

Heinrich events and activities of winter monsoon recorded in bottom sediment of Lake Biwa

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Coastal areas of Honshu Island along the Japan Sea have heavy snowfall and second rainy areas to coastal areas along the Pacific Ocean. This heavy snowfall supplies large volume of melting water and is used for rice planting and become energy source for hydroelectric power generation. Snowfall in winter is firmly related to winter monsoon which blows over the Japan Sea. Consequently, monitoring snowfall can lead to monitoring the intensity of winter monsoon. In order to clarify historical winter monsoon intensity change, we selected Lake Biwa where Mount Ibuki that has heavy snowfall is very near. We carried out chemical analysis of bottom sediment of 18 meters long piston cored at the central part of Lake Biwa. The sediment consists chiefly of muddy sediment and is intercalated by some tephra layers. Depths of the sediment were converted into ages by the age model based on the age of wide spread tephra and radiocarbon dates of sediment. The result shows that frequency of 6ky is present in the total carbon content profile and that of biogenic silica. Ages of minima of total carbon content together with those of total carbon/total nitrogen ratio correlates well with those of Heinrich events. Calcium content profile shows 7ky frequency and minima of calcium content correlate with Heinrich events. On the other hand, phosphorus content shows the same frequency, however, maxima of this content correlate with those of Heinrich events. Among these profiles, that of phosphorus well correlates with that of lake level change which is shown by sand content profile obtained from drilling sediment near the river mouth of Echi river. Phosphorus content is lower during higher lake level. This result shows opposite tendency that manganese and phosphorus contents are higher during high lake level. Based on those results following sedimentation model is proposed. During the periods of abrupt cooling, snowfall was heavier than other periods. At the time of cooling, large volume of melted snow transports calcium rich detritus materials in spring which are supplied from Ibuki mountains those composed mainly of limestone. On the other hand, production of organic materials decrease during cold periods and transportation of organic materials also decreases. Furthermore, because chemical weathering on land is weakened, transportation of phosphorus and manganese becomes smaller. Therefore, calcium content shows normal correlation to snowfall volume whereas that of phosphorus shows reverse correlation. Based on the fact that the ages of this kind of sedimentation correlate with those of abrupt cooling, activities of winter monsoon was stronger at those periods and snowfall became larger which made lake level higher than usual owing to large volume of melting snow.

Keywords: Heinrich events, winter monsoon, lake sediment, drilling core, climate change