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Irminger Sea: Oct 17 - Morse Pond School

Questions from the students at Morse Pond School; Answers by Dr. Bob, Chief Engineer Mike, Bosun Kyle, both Melissas, Captain Kent, and Katie

How big is the anchor?
Knorr has two “Baldt” style anchors that weigh 3,500 pounds each mounted on either side of the bow. Each anchor has 720’ of anchor chain, totaling 1,440’ of chain. Each link on that chain weighs 20 pounds, so each chain weighs 28,800 pounds. So Altogether, Knorr carries 64,600 pounds of anchor and chain, which together is called “ground tackle.”
The anchors hang in “hawse” pipes, and the chain comes out of “chain lockers” and runs through “spurling” pipes. The anchor chain where it comes on deck from the pipes is attached to “capstans,” sort of like giant winches powered by 25 HP 480- volt electric motors. Each capstan is equipped with a “gypsy” designed to bite the chain in order to control the chain as it’s lowered or hoisted. The anchors are further secured (“dogged”) with two safety devices. One is a turnbuckle with “devil’s paws; the other is steel strap, or “riding pawl.”
All this language is centuries old.
Have you heard the old saying, “He came up through the hawse pipe”? It refers to someone who came up through the ranks to, say, captain without going to a merchant marine or naval academy, but rather worked his way up from deckhand. (Thanks to bosun Kyle for the information.)

Where does the sewage go?
As you can imagine, our sewage treatment plant is different from your city sewage treatment plant. We don’t have room for settling ponds, sedimentation and aeration ponds or tanks and all the other usual things used ashore to treat sewage. The objectives of marine sewage treatment are to eliminate organic compounds from wastewater and to kill harmful bacteria. We can hold 13,773 gallons of sewage, and then we need to pump it out ashore in a city treatment plant or treat it with our Marine Sanitation Device (MSD).
The MSD in Knorr uses an electrochemical means to oxidize and disinfect the waste. The electricity oxidizes the organic matter and sets up a chemical reaction that disinfects the waste so it can be pumped overboard.

How high is the tallest part of the ship?
The shipboard term for this question is "what is the air draft of the ship"? It changes within a couple of feet, depending on how loaded the ship is (which also changes our water draft), but is generally right around 100 ft. (30.5 meters). That is from the waterline to the top of the main mast. Our normal loaded "water" draft is 17 feet.

What happens if lightning strikes the ship?
Luckily for us, it is very unlikely that lightning would strike the ship. If it did, it would be looking for a fast path to the ocean water surrounding us. Since the ship is mostly steel (a very good conductor of electricity) surrounded by water (another very good conductor of electricity), for the most part, only the general area of what was hit would be damaged. We would lose any electronic equipment that was attached to antennas, if they were hit. That electricity would want to get through the hull into the water as soon as it could, for the most part.

How much will this research trip cost?
As we discussed earlier, measuring the ocean is very difficult. As an example, we are presently experiencing our third major storm on this cruise and once again we are unable to carry out our measurements. It is also very expensive to measure the ocean, largely because of the cost of operating a ship. When you consider all of the required diesel fuel, food stores, equipment, maintenance, etc. it adds up very quickly. Some of the larger research ships cost up to $40,000 a day to run! But this is not the whole story. It is also expensive to stage the scientific part of the experiment. For example, each of the moorings that we put in the water costs money to build, plus the instrumentation that goes on the moorings is expensive. And don't forget the salaries of the people on board. Then, after the cruise is over, some of us will be studying the data for several years, which also costs money. I won't tell you the exact cost of this experiment, but in general it is not uncommon for a sea-going project to cost more than a million dollars!

Is it fun going up and down in the waves?
Going up and down in the waves is a bit like being on a slow motion roller coaster all day. The ship underneath you is continuously moving so that sometimes you are walking uphill and sometimes downhill. If you really want to feel what it’s like, start off by spinning in one spot 15 times, then try to walk in a straight line. You might find that when you think you are going straight, you actually hit a wall. That’s what we do all the time. There are railings all around the boat for you to hold onto. As they say, “Keep one hand for you and one hand for the ship”.
Everyday activities on the boat are a bit more difficult in a storm. You always have to make sure to tie down everything and watch your drinks. The computers are all fastened to the desks and all pieces of furniture are bolted to the deck. The chairs are usually loose and we have had people fall off them or slide across the room on them. When you go to sleep you need to wedge yourself into the bunk so that you don’t roll out. On really big waves you may even end up in the air. Several of the crew fell out of their bunks during our first storm and they are seasoned seamen.

What is the hardest part of living on Knorr for a month?
To answer this question, we spoke to all of the scientists individually and we have compiled a list of their thoughts.
Dr. Bob: Not being able to have my nightly bowl of Ben and Jerry’s ice cream
Ben: Not being able to relax because you are always moving Dallas: Missing my wife and friends
Dan: Not being able to play with my two sons, Jonah and Ethan
Dave W.: I miss taking my dog for a walk

Dave S.: Not being able to exercise by doing sports like rock climbing
Iain: Being isolated from civilization in a small space with lots of people
Jane: Not having my family and pets around
Jim: I miss my family
Katie: Only having a hundred meters of space to walk around
Kjetil: Not being able to play soccer for a month
Melissa G.: Not being able to call up family and friends whenever just to chat
Melissa P.: Not being able to choose my meals
Nick: The difficulty of communicating with people off the ship Shunli: Being sea sick… continuously
Tom: Being on night shift and having to sleep during the day instead
The crew: Most of the crew are now very used to being at sea. They spend four months out of every six on the water. After chatting with them we found that most of them missed their family and friends the most.

What has been the warmest temperature so far?
Here in this north-Iceland fjord we're seeing the warmest temperature of the entire trip: 37 degrees F (2.46 C). Throughout the rest of the trip, the temperature has been hovering around freezing. However, when we were steaming along the Greenland coast, the temperature was several degrees below freezing.

What kinds of whales and other sea animals have you seen?
So far on this cruise we have been fortunate enough to get some glimpses at a couple minke and sei whales, as well as some orcas, or killer whales. While the orcas were rather close to the boat and their dorsal fins and bodies were visible from the ship, most of the large whales have been several hundred meters away from the boat and only visible because of their blow. Because whales are mammals, just like you and I, they come to the surface to breath air. When they come up to the surface, they exhale the remaining air in their lungs and then inhale before going below the surface again.
When they exhale, the water around their blowholes is forced upward into the air. There is no water actually coming from INSIDE their lungs, a common misconception! This blow is visible for many miles and is usually the first indication that a large whale is present in the area. Most of the time out here, because the sea state has been so rough and the swell so large, the blow is almost all we ever see of the whale. But you can tell many large whales apart from the blows. Some whales, such as fin whales, sei whales, and blue whales, have very large, tall, streamlined blows, while other whales, such as humpback whales and minke whales, have smaller, cloud-like blows. The smaller whales, such as orcas and dolphins are distinguishable by their dorsal fins, their body markings, and their rostrums more than their blows. Besides the minke and sei whales that we have seen, there may also be humpback whales, blue whales and fin whales in the Irminger Sea. Let's keep our fingers crossed that we have some more marine mammal sightings!

Does the CTD bring up plankton or any other ocean wildlife; any problems with CTD/wildlife?
Yes, we do sometimes bring biological matter up on the CTD. As we tow the CTD straight up through the water column, sometimes strands of algae (phytoplankton) can get wrapped around the rails of the cage. The other day, as we brought the CTD back onboard the ship, we found a small krill (zooplankton) resting on one of the rails of the cage as well. In past cruises, if we have gotten too close to the bottom by accident and the CTD cage actually touches the bottom of the ocean, we will sometimes bring up mud and some benthic organisms as well. Fortunately, we haven't gotten the CTD that close to the bottom on this cruise yet! And don't forget about all the microorganisms that are living in each parcel of water! Every small amount of water has the possibility of containing hundreds of microscopic organisms including phytoplankton cells, zooplankton cells, and bacterial cells. There is life in every drop of water!

About how tall and wide is the waterfall from the Denmark Current falling in Irminger?
This deep "waterfall" is nothing like a typical water fall that you see on land. This is because of the rotation of the earth. As Dallas talked about in the Oct 21 dispatch, one of the consequences of being on a spinning earth is that when water moves it gets pushed towards the right (in the northern hemisphere) by the Coriolis force. The faster the water flows, the stronger this force. So let's think about what happens at the gap in the ridge between Greenland and Iceland as dense water reaches it from the north. Initially the water will start to flow down the slope into the Irminger Basin (keep in mind that the bottom slope isn't actually that steep; if it were above the water it would look like the side of a very long hill, not a steep cliff!). Now, as the water begins to flow down the hill it gets deflected to the right. Hence there is a competition between gravity, which wants to pull the water straight down the hill, and the Coriolis force, which actually wants to push the water back up the hill! If these forces were exactly equal then the water would stay on the side of the hill as it flowed to the south.
So how does the waterfall form? Believe it or not, it's because of friction. As the water moves along the side of the hill it rubs against the bottom". This slows it down just a bit, which means the Coriolis force becomes smaller and gravity starts to win the "battle of the forces". So in the end, the water progresses steadily down the hill, but NOT STRAIGHT DOWN. It takes a long time for the flow to reach the bottom. In fact, it doesn't reach the baseof the continental slope until near the southern tip of Greenland. In other words, the water fall extends nearly 400 miles. Kind of weird huh? This means that to see the entire water fall you would have to be looking from a long way away.
One other cool thing about this water fall---which in oceanographic terms is called an overflow. It gets stronger and stronger as it progresses down the hill. This is because it pulls in some of the surrounding stagnant water. So, by the end of its descent, it has become about five times stronger! This deep flow is crucial to our climate. We call it the "Deep Western Boundary Current". Remember that it is returning the cold water southward while the surface currents are bringing the warm water northward. So the Denmark Strait overflow is not only fascinating, it is vitally important to us!

If the deep cold currents get lighter, would one ever crash into a warm current flowing toward it? If yes, what would happen?
The simple answer to this is yes. But believe it or not, this kind of thing already happens in the ocean. We have been talking about the sinking of dense water that occurs in the northern seas (see the Oct 11 dispatch). Well, ocean water can become more dense by getting

colder or by getting more salty. In the waters to the north of Denmark Strait it is the cold air that chills the surface water and makes it more dense. But, in a warm climate, if there were enough evaporation and the water got salty enough, this could cause sinking as well. So both temperature and salinity play a role in how dense the water is. Therefore, in the ocean you can have a warm and salty blob of water be the same density as a cold and fresh blob, so they could sit side by side. Thus, a current carrying warm water could collide with a current carrying cold water---as long as the warm current is salty and the cold current is fresh.

Now let's consider the northward-flowing Gulf Stream, which everyone knows is a warm current. (Did you know that, even in the winter, the surface Gulf Stream can be 70 degrees F?) But the Gulf Stream is also salty and it extends quite deep. On the other hand, the southward-flowing Deep Western Boundary Current is cold and fresh, and extends fairly high off the bottom. Near Cape Hatteras, North Carolina, these two massive currents actually hit each other! More accurately, the lower part of the Gulf Stream collides with the upper part of the Deep Western Boundary Current. Some researchers believe that this collision actually helps change the course of the Gulf Stream and influences the way it behaves. So going back to the original question, if the Deep Western Boundary Current becomes warmer and less dense, it may become shallower and collide more directly with the Gulf Stream. This could cause some major changes in the ocean!

Last updated: December 8, 2008

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