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Biomineral indicators of hydrological, geological and climatic processes in the Arctic

Liudmila Reykhard[1], Nataly Shulga[1], Yekaterina Novichkova[1], Nina Kozina[1], Olga Dara[1], Philipp Sapozhnikov[1], Vyacheslav Gordeev[1], Nikolay Belyaev[1], Andrey Boev [1]

1. Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, Russia

email: mollusc@mail.ru

Research of the biominerals formed by the living organisms under extreme conditions of the Arctic are very important for understanding biostructure formation processes. During the period from 2004 to 2018 numerous samples in water column, ice and bottom sediments were studied in the Arctic region (White, Barents, Kara, Laptev seas) including the polar area (Fig.1a). It was found that a variety of the biominerals was formed by processes of biologically controlled (sea ice, water column and bottom sediments) and induced (bottom sediments) biomineralization.

We determined that in the ice cover of the central Arctic in April 2015 (coordinates: 89°35.27'N 20°24.13'E) opal frustules and skeletons of plankton and sea ice microalgae dominated among biomineral structures (Fig.1b). Their vertical distribution is associated with structural and textural characteristics and mineral-geochemical features of the ice cover. Upper layer of the water column of the central Arctic contained carbonate biogenic components such as coccoliths of *Emiliania huxleyi* (in April 2008; depth: 70 m; coordinates: 88°35.20'N 15°59.92'E) (Fig.1c) and foraminifera shells along with the opal biostructures of diatoms and radiolarians.

Bottom sediments of the Arctic seas contained bioinduced minerals. They formed aggregates such as ferromanganese micro- and macroconcretions with goethite, buserite, birnessite, siderite; pyrite framboids [1] (Fig.1d); nest-shape clusters of vivianite crystals (Fig.1e); carbonate concretions with cement from different types of crystals of magnesian calcite and aragonite [2] (Fig.1f). It was discovered that formation of bioinduced biominerals in local zones of the bottom sediments required not only the increased concentrations of the elements like Fe, Mn, P, S etc., but also a high content of the organic matter. The results of isotope studies (δC13) showed participation of methane-oxidizing bacteria in the formation of carbonate concretions in bottom sediments of the Laptev Sea. Authigenic carbonate formation in the Arctic shelf seas can act as a biogeochemical filter mechanism limiting methane emissions from bottom sediments to the water column and atmosphere [2].

The diversity of the founded biominerals in various natural environments reflects the influence of hydrological, sedimentation and diagenetic processes and can be used as indicators for paleoreconstructions of the Holocene history of the Arctic [3].

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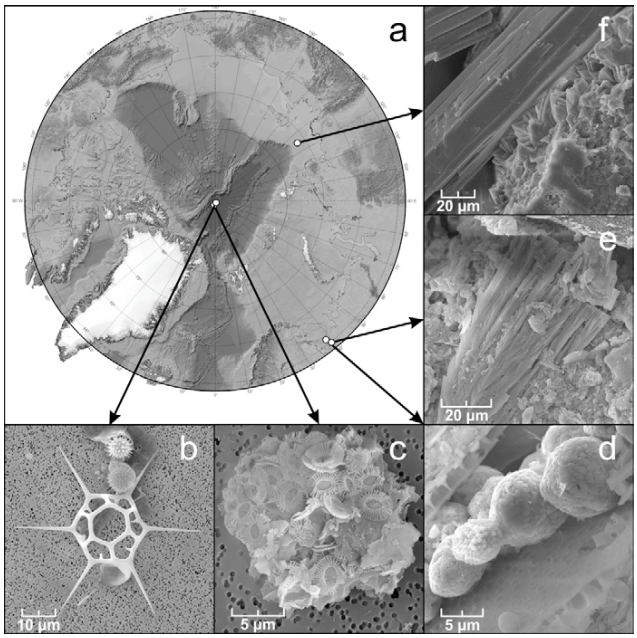

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