

Form 3

## Annual Report

LaMer, Ehime University

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To Director of LaMer

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Include the report on the result of the project/meeting in a separate sheet.

### 1. Project / Meeting title

化学トレーサーによる東シナ海の水塊形成と外洋への物質輸送に関する研究

Water mass formation in East China Sea and material transport to open ocean using chemical tracers

### 2. Members of project / meeting

Name	Affiliation	Position	Contribution part
PI	Zhang, Jing	Pro.	Supervision and management
Members	Zhao, Zunhao	M2	Measurement and Data analysis
	Katazakai, Saki	M2	Measurement
	Noguchi, Tadateru	B4	Measurement
	Kabayashi, Shota	D3	Measurement and Data analysis
LaMer Faculty member in charge	Guo, Xinyu	Pro.	Modeling

### 【Introduction】

The 1.25 million km<sup>2</sup> East China Sea is one of the largest marginal sea face the Pacific Ocean. 70% of this area is shallower than 200m, which is the largest continental shelf area in Pacific. East China Sea has the complex water circulation, the Kuroshio Current flows from tropical northern Pacific Ocean to the East China Sea, then mixing in southern East

China Sea and flow to the Northwest Pacific Ocean via the Tokara Strait etc.. The Kuroshio Current branches (Taiwan Current and Tsushima Warm Current) flow northward and mixed with the coastal water (Yellow Sea Cold Water and Changjiang Diluted Water) in the continental shelf, then transport to the Sea of Japan.

As a carrier of energy and material, seawater of these strait through flows play an important role in East China Sea and surrounding region. This study focus on the seasonal water mass structure in Tsushima Strait, establish a synergy view of chemical and physical oceanography to clarify the 3D snapshot of the water mass structure in strait through flow region. Then provide the detailed fraction of different water mass for further application, like the estimation of material transportation.

#### 【Material and Method】

Samples and datasets used in this study were collected in eight cruises. The salinity, temperature, DO and fluorescence data were collected by CTD, the DO samples were measured on-board by automatic titration.  $\delta^{18}\text{O}$  and REEs samples were stored for our laboratory analysis. Nutrients samples were frozen on board and measured by automatic analyzer.

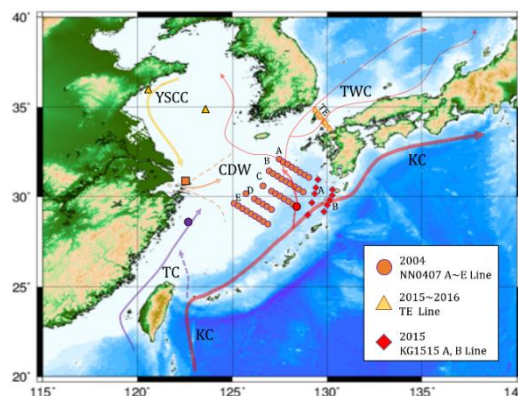


Fig.1 Research region and sampling station.

#### 【Result and Discussion】

Follow the T-S diagram of Tsushima Strait, probable water origins of this area are Changjiang Diluted Water, Taiwan Warm Current, Kuroshio and Yellow Sea Cold Water. The result of multiple tracer analysis suggested the major constitute of the water mass pass through the Tsushima Strait origin from Kuroshio Current system. Yellow Sea Cold Water influence this area in spring, the Changjiang Diluted Water dominate shallow layer (<50m) in summer time. Kuroshio Intermediate Water and Tsushima Warm Current exist in all seasons. Kuroshio Intermediate Water shared 20~40% in all layers over the year, and the Tsushima Warm Current show more variety with season change. And the flow through the west channel and east channel of Tsushima Strait was influenced by different water mass in different season and show collaboration with the monsoon, especially the Changjiang Diluted Water and Tsushima Warm Current in spring and summer. As an application of this study, the distribution results can be used for the estimation of nutrients transportation. The estimation results suggest the P-limitation of the primary production in East China Sea, and

the main origin of nutrients transporting through Tsushima Strait is Kuroshio Intermediate Water.

**【conference presentation】**

1. Zhao, Z., Zhang, J., Liu, Q., Yoshida, T., Water mass analysis of Tsushima Strait by multiple tracers and seasonal contribution of various origin, JpGU 2017, May, Chiba, Japan.
2. Zhang, J., Material transport and interaction between the East China Sea and the northwestern Pacific: joint regional GEOTRACES study in East Asia, 2017 Joint IAPSO-IAMAS-IAGA Assembly, Aug., Cape Town, South Africa.
3. Zhao, Z. and Zhang, J., Water mass analysis of the strait-through flow in eastern East China Sea: approaching by multiple tracer, 2017 Annual Meeting of Annual Meeting of the Geochemical Society of Japan, Sep., Yokohama, Japan.
4. Zhang, J., GEOTRACES and biogeochemical studies in the Western Pacific and its marginal seas, WESTPAC Workshop on “A framework for cooperative studies in the Western Pacific Marginal Seas: Energy and materials exchange between land and open ocean”. Oct. Fukuoka, Japan
5. Zhang, J. and Zhao, Z., Water mass analysis of the strait-through flow in eastern East China Sea: approaching by multiple tracer, Jan., Fukuoka, Japan.
6. Tsutsumi, E., Matsuno, T., Lien, R-C., Nakamura, H., Senjyu, T., Guo, X., Zhang, J., Turbulent mixing within the Kuroshio in the Tokara Strait, 2018 Ocean Science Meeting.
7. Zhang, J., Material transport in the marginal seas using chemical tracers, Marine Geochemical Forum, Mar., Sapporo, Japan.
8. Z. Zhao, J. Zhang, T. Matsuno, Diapycnal and isopycnal mixing? - Approach using rare earth elements-, OMIX annual meeting, Mar. 2018, Chiba, Japan