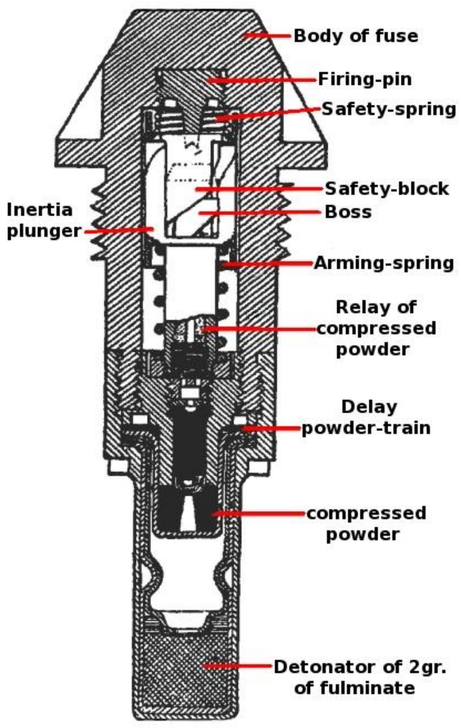
A. 2.3_2

Concentration of methylmercury in marine sediments collected in munition dumpsites

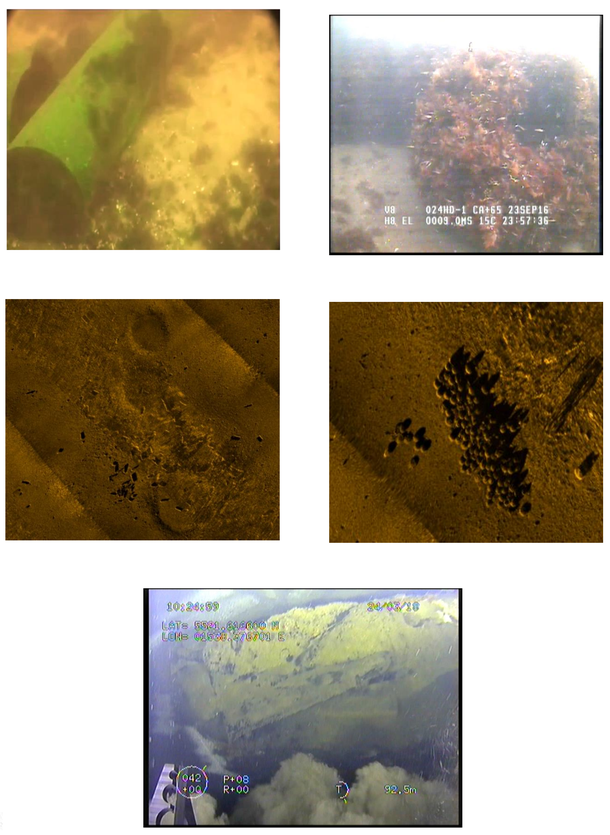
Grzegorz Siedlewicz, Marta Szubska, Ewa Korejwo, Jacek Bełdowski
Institute of Oceanology of the Polish Academy of Sciences, Poland
Email: gsiedlewcz@iopan.pl

Methylmercury (MeHg) is the most toxic and dangerous form of mercury occurring in the environment. MeHg is highly bioaccumulative in organisms and undergoes biomagnification via the food chain. In military ordnance dumpsites higher concentration of mercury are expected, as mercury fulminate was used as a popular primer explosive in detonators of munitions. In most of the munition dumpsites located in the Baltic Sea, environmental conditions promote methylation processes: anoxic conditions, presence of sulfate-reducing bacteria, presence of organic matter and no UV radiation.

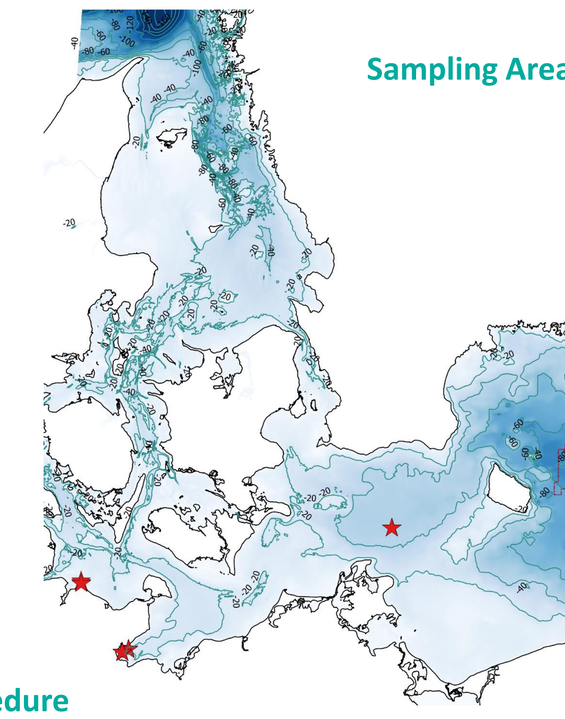
The aim of the studies was adaptation and validation of analytical method designed for MeHg determination in sediments and analyses of environmental samples from Baltic Sea munition dumpsites.



24/31 P.R. Model 1916 1/10 sec. delay fuse
240 mm Trench Mortar, March 1918



Dumped conventional and chemical munition



Distillation system
Brooks Rand Inst

Automated Mercury System MERX-M - Brooks Rand Inst

Analytical procedure

5 g of wet sediment
↓
5 ml extraction buffer KBr, 1 ml 1M $CuSO_4$
↓
10 ml CH_2Cl_2
↓
Shake 1h
↓
Centrifuge 20 min 3000rpm
↓
5ml organic phase added to 25 ml H_2O MiliQ
↓
Evaporation of CH_2Cl_2 (45^oC) in N_2 atmosphere
↓
5 ml of extract added to 25 ml H_2O
↓
300 µl 2M acetic buffer (pH 4,5-5)
↓
50 µl 1% sodium tetraethylborate
↓
GC CVAFS analyses

Validation parameters:
Linearity 0.5-50 pg (R^2=0,9997)
Accuracy: 98%
Precision: CV=9.7%
MDL=0.7 pg (3.5 pg/g d.w.) 3xSD
MQL= 2.2 pg (11 pg/g d.w.) 3xMDL

Sample name	Concentration ± SD [pg/gm]
Gdańsk Deep	
OC MAR 17 GD_1_4	132±15
OC MAR 17 GD_1_2	106±2
Bornholm Deep	
OC MAR 17 BO_2_2	244±4
OC MAR 17 BO_2_7	98±11
BO_OC_SEP17_1	622±48
BO_OC_SEP17_3	130±34
Kolberger Heide	
KH_OC_SEP17_1	640±150
KH_OC_SEP17_1A ROV	316±43
KH_OC_SEP17_1B	69±18
KH_OC_SEP17_3	215±48
KH_OC_SEP17_4	68±19
KH_OC_SEP17_6	17±8
Pelzerhaken	
PH_OC_SEP17_1	45±12
PH_OC_SEP17_2	211±20
PH_OC_SEP17_3	125±37
PH_OC_SEP17_4	306±14
PH_OC_SEP17_5	262±7
PH_OC_SEP17_5_2	78±5
Adler Grund	
AD_OC_SEP17_1	318±68
AD_OC_SEP17_2	642±130

Conclusion

- During the DAIMON project the analytical procedure for determination of MeHg concentrations in the marine sediments was intended.
- The MeHg analytical method was characterised by good validation parameters.
- Results from the environmental samples form munition dumpsites located in the Baltic and North Sea show various concentrations of MeHg from MDL to hundreds pg /g d.w.

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