What climate variability to come? Teaching sedimentary archives of the Middle Eocene of the Paris Basin

In a context of global warming, the modern climate is evolving towards greater variability. The sedimentary record represents a unique archive to understand the interactions between the different processes that control river and sedimentary dynamics (precipitation, seasonality) as well as thermal regimes and their influence on the biosphere. Reconstructing the seasonal parameters (temperature, precipitation) may allow accessing paleo-rivers dynamics and potentially predict current and future climate conditions. The Eocene is a time period with strong climatic variations. It is a privileged archive because the sediments recorded the transition from the warmest interval of the Cenozoic (53-50 Ma) to the abrupt cooling of the Eocene-Oligocene limit (34 Ma), which marks the shift to a perennial ice age. Climatic data indicate that this cooling was interrupted 40 Ma ago by a global warming of 4 to 6 ° C of the ocean bottom waters in 500 000 years. This event called the Middle Eocene Climatic Optimum (MECO) is linked to a sharp increase in pCO_2, suggesting that it is analogous to the modern global warming. However, the data currently available only present an averaged and global view of this event and its impact on fluvial and sedimentary dynamics has never been studied.

The objectives of the PhD are to better document the MECO in the Paris Basin, from the sedimentological and biological point of view by constraining: (1) the evolution of the annual average temperatures and the seasonal temperature gradient in the littoral domain, (2) the associated sedimentary response to such warming. First, paleotemperature reconstruction will be performed from geochemical analysis ($\delta^{18}O$, $\delta^{13}C$; Mines-ParisTech) and Δ_{47} (LSCE) of mollusc shells. Sampling will be carried out in well-constained historical sections of the Bartonien of the Paris Basin. Second, a high-resolution sedimentological analysis will be conducted on these same sections in order to understand the sedimentary response during such a climatic event. The results of this work will have major implications in the field of paleoclimatology and in understanding current global warming. They can be used to increment climate models. These data can also be of use to sedimentological models such as Flumy to better understand the sediment response during extreme events.

This project will be done in partnership with the LSCE of Gif / Yvette (Mr. Daëron), the MNHN (D. Merle) and the BRGM (Justine Briais and Christine Fléhoc).