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What do we really know about (terrestrial) carbonate diagenesis?

Alex Brasier (1) and Anneleen Foubert (2)

(1) School of Geosciences, University of Aberdeen, UK (a.brasier@abdn.ac.uk), (2) Department of Geosciences, University of Fribourg (anneleen.foubert@unifr.ch)

Terrestrial carbonates including tufas and travertines are known as palaeoenvironmental archives. Increasingly evidence points to continued growth of tufas and travertines after deposition of the primary fabric. If we do not understand 'early diagenetic' processes then we do not understand the geochemical and petrographic data archived within terrestrial carbonate rocks.

In many cases early (syn-sedimentary) diagenesis reflects an unstable precursor such as amorphous calcite or aragonite (see Jones & Peng, Sedimentary Geology, 2012), or recrystallization from non-carbonate precursors like calcium oxalates (see for example Cailleau et al., Biogeosciences, 2011). In other cases fabric or geochemical changes may simply reflect highly porous carbonate rock fabrics that allow fluids to flow within the deposit, promoting continued calcite crystal growth. Examples of these and how we might differentiate them will be discussed.

There is a fundamental problem with our approach to understanding processes of carbonate diagenesis. Normally we take our evidence from the rock products, making assumptions about the relative ages of rock fabrics and the processes that have affected them. In most cases this is probably unavoidable, but not for rocks that precipitate rapidly, measurable at rates of centimetres or even metres per year. We will highlight the limits of the traditional petrographic approach using examples from Mono Lake (California, USA), Italy, and the UK, and discuss what can be learned from experiments aimed at understanding what really happens during 'early diagenesis' in terrestrial carbonate rocks. This has implications for understanding diagenesis of carbonate rocks of all types and of all ages.