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Beaufort Gyre Exploration Project: Dispatch 24: Sonobuoys

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Today was a big day for the seismic group onboard the *Louis*. We had a twelve-hour interval to map the sediment thickness and water depth in the western Canada Basin. This work is related to the United Nations Convention on the Law of the Sea that allows coastal states to extend their jurisdiction beyond the present 200 nautical mile limit into a zone that is called the "extended continental shelf" (see also Dispatch 6). However, the UN requires the coastal states to map the extended continental shelf to provide documentation on the sediment thickness and the water depth. The UN has very specific rules how far a state can extend its shelf, but the thicker the sediments the bigger the potential claim.

Summer student Ryan Pike (NRCan) is getting ready to deploy the sonobuoy at the stern of the Louis. A radio transmitter will relay the data back to the ship. *Photo by Thomas Funck, GEUS.*

Today we had the chance to test our new equipment over a longer time period and to collect seismic data in an area of Canada Basin where we expect thick sediments. Shortly after breakfast, our seismic sound source was lowered into the water by the deck crew. The source consists of so called air guns. Once a minute we release 1500 cubic inch of compressed air into the water. The pressure of the air is 2000 psi (pounds per square inch), which is 60 times higher than in a regular car tire. The sound propagates to the seafloor and farther below into the sediments. Whenever the sound wave hits a new sediment layer, the sound will be reflected back to the surface, where we are listening with a hydrophone (a kind of very sensitive microphone).

In the lab, we do a first quality control on a paper record, which looks similar to an echo sounder. We can see the seafloor and all the different sediment layers below, which could consist for example of mud, clay or sand. Later I take the digital data to my computer and do "magic" things (seismic data processing), which enhance the image of the subsurface.

Senior scientist Thomas Funck (GEUS) in the compressor container. The compressed air (pressure of 2000 pounds per square inch) is used by the air guns to create the sound waves for the seismic experiment. *Photo by Ryan Pike.*

With our airgun and hydrophone we can only measure the time it takes for the sound to travel from the airguns, down to a sediment layer and back to the surface. To determine the sediment thickness we also need to know the velocity with which the sound propagates through the sediments. To do that, our technician Borden Chapman (NRCan) and his summer student (Ryan Pike) deployed a sonobuoy this morning. The sonobuoy is equipped with a hydrophone and a radio transmitter. Back on the ship we receive the radio signal and that way we can listen to our airgun shots as the ship moves away from the buoy. A modeling program in the computer can then calculate the velocity of sound within the various sediment layers.

With all that information we can calculate the sediment thickness and use it for Canada's submission to the UN to extend the continental shelf. Everybody onboard is pretty excited about the prospect of making Canada bigger. At the same time, we also get a lot of data that can give us information on the geology of the Arctic and how the 3800-m deep Canada Basin developed over the last 130 million years.

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Technician Borden Chapman (NRCan) with his summer student Ryan Pike in the seismic laboratory. This is the control centre for firing the air guns and recording the data from the hydrophones that listen to the sound waves. *Photo by Rick Krishfield, WHOI.*

Air bubbles rising to the surface from an airgun shot. *Photo by Rick Krishfield, WHOI.*

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