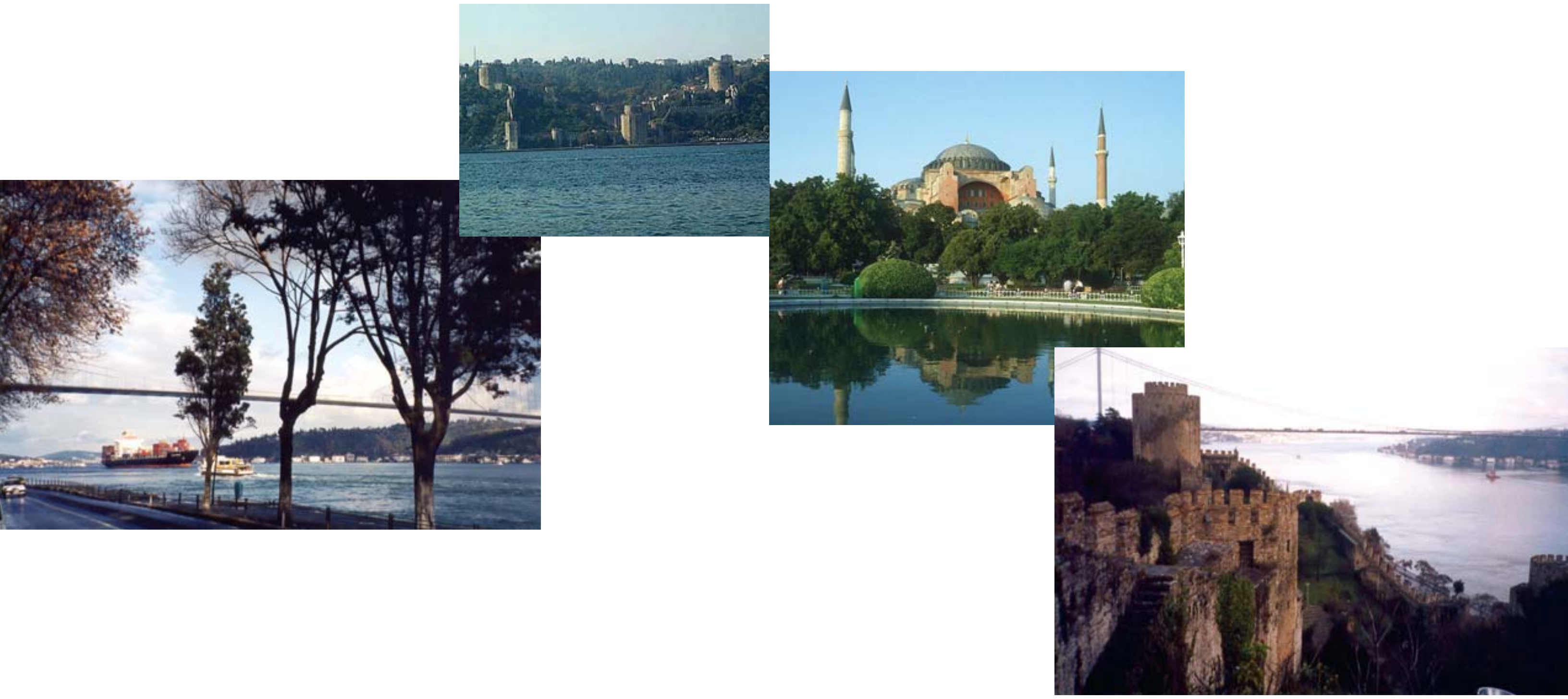
Special Issue on Black Sea Oceanography

In this issue of *Oceanography* we have 10 papers that will introduce readers to the fascinating and exciting research that is being conducted in the Black Sea. I wrote my first Black Sea paper in 1973 with new data from the 1969 *Atlantis II* expedition. This started my long-term interest in the oceanography of this sea, which I have been able to pursue through organizing major research cruises in 1988, 2001, 2003, and 2005. The Black Sea has repeatedly given me opportunities to study major ocean processes in a unique environment. As a result, I have had the opportunity to develop friendships with many scientists from countries in the Black Sea region and this has lead to productive research collaborations.

The Black Sea has many of the features of the big oceans, but on a smaller scale. It has a wind-driven surface circulation with eddies, jets, and filaments. Ventilation occurs to replace the deep water and drive internal upwelling. Numerical models have been constructed to describe these strongly three-dimensional, time-varying processes (**Stanev, this issue**). Part of this ventilation is driven by salt water input through the Bosporus. **Soffiento and Pilson (this issue)** present an account of some of the history of study of the two-layered flow through the Bosporus. The superposition of the biological pump on the physical framework defined by the strong vertical density gradient has resulted in formation of an aerobic surface layer and a sulfide-containing deep layer. At their contact is a layer called the suboxic zone, which has small concentrations of both oxygen and sulfide. Thus, the Black Sea is an excellent location to study oxidation-reduction reactions across the whole redox gradient. Such reactions are important in sediments throughout the world's oceans, but can be studied well here, taking advantage of the fact that characteristic features occur on the same density levels regardless of location. The biogeochemical structure of the water column is described by **Konovalov et al. (this issue)** and its seasonal variability at a location in the Northeast Black Sea, far removed from the Bosporus outflow, by **Yakushev et al. (this issue)**. Anammox (anaerobic ammonium oxidation) is one of the major redox processes important in marine sediments that can be studied in the Black Sea water column, where it is a significant aspect of the nitrogen cycle in the suboxic zone (**Murray**



et al., this issue). The world's oceans in the Proterozoic (2.5 to 0.5 billion years ago) were also thought to have had oxic surface and anaerobic (and maybe sulfidic) deep layers. The Black Sea has been proposed to be a modern-day analog for these ancient environments. Replacing depth with age might be a way to describe the evolution of the chemistry of the ancient ocean. There are pros and cons to this hypothesis that are summarized by **Lyons and Kashgarian (this issue)**.

The Black Sea is also an excellent location to study the impact of environmental change, anthropogenic impact, and climate forcing on physical, chemical, and biological distributions and processes. The declining ecosystems and management systems for their recovery are discussed by **Mee et al. (this issue)**. One of the well known specific examples was the explosive increase in ctenophore populations in the 1980s and their impact on fisheries (**Kideys et al., this issue**). The long-term impacts of anthropogenic forcing (**Oguz I, this issue**) and climate variability (**Oguz II, this issue**) on ecological processes are documented in this issue. The strong correlation of physical, chemical, and biological processes with the North Atlantic Oscillation is particularly noteworthy and serves to emphasize the recommendation that all contiguous Black Sea countries should initiate and maintain monthly time series of characteristic properties. With these we can document, and have a basis from trying to understand how the Black Sea will respond to global warming.

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