Measurement of ^{26}Al in Antarctic Ice ◇

F. Kubo, A. Blinov [a], Th. Huber, V. Lazarev, and E. Nolte
[a] TU St. Petersburg, Russia

1. Production in the atmosphere

^{26}Al is produced in the atmosphere mainly by spallation on argon. To determine the atmospheric production rate the proton induced cross sections for the reaction ^{40}Ar(p,6p9n)^{26}Al were measured [1]. Using a cacade-excitation-model (CEM95) [2] the cross sections for the neutrn induced reaction ^{40}Ar(n,5p10n)^{26}Al were calculated. With the differential flux of protons and neutrons in the atmosphere the total average production rate is calculated to 0.69 atoms m^{-2} sec^{-1}. Due to atmospheric transport and the low precipitation rates the deposition at the poles is much lower [3]. A comparison with ^{10}Be [4] gives a rate of 0.19 atoms m^{-2} sec^{-1}.

2. Production in cosmic dust

Interplanetary cosmic dust has mainly the same composition as C1-chondrites. Using measured cross sections on Mg, Al, Si, Fe and Ca [5] and the flux of the solar cosmic radiation at 1 A.U. a saturation activation of 394 dpm kg^{-1} can be calculated. The main part of the interplanetary dust is produced in the asteroid belt and spirals in towards the sun due to the Poynting-Robertson-effect [6]. Therefore the activtion is calculated to be only two third of the saturation. With an influx of 40 kt a^{-1} of dust [7] this leads to an influx of 0.35 atoms m^{-2} sec^{-1}.

3. Measured samples

To measure the dust influx it is nescessary to reduce the atmospheric component. This can be done by taking samples from regions with very low precipitation rates. This is true for the polar regions of the earth. We measured three samples of Antarctic stations (see table 1).

Station	Latitude	Precipitation [mm a^{-1}]	Mass
Livingston Island	62° 21' S	800	34 kg
Law Dome	66° 24' S	65	31.5 kg
Amundsen-Scott	90° S	20	49.7 kg

Table 1: Origin and amount of measured samples

^{26}Al produced in the atmosphere is bound to aerosols with a typical size of a few μm whereas interplanetary dust particles have a size of several 10 μm. Therefore we used two filters with a pore size of 0.45 and 18 μm, respectivly, to get three fractions (dissolved, atmospheric produced and cosmic dust). The results are given in table 2.

Station	$> 18\mu$m	$> 0.45\mu$m	dissolved
L.I.	0.53 ± 0.38	4.4 ± 2.1	13 ± 3.3
L.D.	2.5±0.6	1.3±0.2	5.8±0.54
A.S.	0.57±0.06	0.28±0.05	1.2±0.14

Table 2: Deposition rates [Atoms m^{-2} sec^{-1}] (blanks not yet measured, values represent upper limits)

4. Conclusion

Asuming that the component in the 18 μm-filter is from interplanetary dust, the measured values of 0.5 atoms m^{-2} sec^{-1} would represent a dust infall of 60 kt a^{-1}. This value has to be considered as an upper limit as the corresponding blanks are not yet meassured and subtracted.

References

[1] F. Kubo *et al.*, Jahresbericht 1997, p. 47
[2] S. Mashnik, Izv.Ak.Nauk Ser.Phys **60** (1996) 73
[3] H. Sachsenhauser, H. Sachsenhauser, diploma thesis, TU München, 1996
[4] G. Raisbeck *et al.*, Nature **326** (1987) 273
[5] T. Schiekel, Ph.D. thesis, Uni Köln, 1995
[6] A. Evans, *The dusty universe.* Wiley, Chichester, 1994
[7] S. Love and D. Brownlee, Science **262** (1993) 550

◇ We wish to thanks D. Balabanski, M. Leuthold, V. Levchenko and Chr. Spiering for supplying us with the ice samples