

Session 1.

Soiltypes and measurements of geothermal properties

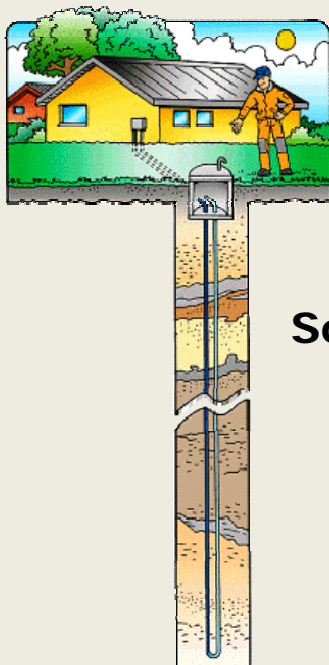


Introduktion to danish geology

Specific question we would like to be discussed

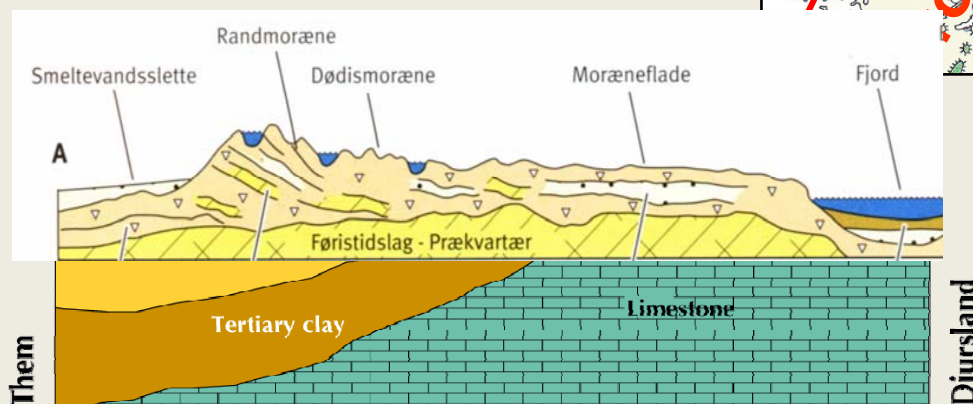
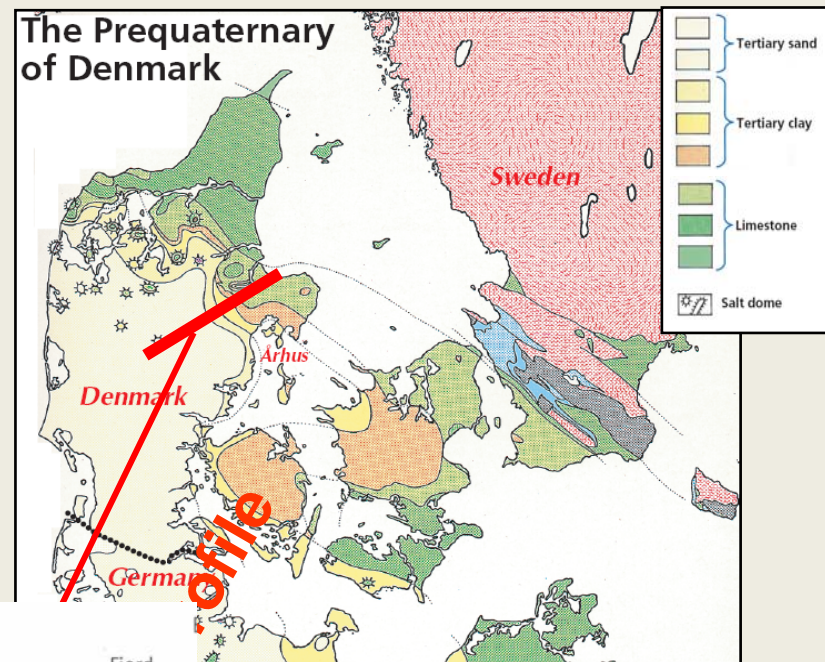
Some short introductions to the questions

Workshop on Closed Loop Borehole 7-8. sept. 2011






The geological framework

Soft sediments and partly consolidated limestones



Cross section profile of the subsoil layers from SW to NE

-  Sand and clay (upper Oligocene and Miocene)
-  Tertiary clay (Palaeocene, Eocene and lower Oligocene)
-  Limestone (upper Cretaceous and Danian)

Specific heat capacity

Thermal conductivity

What relevant table values exist and how were they measured ?

Do we need more measurements with reference to danish geology ?

What soil types are important to distinguish between when estimating energy output from closed loop boreholes ?

Specific heat capacity

Thermal conductivity

How do we best measure geothermal properties in the laboratory and in the field ?

How do we obtain realistic water contents during measurements ?

Geothermal properties

Geothermal gradient and heat flux

**What do we know about the geothermal gradients in Denmark ?
and what is the order of magnitude of the heat flux ?**

Specific heat capacity

Thermal conductivity

What relevant table values exist and how were they measured ?

Do we need more measurements with reference to danish geology ?

What soil types are important to distinguish between when estimating energy output from closed loop boreholes ?

The national borehole database JUPITER

Borehole archive / database
founded in 1926



>240.000 borehole descriptions
=> 5 boringer/km²



Standardized sediment description

Rocktype

- grainsize
- sorting
- minor components
- color
- lime content
- minerals
- etc

What soil types are important to distinguish between when estimating energy output from closed loop boreholes ?

Quaternary	<p>Sandy TILL</p> <p>Clay TILL</p> <p>CLAY, silty (marie or lacustrine)</p> <p>SAND with gravel, poorly soorted (meltwater sand)</p>
Miocene	<p>SAND well sorted, finegrained, micaceous</p> <p>SAND well sorted, coarsegraind, rich in quartz</p> <p>CLAY, silty, micareous, organic</p>
Paleogene	<p>CLAY, rather fat, glauconitic</p> <p>CLAY, fat, smectitic</p> <p>MARL, rather fat smectitic</p> <p>LIMESTONE, sandy, with flint, partly consolidated</p>
Cretaceous	<p>LIMESTONE, finegrained, soft, with flint</p>

Specific heat capacity

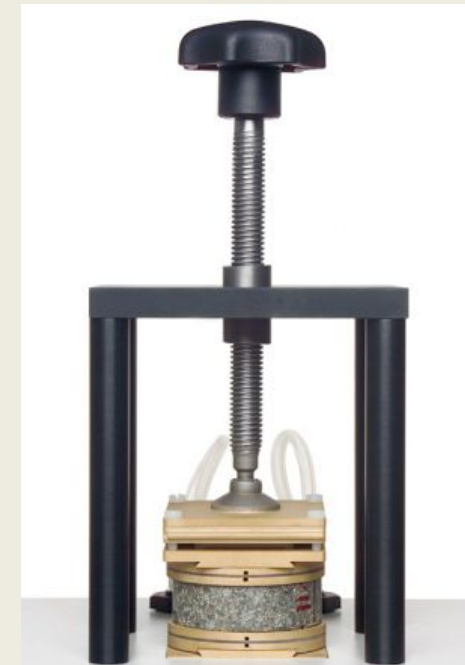
Thermal conductivity

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Needle Probe : Transcient method



Divided bar: Steady state method