

Expanding PlioVAR to PlioMioVAR



Heather L. Ford¹, S. Sosdian², E. McClymont³, S.L. Ho⁴, S. Modestou⁵, N. Burls⁶ and A. Dolan⁷



Figure 1: Blue Clay Formation of Malta at Ras-Il-Pellegrin from the middle Miocene (Badger et al. 2013) (photo credit: Marcus Badger).

Reconstructions of past major transitions and warm climate states are critical for evaluating future climate projections under high greenhouse gas forcing. This working group aims to build on the success of the PAGES working group Pliocene climate variability over glacial-interglacial timescales (PlioVAR; pastglobalchanges.org/pliovar) to include the Miocene and form PlioMioVAR (pastglobalchanges.org/pliomiovar).

For decades the mid-Pliocene warm period has been a data-model comparison target (United States Geological Survey PRISM, PlioVAR, and Pliocene Model Intercomparison Project (PlioMIP); Haywood et al. 2020). During the mid-Pliocene warm period (~3.2 Myr BP), global temperatures are estimated to have been ~2.3°C warmer than today (McClymont et al. 2020) and atmospheric CO₂ is estimated at ~394–330 ppm (de la Vega et al. 2020). However, as modern atmospheric concentrations rise above 410 ppm, it is increasingly necessary to expand our efforts to other periods of sustained warmth.

Expanding interest in Miocene research (~23.03 to 5.33 Myr BP; Lawrence et al. 2021; Burls et al. 2021) includes the mid-Miocene Climate Optimum which is another globally warm equilibrium climate state for data-model comparisons when atmospheric CO₂ was higher than today (~600 ppm; Sosdian et al. 2018). Additionally, the ice-sheet expansion and cooling of the mid-Miocene Climate

Transition presents another opportunity to study threshold climate changes and forcing mechanisms, much like the Northern Hemisphere glaciation during the Pliocene, a PlioVAR scientific objective.

Launching the PlioMioVAR working group will provide a framework for sharing best practices in community-wide engagement, database building and data-model comparison.

Scientific goals and objectives

The PlioMioVAR working group has three main goals. The first is to maintain the existing PlioVAR database and expand to the Miocene by synthesizing climate records and including age-model quality metadata. This will help identify the Miocene target for data-model comparison (likely the Miocene Climate Optimum) and identify gaps in our current Miocene paleoclimate records (temporal resolution, spatial coverage, proxy confidence). The second is to explore new data-model comparison studies to characterize climate variability including transient model simulations and coupled models with biogeochemistry. The third is to compare the long-term evolution of Pliocene and Miocene climate and consider forcing mechanisms like tectonic gateways or CO₂.

Planned workshops

EGU Galileo Conference "The warm Pliocene: Bridging the geological data and modeling communities", with funding from UKIODP and PAGES, is scheduled in August 2022. In addition to presenting the major achievements of PlioVAR, PlioMIP and the rest of the Pliocene community, this workshop will include discussions on launching PlioMIP3, developing synergy between the PlioMIP3 and PlioMioVAR community and strategizing community engagement with the IODP 2050 Science Framework. The

conference will take place in Leeds, UK, from 23 to 26 August 2022 with in-person and virtual options (egu-galileo.eu/gc10-pliocene).

The Miocene temperature community has plans to hold a workshop in the fall of 2022. The workshop would bring together data collectors from various proxy communities to synthesize temperature data. In addition to examining best approaches to a global temperature reconstruction and exploring regional and global temperature patterns, another goal of this workshop is to develop a plan for providing useful output for the modeling community.

Visit the PlioMioVAR website at pastglobalchanges.org/pliomiovar and sign up to our mailing list to keep up to date with our activities. Updates on complimentary Pliocene and Miocene modeling efforts can be found at geology.er.usgs.gov/egpsc/prism/7_pliomip2.html and deepmip.org/deepmip-miocene, respectively.

AFFILIATIONS

- ¹Queen Mary University of London, UK
²Cardiff University, UK
³Durham University, UK
⁴National Taiwan University, Taiwan
⁵Northumbria University, UK
⁶George Mason University, Fairfax, VA, USA
⁷Leeds University, UK

CONTACT

Heather L. Ford: h.ford@qmul.ac.uk

REFERENCES

- Badger et al. (2013) *Paleoceanogr Paleoclimatol* 28: 42-53
 Burls NJ et al. (2021) *Paleoceanogr Paleoclimatol* 36: e2020PA004054
 de la Vega E et al. (2020) *Sci Rep* 10: 11002
 Haywood AM et al. (2020) *Clim Past* 16: 2095-2123
 Lawrence KT et al. (2021) *Eos* 102, doi:10.1029/2021EO210528
 McClymont EL et al. (2020) *Clim Past* 16: 1599-1615
 Sosdian SM et al. (2018) *Earth Planet Sci Lett* 498: 362-376