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Mercury in the Atlantic near Iceland

by
Jón Ólafsson
Marine Research Institute, Reykjavík.

Introduction

In recent years several workers have turned their attention to the study of mercury in sea water and the marine environment. They have generally investigated the natural background of the element, possible signs of anthropogenic input and input from other sources such as volcanism. Perhaps because of the rather high concentrations of mercury reported in samples from the East Greenland Current (Carr et al., 1972), other investigations have followed on mercury in the North Atlantic. Samples of Atlantic water collected south of Iceland had an average mercury concentration of 14 ng l^{-1} (Ólafsson 1974), but there have been reports of similar and also considerably higher mercury concentrations in sea water from around Iceland (Gardner and Riley 1974, Gardner 1975).

The results here presented are for sea water not suspected to be affected by volcanism. Local effects of volcanism have been previously described (Ólafsson 1975).

Methods

Samples have been collected during cruises of R/V Bjarni Sæmundsson, R/V Árni Fridriksson and R/V Hafthór (Fig. 1) using either all plastic Hydro Bios or NIO water bottles and Pyrex bottles for sample storage.

The analysis has been performed as soon after collection as practicable by a flameless atomic absorption technique involving

amalgamation with gold (Ólafsson 1974). For the determination of total mercury, samples from one cruise, B12/74, were treated with 5 ml of 5% $KMnO_4$ solution on collection. Such cold oxidation with acid permanganate is known to be sufficiently strong to oxidize methylmercury (Omang, 1971). In order to avoid increasing the blank by permanganate addition the organically bound mercury in samples from more recent cruises B2/75, B6/75, was released by destruction of organic material, prior to measurement, by ultra violet irradiation from a 1.2 Kw Hanovia lamp (Armstrong et al., 1966). In Table 1 the results obtained after the oxidative treatment are referred to as "total mercury" but "inorganic mercury" when the samples have only been subjected to acidified storage. The difference is termed "organically bound mercury".

Results

The samples from cruise A7/73 cover the North Irminger Sea and some are from the low salinity East Greenland Current. The average inorganic mercury in samples from this cruise was 3.5 ng l^{-1} and the highest concentration was merely 8.1 ng l^{-1}. For all the data (Table 1) the average inorganic mercury is 4.0 ng l^{-1} and the average total mercury 8.7 ng l^{-1}. The organically bound mercury fraction was found to range from 1% to 89% but averages 44%.

This fraction decreased significantly with depth at station B 2/75-27, but at station H 12/74-130 the e was an increase with depth. The latter station was worked inside a fjord in early winter and the mercury distribution may be linked to stable hydrographic conditions and low oxygen concentration (63.5% saturation) of the bottom water. During the B 6/75 cruise in late May 1975, samples of drift ice were collected some 30 nautical miles north of Iceland. Two samples of the melt had total mercury concentrations of 13.1 ng l^{-1} and 16.1 ng l^{-1}. This result together with small mercury concentrations found in the low salinity samples, suggest that sea ice is not a source of mercury in this region. The data in Table 1 in fact reveal very low mercury concentrations for the whole area examined.

It is usually neccessary to store the samples for some time from collection to analysis. In a storage experiment sea water

was spiked with mercury in the form of mercuric chloride, and subsamples taken and stored as common samples. The initial analysis and analysis at regular intervals over a 20 day period gave a concentration of 42.6 $\pm$ 0.9 ng l^{-1}, and showed no signs of alteration.

References

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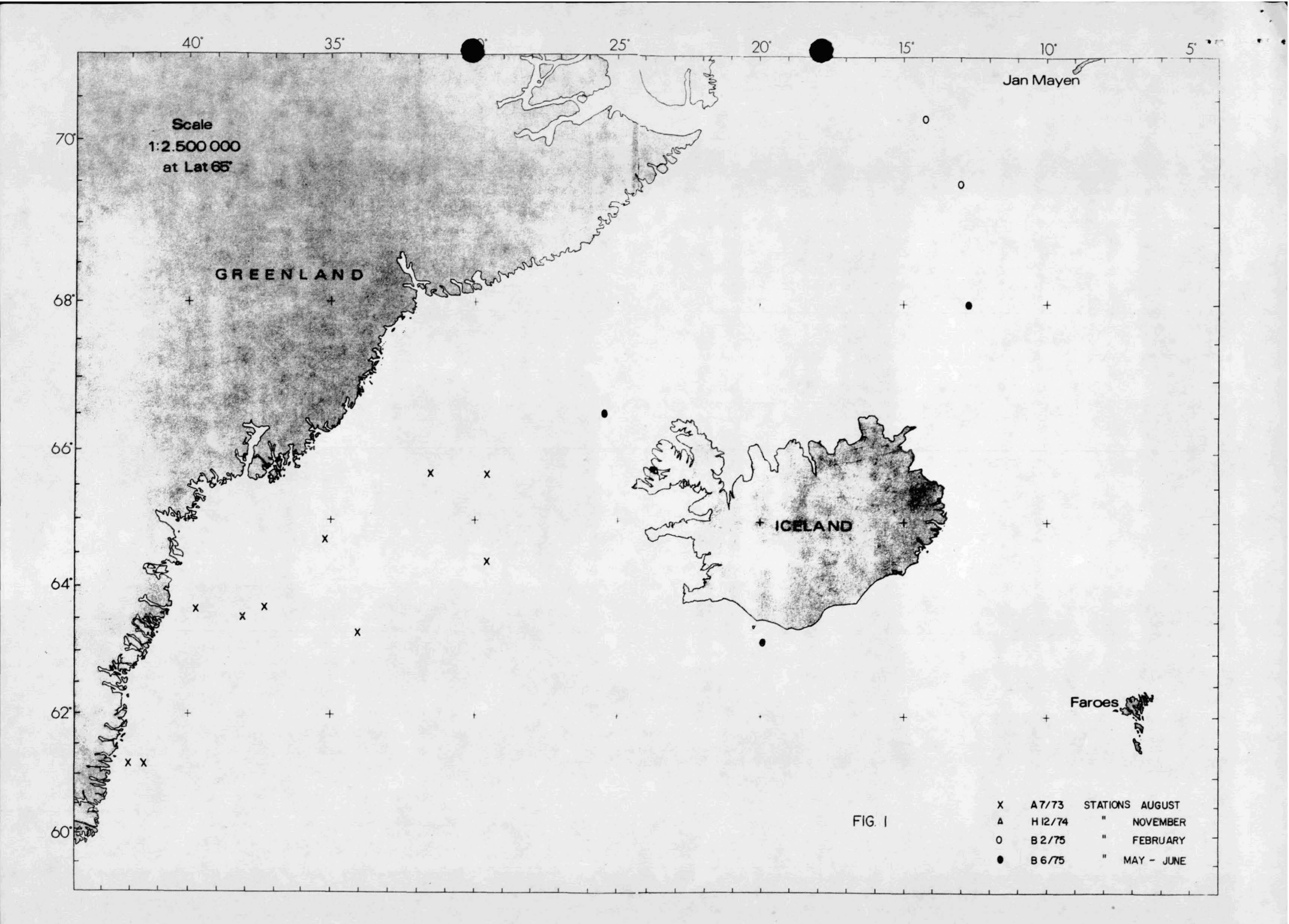
Table 1.

Station	Location and Depth	Depth m	Temp. C°	S o/oo	Mercury ng l^{-1}		
					Total	Inorganic	Organically bd.
A7/75-28	61°10'N	0	3.41	33.804		4.1	
	41°30'W	150	5.69	34.992		7.2	
	900 m	800	4.39	34.938		8.7	
A7/73-29	61°10'N	0	4.63	33.435		5.9	
	42°00'W	50	1.44	34.083		2.4	
	220 m	220	4.12	34.705		3.8	
A7/73-39	63°37'N	0	4.29	33.097		8.1	
	39°42'W	100	5.90	34.902		6.2	
	500 m						
A7/73-41	63°30'N	0	6.15	34.475		4.1	
	38°10'W	190	5.01	34.937		7.8	
	220 m						
A7/73-47	63°40'N	0	2.62	31.841		1.9	
	37°21'W	40	2.88	34.199		1.3	
	400 m	350	2.99	34.772		3.5	
A7/73-49	64°40'N	0	6.73	34.705		2.8	
	35°10'W	100	5.90	34.956		2.2	
	360 m	340	4.94	34.973		2.5	
A7/73-52	63°15'N	0	9.72	35.018		0.8	
	34°00'W	100	6.07	35.044		2.1	
	2700 m	1900	3.34	34.969		1.8	
A7/73-59	65°35'N	0	0.48	30.897		1.6	
	31°30'W	50	5.39	34.748		1.8	
	290 m	250	4.31	34.957		3.0	
A7/73-60	65°33'N	0	0.91	32.881		1.1	
	29°30'W	150	5.69	34.646		3.1	
	750 m	720	0.94	34.878		3.0	
A7/73-62	64°21'N	0	9.84	35.012		1.2	
	29°30'W	100	6.48	35.072		2.6	
	1750 m	1500	3.82	34.984		2.8	
H12/74-130	65°46'N	0	5.91	34.115	8.4	2.3	6.1
	23°45'W	25	6.20	34.365	9.1	3.4	5.7
	101 m	50	6.33	34.517	3.2	1.3	1.9
		75	6.18	34.556	7.7	1.5	6.2
		100	5.64	34.535	12.9	2.5	10.4
B2/75-27	69°30'N	0	-0.20	34.847	12.6	1.4	11.2
	13°00'W	100	-0.18	34.846	10.4	6.1	4.3
	1882 m	500	-0.24	34.910	7.5	5.3	2.2
		1800	-0.91	34.913	5.6	5.1	0.5
B2/75-29	70°14'N	0	-1.68	34.611	10.7	4.1	6.3
	14°12'W	250	0.46	34.923	11.7	3.7	8.0
	1203 m						

Station	Location and Depth	Depth m	Temp. C°	S o/oo	Mercury ng l^{-1}		
					Total	Inorganic	Organically bd.
B2/75-49	63°07'N	0	7.30		6.9	3.2	3.7
	19°54'W	200	7.33		7.3	4.7	2.6
	1125	500	7.21		3.1	0.6	2.5
		1000	5.06		6.7	3.8	2.9
B6/75-43	65°46'N	0	5.86	33.133	9.8		
	23°48'W	50	2.35	34.466	10.3	7.7	2.6
	93 m	90	1.48	34.595	8.5	7.3	1.2
B6/75-53	66°29'N	0	-0.70	32.903	6.9	5.6	1.3
	25°34'W						
	570 m						
B6/75-98	68°00'N	0	0.94	34.790	10.2	6.1	4.1
	12°40'W	300	0.02	34.921	7.2	7.1	0.1
	1896	500	-0.34	34.919	8.6	7.2	1.4
B6/75-136	63°07'N	200	7.32	35.122	9.6	6.7	2.9
	19°54'W	400	7.16	35.128	10.6	6.5	4.1
	1105 m	1000	4.34	35.012	10.9	8.8	2.1


40°
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Jan Mayen
Scale
1:2.500 000
at Lat 65°
GREENLAND
ICELAND
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X A7/73 STATIONS AUGUST
Δ H12/74 " NOVEMBER
0 B2/75 " FEBRUARY
● B6/75 " MAY - JUNE

FIG. 1