Title: ^{36}Cl in the Stratosphere

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Initial measurements of the cosmogenic radionuclide ^{36}Cl in the lower stratosphere have been made by Accelerator Mass Spectrometry. Samples were obtained using the large volume LASL air sampling pods on a NASA WB-57F aircraft. Untreated (for collection of particulates only) and Tetrabutylammoniumhydroxide treated (for collection of particulates and HCl) IPC-1478 filters have been flown on three flights in the lower stratosphere, following techniques by (1).

Cl and Cl compounds are important trace constituents for stratospheric chemistry, in particular with respect to O_3 destruction. Stratospheric Cl chemistry has recently received increased attention with the observation of strong O_3 depletion in the Antarctic winter vortex and in the weaker and more complex Arctic winter vortices.

Cosmogenic ^{36}Cl is produced by spallation reactions from Ar mainly in the stratosphere, and has had several applications as a geochemical tracer. The large amounts of ^{36}Cl introduced by nuclear weapon testing have been removed from the stratosphere by now, and measurements in the stratosphere to obtain cosmogenic production rates and concentration distributions is now possible.

We are investigating the use of cosmogenic ^{36}Cl as a tracer for stratospheric Cl chemistry and for stratospheric/tropospheric exchange processes. In a first attempt we are trying to determine stratospheric and tropospheric production rates, the partitioning of ^{36}Cl among particulate and gaseous Cl compounds, and the respective inventories and removal rates.

Results from a flight at 13.7 km, 30-33°N, 97-107°W, (1.8-2.4 km above the tropopause) and results from a second flight at 17.7 km, 43-45-36°N, 92-94°W, (7.6 km above the tropopause) for the untreated and treated filters respectively are presented below.

Samples	$^{36}Cl/Cl \times 10^{-15}$	^{36}Cl m^{-3} air STP	HCl (ppbV)
#1 particulate	63±7	1.45±0.16 $\times 10^{3}$	
HCl	655±52	1.99±0.18 $\times 10^{4}$	0.26±0.5
#2 particulate	350±20	3.0±0.2 $\times 10^{4}$	
HCl	3260±130	2.9±0.2 $\times 10^{5}$	2.0±0.2

These results show that about 90% of ^{36}Cl atoms are associated with HCl, the main stratospheric gaseous Cl compound. More data will be available at the time of the conference for comparison to the calculated production rates and to the measured deposition rates (2,3). ^{10}Be (another cosmogenic isotope entirely associated with the particulate phase) has not been measured in these samples yet but $^{10}Be/^{36}Cl$ ratios can be inferred from numerous data in the stratosphere at many latitudes and altitudes (M.Wahlen et al., unpubl. data), and can be compared to $^{10}Be/^{36}Cl$ in polar deposition (3). This comparison suggests that Cl might at times be strongly removed in polar regions.

Ref.: 1: Lazarus et al., JGR (1976) 1067. 2: Elmore et al., Nucl. Instr. and Meth. B29 (1987) 207. 3: N. Conard, MS thesis, University of Rochester, 1986.