Middle to late Pleistocene climatic and depositional environmental changes recorded in the drilled core of lacustrine sediments in the Kathmandu Valley, central Nepal

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Since October 2000, we have undertaken core-drilling for pure academic purposes at Kathmandu, Nepal, in order to clarify the continuous paleoclimatic records in the southern slope of the Himalaya and to reconstruct the depositional environmental changes of the ancient lake in Kathmandu (Paleo-Kathmandu Lake) during the last one million years. In this project, we also aimed to clarify the uplift history of the Himalaya and its linkage to paleoclimatic and paleo-environmental changes. We could have penetrated black muddy lacustrine sediments, called the Kalimati Formation, at western central part of the valley (RB core at Rabibhawan) in 2000 (Sakai et al 2001) and southern part of the valley (CP core at Champi and JK core at Jorkhu) in 2003 **(Figures 1 and 2)**. We also could have penetrated the lower part of the fanglomerate, called Itaiti Formation and underlying Lukundol Formation which shows marginal lacustrine facies comprising of fluvial and swamp deposits in 2001 (Sakai 2001a).

The longest core drilled at Rabibhawan is 218 m in length and ranges in age from about 700 ka to 10 ka on the base of

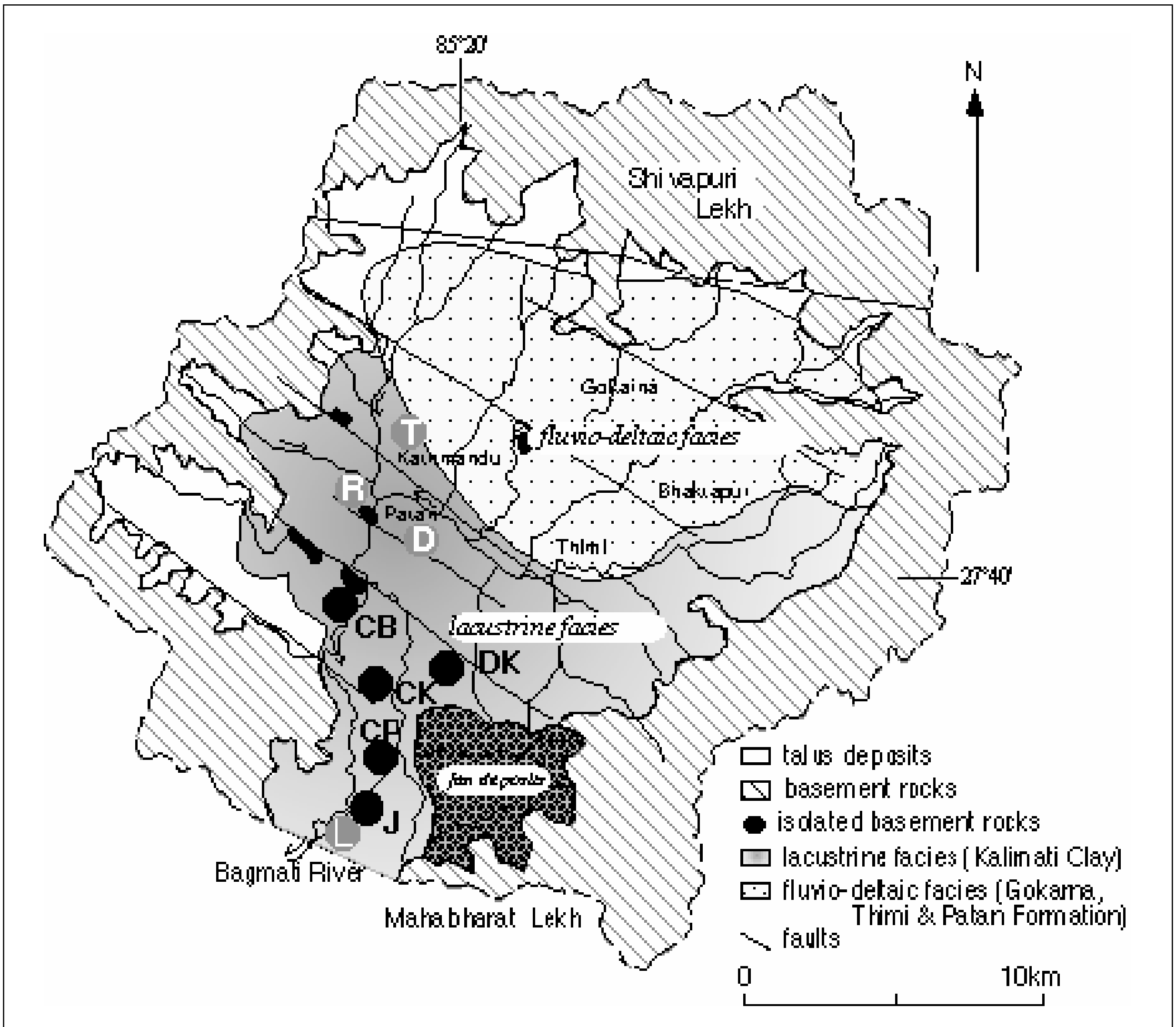

FIGURE 1. Geological outline map of the Kathmandu basin and location of drill-well by Paleo-Kathmandu Lake drilling project. Drilling was carried out in 2000 at T (Tri-Chandra Campus), R(Rabibhawan), D(Disaster Prevention Technical Center at Pulchawk). Drill sites in 2003 are CK (Chayasikot), DK (Dhapakel), CP (Champi) and J (Jorkhu). L: lukundol, CB (Chobal).

paleomagnetic study and AMS 14C dating. Judging from the paleo-magnitic and sedimentological studies of the core from the Lukundol and Itaithi Formation, muddy lacustrine sediments seems to have started their deposition at about 1 Ma. The sedimentaion rate of the muddy lacustrine sediments in the lower to middle parts is eastimated to be 0.2 mm/y, and that of the upper part is about 0.6 mm/y due to smaller compaction.

Surface geological survey in the southern part of the valley and sedimentological study of cores from the Lukundol area suggest that the lake was born by daming up of the Proto-Bagmati river caused by debris flows and following deposition of fanglomerate originated from the Mahabharat Range (frontal range of the Nepal Himalaya) which has started its uplift at about 1 Ma (Sakai et al. 2002).

Three drilled cores at western central part of the valley commonly show that the lacustrine sediments, at 9 to 12 m deep, were eroded by river at about 12 ka. The draining out of the lake-water is likely to be triggered by earthquake, which caused by activation of earthquake fault like as Danuwargaun fault cutting the basin-fill sediments at the southern margin of the valley (Sakai 2001b). In the northern and eastern part of the basin, the muddy lacustrine sediments are covered with thick sandy lacustrine delta deposits, Gokarna and Thimi Formation, more than 80 m thick **(Figure 1)**.

Only one sand bed of 6 m thick is interbedded with muddy lacustrine deposits of RB core. It is attributed to an event bed formed by some tectonic or sedimentological event, because there is no depositional gap between the under- and overlying beds.

$\delta^{13}C$ value of organic lacustrine mud shows at least seven time fluctuation ranging from –30 to –19 ‰ . A fluctuation diagram of pollen assemblage shows similar pattern to that of $\delta^{13}C$ value, and indicated that pollens of cold and dry climate increased when $\delta^{13}C$ has high value. It suggests that grasses including C4 plants expanded their distribution during the glacial period. Total organic carbon (TOC) and carbon/ nitrogen ration (T/N) shows inversed correlation with $\delta^{13}C$, and pollen concentration has good correlation with TOC and C/N. It implies that TOC and pollen concentration were controlled by land plants vegetated in the valley slope. When it was warm and wet climate, C3 land plants seem to have expanded their distribution.

Pollen concentration, total valves of diatom and C/N ratio before ca. 350 ka shows larger amplitude and larger value than those after 300 ka. During the middle Pleitocene from ca. 650 to 350 ka, frequency of diatom valves is characterized by monodominance of *Cyclotella* sp 1 and sp 2. These curious incidents are likely to be related to MIS stage 11problem.

(Refer to papers by Fujii and Maki on the pollen analysis. On the geochemical study, refer to a paper by Mammpuku. A paper presented by Hayashi discusses on the environmental changes based on fossil diatom. The paleo-environmental changes are also discussed by Kuwahara on the basis of study on the clay minerals.)

References

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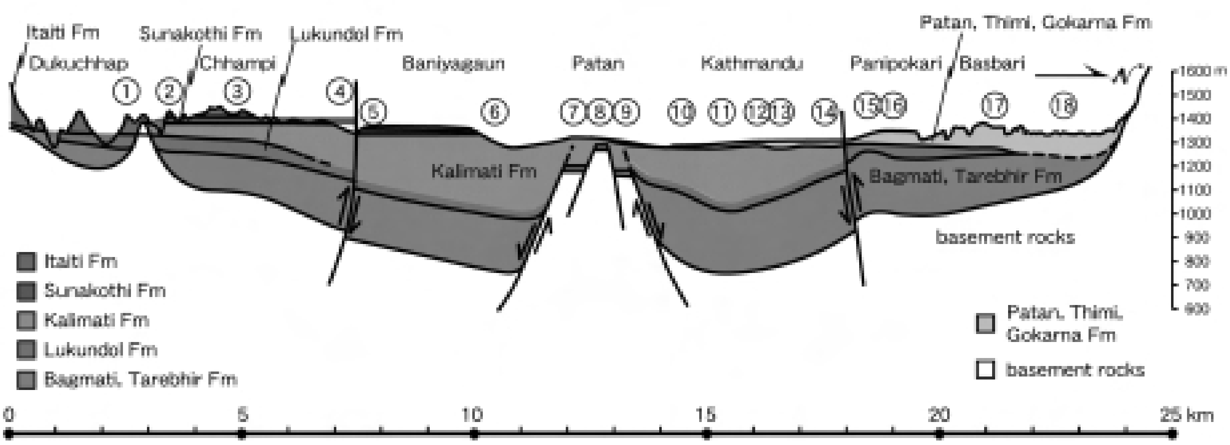

FIGURE 2. Geological cross-section of the Kathmandu Basin based on drill-core data and surface geological survey. No. 1~18: previous drill sites