

The following is a description of: (1) how to access the broader industry dataset archived at the Norwegian Petroleum Directorate and (2) a description of the hydrate analysis dataset, column by column for NorwegianHydrateWellAnalysis.txt

(1) Basis for the dataset in NorwegianHydrateWellAnalysis.txt

The hydrate analysis dataset was based on the analysis of public petroleum industry data from the Norwegian Petroleum Directorate. We recognize that it can be difficult to both access and understand industry datasets when one has a scientific background, as industry terminology is quite different. Figure S1 shows examples of scientific and industry terminology as related to drilling and depth. The most common way to refer to drilling data in scientific ocean drilling is in mbsf (meters below seafloor), however, many scientists also must use other datums, such as mbrf (meters below rig floor) and mbsl (meters below sealevel). In the industry, the most common way to refer to data is in m MD, which is equivalent to mbrf.

Other terminology can be very important if the well is deviated, as MD follows the deviated track, while true vertical depth (TVD) only accounts for depth in the vertical direction (Figure S1). Note that the borehole in the gas hydrate stability zone (GHSZ) is almost always vertical; however, deeper data may be of interest to scientists (such as geochemistry data) and may come from a part of a well that is deviated.

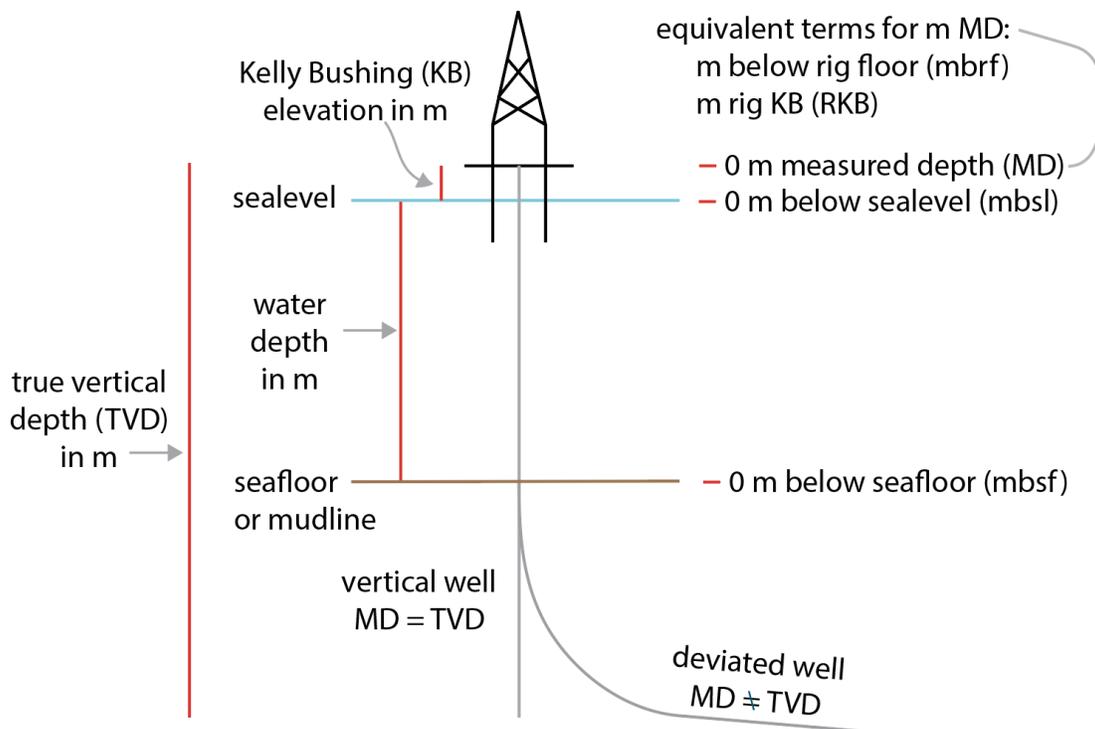


Figure S1. A cartoon showing the common industry and scientific terminology with respect to depth at a well location.

The petroleum industry datasets can be accessed through the Norwegian Petroleum Directorate website. For a quick link directly to the well data, we recommend this direct link: <https://factpages.npd.no/en/wellbore/pageview/exploration/all/7137>

Once on the website, each exploration well can be viewed by clicking the well on the left-hand bar. Each entry for each well has an information bubble, which users can hover over to understand more about each entry. Well logs, if available in pdf format, are under the heading ‘Composite Logs’, usually near the bottom of each file. All wells in this study have well logs available and plotted in pdf format on the Norwegian Petroleum Directorate website. Information such as the location of the well, the bottom hole temperature, lithology, and the depth of oil and gas reservoirs was all collected from this website.

(2) Details about the hydrate analysis dataset, by column

This dataset (NorwegianHydrateWellAnalysis.txt) was compiled from the analysis of industry well log data in the Barents Sea and the Norwegian Margin. The original data was obtained from the Norwegian Petroleum Directorate website, as described in (1).

NorwegianHydrateWellAnalysis.txt

1. Column A: Sea
The well location in the Barents or Norwegian Sea.
2. Column B: Well Name
The name of the well as designated by the Norwegian Petroleum Directorate.
3. Column C: Longitude
The longitude at the wellhead.
4. Column D: Latitude
The latitude at the wellhead.
5. Column E: Spud Date
The date well drilling began.
6. Column F: Water Depth (m)
The water depth in m at the wellhead location.
7. Column G: Kelly Bushing (m)
The depth of the kelly bushing (KB) above sea level; see Figure S1 as an example. The kelly bushing (KB) is a device that is used to deploy drill pipe on the drill floor of a drilling vessel. In the wells offshore Norway, KB is the 0 m level reference for measured depth (MD).
8. Column H: True Vertical Depth (m TVD)
The depth of each well with in only the vertical component. See the example on Figure S1. TVD = true vertical depth
9. Column I: Well Inclination

Wells with less than 10-degree inclination are listed as vertical. Wells between 10 to 25-degree inclination are listed as semi-vertical, and the angle of well inclination is listed. No wells in this dataset are deviated above 25 degrees.

10. Column J: Seafloor Temp (degree C)

The seafloor temperature at the wellhead location, which was estimated from water column temperature and depth data from the World Ocean Database.

11. Column K: Bottom Hole Temp (degree C)

Bottom hole temperature (BHT) as recorded in reports from the Norwegian Petroleum Directorate.

12. Column L: Geothermal Gradient from BHT

The geothermal gradient assuming a linear gradient between the seafloor temperature and the BHT at the TVD.

13. Column M: Geothermal Gradient from DST

A drill stem test (DST) records the temperature in a packed off interval after the borehole fluid has had time to equilibrate with the surrounding reservoir fluid. It provides a more accurate temperature than the BHT measurement. To calculate the geothermal gradient from the DST, a linear relationship is assumed between the temperature and depth of the DST and the seafloor temperature.

14. Column N: Methane BGHSZ (mbsl)

The depth of the base of the gas hydrate stability zone (BGHSZ) for pure methane gas in meters below sea level (mbsl).

15. Column O: Gas Mix BGHSZ (mbsl)

The depth of the base of the gas hydrate stability zone (BGHSZ) for the selected gas mix as described in the journal article in meters below sea level (mbsl).

16. Column P: KB Adjusted Methane BGHSZ (m MD)

The depth of the Methane BGHSZ adjusted for m MD using the height of the KB.

17. Column Q: KB Adjusted Gas Mix BGHSZ (m MD)

The depth of the Gas Mix BGHSZ adjusted for m MD using the height of the KB.

18. Column R: LAS File

This column notes if a LAS file (digital well log file) was available for analysis.

19. Column S: Ro (Ω m)

The estimated or calculated background resistivity to the Gas Mix BGHSZ.

20. Column T: Methane Category

The well category based on the increase in resistivity above Ro to the Methane BGHSZ.

21. Column U: Gas Mix Category.

The well category based on the increase in resistivity above R_o to the Gas Mix BGHSZ.

22. Column V: Porosity

If a fair to high quality bulk density log or neutron porosity log is available in this dataset within the HSZ, yes is recorded in this column.

23. Column W: Intervals (m MD)

Intervals that are at least $0.5 \Omega\text{m}$ above R_o .

24. Column X: Deeper Hydrocarbon Reservoir

If a producible hydrocarbon reservoir was encountered deeper in the well, yes is recorded. If only hydrocarbon shows or no hydrocarbon reservoir is encountered no is recorded.

25. Column Y: Top Hydrocarbon Reservoir (m MD)

If a deeper hydrocarbon reservoir was encountered, the depth of the top of the hydrocarbon reservoir is recorded here.

26. Column Z: Notes

Interpretation for R_o and notes about the well are recorded in this column.