

Isotopic Bioinorganic Chemistry of Chemoautotrophs as a Predictor-Regulator for Formation of Metal Deposits and Factor of Weathering



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Editorial

The role of chemoautotrophs / lithotrophs in the formation of deposits and weathering is almost universally known, however, the results of this biogeochemical activity and mass transfer mediated by chemoautotrophs are radically different depending on the ionic composition of the medium, the salt conductivity effects and the Purbe diagram of the corresponding conditions of this activity, as well as a number of other physico-chemical Characteristics often not considered as impact factors (for simplifying models). Biogeochemical representations of the early period on which models and kinetic approaches to the analysis of similar processes were based are, by most criteria, phenomenological and "empirical", but do not reveal the essence of the processes occurring on the border of the medium processed by microorganisms and the surface of chemoautotrophs as active agents, that process this medium. Meanwhile, from the point of view of biochemical physics (and, in particular, biological kinetics), the mechanisms realized at the interface or in its diffusion neighborhood are decisive in such cases, since the entry of matter into "microreactor" compartments of biological origin and aggregation with biomineralization, as a rule, occur mediated by the surface of the biomembrane.

From the specificity of chemoautotrophs to chemically different media, it can be correlatively concluded that the properties of the membrane are also different and, at a minimum, do not contradict the conditions of their presence in the natural mineral environment. Obviously, this is directly related to mechanisms of action of the membrane in this medium. Any mechanisms that determine membrane activity in an inorganic medium, by definition, must be the mechanisms of interaction of this medium with the membrane, hence - the mechanisms of interaction of structural units that provide the traffic of inorganic ions through the membrane (transmembrane transport). Such structural units are the ion channels of the cell, or rather their aggregate - the so-called. Channel [1], which provides

a balance of transport and specificity in the kinetics of membrane processes. Populations of ion channels are very sensitive not only to the environment, but also to the set of membrane parameters associated with the electrophysiological function [2]; the change in the complex parametrix of the canal of chemoautotrophs leads, on the other hand, to a change in the efficiency of processes near their surface and, as a consequence, to a change in the efficiency of biogeochemical processing of the medium. Separate conditions can not only desensitize the channels [3], but also lead to inhibition or death of cell populations of chemotrophs, which naturally leads to zeroing of the efficiency of biogeochemical processing of the medium due to the zero efficiency of ion channels. Those Ionic channels are known which interact with most elements and interact with the membrane of agents in orogenesis, mineralogenesis, metamorphism (and chemical tafonomia, which determines the preservation of indicative samples in stratigraphy / approximate biomorphological-mediated dating). As examples, we can cite channel structures that interact (in different ways and selectively, although not always absolutely) with: Fe [4], Mg [5], Zn [6,7], Gd [8], La [9], Cs [10], hydrogen sulfate [11], not to mention the generally known calcium, potassium, sodium, and chlorine channels and the possibility of their not absolute selective regulation different from the nominal ions corresponding to the series of substituents and the selectivity functions.

Taking into account the evolutionarily early nature and simple physico-chemical realization of ion-selective channels and selectivity functions, it is possible to assume that canals of autotrophs, including those that did not survive "shadow life", could be considered at rather early stages (for example, corresponding to the genesis and conditions of origin of the jespellites) [12,13]. Taking into account the possibility of isotope fractionation - both carbon [14] and inorganic elements, metals (subjects of competence of metallomics or elementomics [15], respectively), during the

biogeochemical activity of the “planetary microbiota”, it is possible to guarantee the participation of the canaloma and lithotroph membranes in the biological fractionation of isotopes during the formation of deposits and weathering the subject of membrane [16] for These cases should be a set of membranes of a population interacting through ion channels and realizing with their help a filtering, sorption and biocatalytic function, and a communication / coordinating mass transfer in a homogeneous medium or a medium that is homogeneous in a certain parameter. The use of the techniques of the MC-patch-clamp [17] and isotopic methods of local fixation of the potential is proposed for the purpose of synchronous measurement of the activity of the prokaryotic canal and the results of their biogeochemical and isotope-fractionating activity [18].

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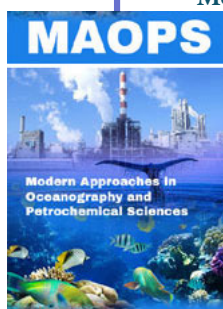
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