c6 The dolomite problem < mudcracks, nodules, dolomite >

Do we read the facts correctly?

I've seen the sea all in a blaze of fire / I've seen a house high as the moon and higher
I've seen the sun at twelve o'clock at night / I've seen the man who saw this wondrous sight.

"All this is true," Thomas Jefferson wrote "whatever you may think of it at first reading." Solution: The lines are missing periods ("stops"). Try reading it this way: "I've seen the sea. All in a blaze of fire, I've seen a house. High as the moon and higher, I've seen the sun. At twelve o'clock at night, I've seen the man who saw this wondrous sight."[3]

Dolostone (made of the mineral dolomite, $CaMg(CO_3)_2$, exists in vast quantities. Its texture, fossil content, and association with seawater-evaporite rock gypsum, have long persuaded geologists that dolostone originates as marine limestone (of the mineral calcite or aragonite, $CaCO_3$) that is subsequently dolomitized by the exchange of half of its calcium with magnesium from seawater.

Seawater is supersaturated with respect to dolomite but dolostone is not directly precipitated (***Footnote c6.1***) from it. Experiments designed to discover how dolomite can precipitate under near-surface conditions where shallow-water marine limestone abundantly accumulates today, have failed. However, the Dolomites, northern Italy, famously expose massive dolomitized Triassic organic coralline reefs and so undeniably were originally shallow-water marine limestones. In 1957, a review of "The Dolomite Question" by Rhodes Whitmore Fairbridge (1914-2006) stimulated efforts to look for modern analogues.[4] The few found cases of limestone being replaced by dolostone are under the coastal sabkhars of Abu Dhabi, UAE, on the tidal flats and in thin supratidal crusts on Andros Island, Bahamas, and in the Coorong lakes of South Australia. None of these are clearly relatable to known ancient extensive thick, variously massive and coralline, dolostones.

One problem has been resolved: In the laboratory, short term, chemical experiments fail because in them sulfate ions inhibit dolomitization reactions. However, in 1982, deepsea drilling in the Gulf of California recovered dolostone in the process of formation from limestone by diagenesis. Kerry R. Kelts (1947-2001) and Judith Ann Makenzie determined that in this natural environment, sulfate reduction by bacteria promotes dolomitization.[5]

A myth has also been replaced by fact (***Figure c6.1***). The dolomite problem, however, remains far from solved. ❑

Footnote c6.1 Playfair in 1802 disparages Richard Kirwan's (1733-1812) notion of precipitation:[6]

The Neptunist who has provided the means of dissolving the materials of the strata, has only performed half his work, and must find it a task of equal difficulty to force this powerful menstruum [solvent] to part with its solution. Mr Kirwan [who had coined the name "plutonist"for any Hutton follower], aware in some degree of this difficulty, has attempted to obviate it in a very singular way. First, he ascribes the solution of all substances in water, or, in what he calls the chaotic fluid, to their being finely pulverised, or created in a state of the most minute division [i.e. as a colloidal suspension]. Next, as to the deposition, the solvent being, as he acknowledges, very insufficient in quantity, the precipitation took place, (he says), on that account the more rapidly.

If he means by this to say, that a precipitation without solution would take place the sooner the more inadequate the menstruum was to dissolve the whole, the proposition may be true; but will be of no use to explain the crystallization of minerals, (the very object he has in view), because to crystallization, it is not a bare subsidence [flocculation] of [colloidal] particles suspended in a fluid [which would produce an amorphous solid as is say opal], but it is a passage from chemical solution to non-solution, or insolubility, that is required.

If, on the other hand, he means to say, that the solution actually took place more quickly and was more immediately followed by precipitation, because the quantity of the menstruum was insufficient, this is to assert, that the weaker the cause, the more instantaneous will be its effect.

Of two propositions, the one of which is nugatory [means: *of no value*], and the other absurd, it is not material to inquire which the author had in view.