Varve chronology in Japan and reconstruction of paleoclimate since last glacial.

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We propose the new varve chronology of Japan since Last Glacial by detailed observations of thin sections after pointing out technical problems to be solved about identification of varve in East Asia and Japan. Varve chronology is very important annual scale like dendrochronology, coral band and annual layers of ice cores in Greenland and the Antarctica to reconstruct high resolution changes of climate and paleoenvironments. In identification and counting of varve, micro-stratigraphical and sedmentological investigations by optical microscopic analysis using thin section are indispensable to success in Quaternary research of East Asia.

[Introduction]

There are generally well-preserved varved sediments in maal of western Europe and brackish-water lakes of Japan. Many chronological and sedimentological studies for high-resolution reconstruction of climatic and paleoenvironmental changes since Last Glacial have carried out by using these varves. Most of varve chronological studies in East Asia and Japan have been based on simple counting of light-gray lamina by using naked eye, though identification of varve is very important in varve chronology. However, there are no detail investigations to solve following scientific questions; What kinds of mineral and chemical compositions do light-gray lamina have individually? How do light-gray lamina form in modern lake? and so on. Also, relationships between varve formations and seasonal changes of water mass environments have not been investigated, though limnological studies have carried out in modern lakes of Japan.

Based on mentions above, we are now thinking that varve chronology in Japan have brought home to us necessity of thin-section observations under optical microscope. [Sedimentary structures and mineral compositions]

We have carried out observing sedimentary structures and sediment-forming minerals by using thin sections and chemical composition by X-ray diffraction and fluorescence methods in varve of Lake Suigetsu. These varve consist of rhythmical alternations of light-gray lamina. Though light-colored lamina were simple type composing of diatom frustules and resting spores. dark-colored lamina were divided into 4 lamina types by different kinds of particles as follows; 1) siderite-rich dark lamina excluding diatom frustules, 2) framboidal pyrite-rich dark lamina excluding diatom frustules, 3) vivianite-rich dark lamina including many diatom frustules and 4) clay mineral-rich dark very fine-grained lamina including diatom frustules and organic debris such as plant leaves and woody fragments.

Occurrence of dark lamina type 3 indicates that there were upwelling stream of nutrient-rich bottom water and blooming of diatom, because this lamina type included many diatom frustules and suggests that this lamina deposited in every spring and autumn. Vivianite grains seems to precipitate under decomposition process of organic compound.

In varve of Lake Holzmaar in the Eifel area of Germany, we could identify 2 different shapes of vivianite grains such as "mono-crystals" and "aggregates". The latter grain types seems to precipitate in bottom sediments under early diagenesis, because this grain type were also recognized in intercalated sand layers but the former type only in varve. These evidence suggest that "aggregate" vivianite grains have never been formed by seasonal changes of water-mass. We identified vivianite-rich lamina on the base of appearance of "mono-crystal" type vivianite grains.

Based on mentions above, we could proposed new varve chronological scale since Last Glacial by using varved sediments of Lake Suigetsu. In particular, 4 dark-colored lamina including 2 lamina of type 3, 1 laminae of type 1 and 1 laminae of type 4 were recognized in several varved horizons of Lake Suigetsu core during late glacial period.

[Concluding remarks]

We propose the new varve chronology of Japan since Last Glacial by detailed observations of thin sections after pointing out technical problems to be solved about identification of varve in East Asia and Japan. In identification and counting of varve, micro-stratigraphical and sedmentological investigations by optical microscopic analysis using thin section are indispensable to success in Quaternary research of East Asia.