CYCLE DE CONFÉRENCES DE CHIMIE

Avec le concours de : ***Manufacture Française des Pneumatiques MICHELIN***
Ecole Nationale Supérieure de Chimie de Clermont-Ferrand
Institut de Chimie de Clermont-Ferrand (ICCF UMR 6296)
U.F.R.S.T. / Master de Chimie / Département de Chimie

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Amphi de Chimie Paul REMI - (Site des Cézeaux)

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ICE & LIFE - Living Cryosphere

The cryosphere is – by definition – the portion of the Earth where water exists in the solid phase as snow or ice. It collectively includes vast areas of sea ice, lake and river ice, glaciers, ice sheets and caps as well as the snow cover and frozen ground including permafrost. A novel aspect of this work is the inclusion of the atmosphere as a living space for microbial communities. Once thought to be barren of life, these icy environments are home to rich microbial communities which are capable of significantly altering the Earth's carbon budget by contributing significantly to the annual availability of new organic carbon, which in turn supports higher forms of life. These ecosystems are highly sensitive to temperate rise due to resulting enhanced availability of liquid water which is the prerequisite for life. Melting of the ice surface promotes increased levels of microbial activity via the creation of unique and ideal life-habitats (e.g. cryoconite holes which are considered "hot spots" for primary productivity and biogeochemical cycling upon the surface of glaciers throughout the Earth´s cryosphere). Colonization of these niches subsequently leads to further darkening of the ice surface. The result is enhanced absorption of solar radiation, promoting further melt and providing yet more water for microorganisms, which are then dispersed to other parts of the ice surface and the glacier forefield. We hypothesize that glaciers become increasingly biological and "greener" as they decay, and that glacier wastage is, in part, a biologically-mediated process that initiates ecological succession long before the ice has disappeared. Microbial activity and depositions influence the albedo of the ice surface and thus contribute to the negative mass balance of retreating valley glaciers also due to climate change. Glacial surfaces are also subject to atmospheric depositions such as manmade radionuclides

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deriving from Chernobyl and atomic bomb test. Here sources and accumulations rates are discussed in connection with applying microbial communities as biodosimeters. Sampling and measurements in the ice matrix implies sources of contamination coupled with low resolution due to poor logistics in extreme environments. This work also presents the development of a novel technique to assess the amount of photosynthetic active pigments in ice. Laser-induced fluorescence emission (LIFE) results in fluorescence response originating from photo-pigments in cyanobacteriadominated cryoconites assemblages with phycoerythrin (PE) exhibiting the optimal target cross section. This inexpensive, low-mass, low-energy method avoids manipulation of the in situ habitat and individual target organisms and does not disturb the microbial community or the surrounding ice matrix which is of immense importance when discussing the ecological relevance of the cryosphere.

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