Abstract ID : **243**

36Cl as a dating tool for deep ice

Content

The $^{10}Be/^{36}Cl$ ratio has the potential to be a dating tool for old ice, as it decays with an apparent half-life of 3.84×10^{5} years and is thought to remove similar production and transport effects affecting the individual radionuclide concentrations in ice cores. Chlorine, however, suffers from post-depositional loss at low accumulation sites in Antarctica, which requires a better understanding for accurate dating. As previous research suggests little to no chlorine loss occurs during glacial times, the $^{10}Be/^{36}Cl$ ratio was determined for all glacial periods covered by the ice core from Epica Dome C in Antarctica to test its potential as a dating method. Additionally, samples from Little Dome C, the new Beyond EPICA Oldest Ice Core drilling site, were measured to understand how the radionuclide concentrations were influenced from the end of the last glacial period and into the Holocene. First results indicate a reasonably good fit between the measured and expected $^{10}Be/^{36}Cl$ decay curve during glacial times. At the beginning of the Holocene, the $^{10}Be/^{36}Cl$ ratio surprisingly returns to a low value similar to that of the last glacial maximum and is accompanied by a peak in the chloride concentration, which may therefore serve as a possible predictor for ^{36}Cl loss. Similar patterns are observed in the Cl^{-}/Na^{+} ratio, which indicates chloride loss when it is lower than the marine sea salt value. These results are encouraging us to also pursue measurements of stable chlorine isotopes, which may indicate loss in ice where fractionation can be found and could even serve as a correction factor to reconstruct the original ^{36}Cl record.

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Track Classification: Time scales and methods for ice dating