Bioalteration of Fe(III), Fe(II) and no Fe-bearing basaltic glasses in the presence of heterotrophic bacteria *Pseudomonas aeruginosa*: Impact of siderophores

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Microorganisms play a role in the alteration processes of basaltic glasses, but the significance of the bacterial-mediated mechanisms involved, especially the siderophore-promoted dissolution, still needs to be evaluated. In this study, 3 synthetic glasses - containing reduced (MORB2) or oxidized Fe (MORB3) or no Fe (HAPLO) - were prepared according to a simplified basalt composition. The samples, contained or not in dialysis bags, were submitted to short-term and pH buffered (pH 6.5) alteration experiments in a sterile or *Pseudomonas aeruginosa*-inoculated Fe-depleted medium. Element release from the glass was measured by ICP-OES. Initial dissolution rates were evaluated for each element in each experimental condition. Bacterial growth and siderophore production were also monitored. The results showed that bacteria had an impact on the dissolution kinetics of all glasses as most of the calculated rates were increased. Reciprocally, the composition of the glass had an impact on the bacterial growth and behaviour in solution. The presence of Fe in the MORB glasses was a determinant growth factor and minimized siderophore production. Meanwhile, the HAPLO dissolution was driven by a siderophore-promoted process. Finally, the use of dialysis bags revealed the existence of a direct interaction between bacteria and glass surfaces, as siderophores were massively produced when the samples were isolated from the cells. The complexity of the bacterial-mediated mechanisms contrasted with abiotic results, all similar whatever the glass composition considered. This work highlighted the key-role of Fe (a key microbial nutrient) in the bioalteration processes of basaltic glass. It also provided experimental evidences regarding the understanding of biological contribution to this fundamental geochemical process.