LOW LEVEL MERCURY ANALYSIS
BY NEUTRON ACTIVATION ANALYSIS

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During the years 1974–77 about 200 low level mercury analyses on samples with less
than 1000 ng Hg/kg were made at the Danish Isotope Centre. This paper describes our
method of neutron activation analysis for low level mercury analysis. The accuracy of the
mercury analyses is shown by the results of the determinations on NBS standard, SRM
1642, and on intercalibration analyses. The accuracy found is better than 10% for samples
with about 100–300 ng Hg/kg and better than 10 ng Hg/kg for samples with less than 100
ng Hg/kg. The limit of detection for the analyses is about 1–5 ng Hg/kg, depending on the
sample and the exact method of analysis. The lowest standard deviations on duplicate
analyses are about 1 ng Hg/kg. The general level found in sea water is about 10 ng Hg/kg, in
ground water about 50 ng Hg/kg, and in rain water about 100 ng Hg/kg.

Introduction

The problems of mercury in the environment have been discussed considerably. From the analytical results the level of output from man-made sources has also been discussed.

For the low level samples (water, Greenland ice) the levels of mercury analysed by different laboratories show great discrepancies. In this paper the low level mercury analyses performed at the Danish Isotope Centre by neutron activation analysis according to SJÖSTRAND1 are described.

Experimental

Collecting and preparation of the samples

3 or 10 ml quartz ampoules are rinsed in nitric acid or more recently by heating to about 500 °C in 2 hours. The samples are transferred into the quartz ampoules and sealed with the sample part cooled in an ice-water mixture. Blanks are empty ampoules, scaled at the same time and place as the samples. Different low level samples are prepared in the following way:

Greenland ice samples are prepared by rinsing the ice core by melting or cutting. Afterwards a smaller sample is taken by further melting or cutting, promptly
transferred to a 35 ml flask, and introduced into the quartz ampoule with a pipette and sealed immediately.

Some sea water samples are taken in a sample collector, transferred to 0.5–1 l bottles, and transferred to the quartz ampoules and sealed. Other sea water samples are taken directly in the evacuated quartz ampoules with the sample collector shown in Fig. 1, and the quartz ampoule is sealed immediately at place of sampling.

Ground water samples are collected in 0.5–1 l bottles with 10% concentrated nitric acid and sealed in the quartz ampoules usually one day after the samples are taken.

Rain water samples are collected via a 20 cm funnel and a nylon filter (1 mm holes) in 5 l polyethylene bottles with 100 ml conservation mixture. The conservation mixture contains 64 ml concentrated nitric acid, 2 μg gold as goldtetra-chloride ion, and demineralised water to 100 ml. 1 to 2 litres are collected each month and sealed in quartz ampoules a few days after.