

Scattered K-feldspars in shallow-water carbonates: a possible proxy for paleoclimate studies

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A basic tenet of shallow-water sedimentology is that carbonate and siliciclastic sedimentation are typically mutually exclusive (and, by the way, that is the reason why the Bathurst community exists!). Even though “mixed” sediments are more and more studied, as scholars of carbonates we know that in most shallow-water carbonate rocks if we want to look for silicates, we turn our attention to the “insoluble” residue (insoluble, of course, to HCl).

While studying the insoluble residue of some samples of Cretaceous shallow-water carbonates, we noticed the presence of small quantities of K-feldspar in early-diagenetic dolomites. According to the monumental, posthumous reference book of Erik Flügel, the occurrence of feldspar is almost never reported as insoluble residue, except in a few cases, generally corresponding to “impure” limestones

. We may assume that this should be a consequence of the intense weathering under warm humid conditions in the subtropical climate belt to which shallow-water carbonates are typically associated.

Nevertheless, after a careful SEM examination of many samples from our collection, we have found that scattered and tiny K-feldspars do occur in several dolomites of different age, either as small (a few μm) irregular to rounded grains or as euhedral crystals filling cavities. Based on a preliminary assessment, the stratigraphic distribution of these occurrences seems significant: so far we have found K-feldspar in Norian dolomites of the southern Apennines (Italy) and of the Zagros (NW Iran), and in Barremian and Albian dolomites of southern Apennines. Conversely, it is not present in Rhaetian-Jurassic and Aptian dolomites of the same localities. The intervals containing K-feldspar correspond, based on previous petrographic and geochemical investigations, to relatively arid phases, compared to the more humid phases that seems to be associated to the dolomites devoid of K-feldspar.

A similar paleoclimatic interpretation was given by Sandler et al. (2004), who found authigenic K-feldspar in the insoluble residue of Cenomanian-Turonian shallow-water carbonates of Israel. According to Sandler et al. (2004, *Sedimentology*, 51: 323–338), the euhedral K-feldspar crystals formed as overgrowth around detrital, wind-blown grains. Their and our findings clearly relate the presence of K-feldspar to early diagenesis and possibly to the dolomitization process itself. According to literature, the most common feldspar in shallow-water carbonates is albite, sometimes accompanied by K-feldspar. Generally, these minerals are linked to incipient metamorphism and deep brine circulation. Regarding our samples, a late-diagenetic origin can be excluded, given the available geological and petrographic data, even though the exact genetical process is presently under study. A full understanding of the factors controlling the occurrence of K-feldspar in shallow-water carbonates could offer a new proxy both for early diagenesis and for paleoclimate studies.

Ongoing systematic analyses on many more samples from other localities will clarify if the presence of these minerals in our samples is a true oddity, or if K-feldspar has gone unnoticed by many researchers up to now simply because it is hard to see...if you are not looking for it.