

Interactive comment on “High-resolution ice nucleation spectra of sea-ice bacteria: implications for cloud formation and life in frozen environments” by K. Junge and B. D. Swanson

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In discussing the potential impact of ice-nucleation activity (INA) on bacteria present within sea-ice brine inclusions, it needs to be kept in mind that for typical inclusion sizes any organism would likely be found within a few tens of micrometers from the nearest ice surface. Hence, rapid equilibration of brine with respect to such ice surfaces would make it difficult to achieve supercoolings sufficient for even strong INA to have any effect, such as potentially leading to nucleation of new crystals (as is implied in the paper).

While this is likely a minor point in the bigger picture, it does raise the question as to

whether nucleation of salt precipitates (with evidence for significant supersaturation relative to the precipitation points of several salts present in sea ice, see, e.g., discussion by Marion et al., 1999) may be of importance for bacteria encased in brine inclusions. For example, bacterially mediated precipitation of mirabilite, a common salt in sea ice, has been shown to be of importance in cold, saline lakes (Dongyang et al., 1998).

Another minor question to raise is whether there are any organisms or viruses for which INA has been reported at small supercoolings of less than 1 K. Figure 3 indicates that this is certainly not the case for the organisms examined here. This has potentially important implications insofar as I am not aware of any temperature-salinity data in the global oceans showing a supercooling that is larger than a few tenths of a Kelvin. This is true even for very clear waters such as those emerging from underneath the Antarctic ice shelves exhibiting very low particulate concentrations but showing ice nucleation at low supercoolings nevertheless (e.g., Bombosch, 1998). This would underscore the point raised in the paper that bacteria (at least those studied here) do not play a role in ice nucleation in the oceans on a geophysically relevant scale.

References:

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