Supporting Information

Finnegan et al. 10.1073/pnas.1117039109

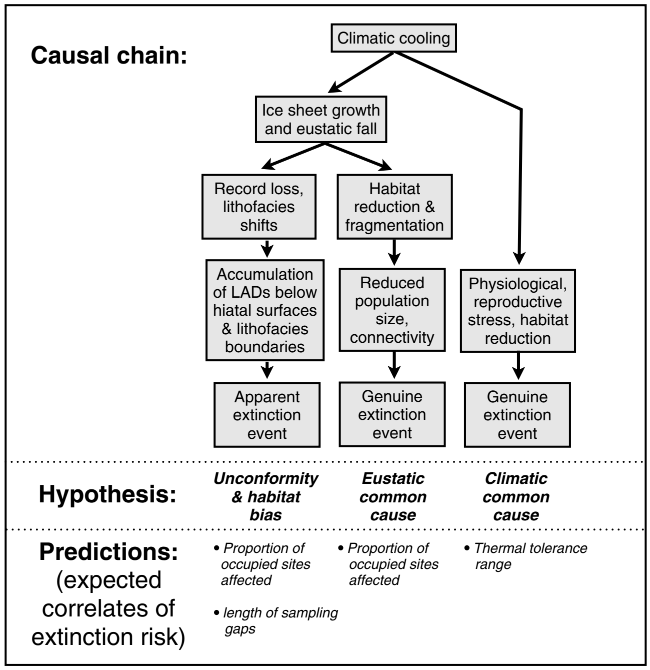
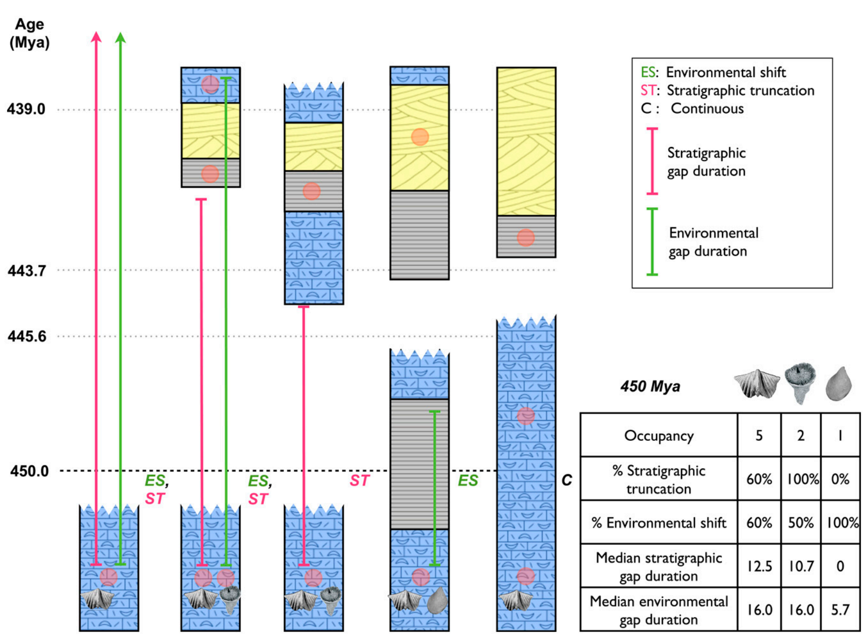


Fig. S1. Causal chains and predicted selective signatures of the hypotheses discussed in the main text.



Occupancy	5	2	1
% Stratigraphic truncation	60%	100%	0%
% Environmental shift	60%	50%	100%
Median stratigraphic gap duration	12.5	10.7	0
Median environmental gap duration	16.0	16.0	5.7

Fig. S2. Simplified hypothetical illustration of the procedure used to calculate gap-related statistics for each genus in each time interval. Paleobiology database collections (red dots) and associated occurrences (depicted only for interval 1) were matched to units in local stratigraphic columns based on stratigraphic nomenclature and geographic coordinates. Each interval boundary in each section containing rock of the appropriate age is assigned one or more of three possible upper stratigraphic boundary types-continuous, environmental truncation (shift), and/or stratigraphic truncation. Both stratigraphic and environmental gap durations in each column are calculated based on the median age of each interval, with intra-interval gaps assigned an arbitrary duration of 0.5 million y; stratigraphically or environmentally continuous sections were assigned gap durations of 0.0. For each genus the total number of different types of stratigraphic boundaries and the distribution of gaps (if any) is tabulated and percent truncation, percent environmental truncation, median stratigraphic gap duration, and median environmental gap duration calculated.

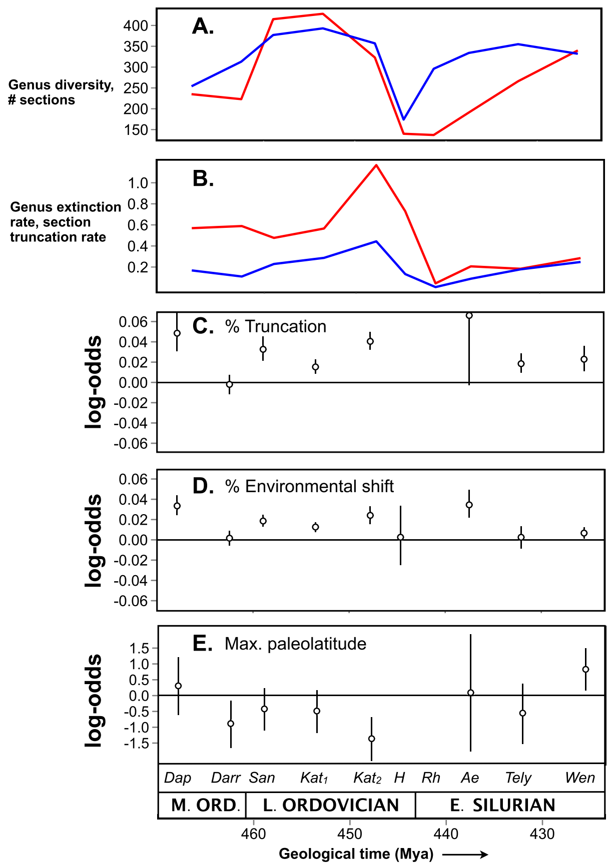


Fig. S3. Diversity, extinction rate, and selectivity trends for the subset of genera that were sampled at every interval within their stratigraphic range. (*A*) Genus diversity and number of stratigraphic packages in Laurentia from Middle Ordovician (Dapingian) through Early Silurian (Wenlockian) time. (*B*) Genus extinction rate and package truncation rate within each interval. (*C–E*) Results of multiple logistic regressions of extinction risk on percent truncation (*A*), percent environmental truncation (*B*), and maximum paleolatitude (*C*) for each interval. Positive log-odds indicate that extinction risk increases as the variable in question increases, and vice versa. In addition to the three variables figured, regressions controlled for genus age, occupancy, substrate preference, and Laurentian and global geographic range. Dap = Dapingian, Darr = Dariwillian, San = Sandbian, K_1 = early Katian, K_2 = late Katian, H = Hirnantian, Rh = Rhuddanian, Ae = Aeronian, Tely = Telychian, Wen = Wenlockian. Hirnantian and Rhuddanian intervals contain too few genera for analyzing some predictors.

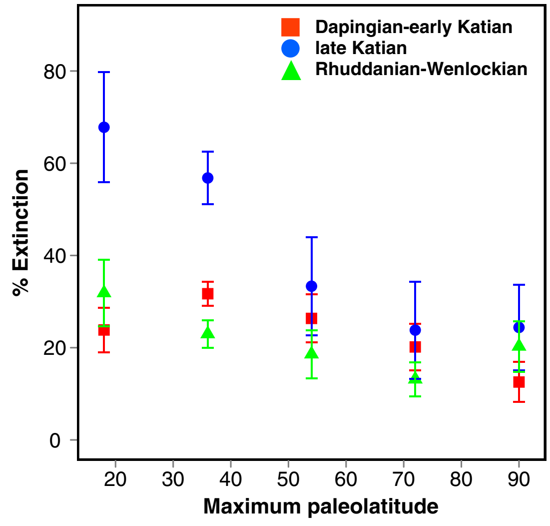


Fig. S4. Proportional extinction of genera as a function of maximum paleolatitude of occurrence for the late Katian interval compared to the averages for the Dapingian and early Katian (Middle-Late Ordovician) and Rhuddanian to Wenlockian (Early Silurian). Error bars are 95% binomial confidence intervals and largely reflect variation in the number of genera in each bin.

Table S1. Results of likelihood ratio tests comparing nested logistic regression models for each interval

Interval	Stratigraphic gaps			Environmental gaps		
	# Genera affected	%trunc *p*	Gap duration *p*	# Genera affected	%trunc *p*	Gap duration *p*
Wenlockian	94	0.341	0.064	539	**0.021**	0.076
Telychian	182	**0.007**	0.564	151	0.847	0.62
Aeronian	8	1	1	126	0.208	0.293
Rhuddanian	0	NA	NA	34	1	0.425
Hirnantian	126	0.511	0.102	10	0.054	1
l. Katian	400	**0.003**	0.906	150	**<.001**	0.123
e. Katian	376	**<.001**	**0.006**	553	**0.022**	0.646
Sandbian	262	0.07	0.865	465	**<.001**	0.262
Darriwillian	113	0.463	**<.001**	220	0.447	0.214
Dapingian	59	0.71	**0.024**	197	**0.001**	0.18

Each test is based on the subset of genera in each interval that experienced at least some stratigraphic or environmental truncation. % truncation *p* is the significance of the difference in fit between a model that includes percent truncation, median gap duration, and occupancy and a model that includes only median gap duration and occupancy. Gap duration *p* is the significance of the difference in fit between a model that includes percent truncation, median gap duration, and occupancy and one that includes only percent truncation and occupancy. Values in bold are significant at the $\alpha = 0.05$ level. It is not appropriate to include genera that experienced no truncation because it would require assigning these genera an arbitrarily short gap duration. Doing so would force a positive relationship between gap duration and extinction risk by including in each model a cohort of genera that had apparently very short gap durations and, because they experienced no truncation, relatively low extinction rates.

Table S2. Comparison of observed late Katian extinctions with extinctions predicted for the late Katian interval by a random forest model trained on early Katian “background” extinction patterns

Laurentian Endemic?	Maximum paleolatitude	% truncation	Total genera	Predicted extinctions	Observed extinctions	Observed predicted
Yes	<40°	<50%	70	29 (41%)	30 (43%)	+1 (2%)
		≥50%	90	53 (59%)	67 (74%)	+14 (15%)
No	<40°	<50%	66	2 (3%)	32 (48%)	+30 (45%)
		≥50%	155	56 (36%)	93 (60%)	+37 (24%)
	>40°	<50%	63	1 (2%)	7 (11%)	+6 (9%)
		≥50%	143	41 (29%)	45 (31%)	+4 (2%)

Observed extinctions are substantially higher than predicted, particularly among genera that experienced relatively minor stratigraphic truncation but had no recorded high-latitude (>40°) occurrences. The excess extinction among these genera is not due to endemicity, as the largest failure of prediction concerns the extinction rate of exclusively low latitude bu nonendemic genera.

Other Supporting Information Files

Dataset S1 (XLS)

Dataset S2 (XLS)