Norwegian mountains were the source of the sediments," says Bøe.

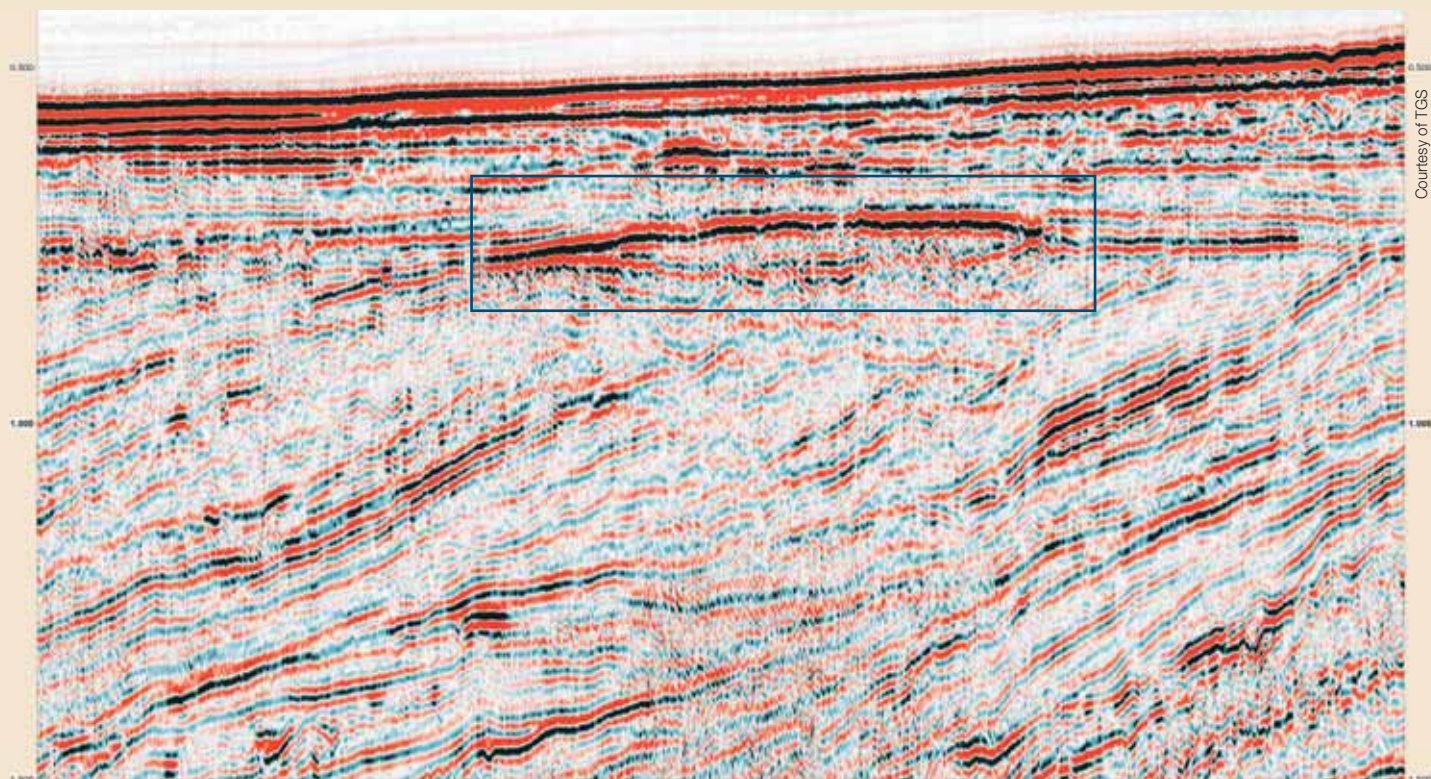
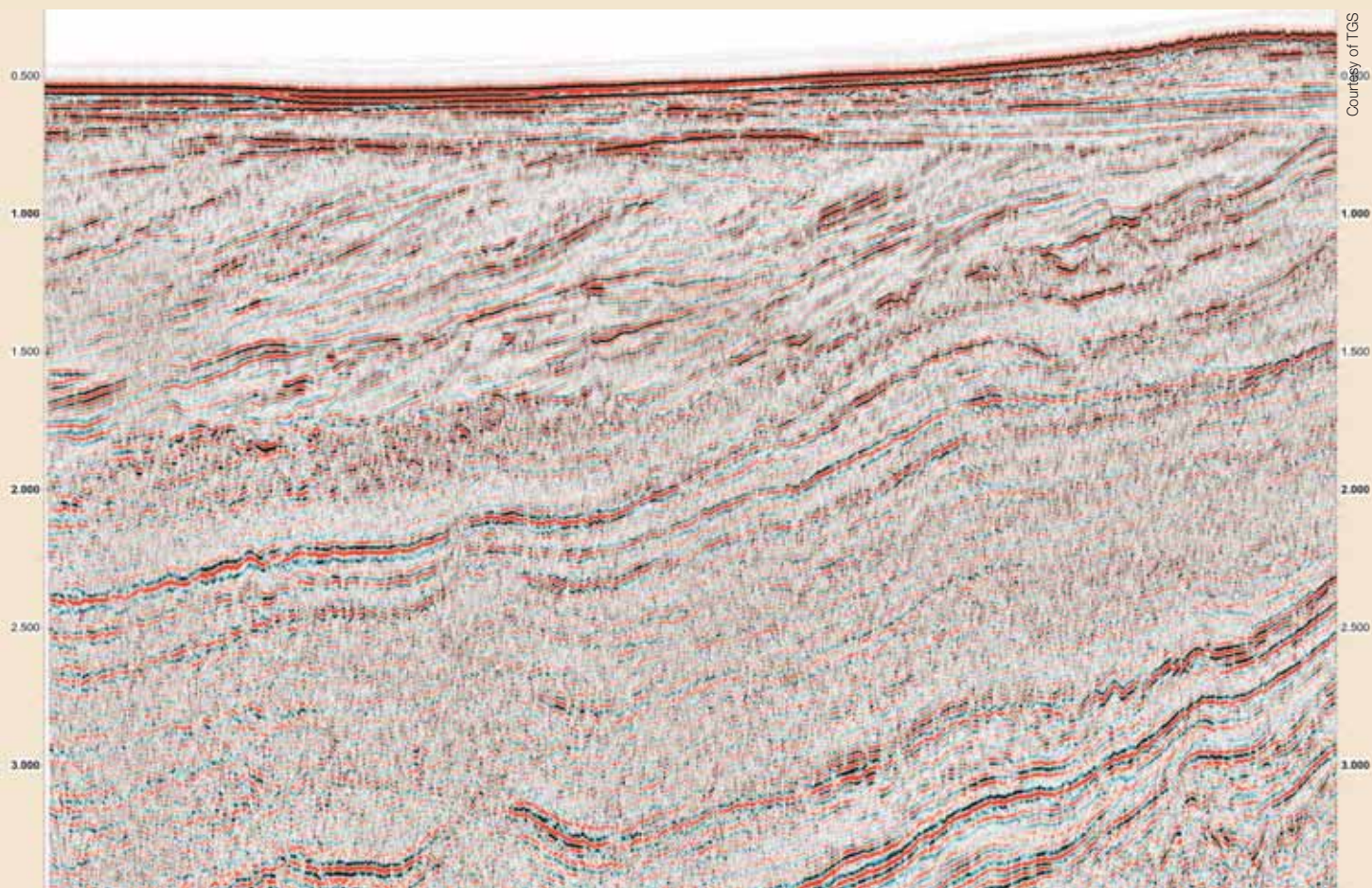
"We are exceptionally pleased with the drilling results on Peon. Large amounts of gas have been proven and we consider the possibility for a commercial development as good. We'll now evaluate data from the well and plan to test the find next year," said Lars Christian Alsvik, director of Hydro Oil & Energy's Exploration Norway business sector.

"The results of the exploration well combined with Hydro's large ownership share in the area (60% in block 35/2) are very positive. This is one of the most interesting finds made in the Norwegian offshore sector in recent years. It lies in a little explored area, it verifies a new exploration model and provides the basis for exciting projects and value creation for Hydro and other players in the Norwegian oil industry," said Alsvik.

Overnight, geologists with expertise in glacial geology have increased their market value substantially.



The discovery in the Peon prospect in the Sogn Graben is situated some 40 km west of the Agat field in block 35/-3 with gas reservoir in deeply buried Lower Cretaceous sandstones.



This 2D seismic line passing through the discovery well 35/2-1 was acquired by TGS-NOPEC already in 1988. At approximately 700 ms two-way time, and only 160 m below sea bottom, the top of the Pliocene sandstone reservoir appears as a strong reflector along the gas accumulation. The lens-shaped body below this event probably indicates the size of the discovered gas accumulation. According to TGS-NOPEC this seismic anomaly can be observed on several seismic lines over an area more than 200 square km. Note also the prograding sequence below the reservoir that consists of Pliocene/Pleistocene sediments.