Responses of nematodes to increased copper toxicity, tailings exposure and sediment deposition from in-situ and laboratory experiments

Mevenkamp Lisa[1], Brown Alastair[2], Guilini Katja[1], Lins Lidia[1], Moodley Leon[3], Stratmann Tanja[4], Sweetman Andrew[3], van Oevelen Dick[4], Westerlund Stig[3], Vanreusel Ann[1]

[1] *Marine Biology Research Group, Ghent University, Krijgslaan, Ghent, Belgium*
Lisa.Mevenkamp@ugent.be

[2] *University of Southampton, Ocean and Earth Science, National Oceanography Centre Southampton, European Way, Southampton, SO14 3ZH, UK*

[3] *International Research Institute of Stavanger (IRIS), Randaberg, Norway*

[4] *Department of Ecosystem Studies, NIOZ Royal Netherlands Institute for Sea Research, Korringaweg 7, 4401 NT Yerseke, The Netherlands*

The impacts of polymetallic nodule extraction on marine benthic organisms are expected to be very variable in nature and intensity, though threshold values for the survival and recovery of deep-sea organisms are largely unquantified. Direct impacts related to the nodule removal include sediment compression and sediment redistribution while the release of toxic amounts of heavy metals or burial with suspended sediments or mine tailings are indirect impacts from the mining operation. Additionally, ore extraction from the nodules may result in the production of substantial amounts of tailings and deposition at the removal site is not implausible. To assess short to medium term impacts of these different types of disturbances we focussed our research on the response of an ubiquitous and very abundant taxon, the nematodes. This presentation provides an overview of the results of lab experiments and *in-situ* experiments performed during the MIDAS project that were designed to investigate the sensitivity of nematodes to copper toxicity and sediment deposition disturbances.

In an experiment assessing lethal concentrations of Cu^{2+} of the nematode *Halomonhystera disjuncta*, a close shallow water relative of the deep-sea species *H. hermesi*, was exposed to different Cu^{2+} concentrations under atmospheric and increased hydrostatic pressure at different temperatures. The results of these toxicity tests suggest that copper sensitivity differs under deep-sea conditions (low temperature, high pressure) from shallow water conditions (high temperature, low pressure) with higher tolerance at low temperatures but increased sensitivity with increased pressure suggesting that shallow water species are not a good proxy to test abyssal response. During RV “Sonne” cruise 242-2, we deployed 6 corrals and exposed the *in-situ* sediment fauna to artificial sediment spiked with different copper concentrations. Treatments included a control without artificial sediment, a control with uncontaminated sediment and four different copper concentrations (1, 5, 10, and 20 mg Cu l^{-1}). After 96 hours of incubation, sediment samples for meiofauna analyses were taken. Only slightly decreased meiofauna abundances were found in the highest Cu contamination treatment while sediment analysis showed a very high copper concentration in the natural sediments. To address the issue of sediment redistribution and potential impacts of tailings placements on deep-sea fauna, two other experiments were conducted, one in controlled lab conditions (with sediment from 200m) and one *in situ* (4200m). In both experiments, the benthic fauna was exposed to iron ore tailings (lab experiments) and crushed nodule substrate (*in-situ* experiment), and meiofauna densities were recorded after an incubation time of 11 days. The lab experiment revealed that differences in sediment characteristics (grain size, organic carbon content) and reduced oxygen penetration resulted in an increased mortality of nematodes in the added substrate. Only preliminary results can be given for the *in-situ* experiment.