# THE IMPORTANCE OF TIDAL FLAT FOR TERRESTRIAL RUN-OFF TO CORAL REEF OF NAGURA BAY, ISHIGAKI ISLAND: LOSS-ON-IGNITION METHOD OF SEDIMENT SAMPLES


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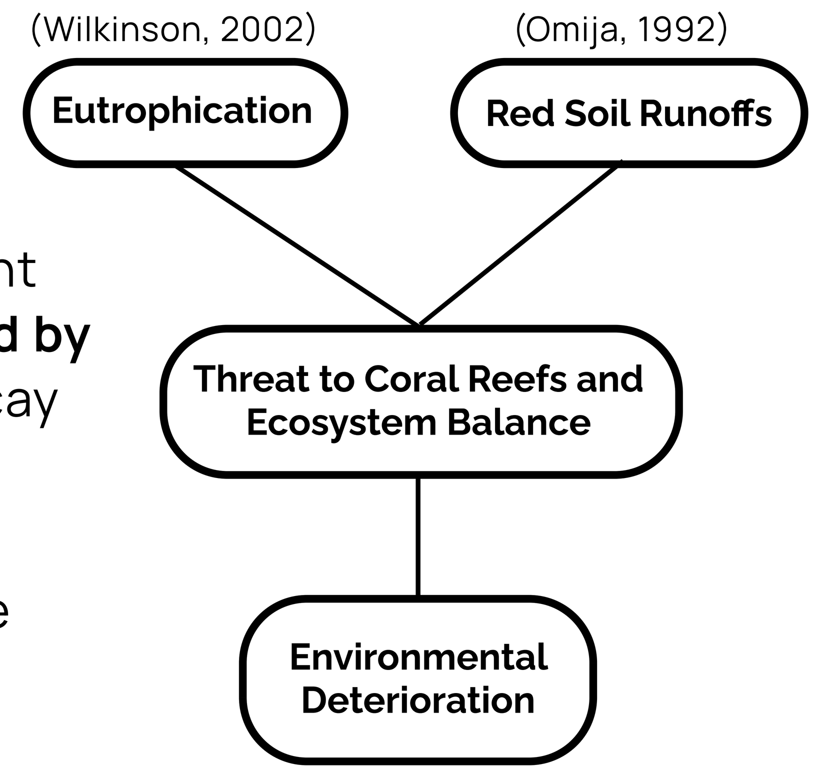
## 1. INTRODUCTION

- Eutrophication and pollution from **increasing sedimentation are threats to coral reefs** that originate on land (Wilkinson, 2002).
- Owing to the intensive soil erosion that accompanies land development projects, **coral reefs along the coasts have been repeatedly covered by silt** throughout the modern history of the Ryukyu Islands, causing decay (Omija, 1992).
- River discharge and land development affected coral growth (Sowa et al., 2014). **However, there are no data of terrigenous material** on the river run-offs of Nagura Ampal that could help the research of the coastal area ecosystem and the coral reefs of Nagura Bay.



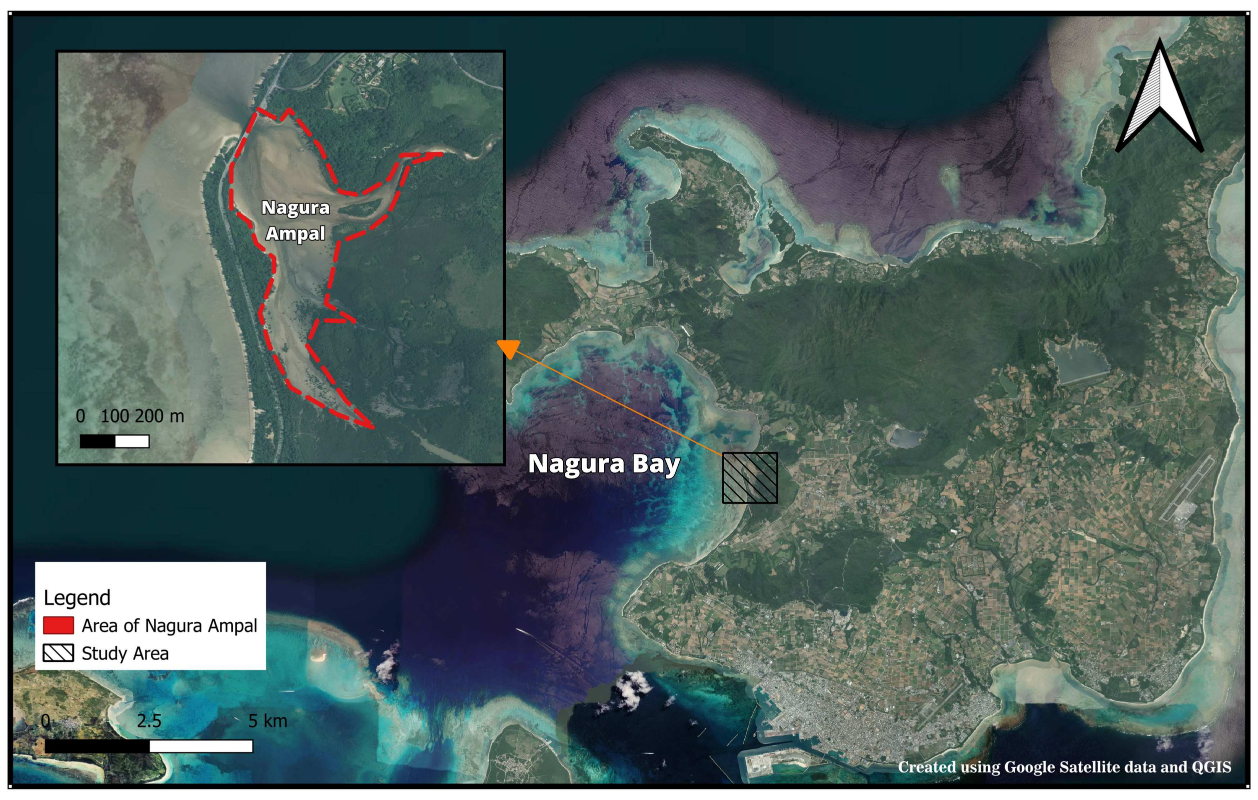

## 2. PURPOSE

1. To provide a **practical methodology** to quantify and analyze the soil contents
2. **To show the carbonate content of sediment of each clustered area** from Nagura River to Nagura Bay
3. **To understand the importance** of the existing ecosystem that surrounds the coral reefs

## 3. STUDY AREA

A research in 2015 has shown that this bay contains the largest underwater karst structure in Japan and abundant living corals in the deeper gentle slopes supporting the regional coral reef systems. (Kan et al., 2015)

Therefore, it is an essential site to study about how the coral reefs in Nagura Bay are being protected by the river discharge.




**Map of Nagura Ampal, Ishigaki Island**

**Figure 1.** (Map of Nagura Ampal, Ishigaki Island)

Nagura Ampal consists of tidal flat, mangrove forests, and seagrass zone. Also, Nagura Ampal is registered under the Ramsar Convention on Wetlands, which also belongs to the Iriomote-Ishigaki National Park of Ishigaki Island.

## 4. METHODOLOGY

### 1 Loss-on-Ignition (LOI)

**Calculate the weight loss of each heating** to determine **%OM (organic matter) and %CaCO3 (Calcium Carbonate)** of a sample leaving the residual terrigenous material (%RM) (Figure 2).

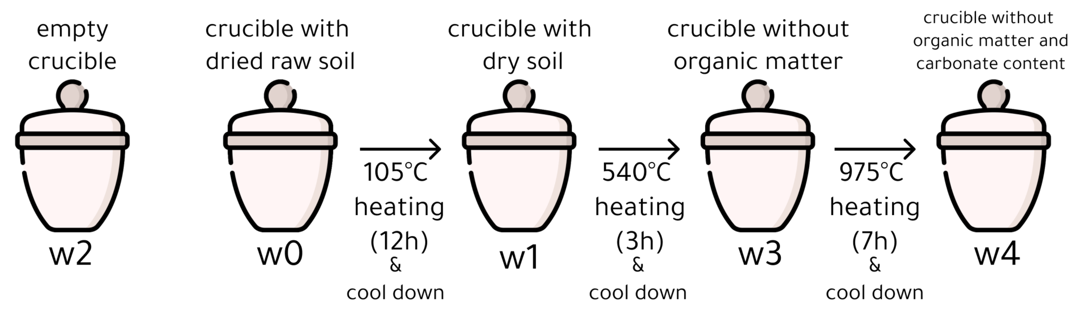



**Figure 2.** Step-by-step workflow of loss-on-ignition (LOI) methodology.

$$\%OM = \frac{(w1 - w3)}{(w0 - w2)} * 100 \qquad \%CaCO3 = \frac{((w3 - w4) * 2.273)}{(w0 - w2)} * 100$$

### 2 X-Ray Diffractometer

**To confirm the loss of carbonate content** and to identify the residual material. (Figure 3)

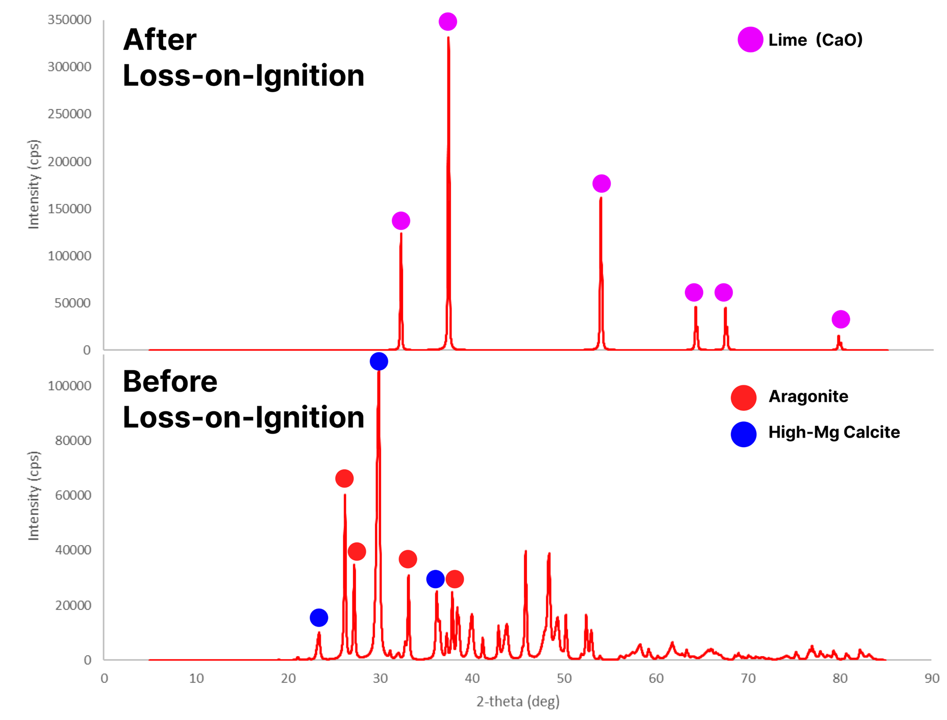



**Figure 3.** Comparison of XRD Profile of a pre-experiment sample (with 95.8% of carbonate content) from Miyara Bay, Ishigaki Island

## RESULTS AND DISCUSSION

### 1. Terrigenous Material decrease from Nagura River to Nagura Bay

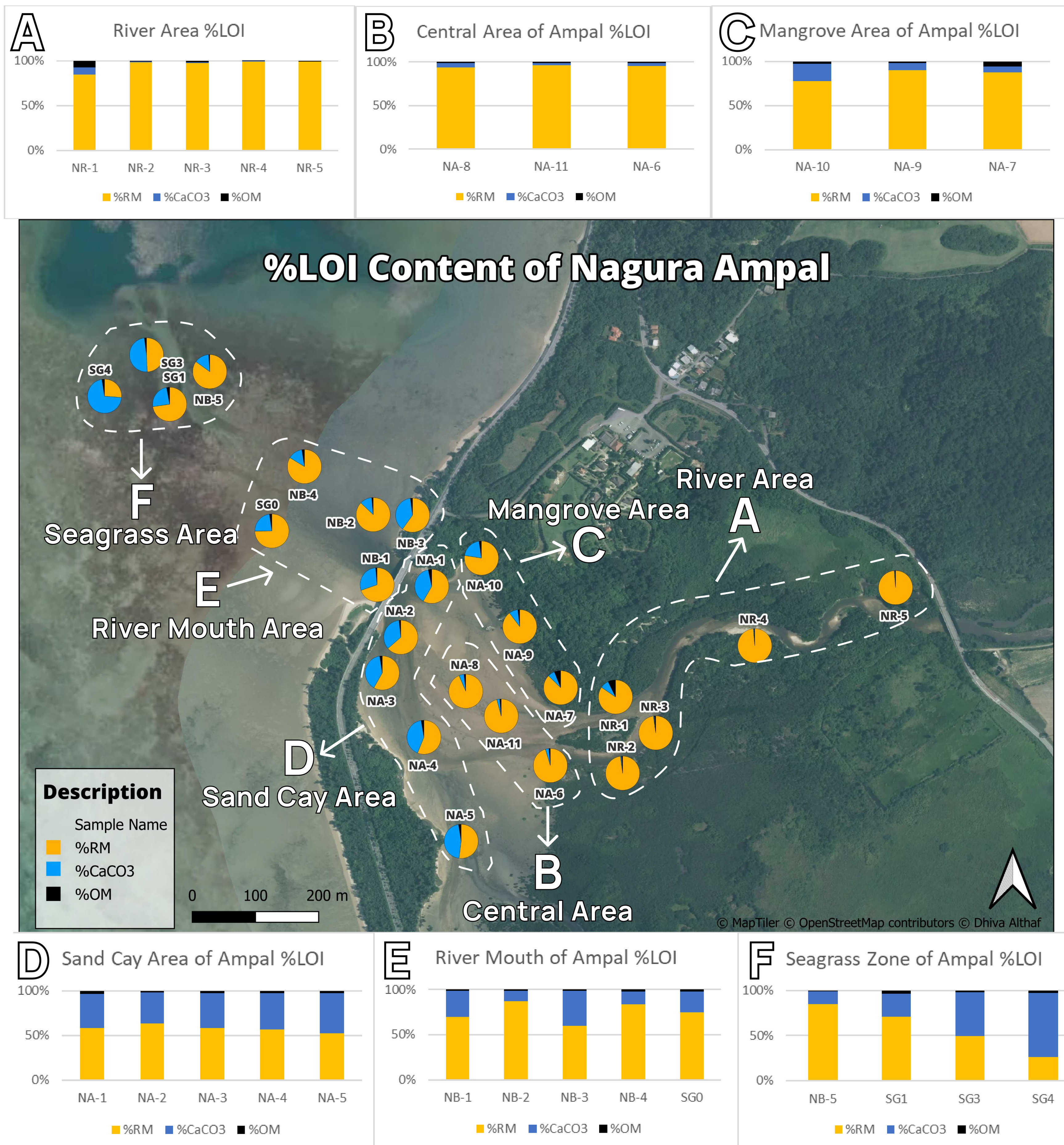



**Figure 4.** LOI result of Nagura River, Nagura Ampal, and Seagrass Zone showing the decrease of terrigenous materials.

**In Figure 4, variations in %LOI content are evident across different areas.**

1. The **river area** which rich in terrigenous material, contrasts sharply with the seagrass zone, showing increased carbonate content and reduced terrigenous material.
2. The **central area (tidal bar)** exhibits a slight uptick in carbonate content but substantial deposits of terrigenous material due to tidal fluctuations. **The sand cay area** is predominantly composed of carbonate content, owing to the reef sediments.
3. Within the **mangrove area**, terrigenous material remains high, yet a noticeable rise in carbonate content is observable closer to the delta. Notably, samples **NR-1** and **NA-7**, extracted from beneath and beside mangrove trees, reveal significant organic matter.
4. Moving outward from Ampal, the **tidal area** displays a marked increase in carbonate content. However, **NB-2** and **NB-4**, collected from the **river mouth creek** contain notable amount of terrigenous material. This trend the same in the **seagrass area**, with **NB-5** sampled from the same river mouth creek. **SG-1** predominantly comprises terrigenous material as it marks the beginning of the **seagrass zone**, whereas **SG-2** and **SG-4**, representing the **established seagrass zone**, show a reduced terrigenous material content.

### 2. Carbonate Content in Nagura Bay Sediments

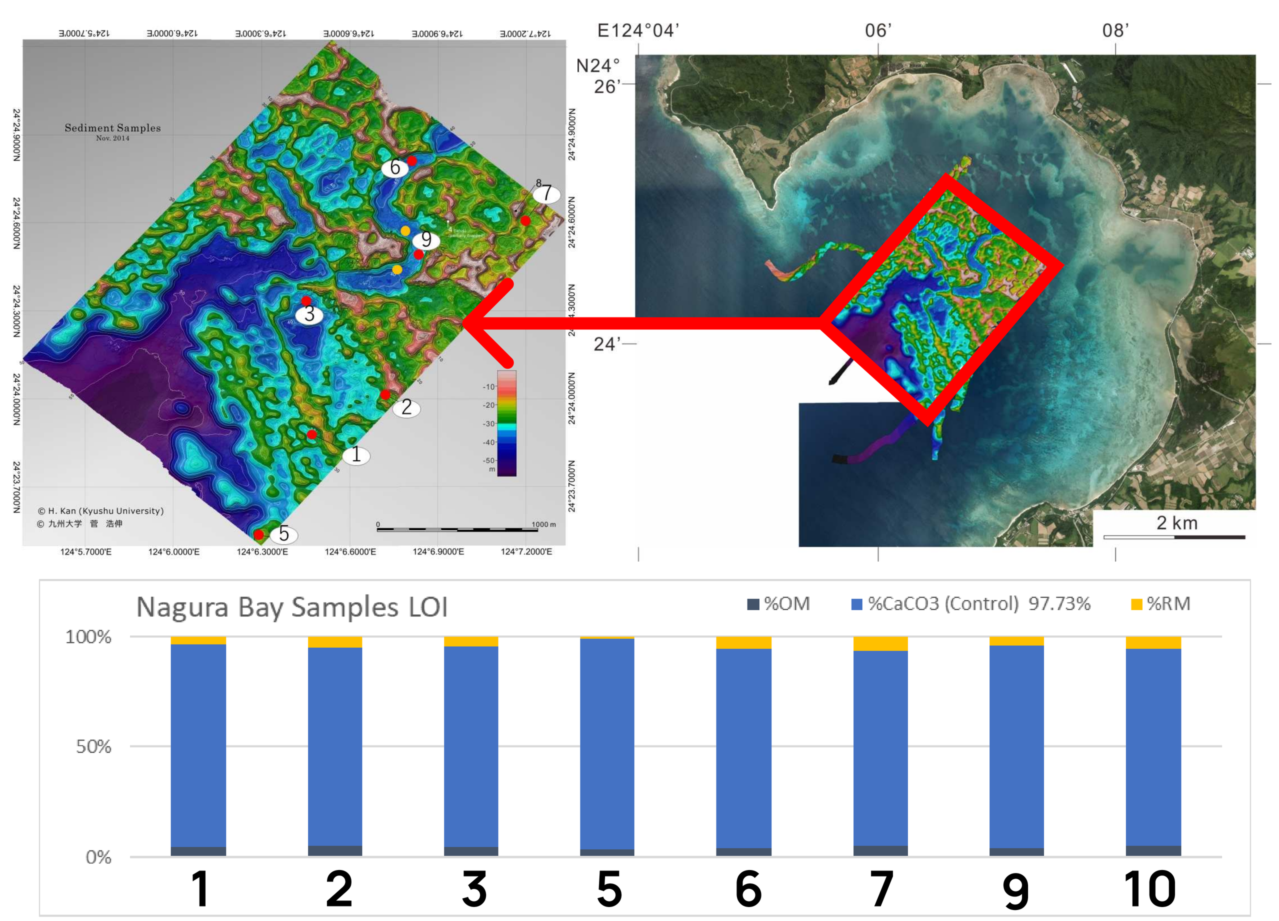



**Figure 5.** LOI result of Nagura Bay seafloor samples showing most of the samples contain calcium carbonate with low-to-none terrigenous material and organic matter. (Map from Kan et al., 2015)

In figure 5, all %LOI of carbonate content from Nagura Bay samples are above 88%, with very little amount of organic matter and residual material, **showing the unaffected properties** of Nagura Bay coral reefs from the terrigenous material of the surrounding area of the bay.


## REFERENCES

- Wilkinson C (2002) In Wilkinson C (ed) Status of Coral Reefs of The World: 2002, Australian Institute of Marine Science, Townsville, 378 pp
- Omija T (1992) Current Status of red soil pollution in Okinawa Prefecture. Newsletter of Okinawa Prefectural Institute of Pollution and Health, 26: 87-96 (in Japanese)
- Sowa, K., Watanabe, T., Kan, H. and Yamano, H. (2014) Influence of Land Development on Holocene Porites Coral Calcification at Nagura Bay, Ishigaki Island, Japan. PLOS ONE 9, issue 2.
- Dean, W. E. (1974). No. I, v. 242-248 FIGS. In JOURNAL or SEDIMENTARY PETROLOGY, ¥~OL (Vol. 44).
- Kan, H., Urata, K., Nagao, M., Hori, N., Fujita, K., Yokoyama, Y., Nakashima, Y., Ohashi, T., Goto, K., Suzuki, A., 2015. Submerged karst landforms observed by multibeam bathymetric survey in Nagura Bay, Ishigaki Island, southwestern Japan. Geomorphology 229, 112–124. https://doi.org/10.1016/j.geomorph.2014.07.032