Temperature profiles may be deeply influenced by metamorphism, depending on the initial composition and thermal conditions. Crusts with different mineral assemblages can result in temperature profiles that are significantly different, even when the same heat flow is applied. In some cases, the differences in temperature can exceed 10°C, leading to different reaction kinetics and mineral assemblage variations.

For the three case studies, different reaction kinetics have been considered, with slow kinetics leading to lower temperatures, especially in the bottom of the lower crust, while fast kinetics result in higher temperatures throughout the crust. The differences in temperature due to reaction kinetics are considerable, with the temperature peaks related to the emplacement of the first dykes being pronounced and short, while those related to the emplacement of the second dykes are lower and more widespread.

Metamorphism has been modeled using a 2D geometry (Fig. 1), with a 20 km thick crust. The model assumes a constant heat flow at the surface, according to the lateral accretion of the crust. The thickness and rheological properties of the crust are considered to be constant during the simulation.

The thermal evolution modeled provides a framework for understanding the complex interplay between thermal conditions, mineralogical assemblages, and rheological behavior of the crust. The temperature profiles are sensitive to the reaction kinetics and can be used to infer the sequence of events that occurred during the geodynamic evolution of the area. The model can be recalculated with different parameters to simulate various scenarios, allowing for a better understanding of the processes that shaped the crust.

References:

- simula research laboratory, Martin Linges vei 17 Fornebu, Norway; (2)Utrecht University, Utrecht, The Netherlands

Alessio Simula