Hydrological and hydrochemical characteristics of modified AABW in the Discovery Gap (Northeast Atlantic) in 2021

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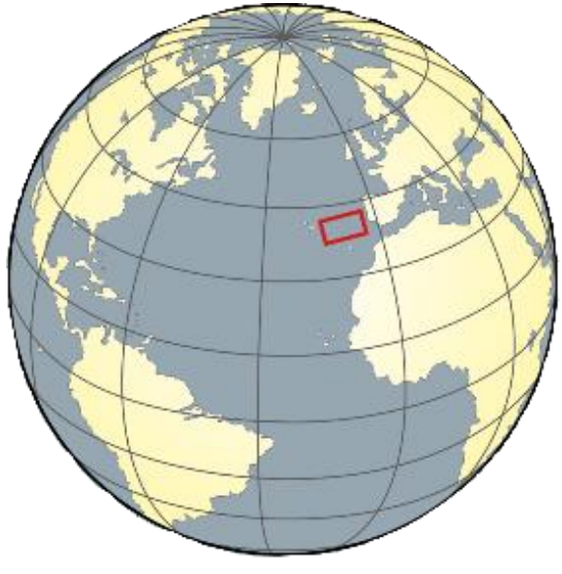

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Introduction

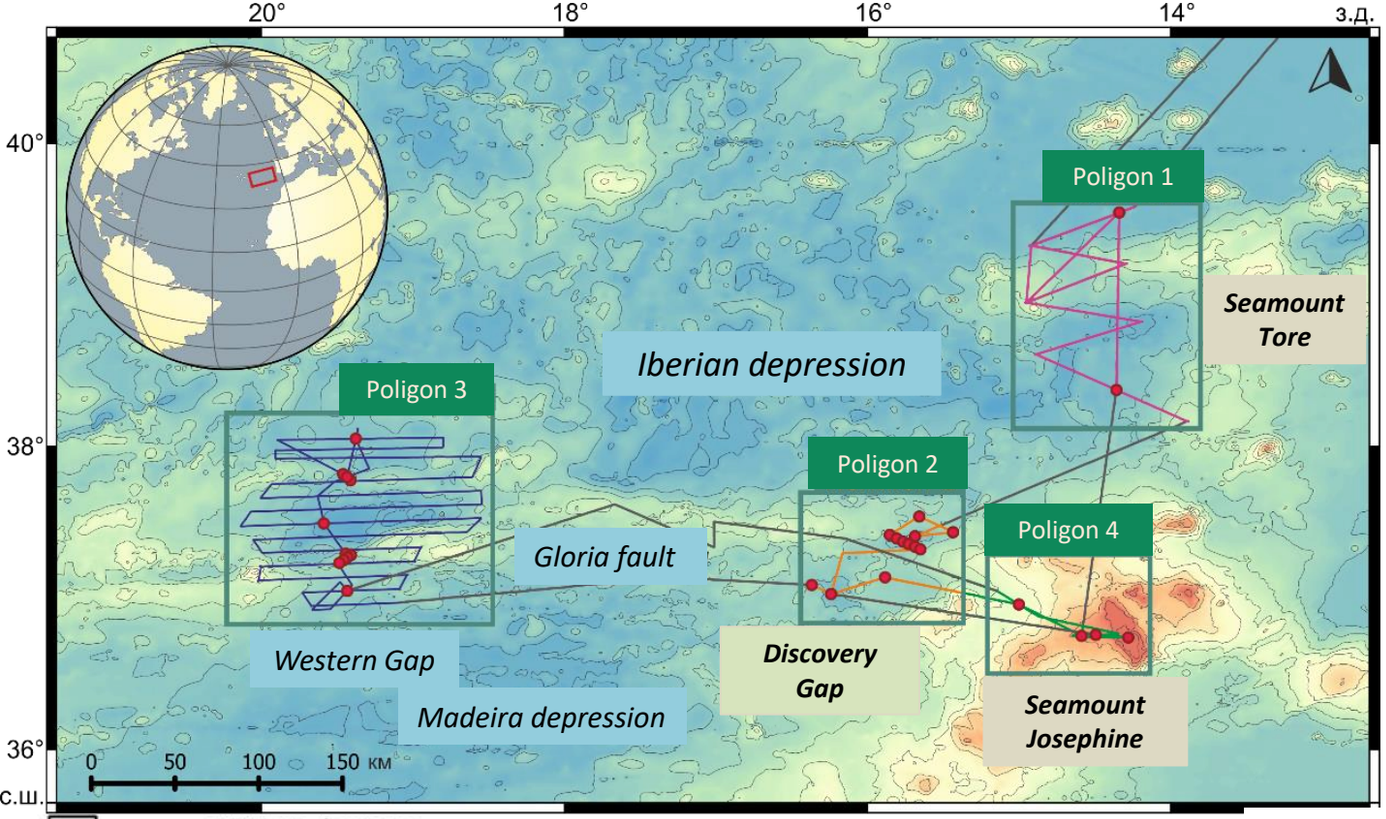


Fig. 1 – The area and types of expedition work in the 59th cruise of the Akademik Ioffe PS (Kuleshova L.A.)

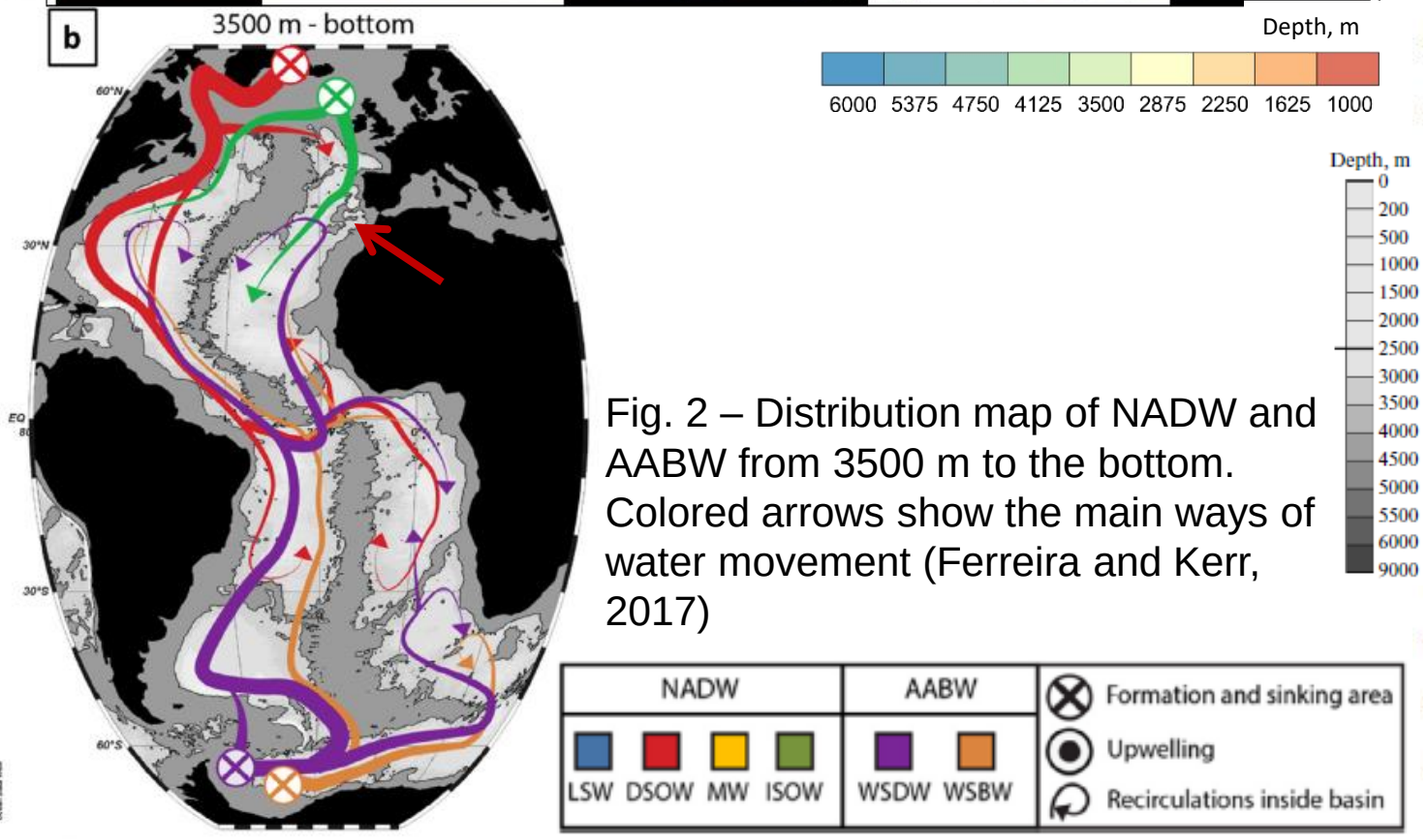
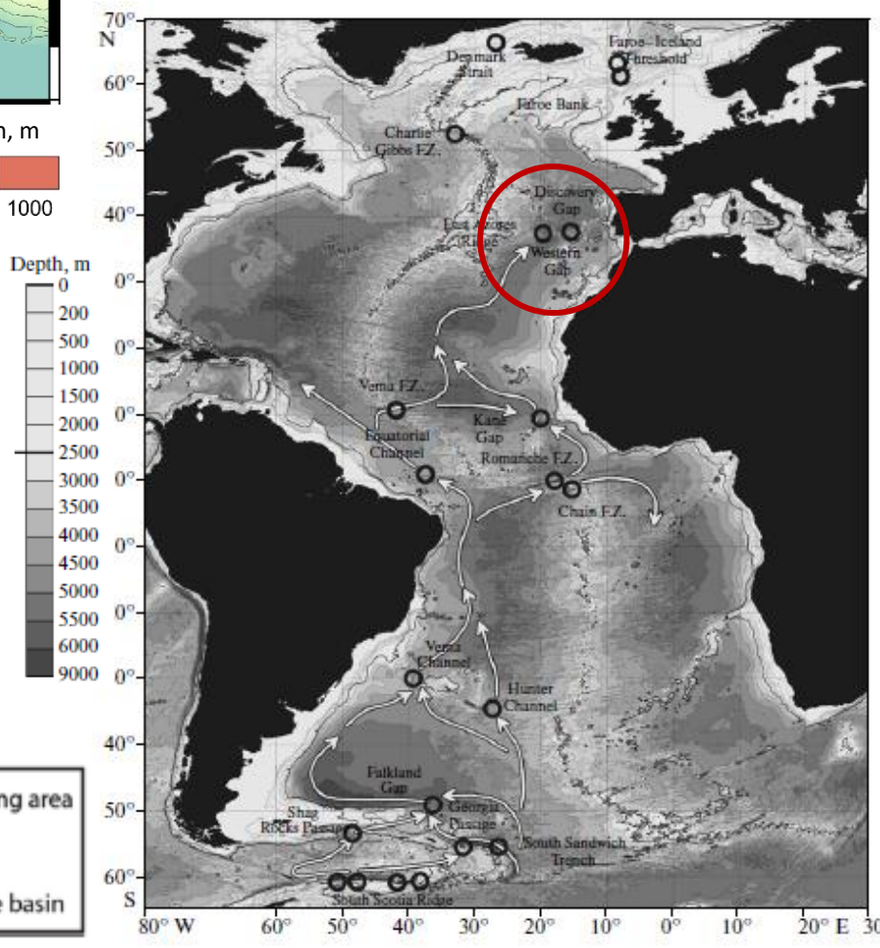


Fig. 2 – Distribution map of NADW and AABW from 3500 m to the bottom. Colored arrows show the main ways of water movement (Ferreira and Kerr, 2017)

Fig. 3 – Scheme of distribution of Antarctic bottom water in the Atlantic (Tarakanov et al., 2013)



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The purpose of the study: description of the hydrological and hydrochemical characteristics of AABW in the Discovery Gap.

Main characteristics of AABV:
- potential temperature < 2°C.
- low salinity (34.785)
- low concentration of dissolved oxygen (5.6–5.8 ml/l)
- high silicon content (50–55 µg-atoms/l) (Wust at al., 1936; Sarmiento at al., 2007)

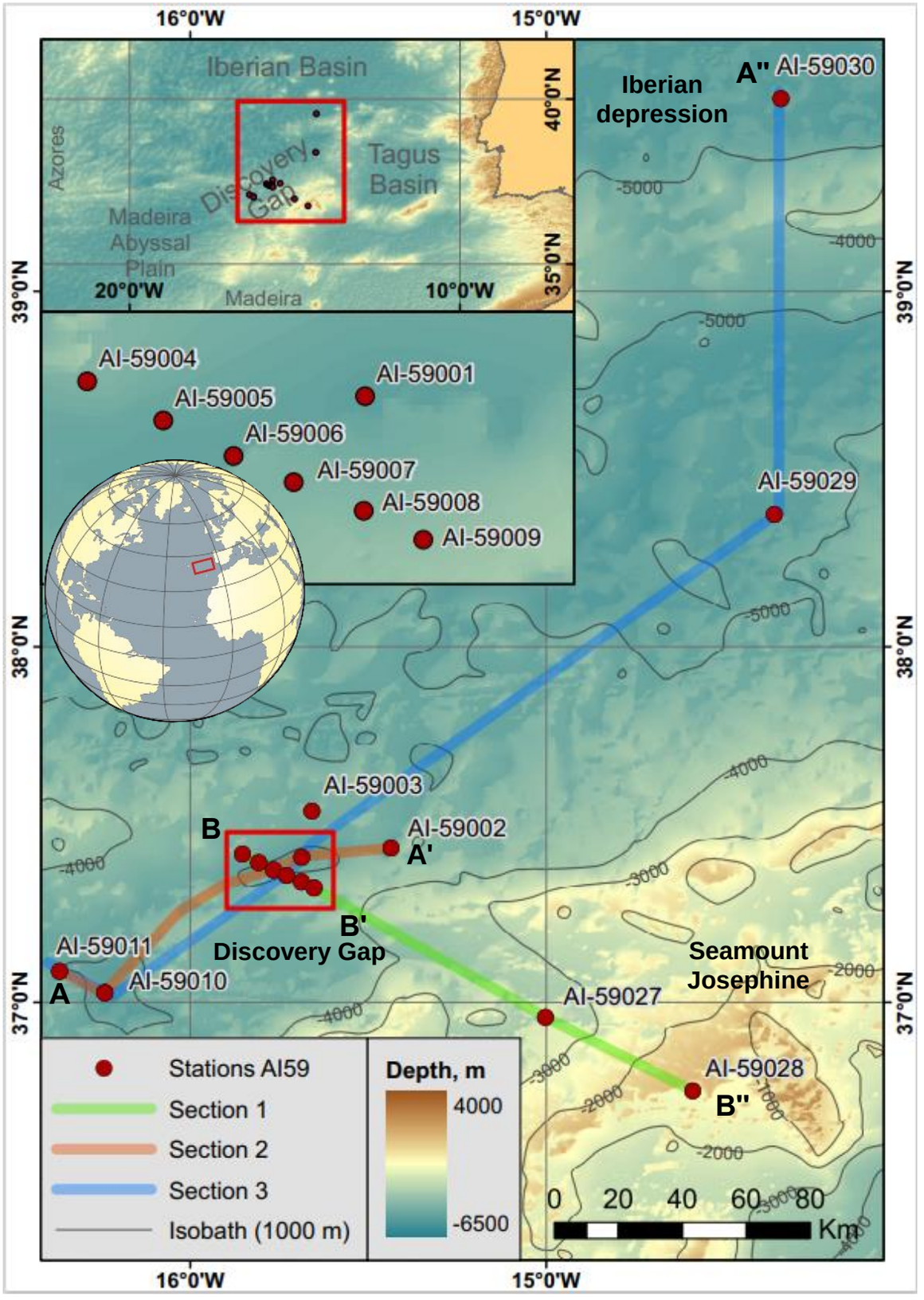
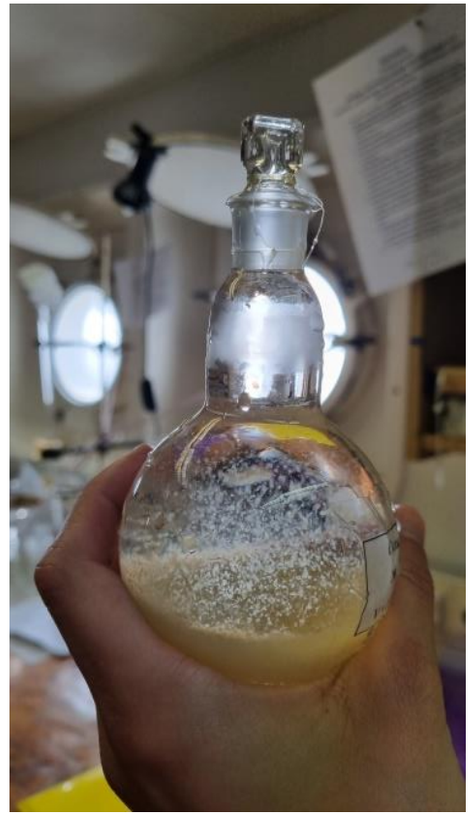
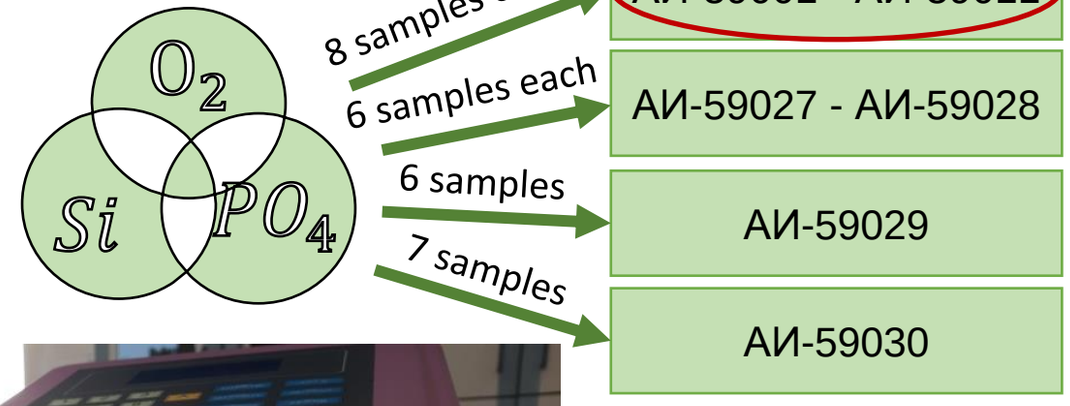


Fig. 6 – A map of the study area on research cruise AI59 (September 24 - October 15, 2021) (Gmyrya E.I.)

Methods

- dissolved **oxygen** - Winkler's method;
- dissolved **phosphorus** - Morphy-Riley method;
- **silicon** - Korolev's method (Bordovsky, Chernyakova, 1992);
- **temperature** - multiparametric hydrophysical explorer SBE 19plus
- **currents** - LADCP RDI Workhorse Sentinel





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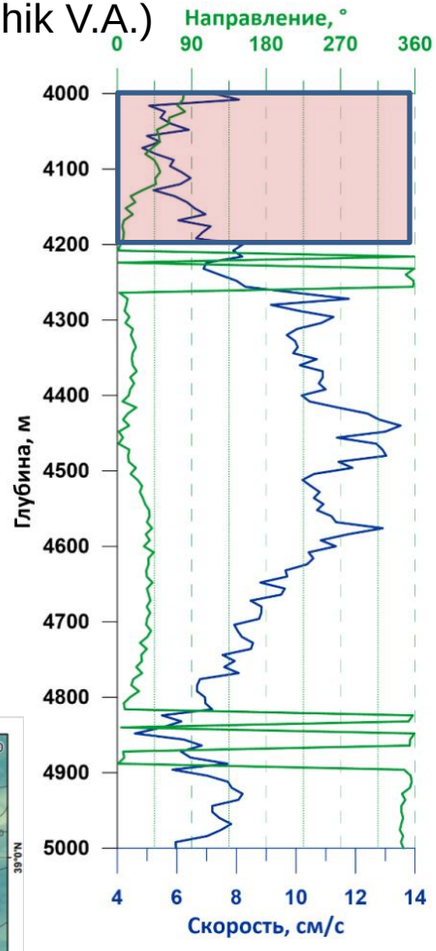
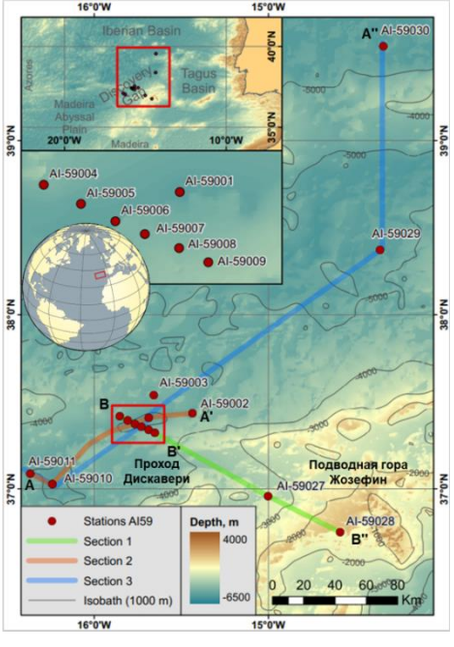
Results and discussion

Fig. 7 – Graph of the distribution of the direction and velocity of the currents by depth at the station AI-59011 (Krechik V.A.)





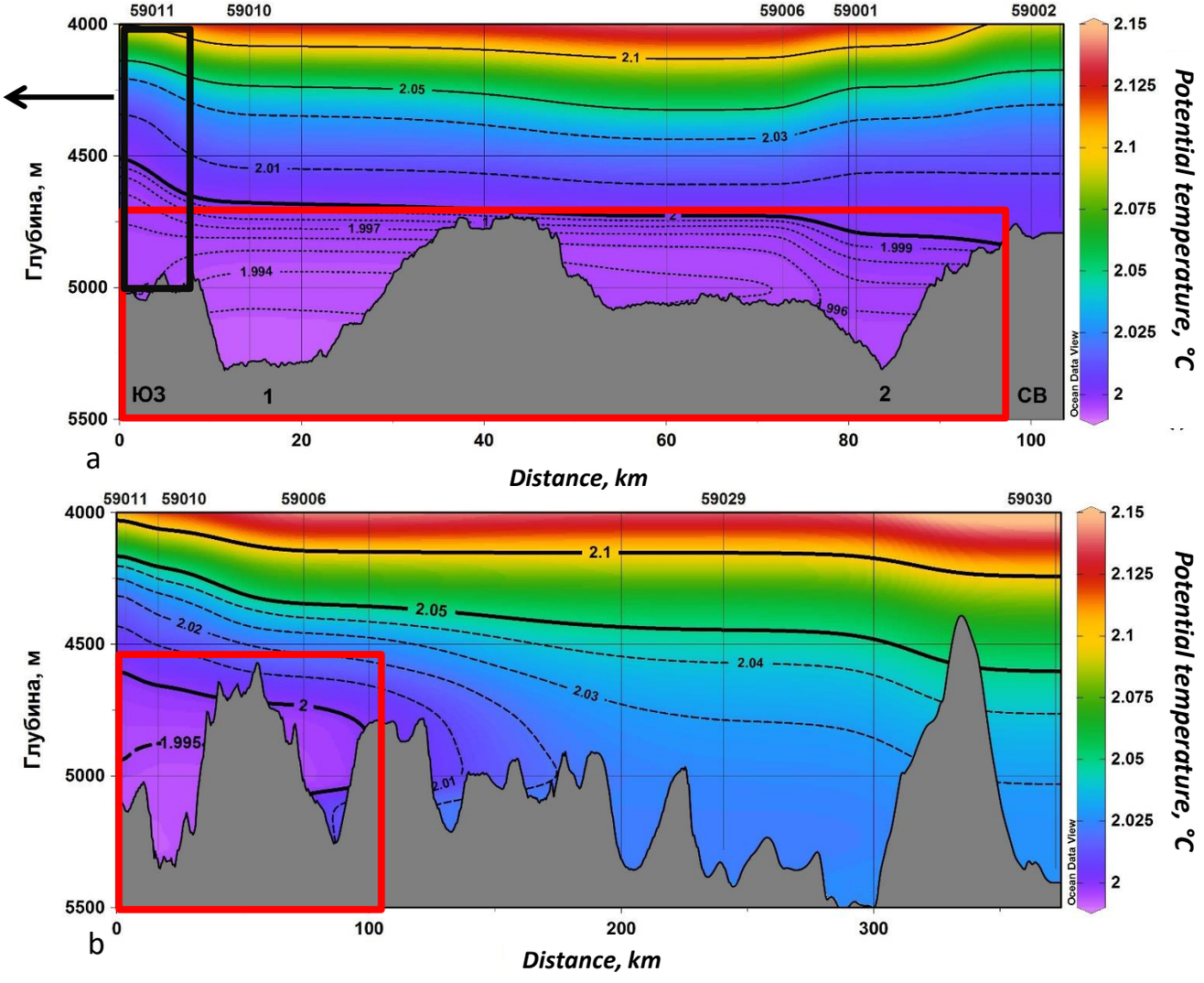


Fig. 8 – Hydrological sections AA' (a) и AA'' (b) with temperature distribution along the depth from southwest to northeast (Kapustina M.V.) performed in the period from 24.09.21 07:55 to 13.10.21 22:08

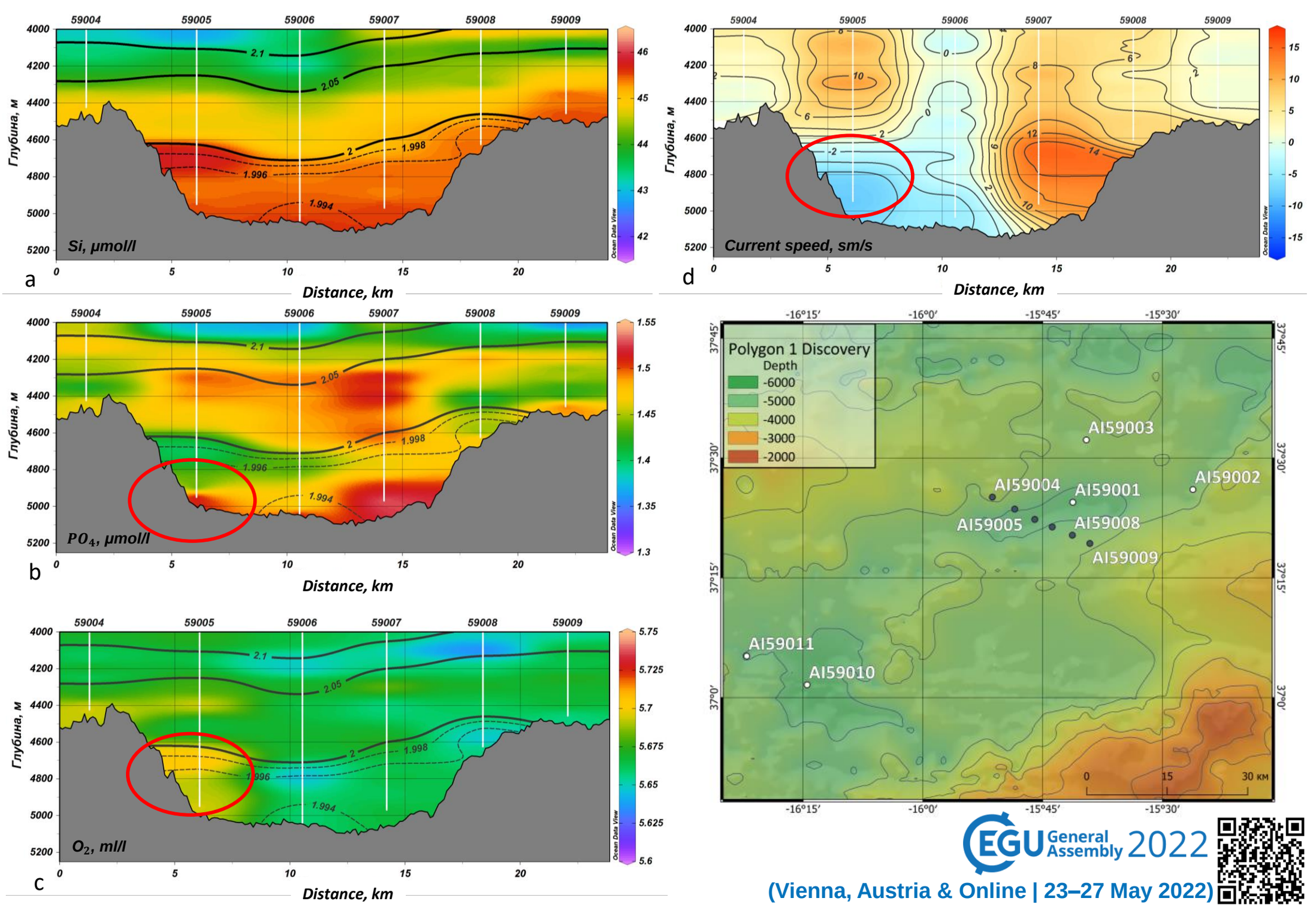


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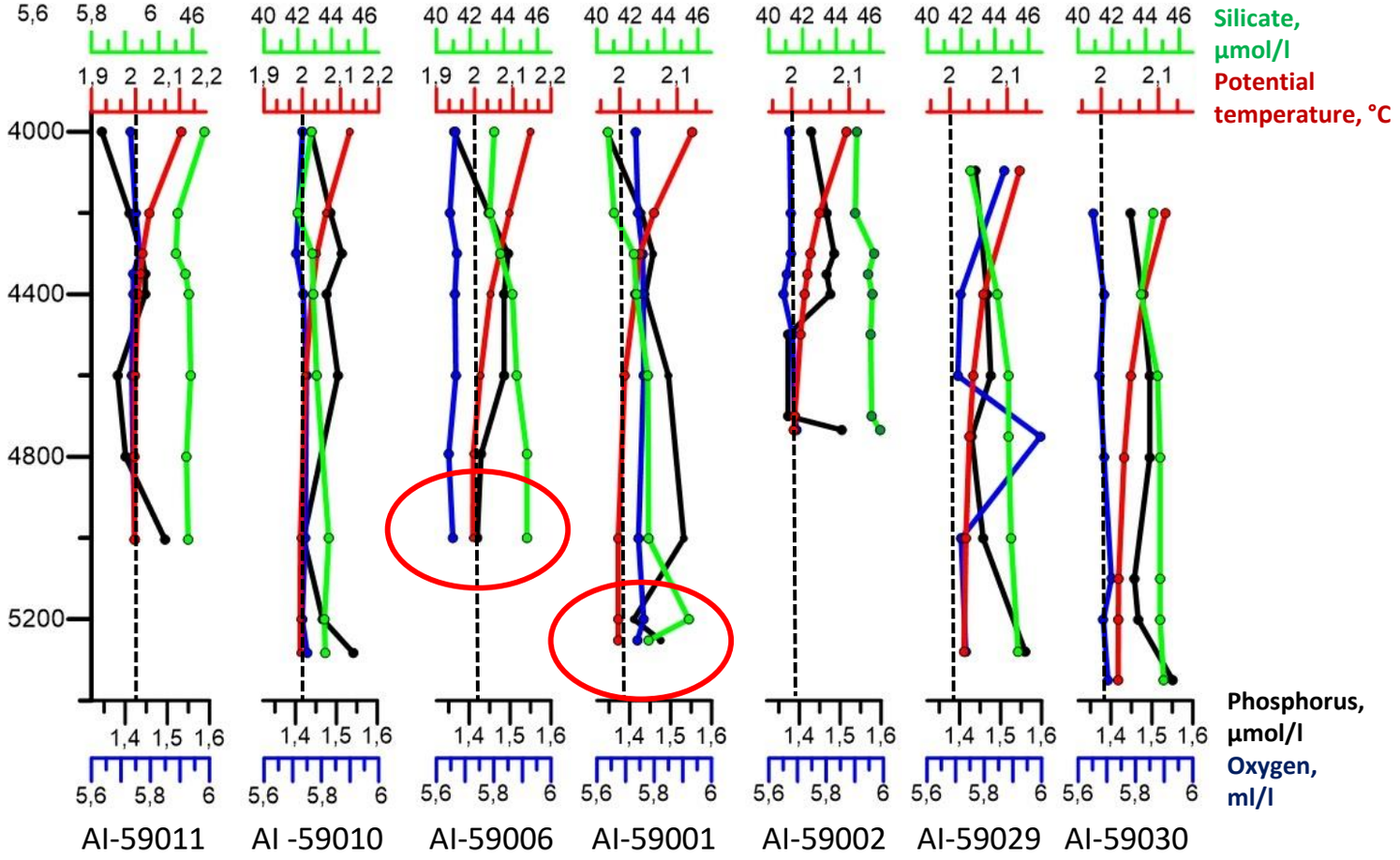
Fig. 9 – Hydrochemical cross-sectional sections of the northeastern part of the Discovery Gap with the distribution of potential temperature, silicon (a), phosphorus (b) and oxygen (c) and the speed and direction of currents (d).



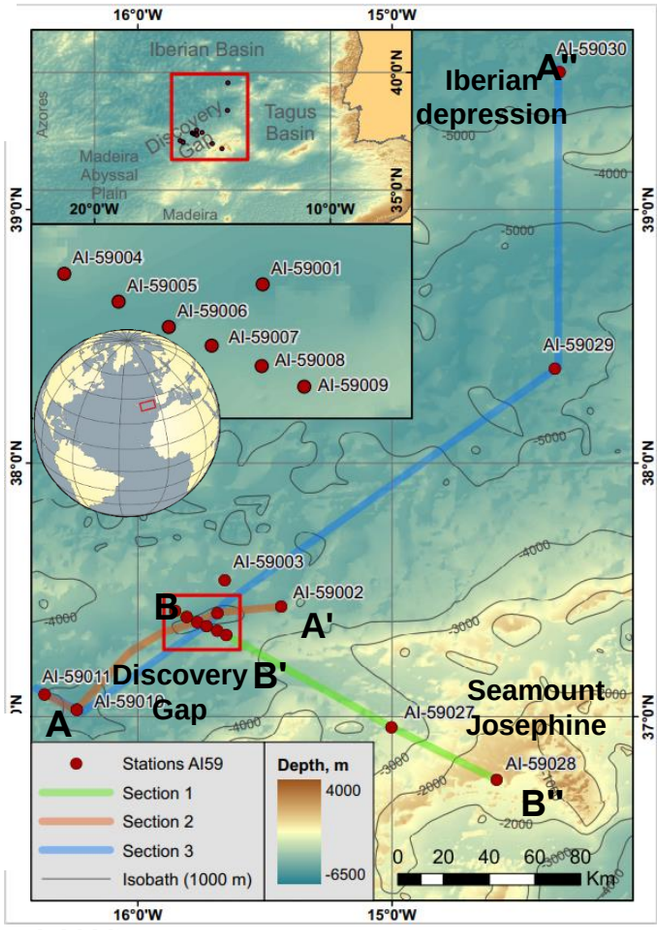
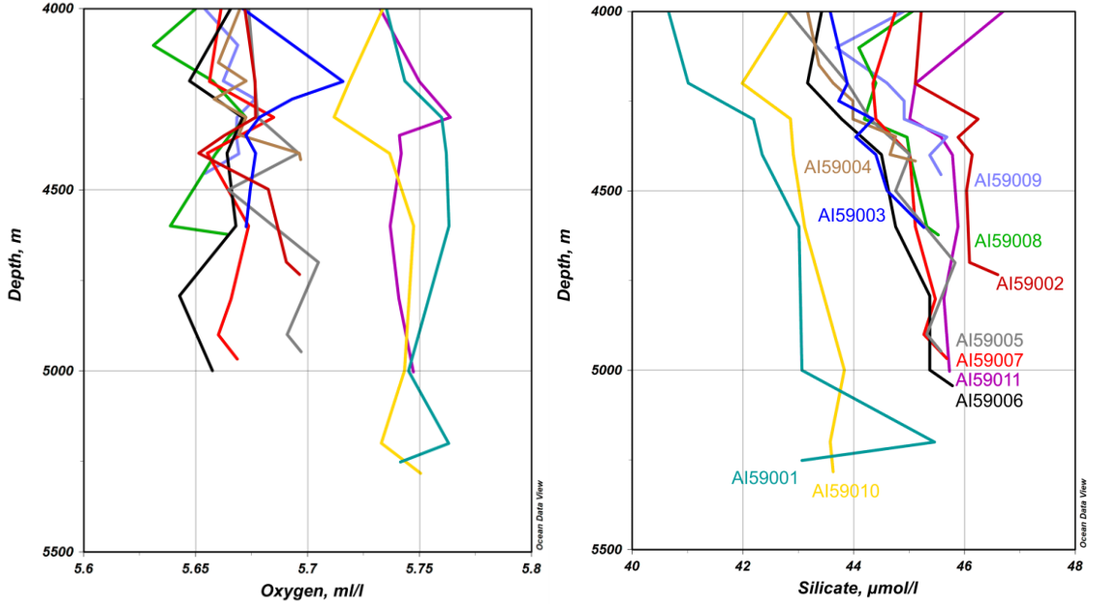


Fig. 10 – Distribution profiles of temperature, oxygen, silicon and phosphorus along the section AA'A'' (September 24 – October 15, 2021) (Bocherikova I.Y.)



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Findings

1. The presence of water with a potential temperature of less than 2°C and a high content of silicon has been confirmed (до 45.58 µmol/l).

2. Advective processes in the cross section of the narrow part of the Discovery Gap, recorded by the current meter, are also reflected in changes in the concentrations of phosphorus and oxygen. High concentrations of phosphates are located in the outlet current along the northern slope, while low concentrations are located in the inlet. At the same time, the concentrations of phosphorus near the bottom increased throughout the section. For oxygen, the opposite pattern can be observed.

3. In the deep-water basins of the Discovery Gap (AI-59010, AI-59001) were recorded, the content of dissolved silicon (difference is about 2 µmol/l) and the high content of oxygen (0.075 ml/l) compared to other stations of passage.

4. According to the obtained temperature measurements in the southeastern part of the Iberian depression (stations AI-59029, AI-59030), AABW is not found in the bottom layer. This is evidenced by the absence of potential temperatures below 2°C, as well as the concentration of silicon and phosphorus, as well as high oxygen concentrations.

5. The distribution of Antarctic bottom water ends at the northern exit threshold of the Discovery Gap. It is characterized by high concentrations of silicon, but other hydrochemical parameters are influenced by local currents.

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