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Editorial

The Japan/East Sea: A historical and scientific introduction

The body of water bounded by the islands of Japan, the Korean peninsula, and the Russian Far East is known as the East Sea in Korea and the Japan Sea elsewhere. In deference to the differing nomenclature, we shall refer to this sea as the Japan/East Sea (JES). The JES has shaped the cultural and economic life of the region since the dawn of human history, yet basic observations of the circulation of the sea date back less than a century, and detailed quantitative assessments of the circulation are far more recent. As shown in Fig. 1, the JES is connected to the North Pacific Ocean via two shallow straits, each with a maximum depth of approximately 150 m. On its southern end, the JES is linked to the Pacific through Tsushima Strait (the location numbered 1 in Fig. 1), and on its eastern side it is connected to the Pacific via Tsugaru Strait (site number 2 in Fig. 1). Farther north, the JES and the Okhotsk Sea are joined through the shallow (<100 m deep) Soya Strait (noted as number 3 in Fig. 1). While its connections are shallow, the JES is over 3700 m deep at some places; in close proximity to the deep interior of the JES, major bathymetric features such as the Yamato Rise (labeled as number 4 in Fig. 1) extend to within 500 m of the sea surface and have a major impact on the circulation at all depths.

It can be argued that the beginning of the modern age of exploration of the JES, at least from the point of view of determining the circulation, was marked by the expeditions of Uda (1934), who conducted the first known systematic surveys of the physical characteristics of the waters of the JES. He remarked on the fact that the subsurface waters of the JES are remarkably cold and homogeneous, a clue that they were formed and mixed over a wide range of depths, probably by wintertime deep convection and vertical mixing. Additionally, Uda noted the relatively high dissolved oxygen content of the subsurface waters of the JES, apparently confirming the notion of regular contact of the subsurface waters with the atmosphere. Following Uda's studies, scientists from the countries of the JES region continued to measure the physical and chemical characteristics of the sea for nearly half a century before Gamo and Horibe (1983) and Gamo et al. (1986) synthesized these observations into a coherent picture of the deep circulation that indicated that the subsurface waters of the JES had been changing rapidly between the 1930s and the 1980s. By the mid-1980s, the deep waters of the JES held considerably less dissolved oxygen (roughly 35 μmol/kg) than they contained in the 1930s, signaling a major change in the nature of wintertime convection and deep ventilation of the waters of the sea. The papers of Sudo (1986) and later Vasiliev and Makashin (1992) and Ponomarev and Yurasov (1994) attempted to build on the work of Gamo and his collaborators in order to discern the sites and mechanisms of deep convection and the formation of the deep water masses of the JES. These studies, along with many others conducted in the late 1980s and early 1990s, generally agreed that the main sites of wintertime convection in the JES probably include the Tatar Strait region in the northern JES (number 5 in Fig. 1), the region of the northwest JES along the Russian coast

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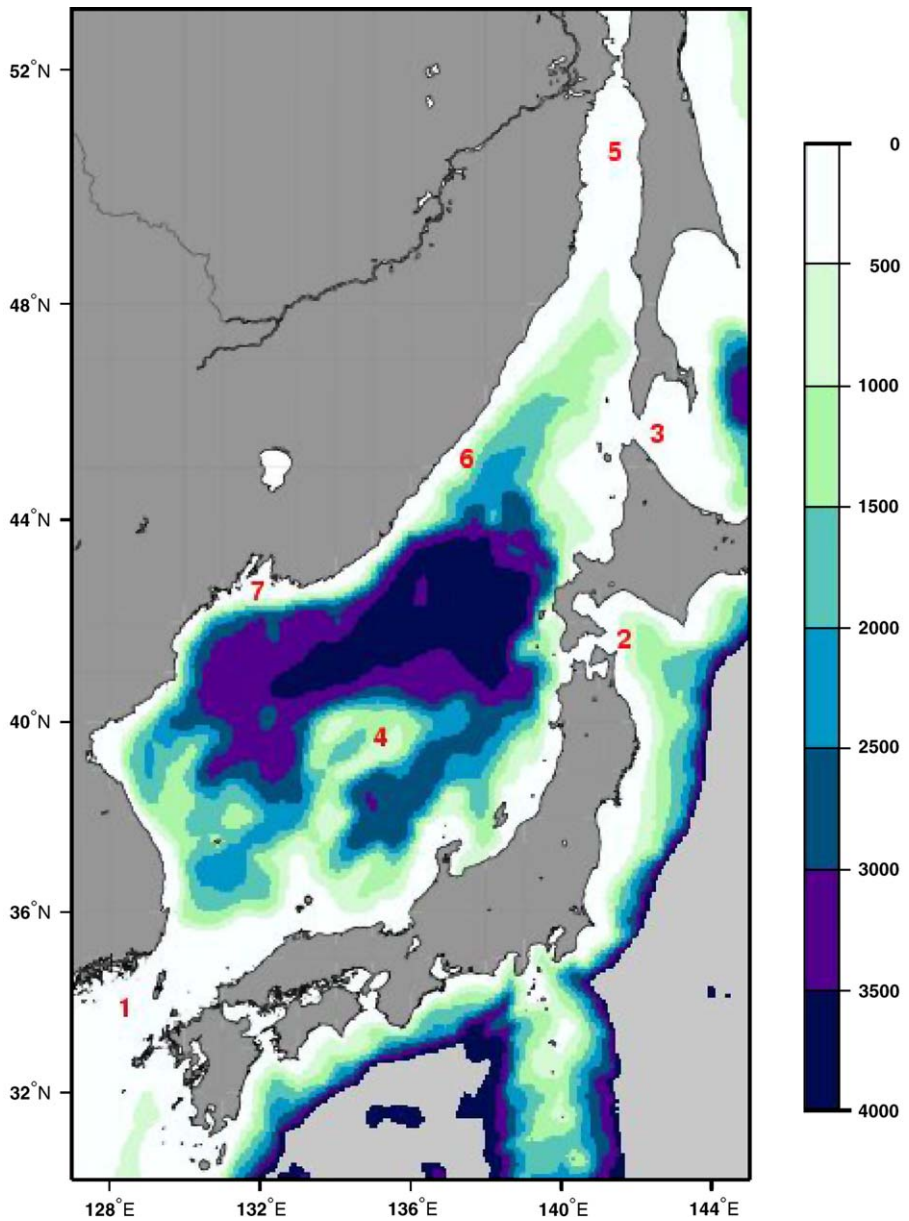

Fig. 1. A bathymetric map of the Japan/East Sea, constructed using the ETOPO5 data set. The color scale on the right gives the depth in meters. Depths greater than 4000 m are plotted as light grey. The numbers shown in red in the figure denote the following features or regions: 1, Tsushima Strait; 2, Tsugaru Strait; 3, Soya Strait; 4, Yamato Rise; 5, Tatar Strait; 6, the northwest JES region along the Russian coast; and 7, Peter the Great Bay.

(denoted as 6 in Fig. 1), and the region directly off Vladivostok, in Peter the Great Bay (labeled as 7 in Fig. 1).

By the early 1990s, it had become clear to physical and chemical oceanographers in the nations bordering the JES that a more systematic,

long-term study of the properties of the JES was necessary in order to track the observed trends and to learn as much as possible about the physical and chemical processes that determine the circulation of the JES. This desire for scientific collaboration, coupled with the political openness that was emerging at the time, allowed the nations of the region to cooperate for the first time in a coordinated way in carrying out observational programs. The Cooperative Research in East Asian Marginal Seas (CREAMS) program was born out of this mutual desire to study the JES and ushered in a new and unprecedented era of international collaborative research in the region. During the second half of the 1990s, the CREAMS group carried out many joint international cruises in both summer and winter in the JES, sharing ships, equipment, technical support staff, and data.

It has often been stated that the JES is a natural laboratory for studying oceanographic processes due to its moderate size and the fact that it extends from a cold, seasonal ice regime at its northern end to a warm, subtropical environment at its southern boundary. Between these extremes are major boundary currents, strong fronts, deep convection regions, sites of strong mixing induced by major topographic features, and a plethora of other phenomena. It would seem that few places in the world ocean manifest such a wide variety of processes in such a relatively small, confined space. In the 1990s the CREAMS group visited most of these venues, attempting to examine and quantify as many of these oceanic phenomena as possible. A central goal of all the CREAMS work was to discern the abyssal circulation of the JES and to attempt to understand the ongoing changes in the subsurface properties of the sea. Data from a number of long-term moorings maintained in the 1990s helped to reveal the nature of the deep flow (Takematsu et al., 1999), and the repeated winter and summer cruises allowed mixing models based on oxygen observations to be constructed that suggested in detail how wintertime ventilation must be changing and what might be expected to occur in the future (Kim et al., 2004; Kang et al., 2004).

The richness of the oceanographic phenomena present in the JES laboratory did not go unnoticed in the United States, and in the late 1990s a group of US oceanographers began an ambitious program of study in the Sea, concentrated on an examination of the flow through the major straits, chemical tracers in the JES, and the nature of the subarctic front. Additionally, several of the US projects were focused on studies of physical/biological interactions. Sponsored by the US Office of Naval Research, the US program was implemented side-by-side with CREAMS and the two groups worked in close collaboration. Under the auspices of this collaboration, the flow into the JES through Tsushima Strait was observed in unprecedented detail over several years, in situ air–sea interaction in the middle of winter was observed over much of the central JES, and high-resolution models of the circulation in the JES were run and analyzed.

The papers in this volume of *Deep-Sea Research* report on some of the results from the CREAMS work and the US program in the JES from the late 1990s and early part of the 21st century. As will be obvious to the reader, the level of technical sophistication in these programs far surpassed that of previous studies, though the modern work is clearly inspired by the seminal work of Professor Uda from the earlier era. It is clear that enough is now known of the basic circulation and water properties of the JES that it can reasonably be hoped that the physical insight and models that have resulted from the work reported herein can in the near future be extended to begin to consider biological and geochemical aspects of the JES circulation in detail. These topics will be considered in the next phase of CREAMS.

The guest editors wish to thank the authors of the papers in this volume for their contributions and patience during the time that this collection was being produced. The work reported here was sponsored by a number of funding agencies in the various countries of the JES region and in the US, and the continuing support of these agencies is gratefully acknowledged. We hope that this volume of papers will in time represent an archive of an important era in the exploration and understanding of the circulation of the JES.

References

Gamo, T., Horibe, Y., 1983. Abyssal circulation in the Japan Sea. Journal of the Oceanographic Society of Japan 39, 220–230.

Gamo, T., Nozaki, Y., Sakai, H., Nakai, T., Tsubota, H., 1986. Spatial and temporal variations in water characteristics in the Japan Sea bottom layer. Journal of Marine Research 44, 781–793.

Kang, D.-J., Kim, K., Kim, K.-R., 2004. The past, present, and future of the East/Japan sea in change: a simple moving-boundary box model approach. Progress in Oceanography 61, 175–191.

Kim, K., Kim, K.-R., Kim, Y.-G., Cho, Y.-K., Takematsu, M., Kang, D.-J., Volkov, Y., 2004. Water masses and decadal variability in the East Sea (Sea of Japan). Progress in Oceanography 61, 157–174.

Ponomarev, V., Yurasov, G., 1994. The Tatar (Mamiya) Strait currents. Journal of the Korean Society of Oceanography 6, 335–339.

Sudo, H., 1986. A note on the Japan Sea Proper Water. Progress in Oceanography 17, 313–336.

Takematsu, M., Nagano, Z., Ostrovskii, A., Kim, K., Volkov, Y., 1999. Direct measurements of deep currents in the northern Japan Sea. Journal of Oceanography 55, 207–216.

Uda, M., 1934. The results of simultaneous oceanographical investigations in the Japan Sea and its adjacent waters in May and June, 1932. Japan Imperial Fishery Experimental Stations 5, 57–190 (in Japanese).

Vasiliev, A., Makashin, V., 1992. Ventilation of the Japan Sea waters in winter. La Mer 30, 169–177.

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