Tropical Weathering in Norway
The NGU - NPD Twin Project

Terje Solbakk[1], Dag Bering[1], Marco Brönner[2], Ola Fredin[2], Bart Hendriks[2], Christian Magnus[1], Odleiv Olesen[2], Jan Steinar Rønning[2] & Jon Arne Øverland[1]
1) Norwegian Petroleum Directorate (NPD), P.O. Box 600, NO-4003 Stavanger
2) Geological Survey of Norway (NGU), NO-7491 Trondheim

The Norwegian Petroleum Directorate and the **Geological Survey of Norway** (NGU) have launched a joint research and mapping project on deep weathering of basement rocks in Norway. The project involves mineralogical, chemical and petrophysical characterization of known occurrences of deep weathering, as well as development and testing of age dating techniques and geomorphological and geophysical mapping tools.

This poster highlights some of the on- and offshore sites in Norway were we already found deep weathering, and presents preliminary work.

Deeply weathered basement are preserved along fault and fracture zones (Fig 7.) onshore Norway in several localities (e.g.) ☆ :

- Vesterålen in northern Norway,
- Beitstad-Inderøya area in mid Norway
- Stadtlandet-Vågsøy in western Norway
- Lista in southernmost Norway
- Kjose-Larvik area, south-eastern Norway

Three of the areas are located adjacent to offshore areas (Fig 1,2), one site is found close to seismic indications of Mesozoic deep weathering (Fig 6). The recognition of preglacial weathering in Scandinavia is not a new phenomena, but was not in focus for several decades in academia.

Fig 1.

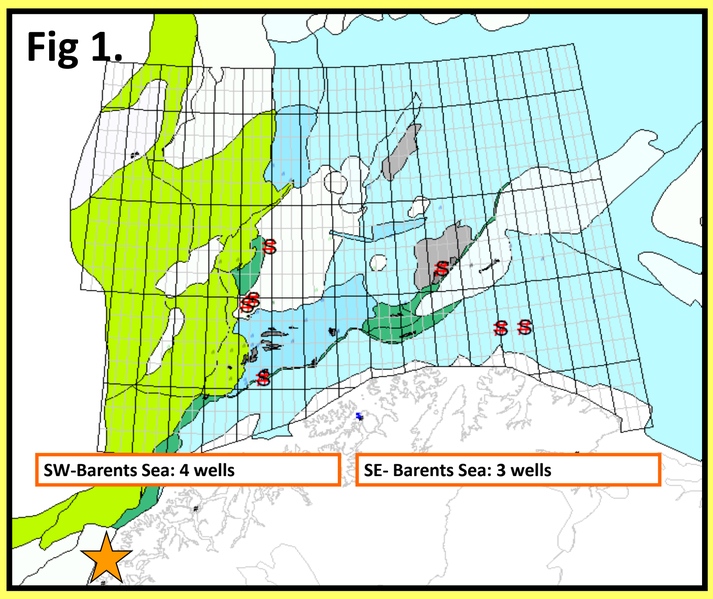
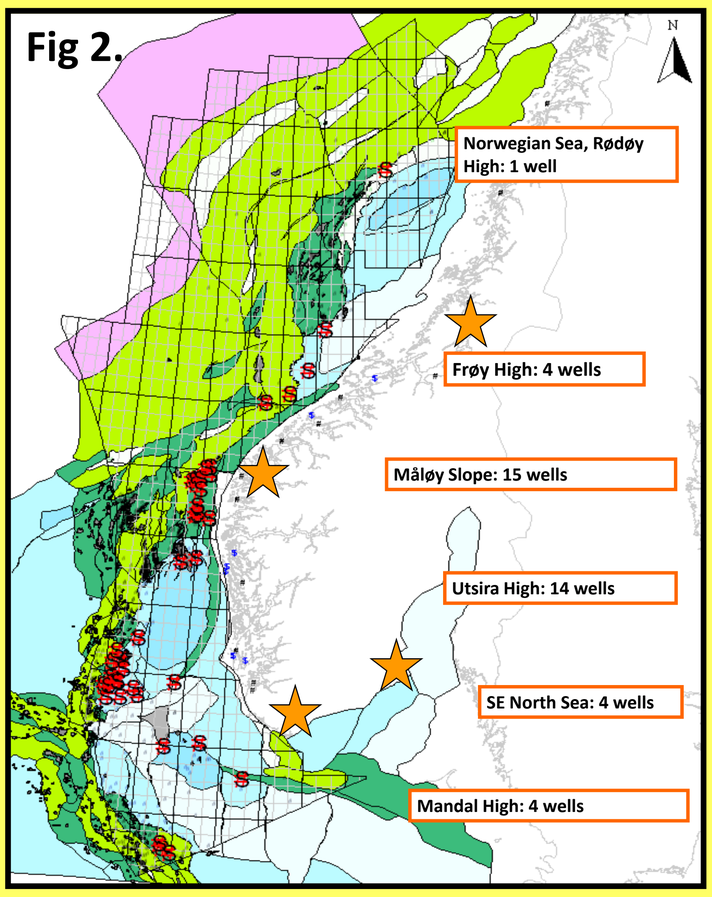


Fig 2.



Weathered basement found in well nr. 1 on the Norwegian Shelf!

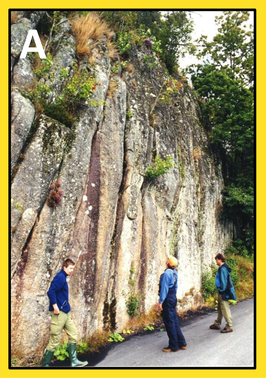
The Norwegian continental shelf is covered by post-Silurian sediments, overlaying crystalline basement. **NPD`s Core Store** contains all the cores taken offshore Norway. Of the more than 1200 exploration wells drilled by the petroleum industry, about 50 wells have reached basement. Even the first exploration well drilled, 8/3-1, terminated in deeply weathered basement. Figure 3 shows a possible DHI in a deeply weathered zone from western Norway.

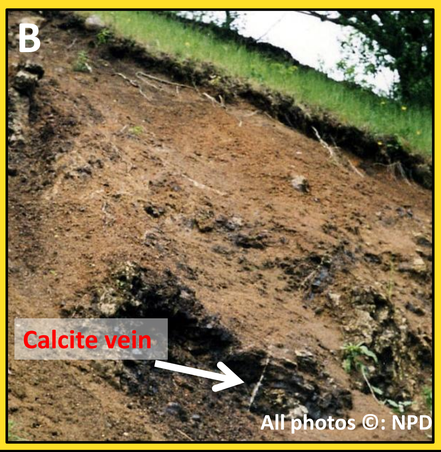
Deep weathering localities, Lista:

A: Granite with karren features.

B: Saprolite with a high Mn and Fe- content.

C: Core stones.





Issues on deep weathering offshore Norway:

- Possible lack of bottom seal in petroleum reservoirs, especially in the provinces Nordland VII, Troms II and offshore the Møre coast.
- Possible hydrocarbon migration route
- Importance for CO_2 storage and possible leakage problems in areas close to coast.
- Weathered basement could act as petroleum reservoir (Well 16/1-4 on Utsira High proved gascondensate in brecciated, and probably weathered, basement, Fig 2).
- Our knowledge about deep weathering in the North Atlantic Petroleum Provinces is limited.

This project will provide new insight and may provide a new play model for hydrocarbon exploration.

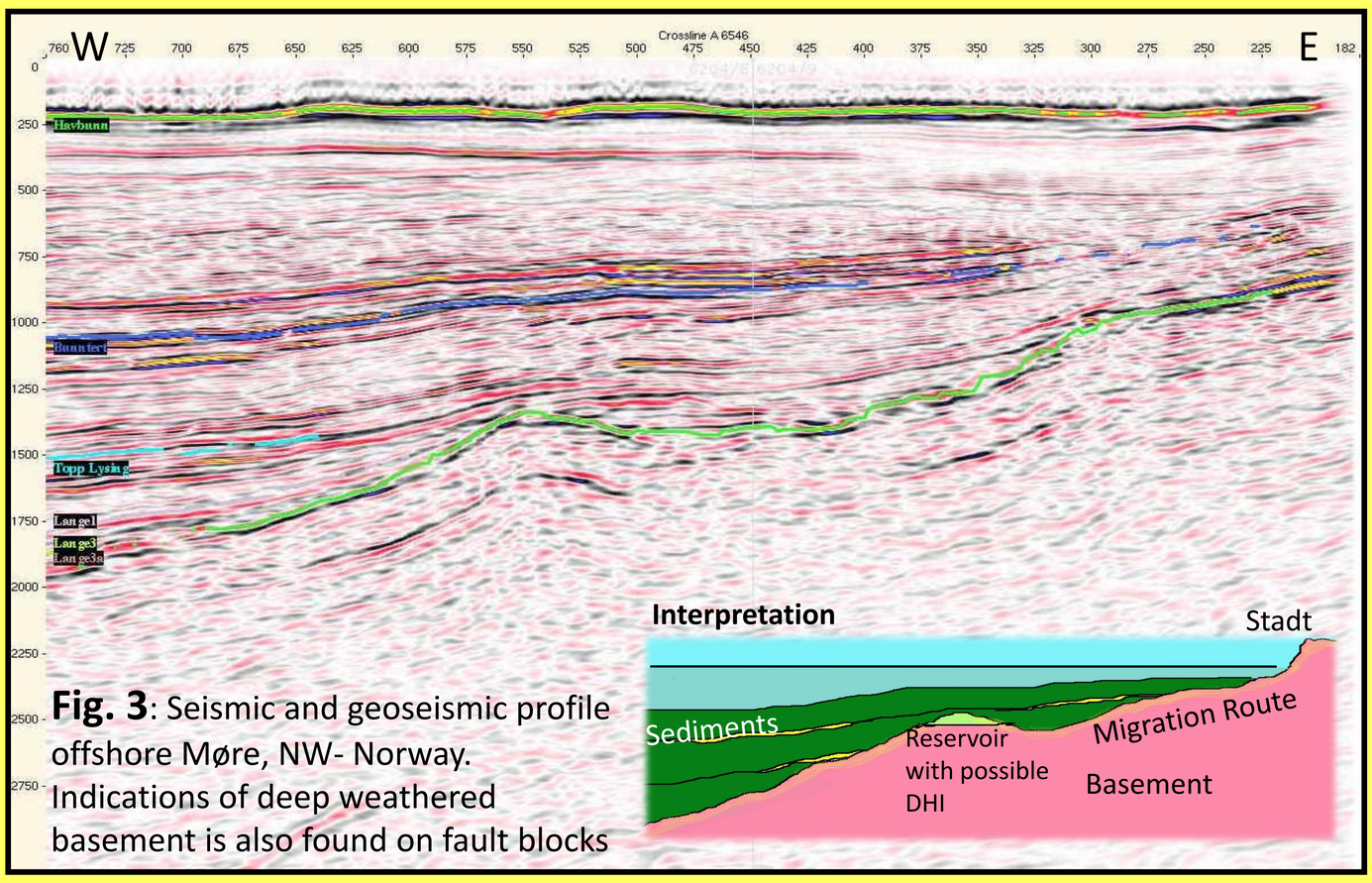
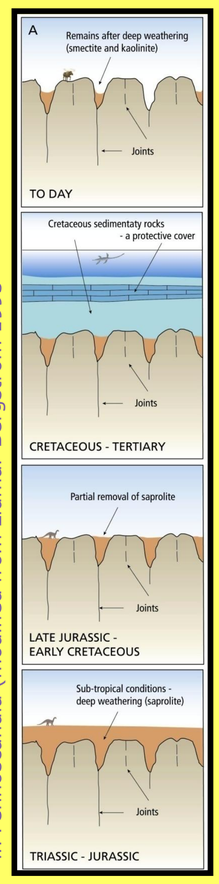


Fig. 3: Seismic and geoseismic profile offshore Møre, NW- Norway. Indications of deep weathered basement is also found on fault blocks

Fig 4.



Schematic diagram of the geological evolution of tropical weathering in Fennoscandia (modified from Lidmar-Bergström 1995

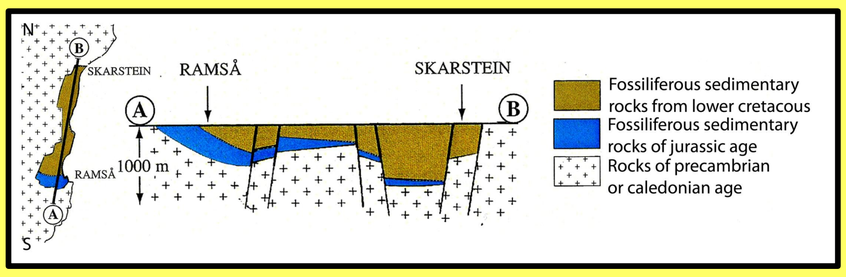


Fig 5. Ramså, Andøya geological profile (modified from Møller 2007)

Onshore hydrocarbons

Andøya in Nordland County, Northern Norway is one of the few sites onshore Norway that contains in-situ Mesozoic sediments (Fig 5.). These sediments were drilled for hydrocarbon exploration during the early 1970s. The drilling revealed deeply weathered basement underlying the Cretaceous and Jurassic sediments (Fig 4).

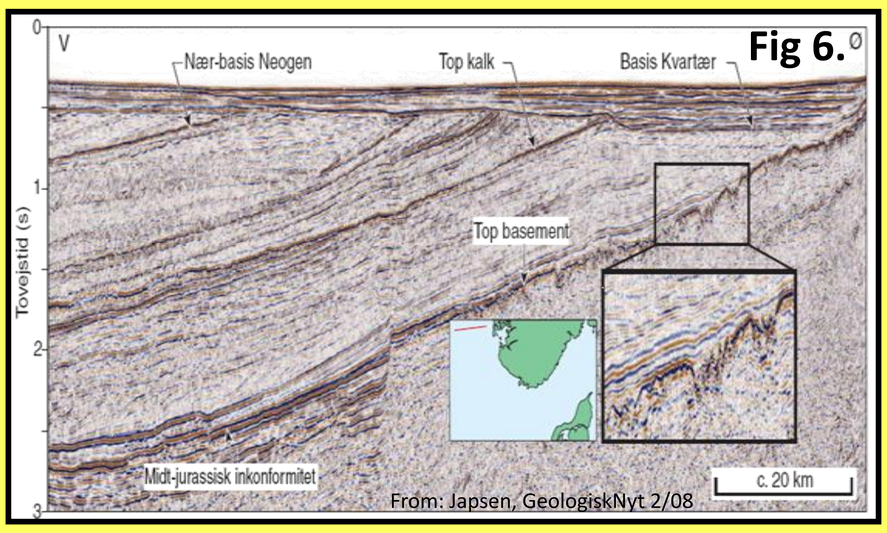


Fig 6: Indications of deeply weathered basement offshore Karmøy, SW-Norway.

Fig 7: Exhumed deeply weathered paleo-surface in the Jøssing Fjord area, SW Norway. Note similarity between fig 4, 6 (box) and 7.