

## Radiolarian faunal characteristics in surface-subsurface waters of the Japan Sea off Sado Island

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Plankton communities in the Japan Sea and their fluctuations over time have previously been addressed in terms of various aspects of their ecosystem, e.g., trophic condition, food-web structure, and environmental change. In the Japan Sea in particular, being a semi-closed marginal sea, the inflow and settlement of planktonic organisms via sea currents passing through adjoining straits have attracted much attention, largely because the historical and dynamic states of these organisms provide information on the past oceanographic characteristics of the Japan Sea and the role of speciation within a geographically isolated marginal sea. The Japan Sea has also been likened to a miniature ocean, being of significant depth and influenced by subtropical and subarctic currents driven by aeolian and thermohaline circulations; consequently, knowledge of the ecosystem of this marginal sea is considered to provide a good analog of that in the large oceans of the world.

The Japan Sea is connected with adjacent seas via four straits: the Tsushima, Tsugaru, Soya, and Mamiya straits, with most of inflowing water originating from the Tsushima Warm Current (TWC). The TWC is therefore of critical importance for the inflow and settlement of fauna and flora that originated from warm-water regions. To assess the influence of the TWC on radiolarian inflow to the Japan Sea, we determined the faunal characteristics and water properties (temperature, salinity, density, and fluorescence intensity) of surface-subsurface waters shallower than 100 m depth in the Japan Sea off Tassha, Sado Island, central Japan on June 4, 2007. Compared with the water properties measured in June 2005, a thick temperature-stratified layer of 16.0-16.6 degrees C was recorded in water shallower than 32 m in June 2007, indicating that the flow force of the TWC had increased in June 2007 relative to that in 2005. This finding is independently supported by broad-based hydrographic data from the Japan Sea (Japan Meteorological Agency).

Although the standing stock is very low, the radiolarian fauna consists of typical cold-water dwellers (*Larcopyle butschlii*, *Cyrtidosphaera reticulata*, *Spongotrochus glacialis*) throughout waters shallower than 100 m depth, along with a warm-water species (*Spongosphaera streptacantha*) that usually occurs in summer around Sado Island. Based on the compiled radiolarian faunal and temperature data, *S. streptacantha* can be considered a typical inflowing species transported by the TWC.

In terms of the characteristics of the biofacies of the Japan Sea, Nishimura (1974) noted that secondary deep-water dwellers in a wide variety of marine species, differentiated recently from shallow-water species, comprise representative faunas that lack typical primary deep-water dwellers that live in the truly deep part of the ocean. Studies of radiolarians in the Japan Sea reveal that deep-dwelling radiolarians are no exception to this trend (e.g., Itaki, 2007), indicating that present-day secondary deep-water planktons flowed into the Japan Sea upon sea currents originating from surrounding seas via restricted straits, subsequently becoming established in vacant ecological niches. Bearing this process in mind, it is possible that *S. streptacantha* is now following the spreading and settlement processes of species that previously inflowed upon sea currents. Ongoing monitoring of this progressive phenomenon will reveal the geographic dispersion and speciation of radiolarians, focusing on its dynamic state in the upper (Tsushima Straits), middle (around Sado Island), and lower reaches (Tsugaru Strait) of the TWC.