Hygroscopic aerosols on plant surfaces: Nutrients or desiccants?

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Vegetation is a major sink for atmospheric aerosols. The deposition of sub-µm particles to leaves and particle interaction with leaf functionalities are reviewed [1].

Aerosol flux measurements have now become accurate enough to locate the reasons for the large differences between measurements and predictions in the inadequacy of models. The differences might be caused by turbophoresis, a process able to describe efficient aerosol transport within the viscous sublayer [2], and to possibly explain the observed high efficiency of leaf epicuticular waxes in collecting aerosols [3]. On transpiring leaves, hygroscopic particles stay or be-come deliquescent after deposition, due to the high humidity conditions within the sublayer [4-6]. This enables liquid transport on and into the leaf.

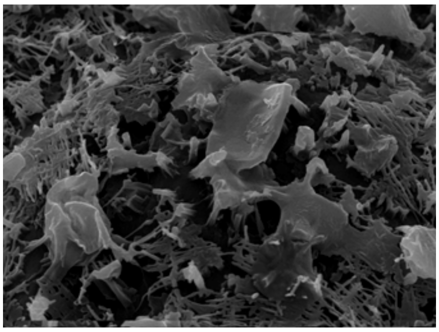

Figure 1: Deliquescent NH_4HSO_4 particles on a cabbage leaf.

Plant surfaces might have adapted to increase aerosol capture and subsequent foliar uptake of ions, especially in ecosystems depending on atmospheric nutrient input. However, the interaction of hygroscopic salts on leaves with plant water relations may become deleterious under drought. It is discussed whether the sharp anthropogenic increase of hygroscopic aerosols during the last century might affect a long-term established balance between plants and aerosols.

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Distinguishing nucleogenic from mantle derived ^{3}He in a 120 Ma uranium deposit

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The discovery that pyrite within the Cretaceous Xiangshan U deposit traps He with $^3He/^4He$ up to 2 Ra (where Ra is the atmospheric $^3He/^4He$) would normally be taken as proof that - at least part of - the fluids involved in ore genesis were mantle derived. However, within the high neutron flux environment associated with U mineralisation, care needs to be taken that production via $^6Li(n,\alpha)^3H(\beta)^3He$ over 120 Ma does not dominate the ^{3}He budget.

The $^3He/^4He$ production ratio *within a fluid inclusion* depends on a) the neutron flux through the inclusion and b) the Li/U ratio within the inclusion (Th is highly insoluble in aqueous fluids, and α implantation into the fluid inclusion from the host pyrite will be insignificant). The mean path length of a thermal neutron in a silicate rock is of the order 0.5 - 1 m[1]. Thus, it is possible to have a situation where there is a high neutron flux (a U deposit, for example) but low U concentrations within the inclusion itself. This combination could potentially produce He with high $^3He/^4He$ ratios.

We modelled the $^3He/^4He$ production ratio within the fluid inclusions as a function of the fluid Li/U ratio (which is not *a priori* known), calculating the neutron flux according to [2]. The models show that fluid Li/U ratios between 0.2 and 2 could account for the range in $^3He/^4He$ measured in these samples. However, given the high ^{3}He concentrations in these fluids ($\sim 1 \times 10^{-8}$ cm^3 STP g$^{-1}H_2O$, calculated assuming all ^{36}Ar present in the fluid comes from air saturated water and using the measured $^3He/^{36}Ar$ ratio of 0.01) the rate of production of ^{3}He via $^6Li(n,\alpha)$ reactions is several orders of magnitude too low. Therefore, we conclude that infact the ^{3}He in these fluids originated from the mantle, with consequences for the genesis of the deposit.

The mineralisation is significantly younger than the late Jurassic acid volcanic host rocks. This study demonstrates that this mineralising event was triggered by an input of mantle derived fluids to the local crust.

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