Stepped Pliocene-Pleistocene Climate variability at Lake El'gygytgyn, NE Arctic Russia, western Beringia

J. BRIGHAM-GRETTE[1]*, M. MELLES[2], P. MINYUK[3]
AND SCIENCE TEAM

[1]Univ Massachusetts, Amherst, MA, United States
    *correspondance: juliebg@geo.umass.edu
[2]Geology, Univ of Cologne, Cologne, Germany
    (mmelles@uni-koeln.de)
[3]Paleomagnetics, NEISRI, Magadan, Russian Federation
    (minyuk@neisri.ru)

The new record from Lake El'gygytgyn, the largest, deepest, oldest unglaciated basin in the circumarctic provides the first complete record of Pliocene and Pleistocene climate change from the terrestrial high latitudes [1, 2]. Lake El'gygytgyn evidence shows 3.6-3.4 Ma ago summer temperatures were ~8ºC warmer than today when pCO_2 was ~400 ppm and ANDRILL records in Antarctica suggest ice sheets were smaller. Multiproxy evidence suggests extreme warmth and polar amplification during the middle Pliocene with low amplitude changes between cold and warm Milankovitch cycles consistent with the LR stack. Sudden stepped cooling events during the Pliocene-Pleistocene transition recorded at Lake E are consistent with a number of marine proxies from the North Pacific and North Atlantic suggesting that polar amplification was recorded across the northern hemisphere in both marine and Arctic terrestrial environments. Summers warmer than present Arctic persisted until ~2.2 Ma, after the onset of Northern Hemispheric glaciation. The warmth recorded at Lake El'gygytgyn raises new questions about the size and geometry of initial ice over North America and elsewhere in the Arctic as well as challenges the notion of perennial sea ice before 2.5 Ma. Our multiproxy evidence is consistent with global sea-level records and other proxies indicating that Arctic cooling was really insufficient to support large-scale ice sheets until the early Pleistocene.

[1] Brigham-Grette *et al* (2013) *Science* **340**, 1421-1427 [2] Melles *et al* (2012) *Science* **337**, 315-320