**GSA Data Repository 2019046**

**Supplemental Information**

**Title: Was the Laurentide Ice Sheet significantly reduced during Marine Isotope Stage 3?**

April S. Dalton*, Sarah A. Finkelstein, Steven L. Forman, Peter J. Barnett, Tamara Pico, and Jerry X. Mitrovica

*april.s.dalton@durham.ac.uk

**Contains three items:**

**(1) Table DR1 A&B (Excel file)**: Inventory of geochronological data (n=735) dating to Marine Isotope Stage 3 (MIS 3; ca. 57,000 to ca. 29,000 yr BP) that are located in the Last Glacial Maximum (LGM) ice extent of the Laurentide Ice Sheet.

**(2) Note regarding the collation of geochronological data**

The intention of this dataset is to present all MIS 3 data in order to lay out the groundwork for future more detailed studies. As such, no analyses or evaluation of these data has taken place here. All dates spanning the MIS 3 interval are included here, regardless of the author's original interpretation or whether age discrepancies exists at the site. Sites were identified based on extensive literature search (using terms such as "MIS 3" and "mid-Wisconsinan"), examination of previous literature reviews, and author knowledge of the region. Latitude and longitude coordinates are provided at two decimal points for consistency among the wide variety of publications. Any user requiring high-resolution coordinates is referred to the original publication. The majority of collated sites show unequivocal evidence of ice over-riding (e.g. they are sub-till). However, some shell and cosmogenic ages are sub-aerial. In the case of shells, these reflect raised marine beds. In the case of cosmogenic ages, these reflect the total time

that the particular feature has been exposed sub-aerially. Cosmogenic exposure ages are included in this synthesis because they are still valuable for delineating the ice sheet, although interpretation of these data should factor burial history into account. Details on the calculation of cosmogenic ages can be found in the original publication. Future work on this dataset will include quality assessment of these ages (Small et al., 2017) as well as the development of ice-margin chronologies for the MIS 3 interval (Hughes et al., 2016).

**3) Description of the geophysical model**

Geophysical simulations adopt the ice history ICE-PC2 (Pico et al., 2017), characterized by a mid-MIS 3 relative sea-level highstand at 44 ka with a GMSL value of -38 m, and peak sea levels of -15 m and -10 m during MIS 5a and 5c, respectively (Creveling et al., 2017). These simulations are characterized by an ice-free eastern sector of the Laurentide Ice Sheet from MIS 5a to MIS 3, consistent with mid-MIS 3 dates on non-glacial deposits in the Hudson Bay Lowlands (Pico et al., 2017). From LGM to present-day, the ice history adopts the ICE-5G model (Peltier, 2004). The calculations are based on the theory and pseudo-spectral algorithm described by Kendall et al. (2005) with a spherical harmonic truncation at degree and order 256. These calculations include the impact of load-induced Earth rotation changes on sea level (Milne et al., 1999), evolving shorelines and the migration of grounded, marine-based ice (Johnston, 1993; Kendall et al., 2005; Lambeck et al., 2003; Milne et al., 1999). Our predictions require a model for Earth's viscoelastic structure and we adopt the viscosity profile VM2 (Peltier, 2004), which is designed to be paired with ICE-5G, and is constrained, in part, by observations in the Hudson Bay (Peltier and Fairbanks, 2006).

**References**


Creveling, J. R., Mitrovica, J. X., Clark, P. U., Waelbroeck, C., and Pico, T., 2017, Predicted bounds on peak global mean sea level during marine isotope stages 5a and 5c: Quaternary Science Reviews, v. 163, p. 193-208.

Hughes, A. L. C., Gyllencreutz, R., Lohne, O. S., Mangerud, J., and Svendsen, J. I., 2016, The last Eurasian ice sheets – a chronological database and time-slice reconstruction, DATED-1: Boreas, v. 45, no. 1, p. 1-45.

Johnston, P., 1993, The effect of spatially non-uniform water loads on prediction of sea-level change: Geophysical Journal International, v. 114, no. 3, p. 615-634.

Kendall, R. A., Mitrovica, J. X., and Milne, G. A., 2005, On post-glacial sea level – II. Numerical formulation and comparative results on spherically symmetric models: Geophysical Journal International, v. 161, no. 3, p. 679-706.

Lambeck, K., Purcell, A., Johnston, P., Nakada, M., and Yokoyama, Y., 2003, Water-load definition in the glacio-hydro-isostatic sea-level equation: Quaternary Science Reviews, v. 22, no. 2, p. 309-318.

Milne, G. A., Mitrovica, J. X., and Davis, J. L., 1999, Near-field hydro-isostasy: the implementation of a revised sea-level equation: Geophysical Journal International, v. 139, no. 2, p. 464-482.

Peltier, W. R., 2004, Global glacial isostasy and the surface of the ice-age earth: The ICE-5G (VM2) Model and GRACE: Annual Review of Earth and Planetary Sciences, v. 32, no. 1, p. 111-149.

Peltier, W. R., and Fairbanks, R. G., 2006, Global glacial ice volume and Last Glacial Maximum duration from an extended Barbados sea level record: Quaternary Science Reviews, v. 25, no. 23–24, p. 3322-3337.

Pico, T., Creveling, J. R., and Mitrovica, J. X., 2017, Sea-Level Records from the U.S. Mid-Atlantic Constrain Laurentide Ice Sheet Extent During Marine Isotope Stage 3: Nature Communications, v. 8, p. 15612 / DOI 15610.11038/ncomms15612.

Small, D., Clark, C. D., Chiverrell, R. C., Smedley, R. K., Bateman, M. D., Duller, G. A. T., Ely, J. C., Fabel, D., Medialdea, A., and Moreton, S. G., 2017, Devising quality assurance procedures for assessment of legacy geochronological data relating to deglaciation of the last British-Irish Ice Sheet: Earth-Science Reviews, v. 164, p. 232-250.