Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.20962

# Reading the rock record for a hierarchy of timescales

**SUMIT CHAKRABORTY**

Ruhr Universität, Bochum, Germany

Presenting Author: sumit.chakraborty@rub.de

The dynamics of geological processes are controlled by geochemical and mechanical processes that operate on timescales that span the range between deep time and instantaneous. The application of kinetic principles is now increasingly allowing the determination of durations and rates of processes that operate on such a range of timescales. This is leading to the recognition of many new processes, understanding of the nature of coupling between them, and their role in the overall evolution of the system. These insights into the hierarchy of timescales is now throwing new light on long lasting debates in fields such as tectonics and volcanology.

Two examples, one each from igneous and metamorphic systems, help to illustrate these aspects. Volcanoes are an ideal setting to study processes occurring on a range of timescales. While volcanic edifices evolve over millenia or even longer, events triggering an eruption occur over days or weeks. There are interlinked processes that occur on intermediate timescales. An example of how the ability to resolve processes on these different timescales is providing new insights is offered by a study of the type locality for volcanic maars in Eifel, Germany. It is being found that these are the consequence of more than “just” magma-water interaction; processes deeper in the Earth play a critical role.

Mountain building occurs over plate tectonic timescales of tens to hundreds of millions of years, but metamorphic rock records show that individual reactions occur over much shorter timescales of several thousand years. Case studies in the Himalaya reveal that the ability to resolve the duration of individual stages in the overall metamorphic evolution is important for shedding light on debates related to modes of exhumation and mountain building (e.g. channel flow or wedge tectonics?).