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)

Pr. Bruce Moffett

JCM Lab Sheffield (UK)

Non-Bacterial Biological Ice Nuclei and their Potential Role in Weather

When biological ice nuclei were first discovered they were described as leaf derived nuclei. Subsequently they were demonstrated to be bacterial in origin. Once this had been established there was a great deal of research on bacterial ice nuclei whereas most other potential biological sources were virtually ignored. The reason for this focus is because bacterial ice nuclei are the most efficient known, initiating ice at temperatures as high as -1.5ºC, and often being associated with plant pathogens. However in temperate climates temperatures lower than this are necessary for precipitation. For the Bergeron-Findeisen process temperatures around -10ºC are much more relevant. Here we present data identifying and partially characterising novel biological ice nuclei which, because of the temperatures at which they are active, have the potential to play a significant role in cloud processes. We have screened simple eukaryotes for ice nuclei and greatly extended earlier work to show that ice nucleation is very common in Lichens collected from Europe, Africa, Australia and Antarctica. We choose lichens because of the earlier reports of ice nucleation and our realisation of their massive biomass (10^{14} tonnes worldwide). We have also shown there are of the order of 10^5 nuclei per gram of tissue. More recently we have begun to include moss and liverworts in our analyses as these also have considerable biomass and occur worldwide. Ice nucleation has been shown to be a feature of all samples tested (25 species to date) with freezing temperatures up to -4.3ºC. The presence of lichen in the atmosphere has already been established. We have demonstrated moss and ice nucleating fungi occur in rain water. We suggest that the ability to form ice at elevated temperatures is a long standing genetic ability and evolved primarily as a means to acquire water. As a secondary effect eukaryotic ice nuclei may play at least as great a role in the initiation of precipitation as bacteria.

Coordinatrice : Christine MOUSTY, Institut de Chimie de Clermont-Ferrand (ICCF-UMR 6296)
Université Blaise Pascal, 24, avenue des Landais, BP 80026 63171 Aubière cedex-France
☎ 33 473 407 598– fax : 33 473 407 108 courriel : Christine.Mousty@univ-bpclermont.fr