Cruise Summary Aranda, April 09

From April 21 – 28, 2009, INFLOW organized a cruise on RV Aranda from Helisinki – Gotland – Åland (Mariehamn) – Turko (Figure 1). The cruise was organized by Harry Kankaanpää (Chef Scientist; SYKE Marine Center, Finnland) and by Aarno Kotilainen (INFLOW project coordinator, GTK, Finnland). The main research goal of the INFLOW project is to understand past and present changes as well as to predict future changes of the saline water inflow from the North Sea into the Baltic under the influence of anthropogenic environmental changes. During the first Leg (April 21 - April 25) of this cruise a team (Jørn Bo Jensen, GEUS, Copenhagen; Sabine Flury, Center for Geomicrobilogy, Århus) from the BALTIC GAS Bonus project joined the cruise. The goal of the BALTIC GAS team was to take sediment and porewater samples from gassy sediments to determine profiles and fluxes of CH_4 and SO_4^{2-} as well as profiles of H_2S, DIC, TN and TC.

Sampling Sites for BALTIC GAS:

Gassy sediments were found at two sites during the first Leg of the cruise; station JML-gas (59.5824833 N, 23.6318167 E; water depth: 80m) and station F69 (59.4700 N, 19.558 E; water depth: 192m) (Figure 1). At both sites long gravity cores (GC) were taken for BALTIC GAS. In addition to the gravity core two multi cores (MUC) were taken at station F69 (Figure 2), since the gas front reached until 25 cm below sediment surface (Figure 3). Coring equipment was kindly provided by IOW Warnemünde, Germany. According to CTD data, the bottom water at station JML was anoxic, while the O2 concentrations of the bottom water at F69 were around 4 ml/l.

Sampling strategy:

GC: Sediment and pore water samples from GC were both taken every 20 cm with cut off syringes (for sediment) and rhizon samplers connected to vacumised exetainers (for Porewater), respectively. For sediment samples, small windows were cut with a saw into the core liner, while for porewater sampling, small holes were drilled in between the windows into the core liner.

MUC: At station F69 two MUCs were taken. One core was dedicated for sediment samples, while the other one was used for porewater sampling. For sediment sampling the core was sliced every 5 cm and samples were taken with cut off syringes while for the porewater, small holes for the rhizon samplers were drilled every 5 cm into the second MUC.

Preservation of samples:

Sediment samples for TN and TC were stored untreated in cut off syringes at 4°C.
For the CH_4, 2 ml of sediment was taken with cut off syringes and transferred into exetainers containing 4 ml 2.5% NaOH. CH_4 samples were stored up-side down at 4 °C until analyzed.

Porewater samples were treated differently depending on the purpose of the measurement. Once the vacumized exetainer was opened, pore water was transferred immediately to vials containing the corresponding preservatives.

Perliminary results of CH_4, SO_4^{2-} and H_2S profiles are presented in Figure 3.

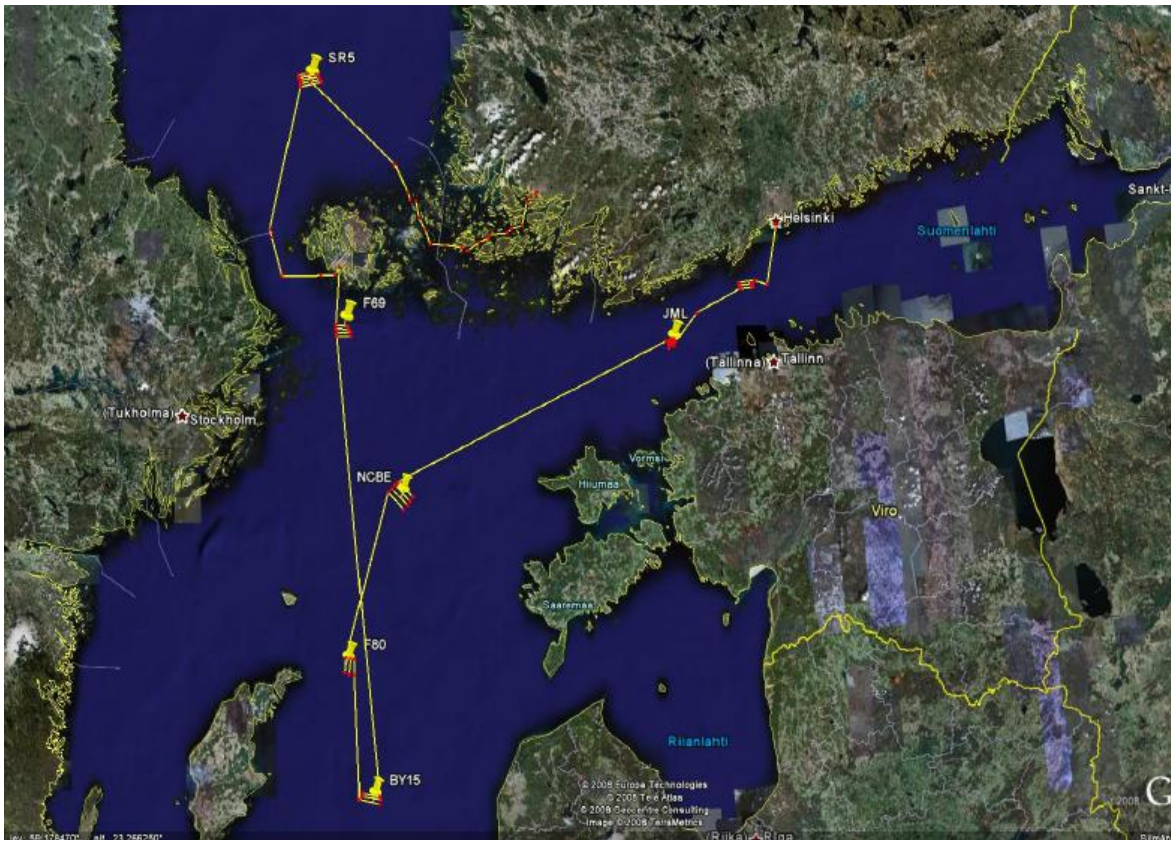

Figure 1. Key sites for INFLOW cruise on RV Aranda, April 2009. Leg 1 Helsinki – Mariehamn (22 - 25 April, 2009) , Leg 2 Mariehamn – Turko (26 – 29 April, 2009).

a) b)

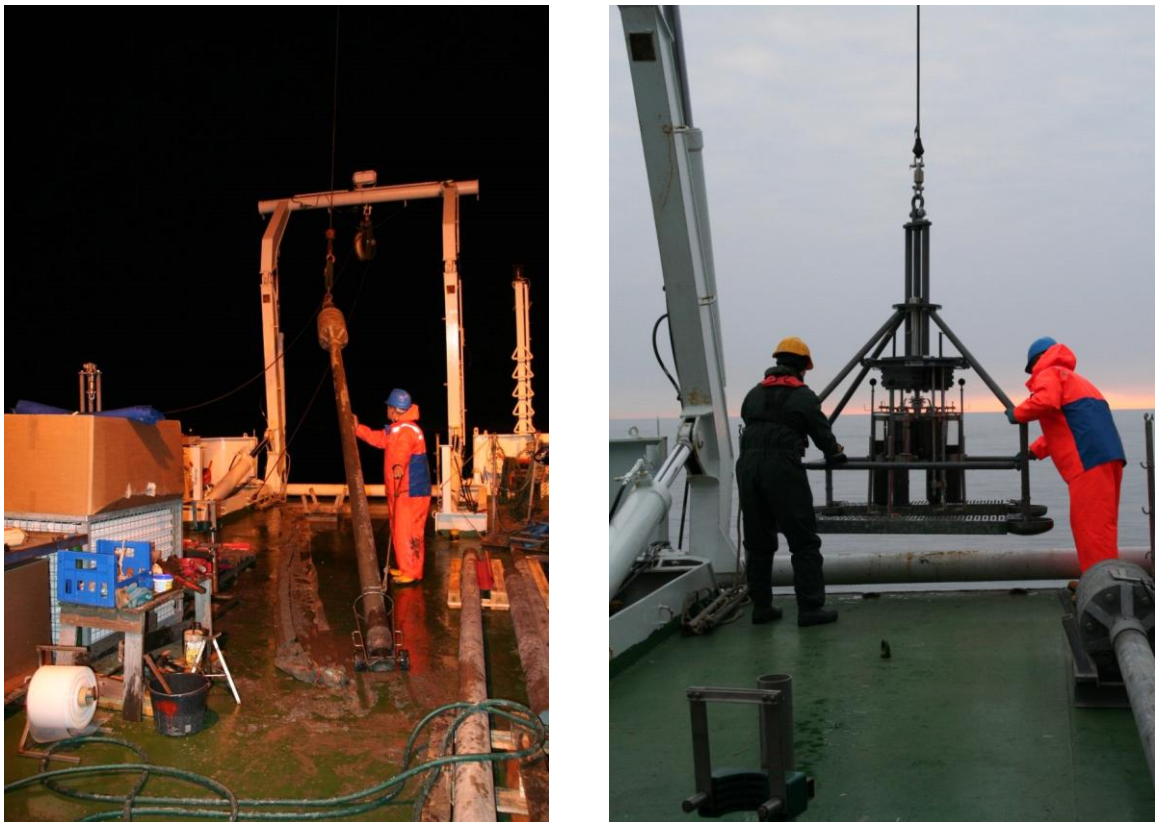

Figure 2. Taking a 6m long gravity core (a) and a multi core (b).

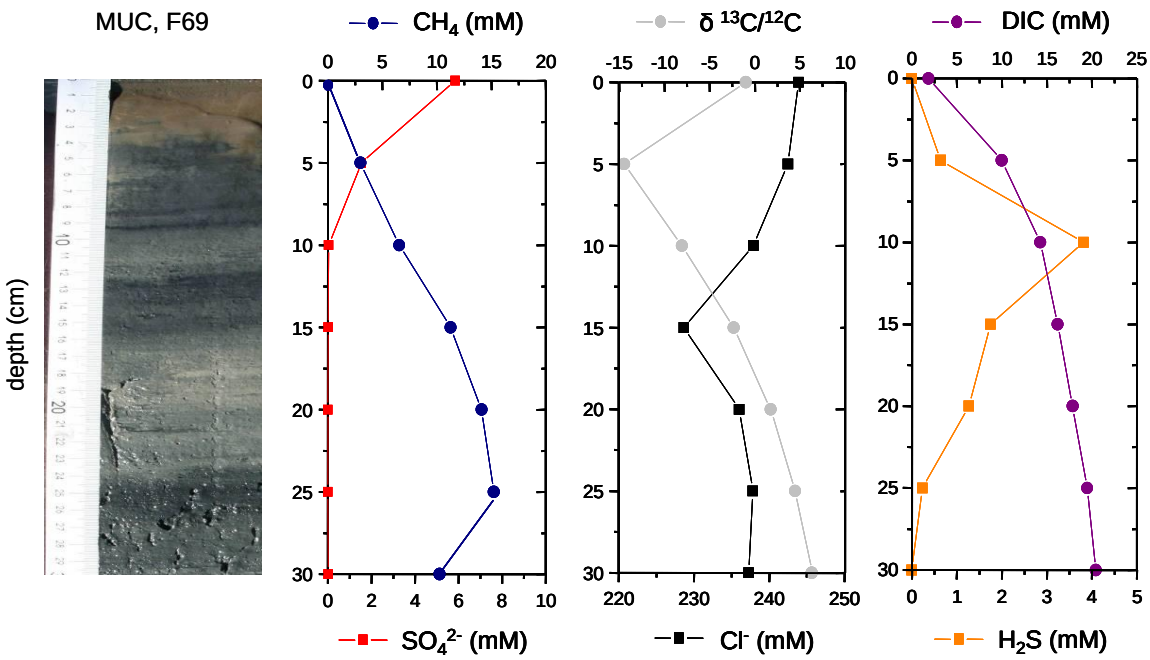

Figure 3. Profiles of CH_4, SO_4^{2-}, H_2S, DIC, $\delta\ ^{13}C/^{12}C$ of DIC and Cl^- for station F69. SO_4^{2-} concentration in the sediment surface water is 5.85 mM. According to this graph, the bottom of the sulfate-methane transition zone at station F69 is about at 10 cm below sediment surface where also H_2S concentration peaks. Maximum methane concentrations are found at 25 cm below sediment surface where large bubble holes have formed (core picture on the left). NOTE, these bubble holes, however, are high likely formed due to degassing and expansion of small gas bubbles during core recovery. CH_4 fluxes in the upper 20 cm are about 3.44 mmol m^{-2} d^{-1}, and the SO_4^{2-} fluxes at the steepest gradient 2.3 mmol m^{-2} d^{-1}.