RV SONNE – SO296/2

21.01.2023 - 21.02.2023

Talcahuano (Chile) - Talcahuano (Chile)

4th Weekly Report (06. - 12.02.2023)

Until noon on February 8, we continued our work in the 2nd working area, Golfo Almirante Montt. In doing so, we set particular priorities according to the previous findings. The first section along the western side of Golfo Almirante Montt (Fig.1 red line) showed that the northern basin had significantly lower oxygen concentrations compared to the southern basin (Fig. 2 top left), but was still about 15% oxygen saturated and not completely oxygen free as reported in previous work. Another surprise was the occurrence of methane in the open water and methane seeps on the seafloor (Fig. 4).

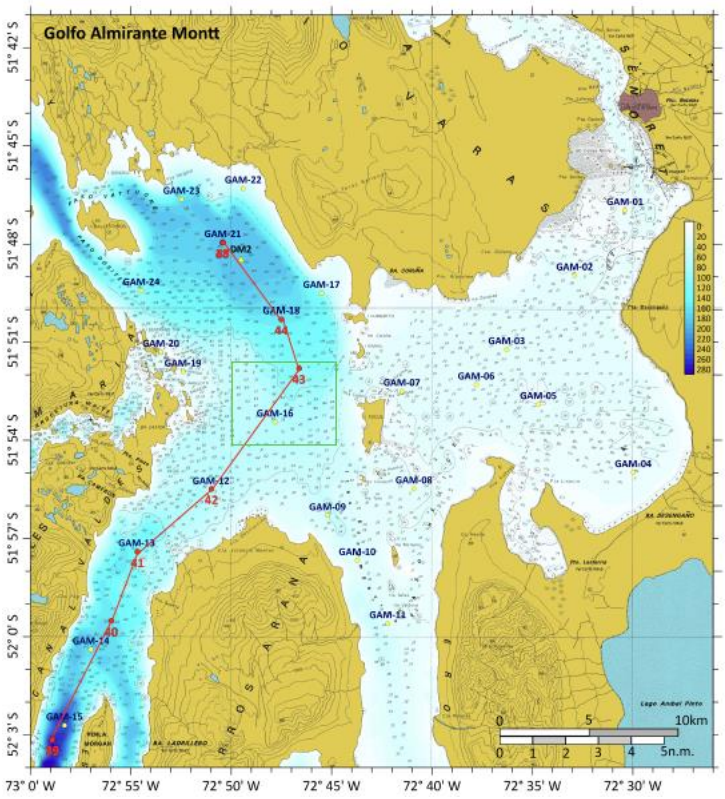

Fig.1: Map of the Golfo Almirante Montt. The red line shows the profile for the measurements of oxygen and nutrients from the northern to the southern basin. The green box shows the section where leaks of methane, so-called pockmarks, were found on the seafloor and mapped. Map: V. Mohrholz

The eastern part of Golfo Almirante Montt is very shallow and mainly influenced by glacial waters to the northeast. A short gravity core of 3.5 meters was taken there, which includes a low thickness Holocene sequence and late glacial deposits. The two western basins are separated by a sill. The Angostura White flows into the northern basin and Canal Kirke flows into the southern basin. The southern basin, Canal Valdes, is very deep and more elongated. To better understand the exchange between these two basins, a profile was measured across the sill with the microstructure probe for four hours on February 7. Oxygen concentration, turbulence, turbidity, and the strength and direction of currents were determined. High-resolution gas and nutrient profiles were also measured with the pump CTD in each of the two basins and at the northern edge of the sill (Fig.3).

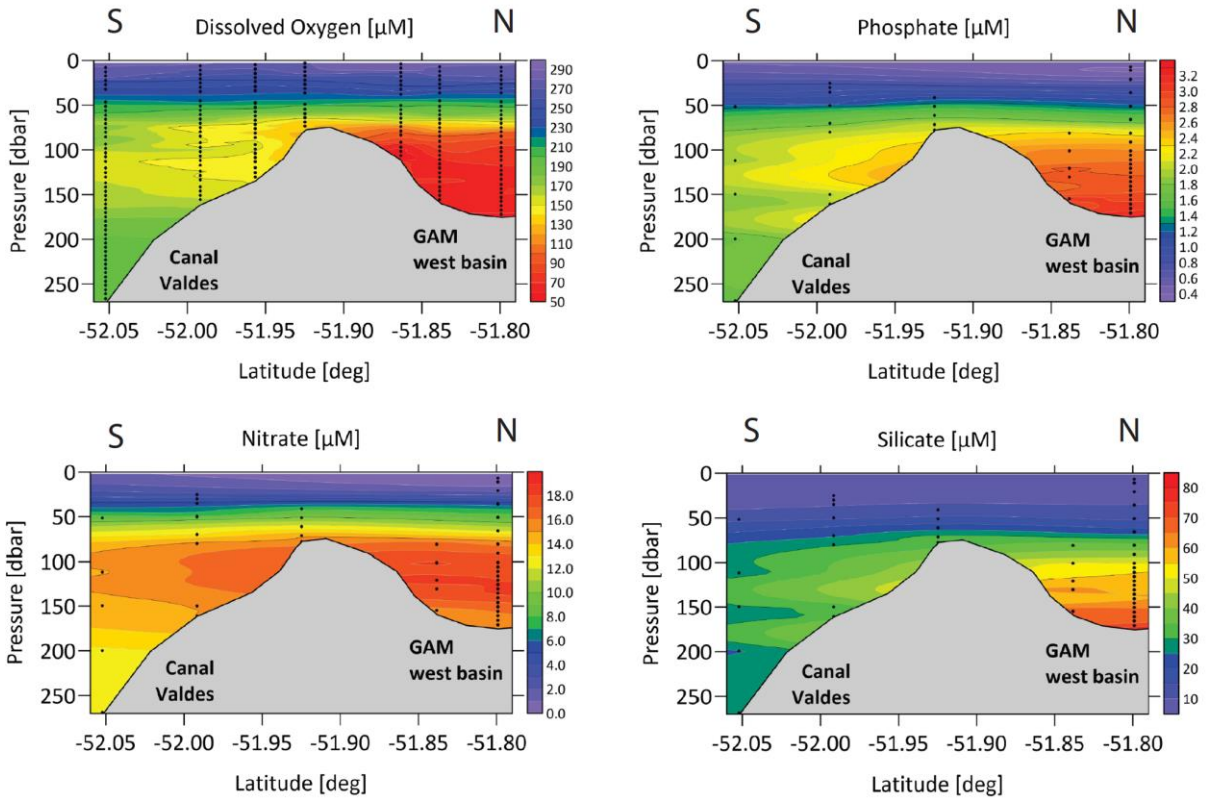

Fig.2: Oxygen and nutrient profiles along the profile in Fig.1. The northern basin has not only lower oxygen concentrations but also significantly elevated nutrient concentrations compared to the southern basin, Canal Valdes. Data: C. Burmeister, V. Mohrholz

At 7 stations along the transect shown in Figure 1, samples were taken with the rosette to determine nutrient concentrations. This revealed that the water of the northern basin was not only depleted in oxygen, but also had significantly elevated concentrations of nitrate, phosphate, and silicate. This shows that the northern basin of Golfo Almirante Montt, despite its remote location, is significantly eutrophic and thus could possibly tip over into an oxygen-free situation as we know it from the deep basins of the Baltic Sea. To what extent this eutrophication is of natural origin or caused by the small town of Puerto Natales in the northeast of the fjord and by the numerous fish farms along the coast cannot be conclusively assessed with the current data.

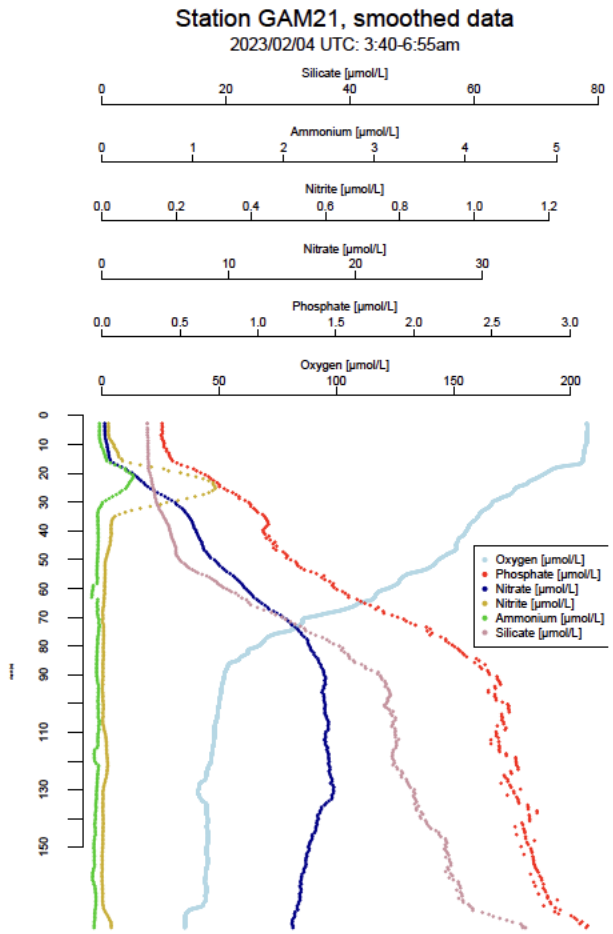

Fig.3: Example of a profile with the pump CTD at the main station GAM-21: One can clearly see the release of silicate and phosphate from the sediment and an incipient depletion of nitrate in the lower water layers. A small peak of ammonium and nitrite at the surface probably occurs as organic material decomposes, but over most of the water column, concentrations of both nitrite and ammonium, as well as sulfide, are below detection limits. Thus, toxic substances are not yet accumulating in this basin under current conditions, despite the low oxygen concentrations. Data: C. Burmeister and J. Fabian

The recovery of the drifter, which had been converted to a mooring, with it's attached sediment trap had to be postponed due to difficult weather conditions with partly heavy squalls. Fortunately, we were able to take advantage of a short, somewhat windless period in the afternoon of February 6 to recover the mooring without damage. After that, we could finally start sampling the sediment at the main station GAM-21 with multicorer and gravity corer, which we had postponed while the sediment trap was still in the water. At this station again a very long sediment core of over 17 m was recovered.

As a final survey before we left Golfo Almirante Montt, another mapping of the seafloor was done with hydroacoustics. This was to get a better idea of the area at the sill that carries methane into the fjord via outgassing from the deeper subsurface (Fig.4).

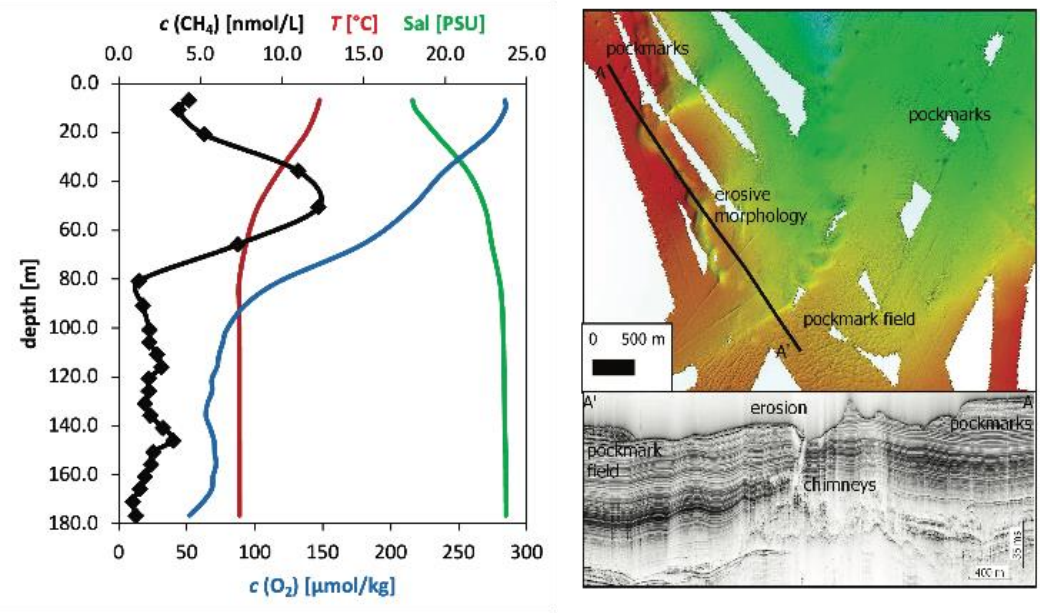

Fig.4: Left: Methane concentration in the water column of the main station GAM-21. Right: Sediment surface with outcrops of methane (pockmarks) on the sill between the basins. The section corresponds to the green box in Fig.1. Data on the left: S. Iwe and O. Schmale, right: P. Feldens and S. Papenmeier.

In the early afternoon of February 8, we left Golfo Almirante Montt again via Angostura White and set course for Punta Arenas for another exchange of scientists before the third leg of our expedition. We reached Punta Arenas late in the evening of February 9, where 14 scientists disembarked and 6 came aboard. In the early afternoon of February 10, we set out for the third work area, the Canal Concepcion/Canal Wide/Seno Eyre fjord system, which we reached in the early morning of February 12. There, after hydroacoustic mapping of the subsurface, the first station was selected to be sampled with the rosette since noon followed by sediment sampling later in the day.

Fig.5: View over Punta Arenas at departure on 10.2.2023. Photo: T. Heene

Greetings on behalf of all participants,

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