Reconstruction of paleoclimatic variations recorded in clay minerals in the Kathmandu Basin sediments by XRD decomposition

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The crystallinity and the relative amount of clay minerals in the Kathmandu Basin sediments by the decomposition procedure of X-ray diffraction (XRD) patterns were estimated in order to reconstruct the paleoclimatic variation recorded in the clay minerals.

The variations of Lanson and modified Lanson illite crystallinity indices (LI and MLI, respectively) between 5 m and 40 m in depth of the drilled sediments were in harmony with those of the relative amount of smectite to illitic minerals (Sm/(Sm+PCI+WCI)) or to chlorite (Sm/(Sm+Ch)) and with the pollen analysis results. These four indicators (LI, MLI, etc.) showed that the major climatic variations in the Kathmandu Basin during the last about 350 ky were closely related to the global climate system.

The determination of the crystallinity and the relative amount of clay minerals in the Kathmandu Basin sediments by the decomposition procedure of X-ray diffraction (XRD) patterns was attempted in order to reconstruct the paleoclimatic variation recorded in the clay minerals. The reproducibility and the error of our decomposition procedure were strictly checked, and Lanson and modified Lanson illite crystallinity indices (LI and MLI, respectively) obtained from the decomposition procedure were compared with Kubler index (KI) as conventional illite crystallinity index.

The reproducibility of the data depended on the XRD data collection rather than the decomposition procedure itself. However, the error in our experimental procedure was very small, which is sufficient for the reproducibility of results.

The variations of LI and MLI between 5 m and 40 m in depth of the drilled sediments were in harmony with those of the relative amount of smectite to illitic minerals (Sm/(Sm+PCI+WCI)) or to chlorite (Sm/(Sm+Ch)) and with the pollen analysis results by Fujii and Sakai (2001). In contrast, the variation of KI was not always congruous with the variations of them. These facts suggest that LI and MLI are available for the estimation of illite crystallinity and that the estimation of illite crystallinity from KI is not always precise or reliable.

These four indicators (LI, MLI, Sm/(Sm+PCI+WCI), Sm/(Sm+Ch)) show that the major climatic variations in the Kathmandu Basin during the last about 350 ky were closely related to the global climate system which is expected by a fluctuation pattern of d18O obtained from planktonic foraminifers of deep sea sediments in the Arabian Sea.