# Class Exercise

Problem 1: Estimation of porosity probability distribution from exploration drilling data.

Exxon mobil has collected 2287 core samples from six cored wells in the Ben Nevis reservoir of the Hebron development. Porosity has been measured for all samples (see the results in the attached excel file). Using this data, calculate the probability distribution function of porosity in the reservoir.

Problem 2: Probabilistic estimation of Original oil in place of the Kobbe Formation

The company ENI has found a reservoir in the Barents sea, Kobbe, 50 km south of the Snøhvit field and 80 km from the LNG plant of Snøhvit in Hammerfest (Melkøya). The water depth in the area is 360 – 420 metres and, luckily, is an ice-free area. The company is evaluating to produce it and baptized the field: Goliat.
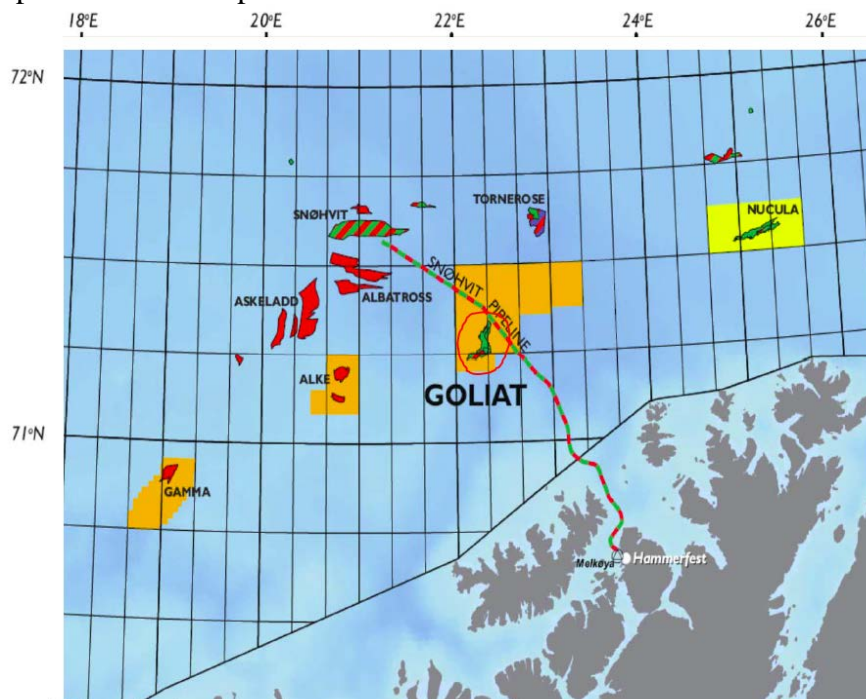
The reservoir contains oil with a thin overlying gas cap and it lies approximately 1800 meters beneath the seabed. The static reservoir pressure is 190 bar.

As part of the early development studies and as required by the Norwegian authorities, your first task is to perform a probabilistic estimation of the total recoverable reserves and the original oil in place of the Kobbe reservoir. The subsurface group has provided (in the excel sheet attached) information on the factors needed to calculate hydrocarbon pore volume: rock volume, net to gross, oil saturation, porosity (all based on a triangular probability distribution). The oil formation volume factor is represented by a uniform distribution.

Assumptions and extra information:

Use the following equation to calculate Initial oil in place (N):

$$N = \frac{V_R \cdot \varphi \cdot S_o \cdot \left(N_{TG}\right)}{B_o}$$

All the input information given is uncertain and reported as a uniform or triangular distribution (min, max or Min, Mode, Max). The details of the distributions have been given in class.

Tasks:
-Perform a Monte Carlo Simulation Study (using 500 and 5000 simulations) to obtain the expected value of the Total Recoverable Oil Reserves and the initial oil in place. Report the outcome as:

- Expected value (Mean or Average)
- Most probable value (mode)
- Median (P50), P10, P90
- Expectation curve for the Total Recoverable Oil Reserves (Plot of Cumulative Probability) and the initial oil in place
- Compare the results when using 500 and 5000 simulations