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Mid-Holocene paleoenvironmental changes and paleoclimatic changes by solar activity in San'in District, weatern Japan

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Evidence shows that solar activity influences climate on a global scale. In the mid-latitude region, climate change is expected to change precipitation patterns. Concurrently, variation in solar activity may influence phytoplankton productivity. It seems that these changes should be recorded in sediment and organic matter deposits in coastal lagoons. In this study, we discuss the relationship between climate change and solar activity in the mid-Holocene in the northern hemisphere mid-latitude region based on grain size analysis, total organic carbon (TOC) content in coastal lagoon sediment core samples.

The INB core was drilled to produce a high resolution record of Holocene paleoenvironmental change in the San'in District, western Japan. The core is 19.17m in total length and is divided into Unit I-VII by lithofacies. Holocene sediment, primarily organic silt, forms Unit III and above in this core. Unit III was deposited from 8.4 to 5.4 ka, when sea level rose during the Jomon transgression; its depositional environment is a coastal lagoon. Progradation of the river mouth during the sea level rise lead to an increase in the C/N ratio of organic matter. Unit IV contains the volcanic Shigaku pyroclastic flow (the sixth stage of volcanic activity of the Sanbe volcano), and Unit V reflects deposition in a freshwater lake or swamp. Above this aggredational sediments were deposited by small rivers.

This study focused on the coastal lagoon sediments of Unit III (8.4 to 5.4 ka); we carried out CNS elemental analysis and grain size analysis with a resolution of approximately five years. TOC content is variable and increases from 0.5 to 5%. Variation of TOC, TS, C/N ratio and Mean grain size are synchronized, and relatively well correlated with atmospheric radiocarbon 14C (Delta ^{14}C) and therefore with solar activity. But it is seen that phase shift in the lower portion of Unit III. A positive peak of Delta ^{14}C indicating low solar activity and a cold period shows high TOC content because of concentration of TOC. On the other hand, a negative peak in Delta ^{14}C indicates a warm period, and has a low TOC content because of clastic dilution. During the warming climate, the river run-off increased and carried much terrestrial organic carbon with fine clastics and nutrient. Planktonic organic carbon contents of sediments were diluted by the clastics. This trend is also observed in a sediment core of Nakaumi Lagoon in San'in District, where it is due to a dilution effect caused by increased precipitation and high productivity because of a higher nutrient load during a warm interval (Sampei et al.,1997).

Keywords: San'in District, Mid-Holocene, total organic carbon content, Delta ^{14}C, paleoclimatic changes, solar activity