New GEOTRACES or GEOTRACES relevant scientific results

- The new results of the Black Sea and Marmara Sea DeepRedox project Cruise (funded by TUBIRAK) held winter of 2020 is given below.

The Black Sea and Sea of Marmara are the two ideal oceanographic study sites to understand the shelf to deep-sea redox gradient, biogeochemical processes, trace metal cycling, burial, and transport. The Black Sea contains one of the world's largest permanent anoxic deep seawater and oxic/anoxic interface of the shelf to basin-wide. Besides, the Sea of Marmara is recently deoxygenated due to climate forcing, anthropogenic artifacts, and eutrophication. The critical deoxygenation of the Sea of Marmara represents the oxygen minimum zone (OMZ) extending the 1000m depth. More to that, the Sea of Marmara is recently under the impact of thick mucilage among its surface and deep seawaters that could intensify organic matter burial, deoxygenation, or presence of the sulfidic deep waters. Therefore, these study sites are the primary concern of the national activities to understand the redox gradient of seawater, nutrients, and redox-related trace metal cycles.

In that regard, seawater and sediment core samples were obtained from 90 and 9 stations, respectively in the Sea of Marmara and the Black Sea (Fig. 1). More to that, nano gold/amalgam sensör attached to Analytical Instrument Systems (AIS ISEA X) brand and model situ system was applied to measure real-time in situ oxygen and hydrogen sulfide if available. The core samples were collected about 50-60 cm in height without disturbance of the sediment-water interface. Each core was sectioned, sliced and porewater extracted from the solid phase and

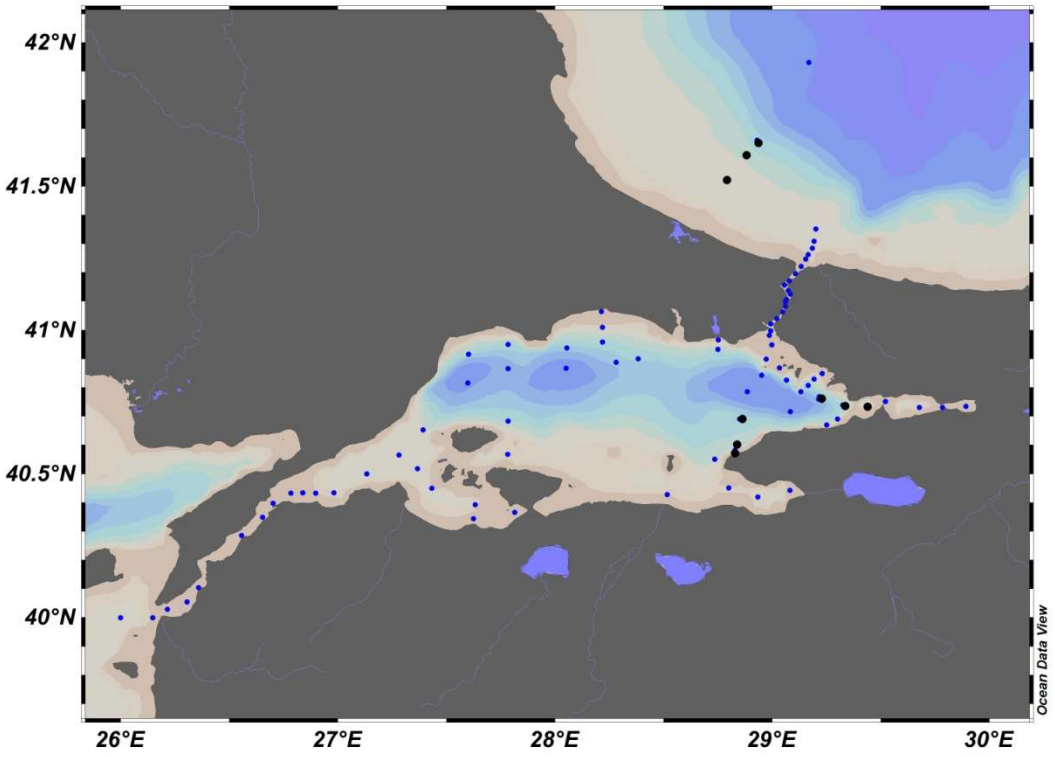

Figure 6. *The stations of the winter cruise in the Black Sea and the Sea of Marmara; blue dots represent only sampling of seawater; black dots represent sampling of core and seawater.*

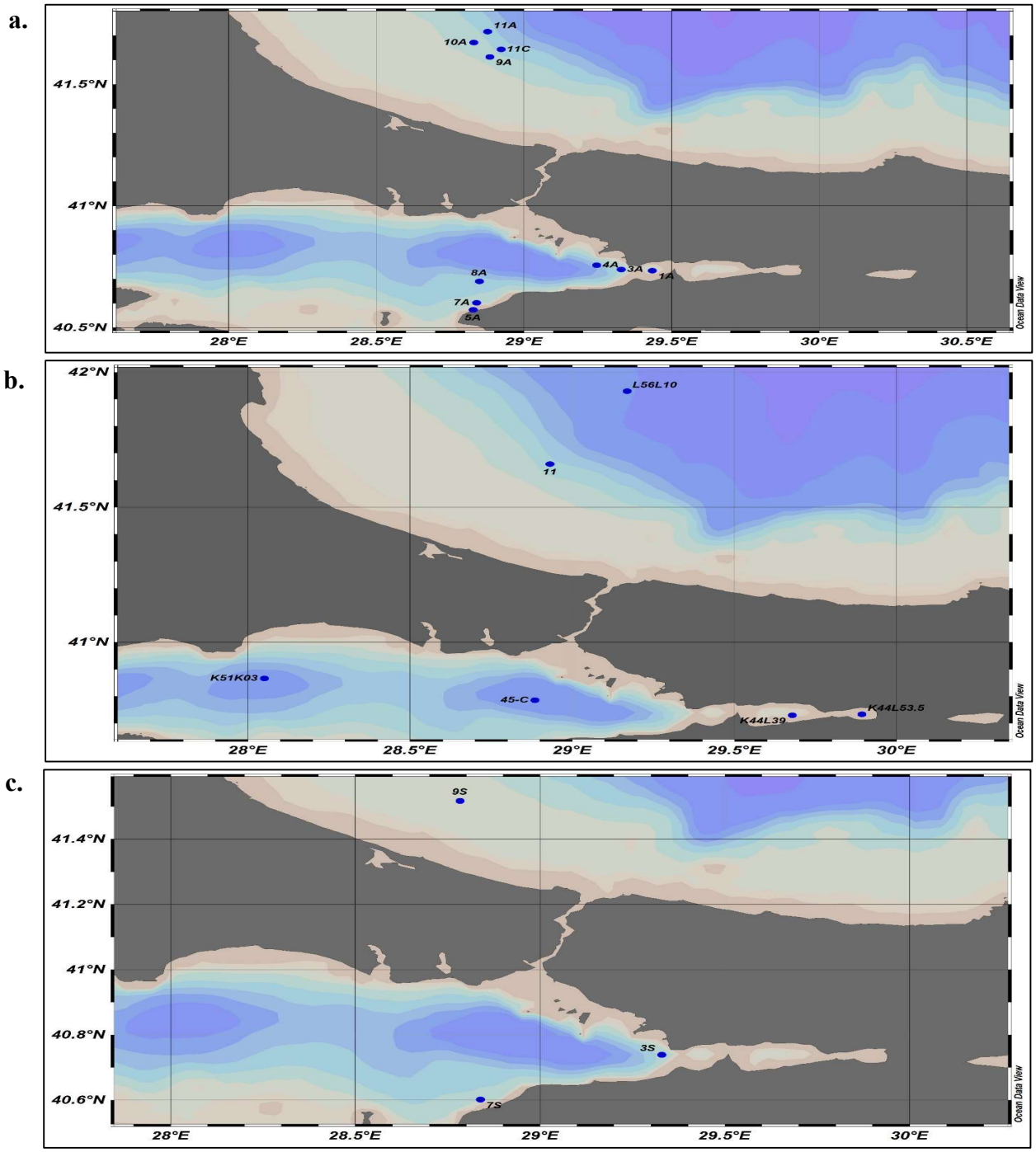

Figure 7. *The core samples collected at stations of winter cruise 2020, a. Fe and dFe of the porewater were measured at 9 stations , b. Fe of the seawater were measured at 6 stations, c. Fe size fractionation of porewater were held at 3 stations*

frozen for laboratory analyses. The total iron, dissolved iron(dFe), and dissolved were measured onboard. Iron size fractionation and seawater iron measurement were held at the selected stations on board. The collected seawater, porewater, and solid samples were subsampled for hydrogen sulfide, trace metals, nutrients, and other major ions (Cl, SO4, Li, Na, K, Mg, Ca) on the campus. Also, the core samples were collected separately for microbial analysis under sterile conditions and frozen immediately.

The porewater Fe and dFe were measured at 9 stations, whereas Fe seawater measurement and Fe size fractionation were held at 6 and 3 stations, respectively (Fig. 2). The porewater subsamples for Fe were spiked with HCl immediately after extraction. The porewater Fe and dFe were measured by the liquid-core waveguide spectrophotometry and Ferrozine method

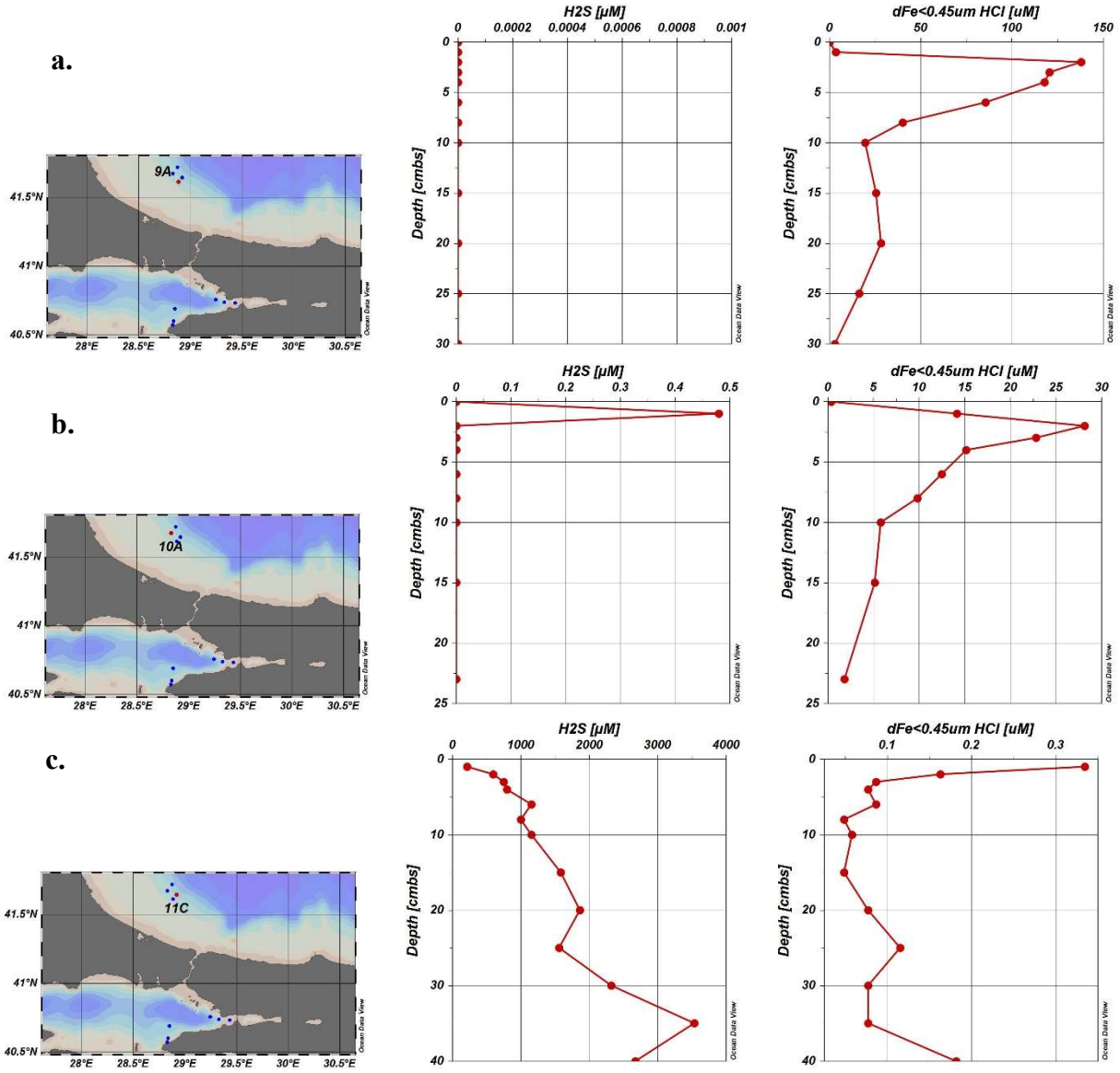

Figure 8. *The Black Sea oxic shelf to deep sulfidic sediment transition, H_2S(µM) and dFe (µM) concentrations a. in the oxic station, b. suboxic station, c. sulfidic station.*

with 50cm optical path length capillary cuvette. All of the subsampling and analysis for Fe detection were practiced with pre-acid cleaned glassware and apparatus and ultra-pure chemicals under trace metal-free conditions on board. The detection limit was 18nM for onboard the liquid core waveguide spectrophotometric analysis. The calibration curve had R2 = 0.9983. Fe size fractionation of porewater was syringe filtered with 0.45 µM nylon membrane, 0.20 µM polycarbonate membrane, and 0.02 µM Anodisc membrane. Each filtrate was subsampled then spiked with HCl and HNO3, separately. The results display the oxic to sulfidic transition from shelf to deep seafloor of the Black Sea and deoxygenation of the Sea of Marmara. The dFe of the oxic Black Sea shelf sediment is times more than the sulfidic basin sediment(Fig. 3).

The deoxygenation of the Sea of Marmara is confirmed with the findings of this study. More to that, the H_2S measured at the sediment-water interface at 2 µM level displays the oxygen minimum zone transition in the İzmit inlet located the eastern Sea of Marmara (Fig. 4).

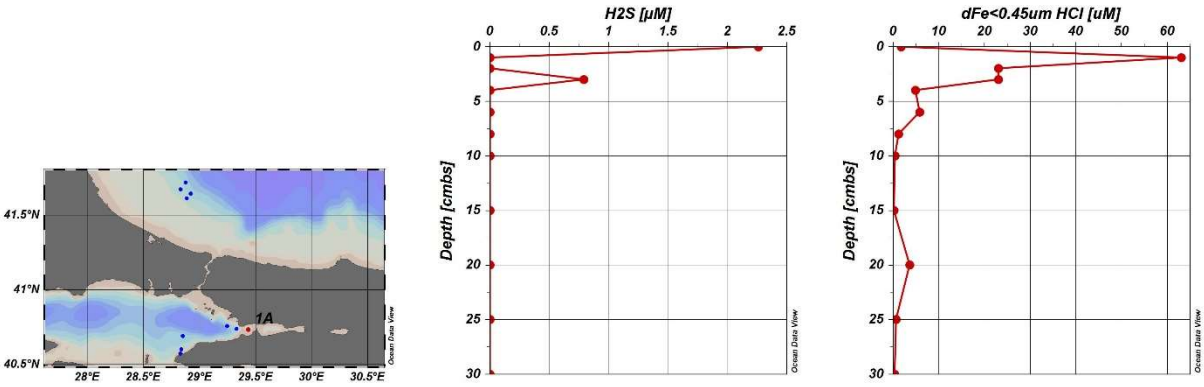

Figure 9. *The H_2S (µM) and dFe (µM) distribution through the sediment column from the İzmit inlet of Sea of Marmara.*

The main findings of the study are the high dissolved iron concentration and fluctuation in the oxic shelf sediment compared to sulfidic sediment. The iron compounds mainly in the dissolved form of the total iron fraction in the sediment, which highlights the importance of the nano-sized iron compounds. The size fractionation of the Fe compounds is mostly linked to its diffusion rate of vertical transition and the surface adsorption capacity of other trace metals and phosphorus. Hence, the high dissolved fraction of iron in the oxic shelf could create nanoparticle accumulation of Fe and Fe-derived microbial life.

GEOTRACES or GEOTRACES relevant cruises

- Black Sea and Marmara Sea Redox Cruise held winter and summer of 2020 with R/V Bilim-2. Fe in the sediment core measured on board with Ferrozine method at nanomolar level.

New projects and/or funding

- EU H2020 BRIDGE-BS consortium project, coordinated by METU IMS has been launched. The project aims to advance Black Sea marine science and innovation with a specific work package dedicated to develop novel observing systems for the Black Sea.

Outreach activities conducted

- 1st summary report of the DEEPREDOX project, 2020.

New GEOTRACES or GEOTRACES-relevant publications (published or in press)

- Akcay, İ., Tugrul, S., Yucel, M. (2021). Benthic nutrient fluxes across a productive shelf adjacent to an oligotrophic basin: case of the Northeastern Mediterranean Sea. https://doi.org/10.31223/X5390F.

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