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Latitudinal climatic gradients in western European and Mediterranean regions from the Mid-Miocene (∼15 Ma) to the Mid-Pliocene (∼3.5 Ma) as quantified from pollen data

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The Neogene is a period of intense deep palaeogeographical modifications and climatic changes, from the "greenhouse" climate of the Early to Middle Cenozoic to the "icehouse" climate of the Late Cenozoic, as attested by oxygen isotope records. Many factors may have played an important role in these changes. Indeed, during this period, significant palaeogeographical modifications occurred due to the plate movements (e.g. Himalayan, Alpine and Andean uplifts, closing and opening of marine gateways). In parallel, modification of the atmospheric CO_2, of the orbital parameters and of the ocean heat transport may have also influenced climate changes. Many atmospheric general circulation model simulations have already shown the influence of topography on global climate through changes in the atmospheric circulation (e.g. Kutzbach et al. 1993; Ramstein et al. 1997). Simultaneously, ocean general circulation model simulations have shown the influence of the modification of the ocean circulation on global climate through changes in ocean heat transport (e.g. Nisancioglu et al. 2003). Other authors demonstrated that the Miocene climate variability was driven by fluctuations in the amplitude of obliquity and eccentricity (Westerhold et al. 2005). However, these studies generally consider that climatic changes are due to a combina-

tion of many factors.

In Europe and the Mediterranean region, the vegetation and climate of this period is well-documented by abundant pollen data, that allows to depict the climate evolution at time of the global cooling.

Here, we present the climatic reconstruction of four key time-slices of the Neogene, the Mid-Miocene ($\sim$ 14 Ma), the Late Miocene ($\sim$ 10 Ma), the Early Pliocene ($\sim$ 5-5.3 Ma) and the Mid-Pliocene ($\sim$ 3.6 Ma). The results show that the climate was warmer than today all along the Neogene, that the transition from a weak latitudinal thermic gradient (around 0.48˚C/degree in latitude) to a modern-like one (0.6˚C/degree in latitude) took place at the end of the Miocene and that the latitudinal precipitation gradient was, from the Mid-Miocene to the Mid-Pliocene, more accentuated than today, with higher precipitation than today in Northwestern Europe and Northwestern Mediterranean but drier than or equivalent to today in the Southwestern Mediterranean region.

Kutzbach *et al.* 1993. *The Journal of Geology*, 101, 177-190.

Nisancioglu *et al.* 2003. *Paleoceanography*, 18 (1), 1006.

Ramstein *et al*. 1997. *Nature*, 386, 788-795.

Westerhold *et al*. 2005. *Palaeogeography, Palaeoclimatology, Palaeoecology,* 217, 205-222.