SUBGLACIAL LAKES ON MARS: AN ANTARCTIC ANALOGUE?

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There are many indications of liquid water being present at the surface early in the history of Mars, but at present, the surface pressure at Mars is too low to allow liquid water to be stable. Today, the polar caps constitute the largest known reservoirs of water ice on Mars. Possible reservoirs of liquid water could exist deep beneath this ice surface, where the overlying ice implies a higher pressure and provides sufficient isolation. The permanent polar caps consist of water with some dust (estimate 2%) and possibly layers of carbon dioxide that have been deposited through millions of years. Their volume is comparable to the Greenland ice sheet.

More than 150 subglacial lakes have been discovered underneath the Antarctic ice sheet. The largest one is subglacial Lake Vostok, the size of Corsica and characterized by a mean water depth >700m. Despite low surface temperatures, a thick insulating ice cover of 4000m guarantees a basal temperature at the pressure melting point. Subglacial lakes could as well exist beneath the Mars polar caps today, although environmental constraints are more severe. However, given the uncertainties of the thermal conductivity, local variations of thickness or heat flow could be sufficient for basal melting to occur (Hvidberg, 2005).

Ice sheets interact with subglacial lakes in a complex way, and this interaction can be traced back to the surface as it influences the surface topography as well as the ice flow field (Pattyn et al., 2004). Such interactions may even allow for survival of surficial lakes during the buildup of an ice sheet as climate is getting colder (Pattyn, 2004). Whether such interactions apply on Mars is the subject of current investigations.

References

