

Formation condition of deposits of sediment wave in the Neogene Aoshima Formation, Kyushu Island, southwest Japan

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The Neogene Aoshima Formation, the uppermost part of a forearc basin fill of the Miyazaki Group, is well exposed along the Nichinan Coast, in Miyazaki City, Miyazaki Prefecture. Sediment gravity flow deposits dominate this formation, showing anomalous depositional sequences and thickness frequency distributions. The sediment gravity flow deposits are well correlated along the palaeocurrent directions of the formation. These deposits, 10 cm to 30 cm thick, are traceable for about 10 km along outcrops exposed at the coast. Sedimentary facies and statistical analyses of the bed thicknesses suggest an offshore depositional setting of a fan delta.

In the formation distributed along the Shirahama Coast of Miyazaki City, bed-by-bed correlations of the sediment gravity flow deposits along approximately 700 m have been performed in our previous studies. In those results, the depositional topography with a wavelength of approximately 600 m to 700 m suggested a sequence of sediment waves. In the present study, we calculated flow velocities of the sediment gravity flows forming the sediment waves and compare the consistency with sedimentary structures in the sediment gravity flow deposits forming the waves.

The sediment wave deposits in the Aoshima Formation have the following characteristics. (1) The beds of the sediment gravity flow deposit are composed of fine- to medium-grained sandstone. Lateral thickness fluctuations are dominant in the upper part of the analysed section. (2) Waves showing wavelengths of approximately 600 m to 700 m have short stoss sides and long lee sides. (3) The intervals of beds in the stoss sides frequently contain many rip-up clasts. (4) The dominant sedimentary structures in the sediment gravity flow deposits forming the waves exhibit spaced planar laminations and massive units. These characteristics suggest that the deposits forming the sediment waves were deposited in an upper flow regime stage and that hydraulic jumps occurred in the intervals of the stoss sides.

The flow velocities of the sediment waves were calculated by examining the relationship between the wavelength and flow velocity of the sediment wave in previous studies. In the calculation, the density difference in the ambient fluid and sediment gravity flow was 10 kg/m³ to 300 kg/m³; deposition-dominated flows that were not included in auto-suspension were considered. The results indicate flow velocities of 3.0 to 17.3 m/s with a palaeoslope of 0.1 degree, 3.0 to 13.0 m/s in 1 degree, 3.0 to 6.5 m/s in 2 degree, and 3.0-4.3 m/s in 5 degree. These estimated flow velocities correspond to the sedimentary structures in the upper flow regime stage in the sediment gravity flow deposits forming the sediment waves.

Keywords: sediment wave, traction carpet, sediment gravity flow deposit, bed-by-bed correlation, flow velocity