Weekly Report No. 5 (6.12. - 12.12.2004)

At the beginning of the week the situation on the floe was stable after the break-up due to low wind speeds. However, several groups had to reach their working area by crossing a small lead which was bridged by some planks. Our Finnish colleagues made full use of good weather conditions to celebrate their national Independence Day with us on the ice with mulled wine and crackers.

In the meantime our underwater vehicle (ROV) had its first operation. A minke whale was observed and filmed when just passing by. Encouraged by its performance the ROV was used to deploy some nets underneath the ice. Initially this work was supposed to be done by our divers. However, the sightings of some leopard seals around the floe prevented them from entering the water. After two days without leopard seals around the ship, the divers then were successfully sampling under-ice fauna and flora on Saturday.

On the ice, cores were drilled for various groups. The biogeochemists were mainly interested in changes of gas and nutrients within the ice. When seawater freezes and becomes sea ice, one would expect its biological and chemical properties to be the same as the water it was derived from. However, from the moment the sea ice congeals, its properties change. The ice crystals are in fact almost pure freshwater because the salt in the seawater is excluded and is concentrated between the ice crystals and is referred to as brine. The colder the ice, the more concentrated the brine, up to 4 times the concentration of seawater at -10°C. The brine becomes isolated in pockets or channels and since there is no or little exchange with the water column below or the atmosphere, temperature as well as the organisms living within the brine begin to alter its chemical composition. While temperature and salinity dramatically affect the ionic composition and solubility of gases, it is the living organisms within that change the composition of the brine. Algae will photosynthesize, produce oxygen (O_2) and consume carbon dioxide (CO_2), whereas bacteria and other organisms such as tiny crustaceans will respire CO_2 and consume O_2. The algae will use up nutrients such as phosphate and nitrates while the bacteria will produce these by remineralising organic material. All these processes cause an imbalance and shift in chemical properties of the sea ice. At the same time, the sea ice

also acts as a barrier to the diffusion of gases from both within the ice and through the ice and we are here to study the rates at which gases such as, O_2 and CO_2 diffuse through the ice, how, where, when and what produces them.

Biogeochemists obtain their samples from sea ice in many different ways, sometimes using obscure and ingenious methods. The simplest method involves scooping the brines with a soup ladle, whereas the most complicated involves sophisticated micro sensors being frozen into the ice. Our most commonly used method is what we call coring, where a specially constructed corer, a type of drill with an electric or gasoline powered motor, is used to drill through the ice which may be over 2 meters thick. The temperature of the core is taken at 10 cm intervals by drilling small holes into the core into which an electronic thermometer is placed. It is important to know the temperature since it gives us an indication of the salinity in the brine pockets and the condition of the ice from which the core was taken. The core, which usually has a diameter of about 9 cm, is then rapidly sectioned into 10 cm pieces, each of which is stored in a plastic container and returned to the ship. There the samples are melted and divided up between the various investigators who will do their analyses of the properties. When all the data have been collected and processed, the scientists will meet and discuss their observations and try and resolve how physical, chemical and biological properties of ice interact and what possible effects, the observed changes in global warming and the ozone hole could have on these processes.

The lead between our "home floe" and those of some working groups widened on Friday. In addition to our skidoo traffic we had to install a ferry schedule for a rubber boat to cross over. This guaranteed a continuous sampling strategy over a prolonged period from only one level area of the floe.

With dismay, but also with pleasure, Sunday proved to be hump day (mid way point), which will be celebrated with some sucking pigs for dinner. Half of our expedition is over. That is why most of us are looking forward to reunite with those back home, whom we are greeting cordially.

For the expedition members
Michael Spindler