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Heat flow of the Norwegian continental shelf

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Terrestrial heat flow influences a large collection of geological processes. Its determination is a requirement to assess the economic potential of deep sedimentary basins. Published heat flow calculations from e.g. major oil provinces are however seldom. Robust heat flow determinations in drillholes require logging of undisturbed temperatures and intensive sampling of core material for petrophysical measurements. Temperature logging in exploration drillholes is traditionally conducted during drill breaks or shortly after drilling, resulting in temperatures severely disturbed by mud circulation and coring is restricted to selected intervals. Alternatively, test temperatures, information from electric logs and lithological descriptions of drill cuttings can be used to overcome these limitations.

The present contribution introduces new heat flow determinations based on 63 exploration drillholes from the Norwegian North Sea, the Mid Norway Margin and the Barents Shelf. Our analyses are based on released DST temperatures, precise lithological descriptions of drill cuttings, previously measured rock matrix thermal conductivities and established porosity laws.

Our results suggest median heat flow values of 64 mW/m2, 65 mW/m2 and 72 mW/m2 for the North Sea, the Mid Norway Margin (mainly the Trøndelag Platform) and the SW Barents Shelf respectively. The Barents Shelf shows significantly high heat flow, suggesting lateral transfer of heat from the mantle of the adjacent young ocean. In detail, heat flow increases by $\sim$ 10 mW/m2 from the southern Norwegian North Sea towards the Mid Norway Margin. This result appears to be in very good agreement with seismic tomographic studies suggesting northward thinning of the underlying mantle lithosphere. Our results together with published marine heat flow data from the Mid Norway Margin suggest a gradual decrease in heat flow levels from both the North Sea and the Trøndelag Platform towards the centres of the deep Møre and Vøring basins. This latter effect is attributed to reduced heat input from crustal sources caused by the extreme attenuation of the crystalline basement below these two basins.