Study of pollens recently caught in the antartic snow

Can palynology be used to study the variations of the polar vortex ?

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1 Idea

Study of pollens hidden deep in Antarctica's Ice has already been used as a powerful tool to look back in the history of plants, where other traces like fossils are not sufficient.

But, what if they could be used for the study of our world, now ? Pollens are tiny particles representative of a genus or even a species, easily carried by the wind over long distances (up to thousands of kilometers)[Rob11]. Since there hasn't been a single endogenous pollen producer in Antarctica for millions of years, all the pollens in its atmosphere are exogenous.

These particles get eventually caught in the ice, where we can find them. This process is driven by the polar Vortex, a giant cyclone that forces the surrounding air to flow on top op the surface. If we can compare the amount of pollens deposited on one year, and the one deposited on another, we could possibly estimate the variation in strength of the polar vortex between these years, if we assume that the concentration of pollens in the air is constant from one year to another.

2 Objectives and experiments

2.1 Setup validation

We must prove that we are able to extract pollens from the ice and that we can observe a change in concentration between different samples. For this, we can send the rover to different locations with different wind/sun exposures and retrieve a piece of ice. Using a microscope, the pollens can be observed and counted (which can also be done by measuring UV absorbance spectra). The DNA sequencing, combined with the study of their morphology will allow us to get insights on the origin of these cells. If the concentration is too low, we will have to concentrate the samples on a membrane prior to observation. The whole identification process may be tested before leaving to Antarctica to ensure a reliable operation.

2.2 Data collecting

If this first part is successful, we can then harvest several samples from various regions around the base. The parameters of interest will be the exposure to wind and sun and the depth at which the sample is collected. The distance from the research base can be an indicator of potential contamination. The samples are then concentrated and splitted into two tubes. One of them is used on site for primary data analysis, in order see if some trends can be observed and if they fit our hypothesis. The rest can be studied after returning home in order to confirm the results with more precise techniques, (and to study other forms of life potentially collected).

2.3 Data analysis

Based on the environmental data collected with each sample, and the depth at which they are harvested, we can try to din a model which will fit with these data and finally compare it with the evolution of the winds over time, recorded by satellites.

3 Needs

In order to conduct these experiments, I would need : :

- A microscope
- A UV source, like a deuterium lamp for the spectrophotometer (Or try to use the hole in the ozone layer ? :)
- The chemicals needed to dissolve the exospore and extract the DNA
- Filters needed to concentrate the samples
- A handbook of palynology, to recognize the patterns in the microscope
- Some internet time, to compare the sequences obtained with databases.

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References

[Rob11] Juan Jos Robledo-Arnuncio. "Wind pollination over mesoscale distances: an investigation with Scots pine". In: *New Phytologist* 190.1 (2011), pp. 222–233.