Migration of sand waves observed in Okinose area of Osaka Bay

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A micro-topography formed on unconsolidated sand particles by water flow with wavelengths from a few meters to several hundreds of meters is called sand waves. On the seabed (water depth between 30-45 m) in Okinose, eastern margin of Awaji Island in Osaka Bay, Japan, sand waves of a range of wavelengths between 10-100 m are observed. In this area, there is a constant flow called Okinose Return Current. Although it is important to elucidate the detailed characteristics, formation mechanism, and migration mechanism of the sand waves in Okinose due to the viewpoint of protection of marine resources and ocean navigation security, they have not been well studied (Yashima, 1992). Therefore, we investigated sand waves on the seabed in Okinose six times in about a year to reveal which direction and how long the sand waves migrate in this period.

We investigated the bathymetry of Okinose using the Multi-Narrow Beam Echo Sounder (MBES) mounted on FUKAE MARU (Kobe University, Graduate School of Maritime Sciences). In addition, seabed samples were obtained using a grab type mud sampler. Dates of the observation were September 27 and November 12 in 2017, and March 24, August 31, September 26, and October 13 in 2018. Survey area was south-north 2 km and east-west 1 km.

Analysis of the bathymetry revealed the sand waves with different wavelengths in southeast Okinose. Following the criteria given by Perillo and Ludwick (1984), sand waves were classified into three types by the wavelengths and the wave heights; large sand waves (wavelengths more than 50 m, wave heights more than 2 m), small sand waves (wavelengths between 10-50 m, wave heights between 0.6-2 m), and megaripples (wavelengths less than 10 m, wave heights less than 0.6 m). In these observations, large sand waves did not move, whereas small sand waves migrated 5 m to the north and megaripples would change every day. Since sand waves usually migrate to the direction of the residual current (Nemeth et al., 2002), our observation of the small sand waves is consistent. In addition, despite three natural disasters of the Osaka Northern Earthquake on June 18, 2018 and two typhoons No.20 on August 23 and No.21 on September 4 both in 2018, large sand waves were not changed obviously.

The structured sand waves have been reported (e.g. Osumi Strait in southern Kyushu, Japan (Ikehara, 1998) and Cadiz Bay in Spain (Nemeth et al., 2007)). Our investigation revealed that the sand waves in Okinose were also structured and classified into three types. Generally, wavelengths and wave heights of sand waves are determined by water depth, particle size of the sediment, and sea flow above the seabed. Therefore, it is important to evaluate the sea flow over the sand waves to understand their formation and migration mechanisms. In the next step, we have a plan to simulate the flow above the seabed of Okinose to approach the formation and migration mechanisms of Okinose sand waves.

Keywords: sand wave, Osaka Bay, migration

