Geophysical Research Abstracts, Vol. 9, 05249, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05249

Synchronic development of the Cyanobacteria and changing carbonate mineralogy in the geological history – key to decision of the dolomite problem?

V. Kuznetsov

Russian State Academy for Oil and Gas, Moscow, Russian Federation

vgkuz@yandex.ru / Phone: 74951351104

The fact of changing of mineral composition of carbonate sediments in the Earth's history was established long ago. It is not possible to work out in detail of this evolution now and to connect it with evolution of biota.

Archean rocks are intensively metamorphosed, but the main part of marbles and calciphyres have calcite composition. Proterozoic, especially Middle and Upper Proterozoic carbonate rocks are predominately dolomites. It is principally important that in this period there are giant deposits of magnesite connected with dolomites. These are the cases of specific magnesite-calcite mineral association. Both dolomites and limestones developed in the Paleozoic. The limestones prevail from the Middle Mesozoic.

Those changes are correlated with the development of the autotrophic organisms and firstly with Cyanobacteria.

A number of important levels can be distinguished in the bios evolution and dolomite formation.

The first is the Early-Middle Proterozoic boundary – beginning and flourishing of stromatolites and beginning of the mass dolomite sedimentation.

The second is the reduction and destruction of stromatolite-forming communities in Vendian. It initiated a first decrease of accumulation intensity of dolomite at the Riphean-Vendian, and than Vendian-Cambrian boundary.

The third is the land vegetation appeared at the Early-Late Paleozoic boundary. This

new ecosystem found out to be more successful in terms of assimilating of carbon dioxide and producing oxygen, and forced out stromatolite-forming communities. In the shallow-water sea environment geochemical functions of the latter partially went to calcareous Cyanophytes (Calcibionts), which favored much to the dolomite formation in those paleogeographical conditions.

The fourth boundary is found in the Middle Mesozoic. *Since the Jurassic and especially the Cretaceous carbonate precipitation shifted to the pelagic zone and become planctonogenic.* Among other marine autotrophic organisms phytoplankton acquired a crucial importance. The region of the development of Cyanobacteria and benthic algae, which created geochemical conditions favorable for the formation of dolomites, turned out to be restricted by rather small areas and specific conditions of littoral and half isolated basins where the main process of dolomite formation shifted.

The same changing are established in individual carbonate records of the various age. Limestones with stenohaline marine fauna were replaced by dolomites with microbial communities.

The close synchronism between the temporal distribution of Cianobacteria and the development of dolomites suggests an important role of Cyanophytes in dolomite formation. Cyanophytes actively assimilated carbon dioxide dissolved in water, thus assisting in increasing the pH value and therefore domains of these communities were characterized by geochemical conditions favorable for the deposition of magnesian compounds.

The detail mechanism of this process was investigated by S. Burns et al., 2000; Cr. Vasconcelos et al., 1995.

It seems on the whole, that quantitative side of dolomite formation evolution, i.e. decreasing dolomite part in the Earth's history is stipulated by evolution of the biota and particularly Cyanobacteria, while change of facial position was determined with the change of the paleogeographic areas of carbonate accumulation [Kuznetsov, 2001; 2005].

References

Burns S.J., Baker P.A., Vasconcelos Cr. Dolomite formation and biochemical cycles in the Phanerozoic // Sedimentology, 2000. V. 47. Supplement 1. P. 49 – 61.

Kuznetsov V.G. 2001. The Possible Influence of Bios Evolution on Dolomite formation in the Earth/s History // Doclady Earth Sciences, Vol. 378, N 4, pp. 402-405

Kuznetsov V.G. 2005. Evolution of dolomite formation and its possible causes // Bull. Moscow Society of Naturalists. Section of Geology. V. 80, N 4, pp. 49-66 (in Russian)

Vasconcelos Cr., McKenzie Ju., Bernasconi St., Grujic D., Tien A.1995 Microbial mediation as a possible mechanism for dolomite formation at low temperatures // Nature. V. 377. P. 220 – 222.