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Life development on the boundary lava-water (on the example of Palaeoproterozoic Ongeluk lavas of South Africa)

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It is shown on the example of Early Proterozoic pillow-lavas of South-Africa that the boundary lava – water is very interesting from the point of view of bacterial paleontology. In the rocks, corresponding to this boundary, such forms as bacteria, including cyanobacteria, developed, cyanobacterial or bacterial mats formed and probably even such highly organized forms as eucaryots existed.
Present-day microbial life is known both in surface rocks and deep underground. The main part of terrestrial microorganism biomass is underground. Microorganisms inhabit wet fissures in volcanogenic rocks and leave evidence of their existence as imprints in the rock or as the chemical remains of their vital functions. Under subsurface conditions, manifestations of recent microbial life are often in closely connected with the boundary between volcanogenic rock and water.
The most ancient microfossils connected with this boundary, were described from Mezo-Archaean pillow-lavas from the Barberton Greenstone belt of South Africa. It is supposed that microbial life inhabited these underwater volcanogenic rocks just after their extrusion about 3.5 GA ago (Furnes et al., 2004). J. Schopf (1993) was the first to discover fossil filament microbes, resembling cyanobacteria, in the Early Archaean (3.465 Ga) of Western Australia. Another microbial discovery in volcanogenic rocks was in Archaean (3.235 Ga) volcanogenic massive sulphide deposits in the Pilbara Craton of Australia. In this case bacterial life was confined to a system of underwater thermal springs (Rasmussen, 2000).
In this work samples were studied from pillow selvages of the Palaeoproterozoic Ongeluk lavas on the western margin of the Kaapvaal Craton of South Africa . A refinement of earlier dates for the Ongeluk-Hekpoort extrusion is a Pb-Pb isochron age of 2222±13 Ma.
A rather diverse set of pseudomorphs of biogenic objects were found in these Early Proterozoic pillow-lavas. Among these forms are filaments, cocci and others. The elemental chemical composition of pseudomorphs and the host rocks is identical. As a rule silicon and iron (in variable ratios) predominate, there are also aluminium, calcium and magnesium.
Solidifying Palaeoproterozoic Ongeluk lavas during underwater eruptions create rather favourable conditions for life development. On the boundary lava – water bacteria, including cyanobacteria, developed, cyanobacterial or bacterial mats formed and probably even such highly organized forms as eucaryots existed. Forms were also found which are not connected (from our point of view) with cyanobacterial mats.

Thus solidifying basalt lava, being in contact with water could create rather favourable conditions for the development of multilayered cyanobacterial mats. The waters should contain sufficient amount of sulfates for bacterial sulfate reduction (sulfide framboid finds are the evidence).

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