Supplemental Material

S.1. Definitions

In order to summarize changes in the shape of the sedimentary odd chain-length *n*-alkane distribution over time we used measures of the peakedness (*kurtosis*) and asymmetry (*skewness*) of the distribution. Kurtosis and skewness are commonly used to describe the shape of probability distributions of random variables. Positive kurtosis indicates a relatively peaked distribution, while positive skewness indicates a distribution with a tail extending toward values larger than the mean. Here we adapt these measures to describe the shapes of the odd-chain *n*-alkane relative abundance distributions in SL sediments. We first used the relative abundances of the odd chain-length *n*-alkanes (as % of total odd *n*-alkanes) in each sediment sample to define a frequency distribution with a total population (n) of ~100. For example, if nC_{29} comprised 30% of the total odd *n*-alkanes, it was assigned a population of 30. This was repeated for all odd chain lengths between C_{17} and C_{35}, with the % abundance rounded to the nearest whole number. We then calculated the *kurtosis* and *skewness* of the odd chain-length *n*-alkane distribution as follows:

$$kurtosis = \left\{\frac{n(n+1)}{(n-1)(n-2)(n-3)} \sum_{i=1}^{n} \left(\frac{x_i - \bar{x}}{s}\right)^4\right\} - \frac{3(n-1)^2}{(n-1)(n-2)}$$

$$skewness = \frac{n}{(n-1)(n-2)} \sum_{i=1}^{n} \left(\frac{x_i - \bar{x}}{s}\right)^3$$

where n is the total population (~100), x_i is the ith chain length value, $\bar{x}$ is the mean chain length, and s is the standard deviation of the chain-length distribution.

S.2 Testing chain-length distribution differences between time intervals

In order to evaluate the significance of *n*-alkane chain-length distribution changes between various time intervals delineated in our records (i.e., LH, MH, EH, LP), we applied both parametric (*t* test) and non-parametric (Mann-Whitney U test) tests of difference for each measure of the chain-length distribution shown in Fig. 5 (ACL, skewness, kurtosis, $n\mathrm{C}_{23}$ and $n\mathrm{C}_{29}$ relative abundances). The results did not differ between the parametric and non-parametric tests, so we report only the *t*-test results. The average ACL, skewness, kurtosis, $n\mathrm{C}_{23}$ relative abundance and $n\mathrm{C}_{29}$ relative abundances of the LH interval (2.95 ka - present) were statistically-distinct from the averages of the MH (7.5-3.0 ka) and EH (10.7-7.5 ka) interval for all measures ($p < 0.0003$), supporting our contention that the LH-MH transition witnessed a substantial change in the composition of plant *n*-alkane sources at SL. The other transitions we highlight (LP-EH, EH-MH) were less stark, but in many cases the adjacent intervals were nonetheless statistically distinct. The mean values of distribution kurtosis, skewness, $n\mathrm{C}_{23}$ relative abundance and $n\mathrm{C}_{29}$ relative abundance between the LP and EH intervals were significantly different ($p \leq 0.02$), as were the skewness and kurtosis between the EH and MH intervals ($p < 0.001$). $n\mathrm{C}_{23}$ relative abundance differences between the EH and MH fell just short of significance at the 95% level ($p < 0.06$). ACL was not significantly different between the LP and EH or the EH and MH intervals.