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Cl-36 exposure dating with a 3-MV tandem

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We have developed a method to detect ^{36}Cl at natural isotopic concentrations with a 3-MV tandem AMS (Accelerator Mass Spectrometry) system. Several techniques were compared: the difference in residual energy of ^{36}Cl and ^{36}S ions after passing through a silicon nitride absorber foil was used to separate the ions in a magnetic deflector. Alternatively, the difference was resolved with a TOF detector. The best results were obtained by separating the ions in an optimized ionization chamber (developed at the ETH/PSI, Zürich, Switzerland) with a split anode providing two ΔE measurements, providing a relative suppression of ^{36}S of 3×10^{-4}. This resulted in a measurement with a sulfur-induced background for ^{36}Cl/Cl of 3×10^{-14}, and $(7\pm7)10^{-15}$ after a S-proportional background subtraction. Further improvements are expected.

First measurements on exposure dating samples were performed for sites in Italy and Iran, already dated by other laboratories, in the 10^5 and 10^6 at ^{36}Cl/g range, respectively. We observe a good general agreement, but a yet unexplained systematic offset of -25% of our results.

These first measurements demonstrate that also 3-MV tandems, constituting the majority of dedicated AMS facilities, are capable of ^{36}Cl exposure dating, which is presently the domain of larger facilities. Besides our first dating results, we discuss the advantages of the different detection methods.