**LIST OF SUPPLEMENTARY MATERIALS**

Supplementary material Nº 1: Grain size analysis results. File: Supplementary material 1 - Grain size analysis.

Supplementary material Nº 2: X-Ray fluorescence (XRF) core scan analysis. File: Supplementary material 2 - XRF data.

Supplementary material Nº 3: Figure of core image, stratigraphy, and elemental composition (Ca, K, Si and Ti) and ratio (Mn/Ti and Fe/Ti) profiles from the analyzed core intervals with micro-XRF on cores 34A, 33A, 17A and 18A. Cores 34A and 33A are presented as a composite core with all the analyzed intervals. File: Supplementary material 3 - XRF profiles.

Supplementary material Nº 4: Table providing a list of the years in which ice-dam events and ruptures have occurred at Glaciar Perito Moreno. This data was retrieved from a compilation made by Guerrido et al. (2014).