IRIDIUM CONTENT OF POLAR ICE AND ACCRETION RATE OF COSMIC MATTER.

H. Takahashi,[+] Y. Yokoyama,[+] E.L. Fireman,[x] and C. Lorius[++]. + Centre des Faibles Radioactivités, CNRS-CEA, 91190, Gif-sur-Yvette, France; x Smithsonian Astrophysical Observatory, Cambridge, Mass. 02138; ++ Laboratoire de Glaciologie Alpine, CNRS, Grenoble, France.

We report here the results of Ir determination of Greenland ice (particulates) and of Antarctic ice (whole sample).

Introduction. Iridium is markedly depleted in the earth's crust and hence has been used as a sensitive indicator of cosmic matter. Barker and Anders(1968) have measured Ir and Os contents of deep-sea sediments to estimate the accretion rate of cosmic matter. Ganapathy et al.(1970) measured 16 trace elements including Ir in lunar fines and found 2 % admixture of carbonaceous-chondrite-like material. Polar ice having the lowest deposition rate on the Earth is considered as one of the best candidates for the search of cosmic dust. Vosters et al.(1974) and Bibron et al. (1974) have measured Ni and ^{53}Mn in Antarctic ice. Large collections of particulate and dissolved material from Greenland ice have been made by McCorkell et al.(1967) but their search for cosmic dust has proven nearly fruitless. We have undertaken a measurement of Ir in their collections of particulates. A preliminary result of Ir determination of Antarctic ice is also reported.

Samples. Description about Greenland ice particulates is given in Table 1. Antarctic ice sample was taken at Dome C station situated at a distance from the coast of 1200 km.

Neutron activation analysis of Ir. We have used a procedure reported by Keays et al.(1974). Samples were irradiated in nuclear reactor. Ir was separated, purified and counted with GeLi and NaI(Tl) gamma ray spectrometers for ^{192}Ir activity.

Results and discussion. Results for Greenland ice particulates are summarized in Table 2. Ir content of 0.37-3.4 ppb in the particulates is 2 or 3 orders of magnitude as high as that of typical terrestrial rock, BCR-1 (about 0.002 ppb) and an order of magnitude as high as that of deep-sea sediments (0.06-0.5 ppb). Table 3 summarizes the results of Antarctic ice. A large blanc probably due to HCl used for concentration of ice before the irradiation is subtracted and an Ir content of $(31\pm12)\times10^{-14}$ g/l is obtained: it is an order of magnitude higher than that of Greenland ice. This difference can be ascribed to the different snow accumulation rates in the two stations: 326 and 32[illegible] g/cm^2/yr respectively. An Ir influx of 2×10^{-15} g/cm^2/yr and a cosmic matter accretion rate of about 60 tons/day obtained in this work are in good agreement with the previously reported results by Ir method. Table 4 summarizes the results of chemical and radiochemical methods. Lunar microcraterdata have shown a rate of a few tens of tons/day (Hartung et al.1972; Dohnanyi 1972). Apollo window meteoroid experiment data are consistent with a particle mass spectrum giving a rate of 35 tons/day(Cour-Palais 1973).

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Table 1. Greenland ice particulates investigated.

Water well formed by	H_2O processed (liter)	Collection method	Particle-collection efficiency (%)	Weight of particles collected (g)	Sample irradiated No.
Steam	2.4×10^5	Millipore filters	100	49.61	1A 1B
Heat exchanger	2.4×10^6	Cation resin Mixed resin	} 70	21.96 7.10	2 3
Reference samples					
Allende (No.3529)	C3-chondrite				Ref.A
Ir standard					Std.1

These samples were irradiated together to a neutron flux of 2.8×10^{13} n cm^{-2} s^{-1} for 8 hrs. in the EL-3 reactor at Saclay.

Table 2. Activation analyses of Ir in Greenland ice particulates.

No.	Sample weight (g)	Chemical yield (%)	Count rate (cpm)	Ir content in particles (ppb)	Ir content in ice (10^{-14} g/l)
1A	0.1363	25.6	0.539±0.036	0.32±0.03	} 7.0±0.7
1B	0.2359	28.8	1.203±0.050	0.36±0.03	
2	0.1168	20.6	0.902±0.040	0.77±0.06	} 1.7±0.14
3	0.1538	22.5	5.679±0.068	3.35±0.24	
Reference samples					
Ref.A	0.01562	57.4	368.1±4.8	837±60	-
Std.1	9.952 ng	-	488.0±3.6	-	-

Table 3. Activation analysis of Ir in Antarctic ice.

No.	Sample weight (g)	Chemical yield (%)	Count rate (cpm)	Ir found in irradiated sample (10^{-12} g)	Ir content in ice (10^{-14} g/l)
4 Antarctic ice	3847	1.62	0.277±0.017	4.1±0.4	31±12
5 Blanc	3000	8.3	0.996±0.041	2.9±0.2	
Reference samples					(ppb)
Ref.B BCR-1	0.0549	30.0	0.178±0.017	0.14±0.02	0.0026±.0004
Std.2 Ir	0.3532 ng		1472.4±17.3		

These samples were irradiated together to a neutron flux of 5.2×10^{13} n cm^{-2} s^{-1} for 5 days in the OSIRIS reactor at Saclay.

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