



Ice – not just H₂O (Louis Agassiz Medal Lecture)

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Many of the important properties and uses of ice that fascinate cryospheric scientists actually depend on impurities that are present: isotopic variants of water molecules, small amounts of soluble and insoluble material derived from the aerosol and gas phase, and the trace constituents of the air bubbles that make up around 10% of the volume of ice at atmospheric pressure. In this lecture, I will first discuss how these impurities, and their location within the ice structure, affect local properties of the ice such as the electrical conductivity and mechanical strength, which scale up to give ice sheets their geophysical properties. I will then consider how the concentrations of different impurities are used to give unique records of palaeoclimate and palaeoenvironmental properties, extending so far 800,000 years back in time. This will be illustrated particularly with data from the EPICA Dome C ice core. Bringing the presentation full circle (and towards Agassiz!), I will discuss how the data from ice cores and other palaeoclimatic archives are starting to lead us towards understanding of the causes of the most prominent feature of late Quaternary climate: the huge glacial/interglacial swings in temperature, that are accompanied by the waxing and waning, roughly every 100,000 years, of great northern hemisphere ice sheets.