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Since a large number of protected species (e.g. Atlantic northern right whale, blue whale, great white shark, leatherback turtle) can be found in the St. Lorenz Bay, seismic measurements are subject to strict regulatory requirements. During our cruise, compliance with these regulations is monitored by three independent marine mammal observers (MMOs) who embarked in Charlottetown last week.

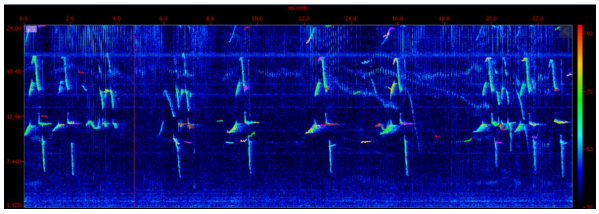

Fig. 1: Spectrogram showing signals of dolphins detected during a shutdown on 26.9.2021.

While seismic experiments are carried out, the MMOs continuously monitor the area around the ship for signs of marine animals. During the day this is done visually or acoustically at night or during periods with poor visibility by means of a PAM system (passive acoustic monitoring, see Fig. 1). In the case that marine mammals or protected species are detected at a distance of less than 1000m around the ship, all seismic work is shut-down immediately and is only allowed to continue, if the animals have left the protected area for at least 30 minutes. Even stricter requirements apply to the northern right whale.

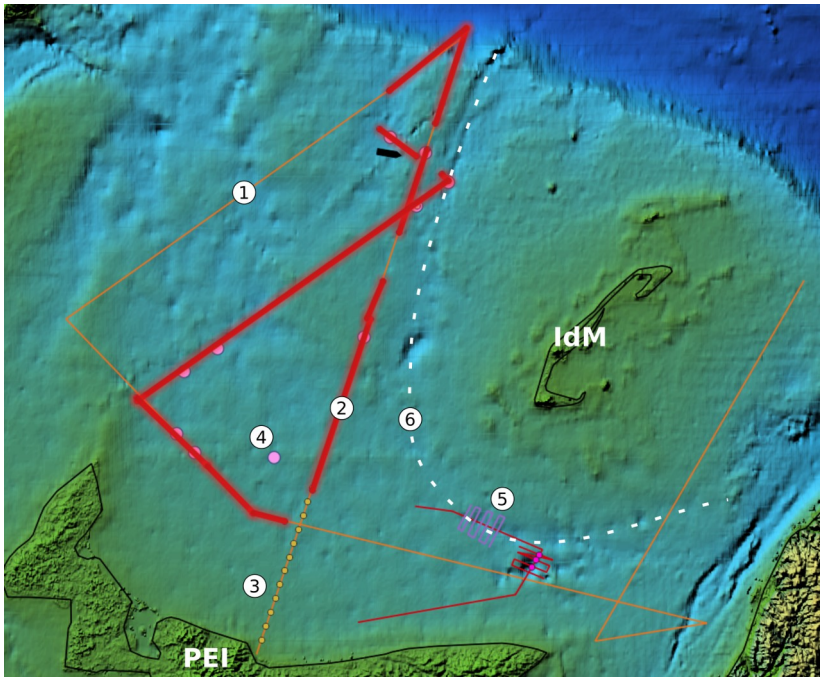

Fig. 2: Working area in the Gulf of St. Lawrence with the Prince Edward Island (PEI), Iles de la Madeleine (IdM), the main seismic profile line (1), locations of OBEM stations (3) and gravity cores (4), and hydroacustic profiles (5). The area around the IdM, especially in the east, is characterized by strong salt tectonics. The ring-shaped structure around the IdM (6) could indicate a thinning of the underlying salt layers (→ withdrawal basin).

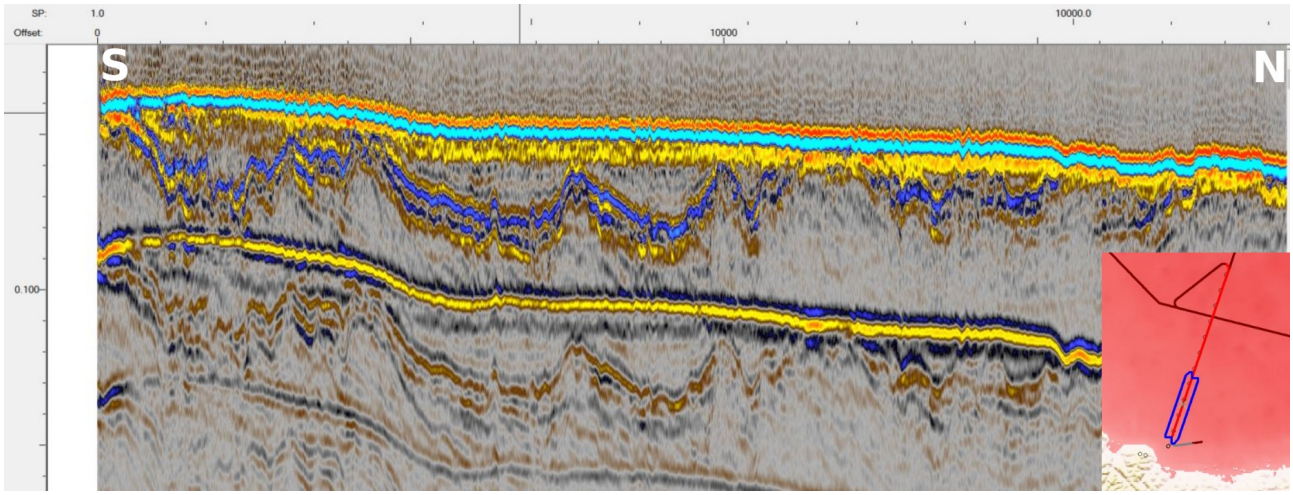

Fig. 3: Seismic section along the main profile directly north of the PEI. Due to the shallow water depth (<50m), the sea floor is visible as a strong reflector even for very short periods of time. A heavily structured layer lies directly underneath. The deeper areas of the section are heavily influenced by multiples due to the shallow water depth.

During the seismic profiling and the hydroacoustic measurements with the multibeam echo sounder and Parasound, which were carried out in the last week between 25.9. - 28.9., we had to shutdown all systems around midnight several times due to dolphin warnings from the MMOs. One could almost get the impression that the dolphins were checking us out after sunset to see what was going on. Despite the many interruptions, partly also due to minor technical problems with the seismic streamer, we were able to continue the measurements along an almost 900km long overview profile and completed this a few hours ago ("1" in Fig. 2).

Since large penetration depths are of secondary importance within the scope of our project, which focuses on the investigation of an aquifer system at a depth of at maximum a few hundred meters, we use a seismic streamer with a short length of 260 m and high spatial resolution of 1.56m. Fig. 3 shows a first unprocessed section acquired directly north of the PEI along the main profile. Due to the shallow water depth of less than 50m, the reflection of the seabed and the first multiple are already visible at a very early times. Additionally, a structured reflector directly beneath the sea floor can also be seen in the raw data. Due to the strong influence of the multiples, extensive processing of the data will be required before further structural interpretations of deeper structures are possible.

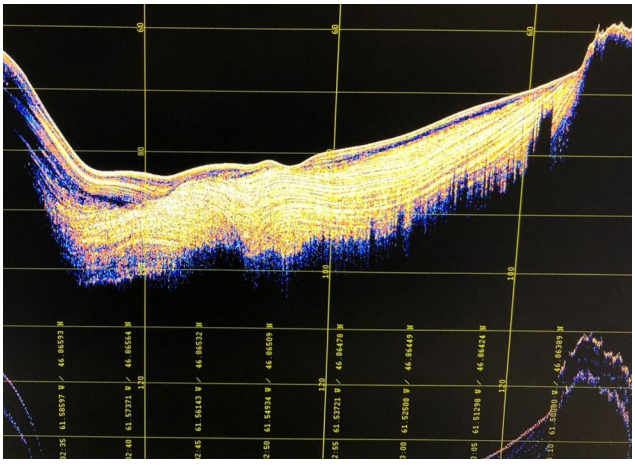

Fig. 4: Sediment-filled depression imaged by the sediment echo sounder (Parasound).

In the hydroacoustic measurements we could see that large areas of the bay are characterized by a very hard surface which can practically not be penetrated by the sediment echo sounder. However, in some sections of the profile (compare “6” in Fig. 2) stratified sediments were found within shallow depressions (see Fig. 4).

With the information from the acoustic methods, we tried to obtain sample material with the gravity corer in several places over the past week. At first we only used the 3m core barrel, as we were not sure whether a sampling would be successful at all. In the end, we were able to gain 5m of core material in five attempts. Our best core with full recovery of 3m showed sandy layers and clayey sections with sand lenses, which could be of interest in the scope of our research questions. The sampling with the gravity corer will be mainly conducted in the second half of the project after our stop for stashing up supplies in Halifax on October 18th.

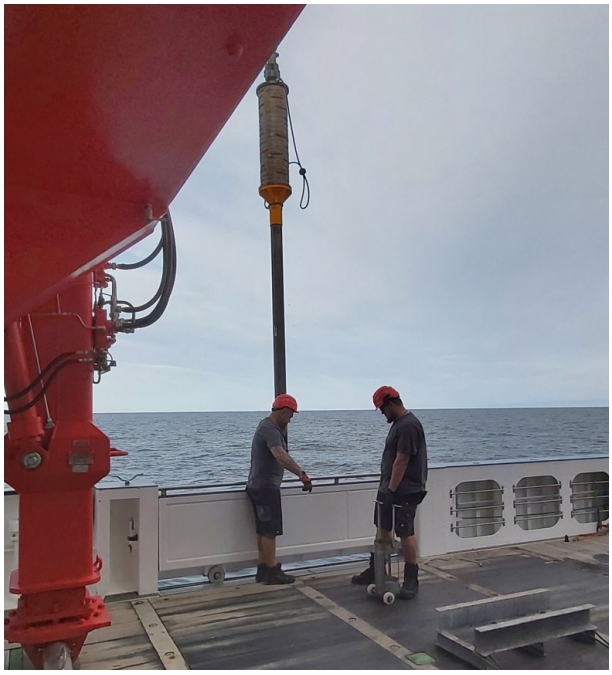

Fig. 5: Sampling with the gravity corer. (Photo: Sebastian Hölz)

Finally, I would like to briefly report on the first deployment of our towed CSEM system. The system consists of a long tail (approx. 700m) consisting of four receiver dipoles and one transmitter dipole attached to a heavy device carrier for the transmitter ("pig"). During the morning of of September 30th we began deploying the system directly north of the PEI with the plan to drag it over the seabed along the main profile line. However, after just a few hundred meters we had to stop measurements due to technical problems. After hauling in the system, we found that the rigging, electrodes and mechanical superstructures had already been severely damaged on this short stretch. Fortunately, the overall damage was still within tolerable limits. Currently, we are assessing, whether or not we still can use the bottom-towed CSEM system on the hard seafloor with a lots of debris, which seems to be predominant in the working area.

Fig. 6: EM Team before the first deployment of the CSEM transmitter. (Photo: Thies Bartels)

In this moment, we are just approaching the main profile to make a second attempt for our EM experiment with an alternative CSEM transmitter. Since this is about to start, I won't be able to report about this until next week.

With best regards on behalf of the crew of cruise MSM103

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