

BIOMARKERS AND LIFE DETECTION STRATEGIES IN THE FIRST STEPS FROM MASE PROJECT

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Mars Analogues for Space Exploration (MASE) is a four year collaborative project of work supported by the European Commission Seventh Framework Contract to isolate and study anaerobic microorganisms from extreme Mars-like environments. The main objective is to gain knowledge about the habitability of Mars by the study of adaptation of anaerobic life forms, its relationship with the environmental context and methods to detect their biosignatures.

Biomarkers (as a sign of life) are indicators of life or of the physico-chemical process of life (tell-tale signals). The amount in which they present is a critical issue that requires to develop powerful methods and specialized techniques to detect them.

In MASE project we expect to apply and adapt some known techniques to detect biomarkers (as well as complementary lab techs to confirm data). We have started to use the new LDChip450 (Life Detector Chip with 450 Antibodies) with samples from the three MASE campaigns.

Thanks to the help and the expert advice of Molecular Ecology Laboratory in CAB (Center for Astrobiology) and from their previous experience with smaller versions (LDChip200 and LDChip300) [3], [4] used in others analogous like Atacama Desert, Antarctica or a South African mine, we started to use LDChip450 as an ambitious approach to characterize the biotic component in the selected MASE analogues. It consists in a shotgun strategy to detect a huge set of different epitopes by a sandwich multiarray immunoassay [1], [2].

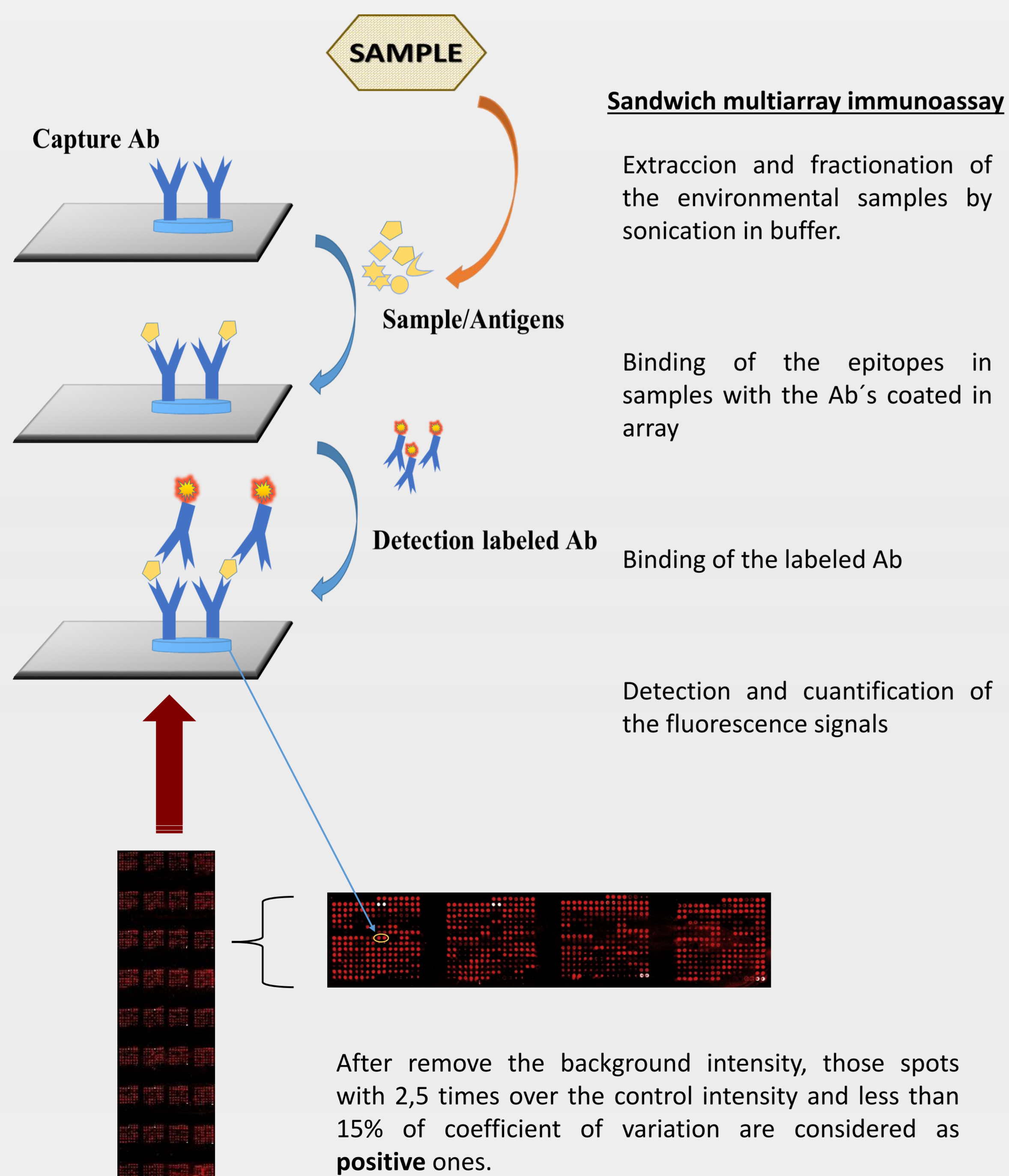
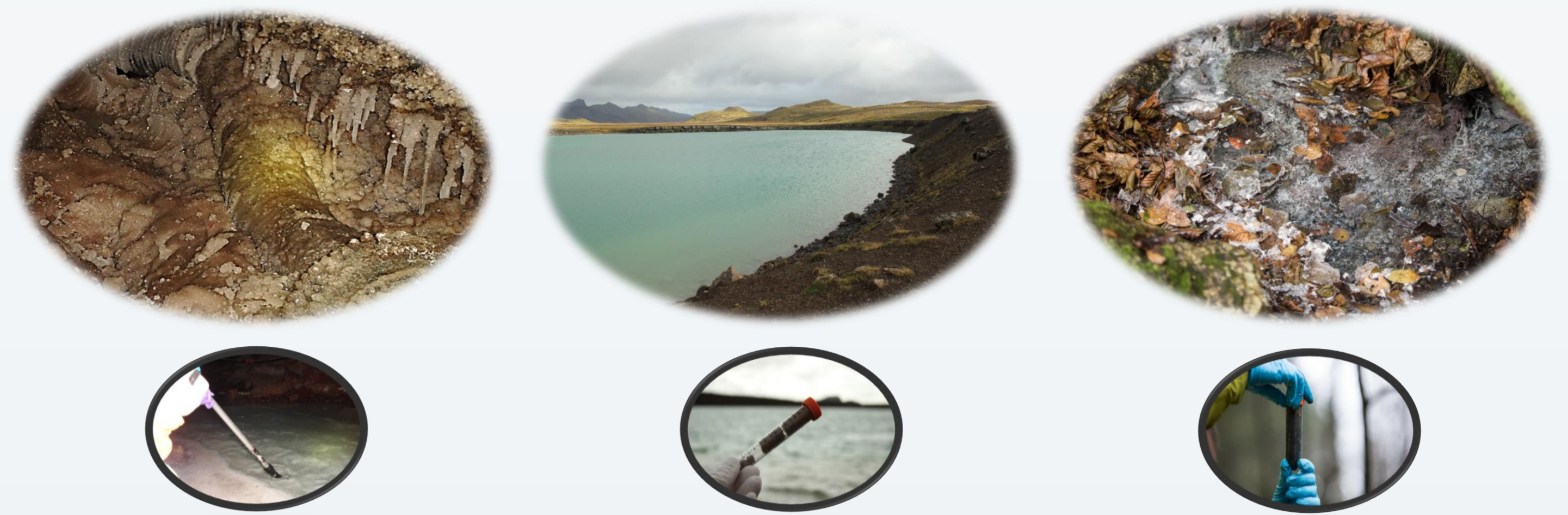


Fig. 4. Workflow of a sandwich immunoassay and a real image of an hybridized LDChip 450

References:

- [1] Fernández-Calvo et al.. (2006). *Planetary and Space Science*, 54, 1612-1621.
- [2] Parro V. et al. (2008). *Astrobiology*. 8 (5):987-99.
- [3] Parro V. et al. (2011). *Astrobiology*. 11 (10): 969-96.
- [4] Yolanda Blanco et al. (2012). *Environmental Microbiology*. 14 (9): 2495-2510.



1. Fig.1. Overview and sampling in Boulby mine. [CPL/Boulby mine]

2. Fig. 2. Overview and sampling in Grænavatn Lake. [Euan Monaghan/MASE]

3. Fig. 3. Overview and sampling in Regensburg. [Anna Auerbach/MASE]

Sample sites main features

1. Boulby mine (England). Boulby is a 1.1-km deep working potash mine in the north-east of the UK which contains sequences of halite and sulfate deposits, the interior of which are subjected to anaerobic conditions. Low water activity caused by the high salt concentrations.

2. Grænavatn Lake (Iceland). It is situated near a group of maar type explosion craters. Grænavatn Lake is about 45 m deep and few hundred meters in diameter with sulphur compounds. It is in average 4°C with pH around 2 and there is a hydrothermal activity on the bottom of the lake.

3. Sulphidic springs (Germany) Two cold sulfidic springs near Regensburg (Sippenauer Moor and Mühlbach Schwefelquelle). Constant temperature of 10°C, pH neutral, very low organics compounds but a high amount of sulfate and ammonia.

Results

The plots show the relative fluorescence intensity of those positive spots. Numbers correspond to groups and environments from which antibodies were produced and coated in the LDChip.

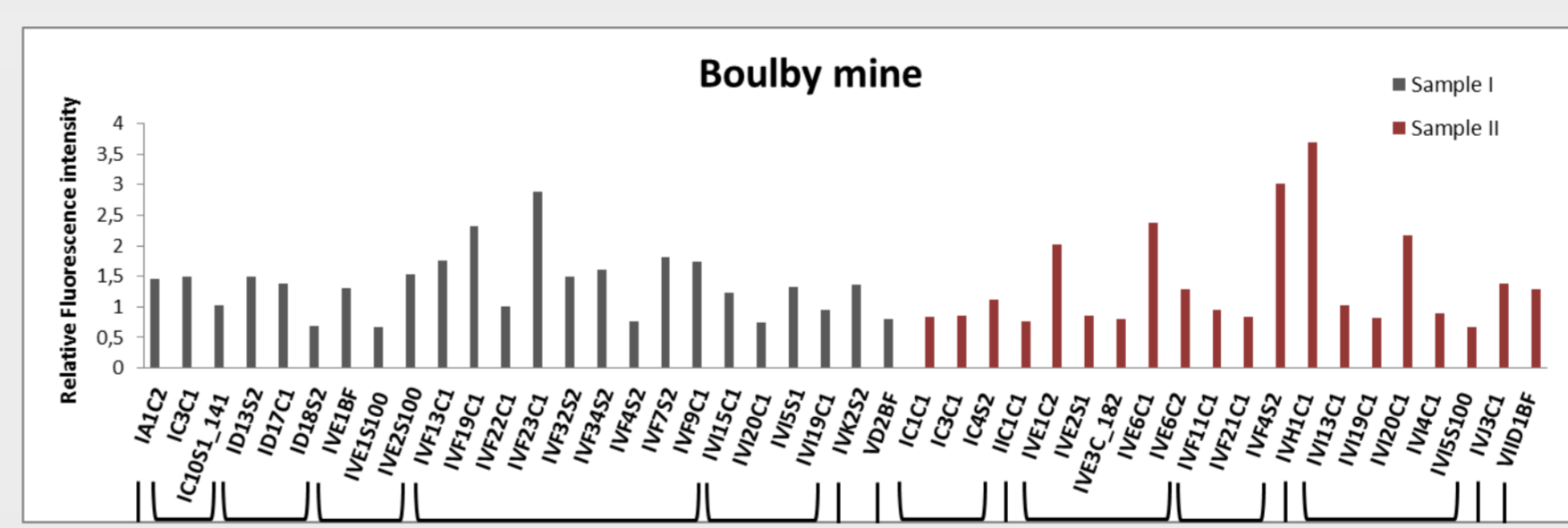


Fig. 5. Relative fluorescence intensity of positive spots and clasification in Boulby samples.

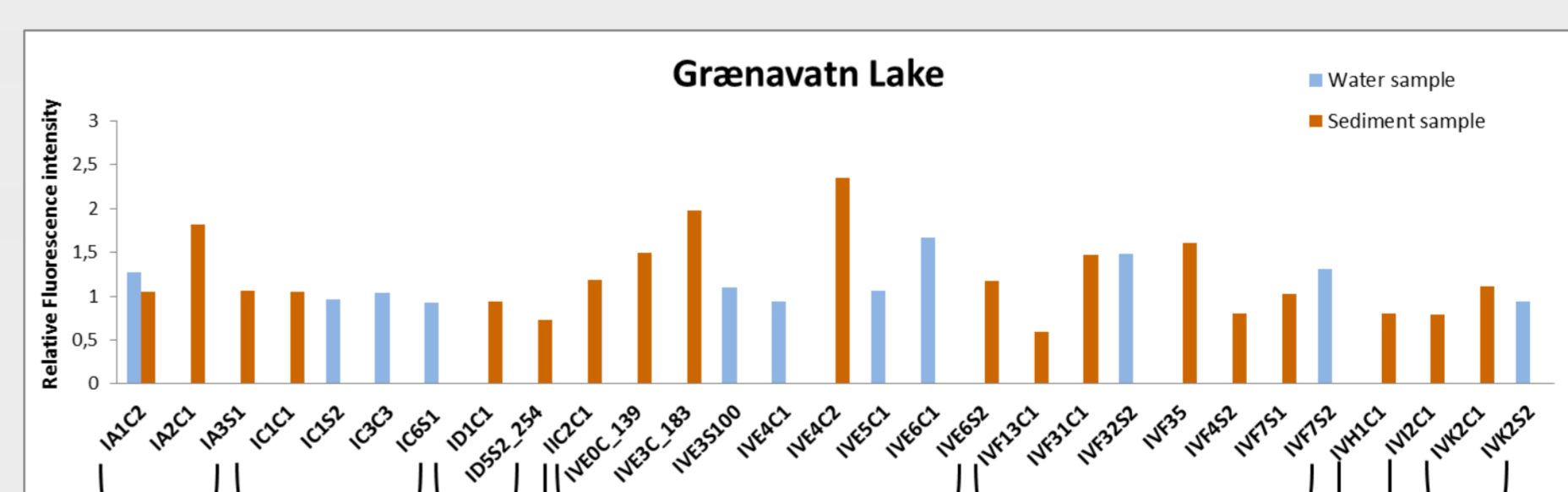


Fig. 6. Relative fluorescence intensity of positive spots and clasification in Iceland samples.

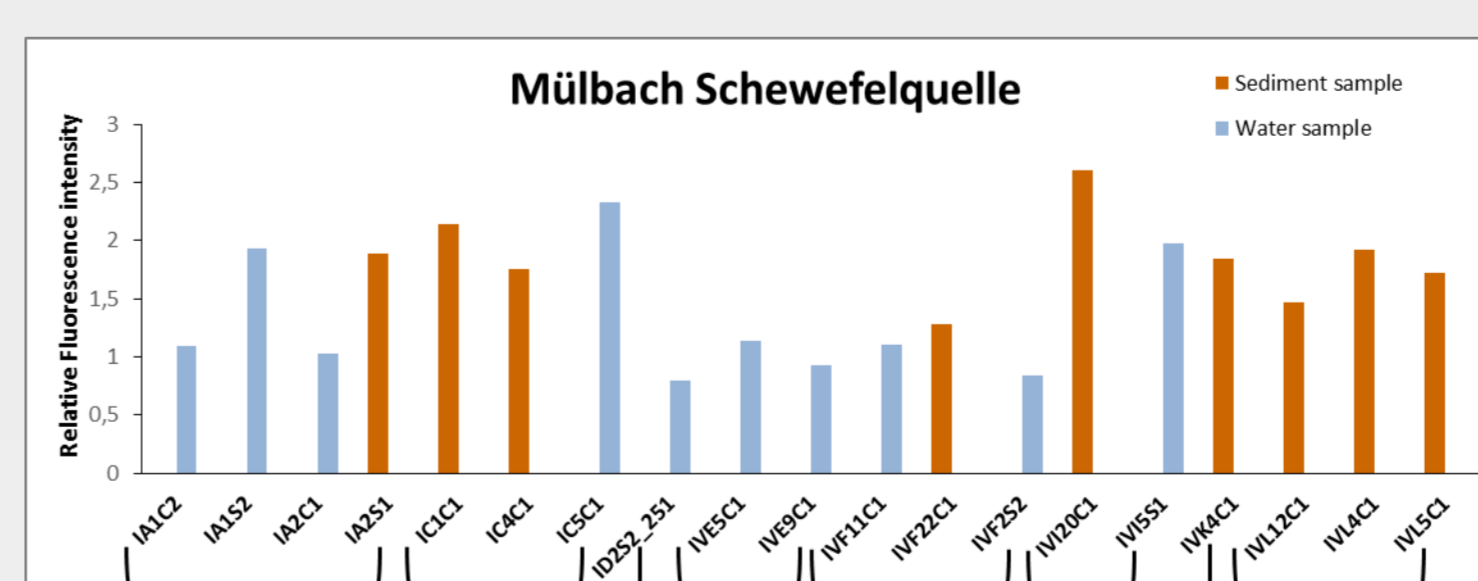


Fig. 7. Relative fluorescence intensity of positive spots and clasification in Mülbach Schwefelquelle samples.

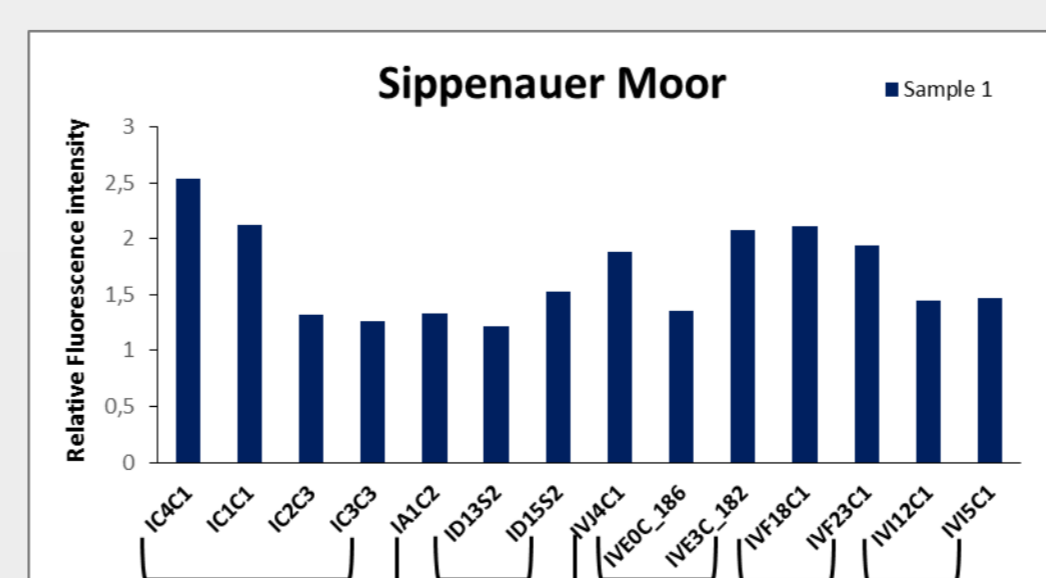
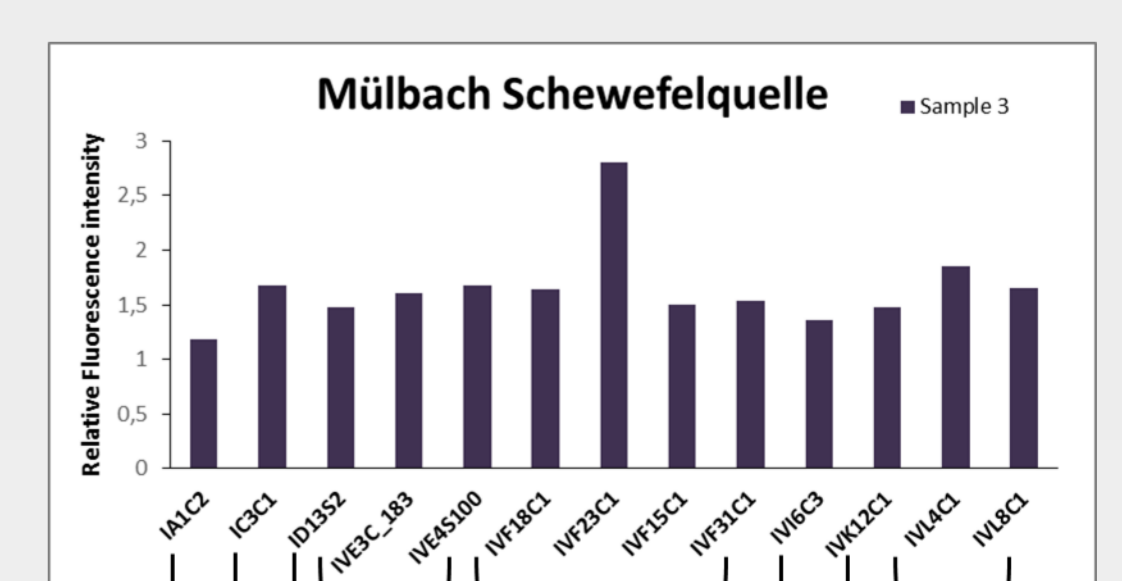


Fig. 8. Relative fluorescence intensity of positive spots and clasification in Sippenauer Moor sample.

Groups from which Abs have been produced:

- I: Water (Rio Tinto)
- II: Sediments (Rio Tinto)
- III: Rocks (Rio Tinto)
- IV: Fe-S oxidizers cultures
- V: Psychrophiles cultures
- VI: Mesophile bacteria
- VII: Cyanobacter group
- VIII: South African mines
- IX: Spores
- X: Archaeas
- XI: Perchlorate reducers
- XII: Rocks (Mesophile environment)

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