Lutetian conid snails from the Paris and Hampshire Basins as seasonality archives of the middle Eocene

Alexander J. CLARK[1], Johan VELLEKOOP[1,2], Zita KELEMEN[1] and Robert P. SPEIJER[1]

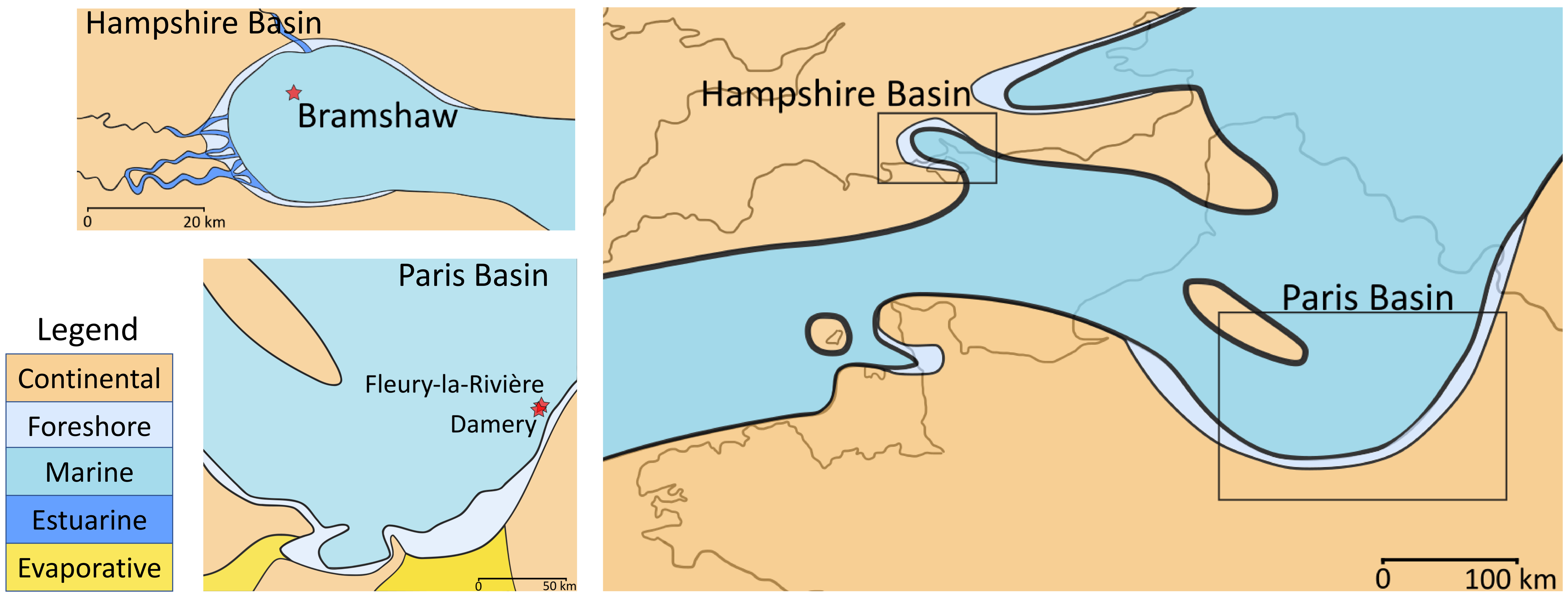
[1]Department of Earth and Environmental Sciences, KU Leuven, Celestijnenlaan 200E, B-3001 Heverlee, Belgium
[2]Analytical, Environmental and Geo-Chemistry, Vrije Universiteit Brussel, Pleinlaan 2, B-1050, Brussels, Belgium

The Lutetian Paris and Hampshire Basins

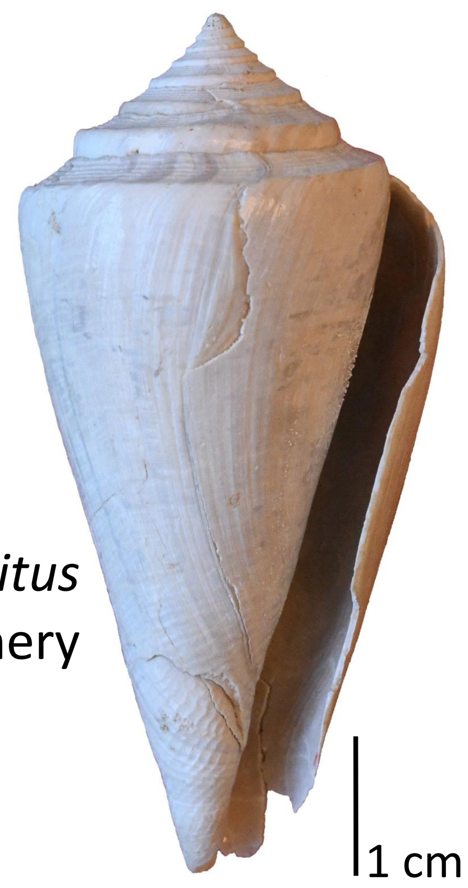
The Lutetian was a period of change, with Earth's climate in transition from greenhouse to icehouse conditions. Tropical conditions reigned in northwest Europe, with high average temperatures and strong periods of rain and drought. In this climate *Conidae* thrived and populated the Paris and Hampshire Basins.

Conid shells are made up of aragonite, from which carbon and oxygen isotope samples were obtained and used for paleotemperature reconstruction.

Three *Eoconus edwardsi* from the Hampshire Basin (Bramshaw) were used and three *Eoconus deperditus* from the Paris Basin (Fleury-la-Rivière & Damery).



Paleogeography of the Paris and Hampshire Basins, adjusted from Gibbard & Lewin 2003, Huyghe et al. 2015



Eoconus deperditus from the Damery locality (DM1)

Differences between the Paris and Hampshire Basins

The latitudinal difference between the Paris and Hampshire Basins is 3°N with a 300 km distance between the localities. Expected differences in temperature and seasonality are therefore minimal. The obtained data confirms this, with seasonality not differing significantly between the two Basins; 9°C vs 10°C.

The obtained temperatures for the Paris Basin are within the range of previous studies from the same localities. A reduced seasonality signal in the Paris Basin conid specimens, 9°C vs 11-13°C, is potentially due to a greater living depth than the previously used gastropods. This is further supported by the lower absolute temperatures between the conids from the Paris Basin and Hampshire Basin.

Eoconus edwardsi from the Bramshaw locality (BR1)

Hampshire Basin	This Study (°C)	Andreasson & Schmitz 2000 (°C)	Purton & Brasier 1997 (°C)
Species	*Eoconus edwardsi*	*Turritella sulcifera*	*Clavilithes macrospira*
Assumed $\delta^{18}O_{sw}$ (‰)	-0.68	-1.20	-1.00
MWT	22	16	21
MAT	27	22	25
MST	32	28	35

Paris Basin	This Study (°C)	Andreasson & Schmitz 2000 (°C)	de Winter et al. 2020 (°C)
Species	*Eoconus deperditus*	*Turritella imbricataria*	*Campanile giganteum*
Assumed $\delta^{18}O_{sw}$ (‰)	-0.59	-1.20	-0.75
MWT	20	14	21
MAT	25	21	26
MST	29	27	32

There is something in the water

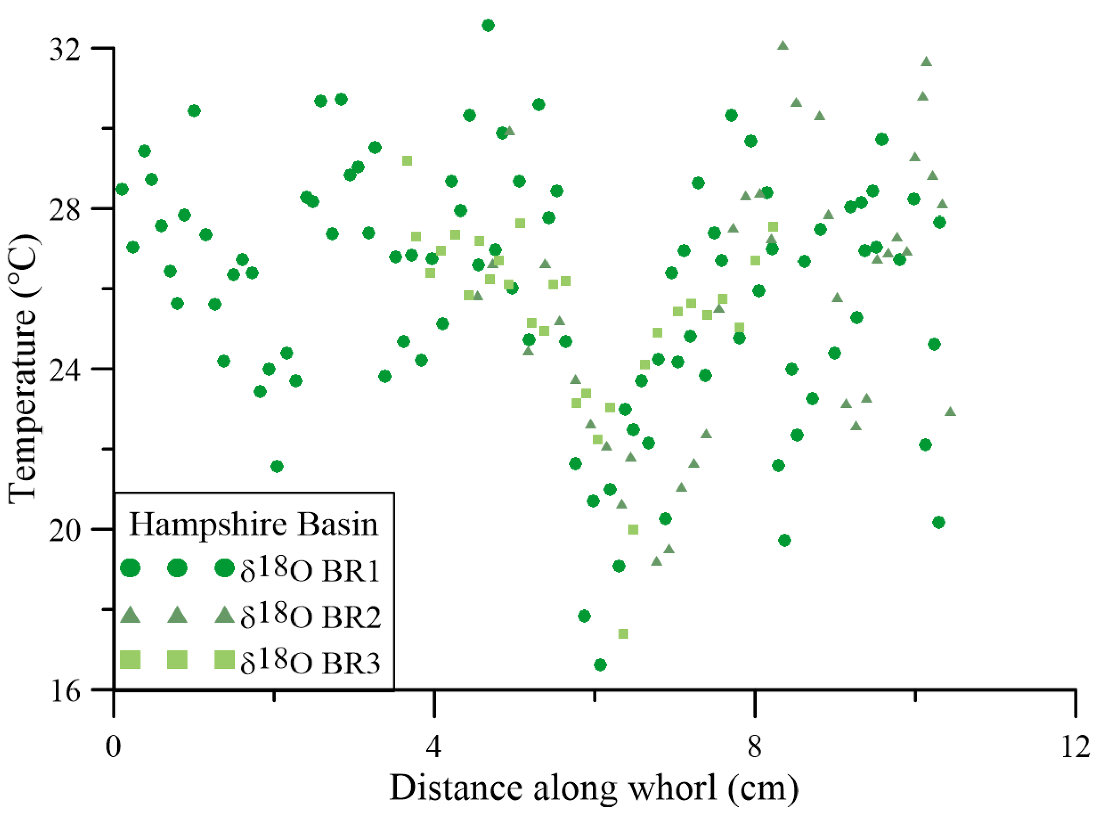
Previously recovered paleotemperature data from the same locality and bed can be used to constrain the obtained data, and estimate ideal temperatures [de Winter et al. 2020]. From this the approximate oxygen isotopic value of the seawater ($\delta^{18}O_{sw}$) can be found.

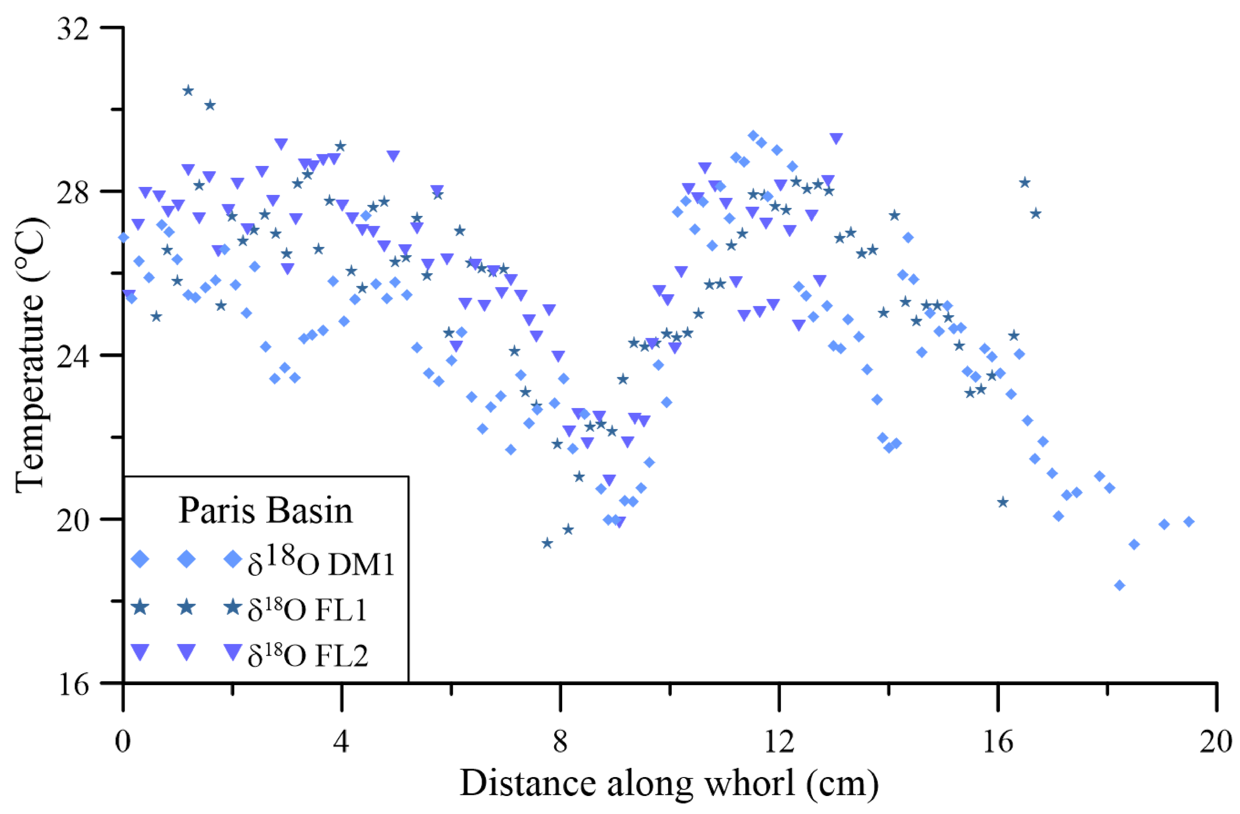
A significant difference can be seen between the Paris and Hampshire Basins, with a >1‰ in $\delta^{18}O_{sw}$. This highlights the extensive fluvial influence present in the Hampshire Basin. Paleotemperatures obtained must therefore be treated with caution and take this into account, with adjustments needed to the used $\delta^{18}O_{sw}$.

Conclusion

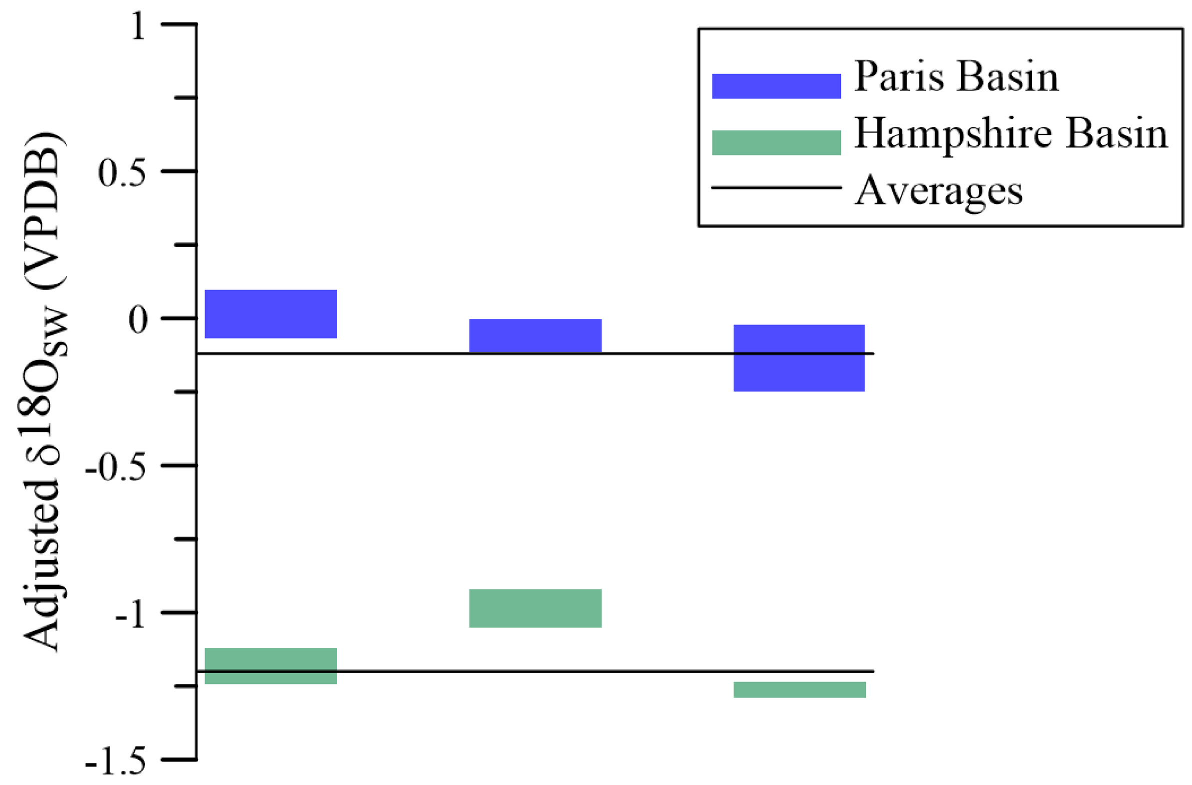
Oxygen isotopes obtained from conid shells show a similar seasonality between the Paris and Hampshire Basins. Greater fluvial influences are inferred in the Hampshire Basin, highlighting the need for caution in the used $\delta^{18}O_{sw}$ in paleotemperature reconstructions.

Reconstructed Paleotemperatures





Adjusted oxygen isotopic value of the seawater



KU LEUVEN

Department of Earth and Environmental Sciences

VUB VRIJE UNIVERSITEIT BRUSSEL

References:

Andreasson & Schmitz (2000) *GSA Bulletin*, 112.

de Winter et al. (2020) *Geochem. Geophys. Geosys.* 21(4).

Gibbard P.L. & Lewin J. (2003) *Journal of the Geological Society*, 160.

Huyghe et al. (2015) *Journal of the Geological Society*, 172.

Purton & Brasier (1997) *Geology*, 25 (10).