



Compaction of North-sea chalk

Dániel Keszthelyi, Dag Kristian Dysthe, and Bjørn Jamtveit

Physics of Geological Processes, University of Oslo, Norway (daniel.keszthelyi@fys.uio.no)

The Ekofisk field is the largest petroleum field in the Norwegian North Sea territory where oil is produced from chalk formations. Early stage of oil production caused considerable changes in pore fluid pressure which led to a reservoir compaction. Pore collapse mechanism caused by the dramatic increase of effective stress, which in turn was caused by the pressure reduction by hydrocarbon depletion, was early identified as a principal reason for the reservoir compaction (Sulak et al. 1991).

There have been several attempts to model this compaction. They performed with variable success on predicting the Ekofisk subsidence. However, the most of these models are based on empirical relations and do not investigate in detail the phenomena involved in the compaction.

In sake of predicting the Ekofisk subsidence while using only independently measurable variables we used a chalk compaction model valid on geological time-scales (Japsen et al. 2011) assuming plastic pore-collapse mechanism at a threshold effective stress level. We identified the phenomena involved in the pore collapse. By putting them in a sequential order we created a simple statistical analytical model.

We also investigated the time-dependence of the phenomena involved and by assuming that one of the phenomena is rate-limiting we could make estimations of the compaction rate at smaller length-scales. By carefully investigating the nature of pressure propagation we could upscale our model to reservoir scale. We found that the predicted compaction rates are close enough to the measured rates. We believe that we could further increase accuracy by refining our model.

Sulak, R. M., Thomas, L. K., Boade R. R. (1991) 3D reservoir simulation of Ekofisk compaction drive. *Journal of Petroleum Technology*, 43(10):1272-1278, 1991.

Japsen, P., Dysthe, D. K., Hartz, E. H., Stipp, S. L. S., Yarushina, V. M., Jamtveit. (2011) A compaction front in North Sea chalk. *Journal of Geophysical Research: Solid Earth* (1978–2012), 116(B11)