Storm beds of the Ashiya Group and climatic change at 29Ma

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The Oligocene Ashiya Group, distributed in North Kyushu, consists entirely of marine sediments in back arc basin prior to the opening of the Japan Sea. It is divided into the Yamaga, Norimatsu, Jinnoharu Sakamizu and Waita Formations. The sequence boundary was recognized between Norimatsu and Jinnoharu Formations which is assigned to ca. 29 Ma based on the U-Pb age dating of zircon in intercalated tuff. This sequence boundary is thought to correspond to the largest sea level fall in Haq curve during the mid-Oligocene. The aim of this study is to describe the sedimentological characteristics of the thick-bedded storm beds in the Jinnoharu Formation above the 29 Ma sequence boundary, and to compare wavelength, amplitude and thickness of the storm beds of the Jinnoharu Formation with those of Waita Formation.

The Jinnoharu Formation represents some parasequence sets of shoaling upward, ranging from lower shoreface to upper shoreface environments. The parasequence set begins with ravinement deposits at base, passes to alternating beds of sandstone and siltstone, amalgamated thick storm beds, and ends with Ophiomorpha sandstone. The amalgamated storm beds succession is about 10 meters thick with intercalations of slump bed at bottom and two lenticular Ophiomorpha burrow horizons. Hummocky and/or swaley cross-stratification, sub-parallel lamination and multi-grading lamination are well identified internally. The average thickness of each storm beds in the Jinnoharu Formation attains to about 85 cm, whereas that of the Waita Formation reduces to less than half, about 31 cm. In addition, the wavelength and amplitude of storm beds of the Jinnoharu Formation is larger than those of Waita Formation. The relationship between bed thickness and wavelength of storm beds in both the Jinnoharu Formation and the Waita Formation shows linear relationship of the exponential function, suggesting that bed thickness and wavelength of storm beds were controlled primarily by intensity of storm waves. These observations suggest that potentiality higher frequency and strength of storm activity during the deposition of the Jinnoharu Formation, just after the large sea-level fall of 29Ma, than that of Waita Formation.

Sudden depositional environment changes above the 29 Ma sequence boundary can be also observed in the Nichinan Group in South Kyushu and Nishisonogi Group in West Kyushu. Beginning of deep sea fan sedimentation in the Nichinan Group and increasing of hyperpycnal sedimentation with abundant siderite nodules and orthoqartzite pebbles in the Nishisonogi Group are thought to be related to the frequent flooding on land from paleo-Asian continent. Such a remarkable change of sedimentation in various environments from coastal, shelf to deep sea deposits across the 29 Ma sequence boundary suggests that drastic climatic change in relation with the glaciation of Antarctica during the Oligocene.

