March 9, 2006
Dr. Tom Wagner
Office of Polar Programs
National Science Foundation
Washington, D.C.
Dear Tom,
Greetings from the *N B Palmer*. It is the first sunny day we have had since arriving in the Weddell Sea five days ago and spirits of all aboard are high. Ice conditions in the northwestern Weddell Sea have, to date, been less than desirable, with 60% to 80 % ice cover and persistent northerly winds that move the ice at rates of up to a knot. Until today we have had to deal with heavy fog that has at times reduced visibility to a couple of hundred meters. Our first attempt at the outer shelf site (Proposed Site 6) was aborted after reaching 7 meters depth due to ice moving over the site. As was expected for our first site, it took a while to work the bugs out of the system.
After departing Proposed Site 6 we steamed westward to Proposed Site 4 where we found a lead in the ice and began lowering pipe. Again, we were forced to move off site due to a large ice floe. We did drill to a depth of 9.24 meters before abandoning the hole. We left the drill string in the water and maneuvered to a different location, approximately 2 kilometers from the proposed site, where we found another large lead in the ice. Working in heavy fog the captain and mates did a remarkable job of avoiding large floes and we were able to remain on this station for 9 hours. We drilled to a subbottom depth of 52.2 meters.
Our objective at Proposed Site 4 was to sample the thick glacial section that rests above a prominent shelf-wide glacial unconformity. Our seismic stratigraphic model indicates that this section is of Miocene age and we hope to test and refine this model so that the timing of initial ice sheet grounding on the continental shelf can be constrained.
This morning we moved back to our original Proposed Site 4 where the Quaternary overburden is much thinner. Again, ice floes caused us to abandon the site after reaching a sub-bottom depth of 11.2 meters. We did recover a small amount of sediment and are awaiting results from micropaleontological analysis of the material. In the three holes close to Proposed Site 4, we recovered 6.92 meters of core, in addition to bagged samples from non-cored intervals, containing glaciomarine sediments, but have not yet been able to date the section due to a lack of microfossils.
While the ice and fog have hampered our efforts over the past four days, we are excited to learn that modifications to the drilling equipment have greatly accelerated our drill time. At one point yesterday we were drilling at rates of

a meter every 5 minutes and core recovery was taking between 20 and 30 minutes. So, what we need now is a break in the ice. Our plan is to continue with the present drill and move operations until we get a low-pressure system moving into the area. That should blow the ice away from the coast and create better conditions for drilling. So, we continue to keep a watchful eye on the barometer and weather faxes.

Cheers for now,

John

See http://shaldril.rice.edu for more information.

March 16, 2006
Dr. Tom Wagner
Office of Polar Programs
National Science Foundation
Washington, D.C.
Dear Tom,
Greetings from the *N B Palmer*.
Much has happened in the week since I last wrote. We got a small break in the ice and weather conditions and were able to drill a site along the northern flank of the basin that was an alternate for our Proposed Site 2. The objective was to sample the late Eocene/Lower Oligocene. We drilled to a subbottom depth of 20.0 meters and retrieved 6.31 meters of core after the targeted interval was reached. Coring efforts concentrated on the lower part of the hole, beneath the younger glacial section. The cores recovered from this site contain muddy, very fine sand with abundant shell fragments and dispersed organic material. The paleontologists found diatoms and nannofossils that provide a tentative age of latest Eocene to early Oligocene. The sediments also contain abundant benthic foraminifera. Ice-rafted stones within the cores appear to be intra-formational in origin, indicating sea ice rafting. Our preliminary interpretation is that the strata at this site are inner shelf deposits.
We were very happy to find that our age model is correct, at least for this part of the section. The carbonate material in the cores shows little evidence of alteration, so we should be able to acquire

strontium isotope ages for the section. Also, the occurrence of organic material leaves us optimistic that there will be sufficient pollen and spores for palynological analysis.

We were forced to abandon Site 3 by ice floes. We steamed to another alternate location and reached a subbottom depth of 10 m, still within the overburden, before being pushed off the site by ice. After a few hours of surveying the area for more alternate sites we decided to check out ice conditions off Joinville Island, along the northeastern edge of the James Ross Basin, north of the ice edge. We conducted a seismic survey of the area and were delighted to discover a thick stratigraphic section, but were not able to tie the section to our data set to the south. We will acquire seismic data to connect the two study areas after we complete our drilling in the area. The area is mostly ice-free, with the exception of scattered icebergs and sea ice. In the early morning of March 15 we lowered pipe and began drilling our first hole at this site.

We have now been on Site 5 for over a day and have drilled to a sub-bottom depth of 28 meters. Several problems with drilling equipment occurred during the day, resulting in the relatively slow rate of penetration. The drillers think that some of the problems are related to collapse of the hole; the seafloor at this site is covered by a gravelly lag. Despite these frustrations, the site has proven to be well worth the effort. The paleontologists are confident that the older deposits sampled just below

the glacial overburden are of middle to late Miocene age. Middle Miocene is the time when the West Antarctic Ice Sheet underwent major expansion, having advanced onto the continental shelf in the Ross Sea. Efforts to sample middle Miocene strata on the northern side of the Antarctic Peninsula during ODP Leg 28 were unsuccessful, so the early evolution of the Antarctic Peninsula Ice Sheet has remained elusive. So, we are all excited about the prospects for this area and plan to spend the next few days sampling as much of the stratigraphic section as possible. The seas remain calm and drifting icebergs have, thus far, not posed a threat to our drilling efforts here.

Cheers for now,

John

Week 3

Dear Tom,

This has been a week of ups and downs for all onboard. When I last wrote we were at our fifth site, where we recovered 13 cores that sampled the middle Miocene section. Shortly after I wrote we sheared the drill pipe and were forced to abandon the site. The cause of the problem remains uncertain, but the best explanation is that strong currents resulted in the pipe being lowered at an angle, which resulted in weakness when we began drilling. The positive side is that we did recover good core that possibly records the earliest stages of glaciation in the region.

The next site we occupied was intended to sample the upper Miocene section. We drilled to a subbottom depth of 20 meters and, while having to abandon the site due to approaching ice before reaching the Miocene section, recovered a relatively thick interval of Pliocene sandy contourites. The cores contain abundant fossil material, both microfossils and invertebrates. We all remain baffled as to the source of so much well sorted fine sand. This could imply a warm interval within the Pliocene when deltas sourced the shelf.

We drilled a second site aimed at sampling the Miocene section and at this site the bottom hole assembly broke. At this point we decided the bottom conditions (abundant gravel near the top of the hole) were responsible for the equipment failure and departed the area. So, we found ourselves sailing back south, into the sea ice. After a day of

unsuccessfully searching for ice-free sites we decided to drill our Holocene site in the Firth of Tay. As it turned out, this was a good decision because the wind has been consistently in the 20 to 40 knot range for the past 24 hours. The good news is that a low pressure system is moving through the area and the winds have been consistently out of the north. So, we are hoping that this system is the one we have been waiting on to blow the ice around a bit, opening up some of our sites.

After several hours of multibeam and subbottom profiling we decided to drill a basin in the central part of the Firth of Tay where a relatively thick section of acoustically laminated sediments, estimated from seismic data to be greater than 50 meters thick, exist. The Kasten core at this site was the most organic-rich sediment I have ever encountered. When we opened the core just before breakfast the smell spread up and down the ship, damping our appetites.

We sampled to a subbottom depth of 75 meters before encountering unilithic gravels that are assumed to rest above the basement. Core recovery in the upper 20 meters was poor, due to the high water content of the sediment. Below this level we obtained about 90% recovery. We need to visit this site again and obtain a jumbo piston core of the upper 20 meters of section. The cores contain abundant organic material and macrofossils, so we are encouraged about the prospects for obtaining an excellent radiocarbon chronostratigraphy.

The wind is starting to diminish a bit, so we are

planning to go back south to our Proposed Sites 2 and 3 in the early morning. In the week remaining we intend to go all out in our efforts to core Oligocene and early Miocene strata.
Cheers,
John

Week 4

Dear Tom,

This is my last weekly report and what a week it has been. When I last wrote we were headed back into the Weddell Sea from the Firth of Tay to re-occupy our proposed site 2, which was intended to sample the Oligocene section. As we were steaming for the site location the winds increased to between 50 and 60 knots and we were forced to ³ride it out² for a day, drifting in the sea ice. During the night we were blown over 20 miles off our desired ship's track. Once the storm subsided we began assessing ice conditions in our proposed Oligocene sites. We finally found open water behind a large iceberg in the area of one of the sites. We lowered pipe and just as we were preparing to drill the berg began to drift away from us at nearly a knot. Within minutes the sea ice moved into the area and we were forced to shift the site to a new location. Again, we lost our window in the sea ice. At that point we were faced with a new low-pressure system moving into the area, so we elected to seek refuge behind Seymour Island, away from the concentrated sea ice.

Our objectives in the Seymour Island area were of a technical nature, intended to address several questions about drilling and sampling sedimentary rock while stabilizing the ship in fast ice. We searched for several hours for an area with fast ice, but without success. We finally occupied a site on the eastern flank of James Ross Island and began drilling. The weather deteriorated while on the site,

but the ship was able to hold station well in winds up to 45 knots and we were able to recover sedimentary rock for a long enough time to measure the rate of penetration and sampling. The rate of penetration was just under one meter per hour with about 50% recovery, but we did acquire good core.
On the morning of the 30th weather conditions seemed to be improving, so we pulled pipe and headed back out to the open shelf. Unfortunately, the front had not completely blown itself out and by evening we again found ourselves struggling in strong winds and rapidly drifting sea ice and icebergs. During this time we re-visited our Oligocene sites only to find them covered by drifting sea ice. In fact, at one point on the morning of the 31st the captain expressed concern that we were going to have problems getting out of the Weddell Sea. We steamed north and east toward Joinville Island to our final set of sites where we believed Oligocene and early Miocene strata are situated near the sea floor. In the early evening of the 31st we made our way to our preferred site and began lowering pipe. At this stage we had less that 12 hours of drilling time before we would have to head north. I must confess that I was beginning to think that we had missed our chance to sample the ever elusive Oligocene section. Everyone on board seemed totally committed to drilling this last site, despite the fact that we have had problems in this area with maintaining holes. You can only imagine the joy we felt when our first core came to the surface and we observed lithified muddy sand

in the cutter. The paleontologists onboard then presented us with the joyful news that we had indeed sampled Oligocene strata. We were able to retrieve about 3 meters of core before drifting sea ice forced us to abandon the site, just minutes before our agreed upon departure time. At one point a large iceberg threatened to cause us to abandon the site, but some very skilled ship operating by Captain Scott Dunaway bought us the time needed to reach our drilling target. There was a lot of jubilation onboard during the night and early morning and a feeling that we had in the final hours achieved one of our most important objectives. This was our home run in the bottom of the ninth.

Over the next few weeks and months we will all examine and re-examine the success of SHALDRIL. Here is my initial assessment. First, the ice conditions we encountered this year were the worstcase scenario, thick multiyear ice drifting at rates that were totally unpredicted from our knowledge of currents in the area. As a result, we did not core at any of our initial proposed sites, yet we sampled every one of our stratigraphic targets. The fact that SHALDRIL is so mobile enabled us to improvise and overcome bad weather and severe sea ice conditions and exploit alternate sites. We even had to acquire additional seismic data to locate back-up sites in areas we never expected to visit. Our longest penetration was 50 meters, but we were able to move onto location and acquire several meters of core in the most adverse of conditions. Our drill and run

strategy has certainly proved viable.
The older time intervals we have sampled (latest Eocene-earliest Oligocene, Oligocene, middle Miocene, and Pliocene) are all poorly represented in the outcrop record and the SHALDRIL cores will undoubtedly reveal much about the climate and glacial evolution of the Antarctic Peninsula. We have collected two excellent, expanded Holocene records (Maxwell Bay and the Firth of Tay) that will provide regional coverage needed to better understand Holocene climate evolution. Only one Holocene site was listed in our original proposal. We were not able to core continuously a grounding zone wedge (our proposed Site 5). This simply was not possible given the limited time we had on any given station. I feel particularly bad about this because there was considerable interest in this site on the part of the glacial geology community and it was Julia Wellner's favored site. No one has worked harder than Julia to make SHALDRIL happen and she did not get her prize. But I know that Julia, Woody Wise, Steve Bohaty and Pat Manley all agree with me that we have accomplished a great deal during this cruise and we are all excited to see what the palynologists and other experts are able to learn from SHALDRIL cores.
In addition to the scientific accomplishments, we have tested the ship and the drilling and coring systems under the most adverse conditions and have gathered considerable data for planning futures SHALDRIL cruises. The ship is capable of holding station in winds up to 45 knots, our hope was to be able to

maintain station in 30 knots winds. The drilling rig is capable of penetrating up to 20 meters of glacial overburden and sampling older strata within 24 hours time. Core recovery is less than we had hoped for in glacial sediments, but we never had time to really utilize the full spectrum of tools available for this type of work. Core recovery in partially lithified sedimentary material is quite good (greater than 80%). Drilling in sedimentary rock is a bit slower than we had hoped, but the information we have gathered will enable us to make realistic estimates for future SHALDRIL projects.

The ultimate assessment of SHALDRIL will come after the science is done. As for me, I think it has been a success, but I can't help but wonder just what we would have accomplished had we had a good ice year.

Enjoy your cruise.

John