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DOLOMITE PROBLEMS

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There are many modern and ancient opinions on the origin of dolomite, and the general opinion on the geological and geochemical side is that the origin of the dolomites is not yet clear enough. That there are different sorts of dolomites is generally agreed. The kinds of dolomite are as follows:

(1) Replacement of limestone and dolomitic limestone, of the ready-made, consolidated, petrified, rock by more dolomitic material. It is easily recognized in the field from its contacts, which have no relation to the original stratification. The causes are superimposed and local. Such dolomites are cavernous if compared with the intact rock. Introduction of $MgCO_3$ is doubtful; the dolomitization proceeds by means of extraction of $CaCO_3$ (porosity!), and the $MgCO_3$ already present stays put.

(2) Diagenetic dolomitization in unconsolidated sediments, on the sear floor, in conditions of saturated interstitial solutions, the chemistry and physics ~~of~~ which are however terra incognita. The process is partly similar to (1) (extraction of $CaCO_3$), but involves also the addition of $MgCO_3$ from the sea water. In unconsolidated sediments there is little chance for voids and caverns; the rock will be compact. However, a sequence of dolomitic and less dolomitic strata may result; a whole formation of a dolomite is less likely under such conditions. Aragonitic fossils, of course, will be easily replaced by dolomite. The much-discussed Funafuti is an extreme case illustrating the dolomitization of porous corals and coral debris, which themselves from the beginning contained large amounts of $MgCO_3$. The situation can be viewed from a "front" aspect, the front being the contact of the free water and the sediments, which moves upward in accordance with the advance of sedimentation.

Of course, additional dolomitization by extraction of $CaCO_3$ can be superimposed at any later time on such rocks, when the dolomitization is incomplete.

(3) Primary dolomites, precipitated directly as original dolomite, or calcareous-dolomitic sediments. Such rocks are compact and stratified and all details of stratification are well preserved. They may form interbeds only, or conspicuous dolomitic formations. Opinions on the origin of such rocks are divided, and all are obscure.

(4) Clastic dolomitic beds, "dolarenites", derived by erosion of pre-existing rocks. Sometimes the identification of such "arenites" is inconclusive because dolomite (and limestone) grains behave on the sea floor as other sand grains, ooliths, etc., and with the rock show stratification, current-bedding, flowage, etc. Recrystallization also too often obscures the issue.

(5) Dolomitic shales, sandstones, etc., which may be of any of the types above, or of a mixed origin.

Now, students commonly try to explain the dolomites from present-day conditions, and even laboratory experiments are set according to these conditions. I think that an historical approach is thus completely neglected. The concept of geological time (date-time, not physics parameter) has to be introduced.

My statistics on the distribution of dolomitic formations in the geological time scale are very incomplete; still, it seems that more dolomitic formations came into existence in the Algonkian time than in the subsequent periods, if primary dolomites are taken into account. I think that the frequency curve of primary dolomites decreases rapidly with the advance of time, and was already very low at the start of the Mesozoic, after which dolomitic formations became exceptions. The gradual relative decrease of magnesium in carbonate rocks during the past is discussed recently by Ph. H. Kuenen (Marine Geology). A Russian author (N.M. Strahov) thinks that in the Pre-Cambrian the salinity of the water was lower than at present, and that there was certainly more CO_2 in the atmosphere and, consequently, in the sea. So, in Pre-Cambrian and early Palaeozoic time the marine environment was different, and it is perhaps worthwhile to investigate theoretically and experimentally, whether such conditions favoured the precipitation of dolomitic sediments and their preservation in the course of diagenesis.

The increase in salinity of the sea cannot be verified; it is a reasonable deduction. Also a change in the ratios of the salt components during oceanic time is not evident but is nevertheless possible. A gradual decrease in the amount of free CO_2, however, is evident. The carbon dioxide is captured by the biosphere and stored in the deposits of carbonate rocks and the caustobioliths. The amount of free carbon dioxide steadily decreased and only the burning off of the coal and oil may change for a while this inevitable course. So, there is ample reason to assume that in the Algonkian time a different enviionment existed and controlled, inter alia, the precipitation of carbonate rocks. The excess of free carbon dioxide favoured, perhaps, the marine algae like Collenia, etc.

From the recollections outlined above at least a partial explanation of the tie between galena and the dolomites is apparent. In Algonkian time dolomitic formations were more numerous than ever after and the ore had more chances to settle in dolomites, and especially in such dolomites as formed in internal basins. Bonterre was, perhaps, one of the last chances of a similar event, and is already in Cambrian time. Where and when no dolomites are available, ordinary limestones and other rocks become the hosts. Of course, iron, lead, zinc, and copper are everywhere dispersed in the sediments, and their concentration into orebodies may be governed by the original set-up as well as by subsequent events.

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