Wet Winters in the Eastern Siberian Arctic during the Miocene

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Eastern Siberia (a 7.3 million km^2 area, similar to Australia in size) features numerous plant fossil localities, many with spectacularly preserved Neogene fossils (e.g., Baekovo and Nekkeiveem; Khapchan-Timmerdekh; Mamontova Gora). Although these sites have been described in full using classical methods (e.g., Baranova and Grinenko, 1989; Baranova et al., 1970; Biske, 1970; Dorofeev, 1969; Grinenko et al., 1989; Nikitin, 2006, 2007), geochemical proxy techniques have not yet been applied. Here we report the first stable isotope analyses of fossil wood from northeastern Siberia: 512 high-resolution intra-ring analyses of carbon isotopes (IRA-δ^{13}C) in 6 specimens of Miocene wood from the Finish Creek site, located near Cherskiy, Sakha Republic, Russia. Using our model for reconstructing the ratio of summer to winter precipitation (P_s/P_w) from IRA-δ^{13}C (Schubert and Jahren, 2011, *GCA*), we quantified the seasonal precipitation in far northeastern Siberia (~69 ^{o}N) during the Miocene. Although the median value for P_s/P_w during the Miocene was similar to today (P_s/P_w = ~2), we observed much greater variability in P_s/P_w during the Miocene than today. Specifically, years with P_s/P_w < 1/2 occurred ~4 times more frequently during the Miocene than today. When taken with independent estimates of mean annual precipitation based on nearest living relatives (581 to 1206 mm; Popova et al., 2012), our Miocene values for P_s/P_w suggest at least 2.8 times greater winter precipitation during the Miocene relative to today, and at least 5.5 times greater winter precipitation than today in ~10% of years sampled (6-month winter precipitation averages ~70 mm/yr today). Our result differentiates the Siberian Arctic Miocene from the Canadian Arctic Eocene which featured wet summers in the Eocene Arctic of Canada using similar methods, highlighting spatial and temporal variability in the Arctic paleoclimate record of the middle Cenozoic.