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Supplementary text for

Modeling the dynamics of a Late Triassic vertebrate extinction: the Adamanian/Revueltian faunal turnover, Petrified Forest National Park, AZ, USA

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NOTES ON TAXON SAMPLING

Diagnoses of fossils used in this analysis are current as of Summer 2018. As Parker and Martz (2011) observe, many taxa in the Chinle of Petrified Forest National Park (PEFO) persist through the Adamanian/Revueltian (A/R) faunal turnover: these include Crocodylomorpha, Coelophysoidea, Rauisuchidae, Shuvosauridae, Silesauridae, Sphenosuchia, *Vancleavea campi*, and *Koskinonodon perfectus*, following the recognition of Gee et al. (2017) and Gee and Parker

(2017) that *Apachesaurus gregorii* likely represents a juvenile of this taxon. Because these taxa are not thought to originate or go extinct within the analytical time series, we exclude them from our analyses.

The Adamanian faunal assemblage is comprised by *Acaenasuchus geoffreyi*, *Trilophosaurus* sp., *Calyptosuchus wellesi*, *Placerias hesternus*, *Desmatosuchus spurensis*, *Smilosuchus* sp., *Scutarx deltatylus*, *Poposaurus gracilis*, *Adamanasuchus eisenhardtae*, *Tecovasuchus chatterjeei*, *Acallosuchus rectori*, and *Crosbysaurus harrisae*, while the Revueltian assemblage is comprised by *Machaeroprosopus* sp*., Chindesaurus bryansmalli, and Revueltosaurus callenderi*, and *Rioarribasuchus chamaensis*. Additionally, while not confined to the Adamanian or Revueltian, the pattern of fossil occurrences of *Typothorax* sp. and *Paratypothorax* sp. (Parker and Martz, 2011) suggests that these taxa originated sometime during the analytical time series. Each of the taxa above must meet three criteria to be included in this analysis:

1. Fossils must come from those Chinle localities where published U-Pb dates accommodate rigorous age estimation in a Bchron age-depth model (i.e. Petrified Forest National Park, the *Placerias* Quarry (Camp and Welles, 1956), and the Hayden Quarry (Irmis et al., 2007)). Age constraints based on fossils or lithology, often established at those Chinle localities where geochronologic dates are unavailable, do not rise to the level of temporal precision permissible for this analysis.
2. The Alroy (2014) algorithm requires that each taxon have at least three fossil occurrences of different ages: two to define a temporal range, and at least one between them to define a frequency within that range. We therefore exclude all taxa known from fewer than three total fossil occurrences at PEFO, the Placerias Quarry, and the Hayden

Quarry: these include *Tecovasuchus chatterjeei* (PFV 211), *Acallosuchus rectori* (PFV 124), and *Crosbysaurus harrisae* (PFV 122). We also exclude on these grounds *Rioarribasuchus chamaensis* (PFV 075, PFV 366, and the Hayden Quarry) because our Bchron age-depth model frequently reconstructs two or more of these localities as contemporaneous, pushing the taxon below the analytical threshold.

3. Fossils must occur in localities correlable to U-Pb dated beds via continuously-exposed outcrop. We include seventy-one Petrified Forest fossil localities in this analysis, but exclude fifteen additional localities that do not meet this criterion. General stratigraphic positions can be established for these additional localities per the stratigraphy of Martz and Parker (2010; see also Parker and Martz, 2011); however, the uncertainty associated with those correlations—information required to integrate a locality into our age-depth model—cannot be tallied into a non-arbitrary cumulative term, as can those associated with correlations constructed along continuous outcrop. Accordingly, we exclude from the analysis *Scutarx deltatylus* (occurrences at PFV 224, PFV 169, PFV 304, and PFV 355, but the latter three of these cannot be correlated to dated beds of Ramezani et al. (2011) with sufficient stratigraphic precision) and *Poposaurus gracilis* (occurrences at the *Placerias* Quarry, PFV 161, and PFV 336, but the last of these cannot be correlated with sufficient precision).

We therefore attribute to the Adamanian extinction event the extinctions of *Acaenasuchus geoffreyi*, *Trilophosaurus* sp., *Calyptosuchus wellesi*, *Placerias hesternus*, *Desmatosuchus spurensis*, and *Smilosuchus* sp., and to the Revueltian origination event the originations of *Machaeroprosopus* sp., *Chindesaurus bryansmalli*, and *Revueltosaurus*

callenderi. We exclude *Typothorax* sp. and *Paratypothorax* sp. from this analytical definition of the Revueltian origination because Adamanian-aged fossils belonging to these taxa exist.

Many taxa included in our analysis are not endemic to the study area (northeastern Arizona and north-central New Mexico), yet those fossil occurrences contained within our data set (at PEFO, the *Placerias* Quarry, and the Hayden Quarry) represent the only geochronologically-controlled portion of their record. It is possible that younger fossils may exist elsewhere, but this cannot be demonstrated with current evidence.

The A/R turnover represents a transition between assemblages of genera, not species, and moreover, many fossils in PEFO are not diagnosable to the specific level; as is common with fossil vertebrate taxa, we therefore perform our analyses at the generic level. Additionally, because the Alroy (2014) and Solow (2016) methods require only the knowledge that a genus was present at a given time, our analyses do not consider abundance, nor do we attempt to discriminate between fossils belonging to unique individuals at a given locality. All locality data are permanently stored at Petrified Forest National Park. Table S7 lists voucher numbers for all fossils included in the analysis.

AGE-DEPTH MODELING IN BCHRON

The methods of Alroy (2014) and Solow (2016) require a record of known fossil ages to reconstruct extinction probability. Notably, however, these methods provide no means of accounting for the temporal uncertainty inherent in such records in deep time. It was therefore necessary to establish a mechanism for assessing the precision with which absolute ages could be interpolated for fossils throughout the thickness of the dated Chinle sequence exposed in PEFO.

For each PEFO fossil locality, we calculated a distribution of plausible ages using a pair of age-depth models constructed in the R package Bchron (v. 4.3.0, Haslett and Parnell, 2008). We defined separate models for northern (Figure S1) and southern (Figure S2) PEFO for practicality, as stratigraphic correlations can be most precisely defined between U-Pb dates and those fossils situated closest geographically. Ages of fossils in northern PEFO could thus be best determined with a model employing the date KWI (Devil's Playground, northern PEFO; Ramezani et al., 2011), and southern fossils with a model employing P-57C (Mountain Lion Mesa, southern PEFO; Nordt et al., 2015). In cases when we could not determine exactly which bed at a locality yielded fossils, we reported that stratigraphic uncertainty to the age-depth model, which accordingly produced a broader distribution of possible ages for all fossils at that locality. In those cases when we could assign particular fossils at a locality to distinct beds, we entered those beds, with their corresponding stratigraphic uncertainties, separately in the model.

Inputs for the Bchronology function, used to build northern and southern PEFO age-depth models, are respectively available in Tables S1 and S2. Age inputs ("ages" and "ageSds" arguments) are scaled down by 10^3, but Bchronology scales them to their true magnitude as the ageScaleVal argument defaults to 1000. Stratigraphic inputs ("position" and "thickness") are derived from the original field notes supporting the correlations of Ramezani et al. (2011), in addition to the positions Atchley et al. (2014) and Nordt et al. (2015) report for the dates SS-7 and P57-C. Because all ages are derived from a U-Pb isotopic system, we set the calibration curves ("calCurves") argument to "normal," following the instruction of Bchron documentation for non-14C ages. Each age model was run for 1,000,000 iterations, with a burn-in period of 200,000 iterations and one iteration kept every 800 steps beyond the burn-in. Diagnostics (convergence checks and posterior outlier probability by date) of the age models are available in Tables S3 and S4.

We estimated ages for the *Placerias* and Hayden Quarries by respectively sampling ages in Bchron from the dates AB0513-2 (Ramezani et al., 2014) and Hayden 2 (Irmis et al., 2011). This approach, by contrast to an age-depth model, is justified because these dates were sampled directly from fossiliferous beds at both localities. It should be noted, however, that additional fossiliferous horizons exist at the Hayden Quarry beyond that containing Hayden 2. We thus assumed that the broad analytical uncertainty associated with that date ($\pm$ 0.7 Ma) encompasses the complete depositional age of the Hayden Quarry.

We estimated ages for these localities first by passing the inputs given in Tables S5 and S6 to the function BchronCalibrate to calibrate the dates. We then passed the subsequent outputs to the function sampleAges to generate ages. BchronCalibrate was run with all arguments set to

their default values, and sampleAges with the “n_sample” argument set to provide 1000 age estimates.

NOTES ON MODEL INTERPRETATION

The model employed in this study differs somewhat from that of Alroy (2014) and Solow (2016) in the nature of its fossil data. The simulated data presented in Alroy (2014) have a temporal precision unavailable here, as there is no uncertainty of which time bin ought to contain a given taxon occurrence. The same problem is present in the alternative approach of Solow (2016). We address the issue through our age-depth model. The model builds age distributions reflecting the temporal uncertainty around each fossil, and our analyses account fairly for that uncertainty by considering the full breadth of these distributions in constructing posterior probability densities of extinction/origination (by averaging results from 1000 runs of the Alroy (2014) and Solow (2016) algorithms, with each run corresponding to a unique combination of draws of fossil ages from the distributions produced by the age-depth models).

Figure 2 (main text) illustrates the density of the probability that taxa go extinct or originate through time. Extinction or origination is most likely where the pair of curves (top and bottom respectively representing analyses run with the Alroy (2014) and Solow (2016) methods) for each taxon are highest, and less so where they are lower. The reason that most curves extend far throughout the time series is the sparseness of fossil data. For example, because *Placerias* has few fossil occurrences, the algorithms conservatively predict a broader distribution of possible extinction times. This gives the long flat curve pictured in Figure 2. What it does not signify is that *Placerias* must have survived for an anomalously long time after the last fossil; all it indicates is that the model cannot constrain the time of that extinction with a great degree of certainty. If we consider the curves of all taxa, rather than *Placerias* alone,

much overlap is evident. Clearly, there is some probability that extinctions and/or originations were synchronous.

We carry the analysis further by quantifying the exact probability of synchroneity. The probability that extinctions and/or originations were synchronous is simply the joint probability that those events happened in a single analytical interval. This joint probability can be straightforwardly calculated as the product of the respective areas under the densities of those taxa, as pictured in Figure 2. The summation of these joint probabilities across the full time series gives the total probability that any number of extinctions and/or originations were synchronous at any time in the analytical window, regardless of when exactly that time was. Table 1 and Figure 3 (main text) report these overall probabilities.

TESTING OF THE ASSUMPTION OF UNIFORM FOSSIL RECOVERY

The Alroy (2014) and Solow (2016) methods assume that fossil sampling probability remains uniform through the stratigraphic record of each taxon—a condition far from certain in the terrestrial fluvial system represented by the Chinle. We test this assumption via the uniform probability plot correlation coefficient (PPCC) approach of Vogel et al. (2009; see also Wang et al., 2009). This test assesses how well a stratigraphic pattern of fossils fits a uniform distribution. Outputs of tests such as this are typically interpreted graphically, but because of the prohibitively large number of iterations we performed (11,000; one test per interpolated Chinle chronology per taxon), we instead automated the hypothesis testing procedure described by Vogel and Kroll (1989, p. 343) to assess the realism of assuming uniformity.

Among the 1000 stochastically interpolated Chinle chronologies provided by our age-depth model, the test cannot consistently distinguish between uniform and fossil patterns of *Acaenasuchus* (100.0% of chronologies accord with uniform distribution), *Calyptosuchus* (99.9%), *Desmatosuchus* (93.3%), *Machaeroprosopus* (99.9%), *Paratypothorax* (100.0%), *Placerias* (100.0%), *Smilosuchus* (100.0%), and *Trilophosaurus* (100.0%). Notably, this list encompasses the full Adamanian assemblage, as well as *Machaeroprosopus*, the diagnostic taxon of the Revueltian biozone.

Uniformity can be rejected for the three remaining taxa (*Chindesaurus*, 18.0% of chronologies accord with uniform distribution; *Revueltosaurus*, 4.10%; *Typothorax*, 0.70%) because their fossil occurrences skew young. Because we do not attribute *Typothorax* to the Revueltian biozone, only the former two taxa bear upon the results of the analysis. If we therefore ignore these taxa while calculating the probability that Adamanian extinctions

coincided with Revueltian originations (here, that of *Machaeroprosopus* alone), the result is 3.68×10^{-12}. Because this figure compels us to reject the null hypothesis—just as we would without ignoring *Chindesaurus* and *Revueltosaurus*—we may conclude that violations of assumed uniform fossil recovery in this study system are not so egregious as to meaningfully distort our analysis.

ADDITIONAL ANALYSIS ASSUMING UNDERSAMPLING OF TAXA

Alroy (2014) recognized that if a taxon existed prior to the beginning of the stratigraphic record at hand—a circumstance he dubs "undersampling" of that taxon—its prior extinction probability $P(E)$ would be too large. Given our uncertainty of whether this dissonance between the observed and true ranges ever truly exists, Alroy (2014) suggested doubling the range term R of the prior as a fair correction to the problem. We took this advice, and performed a more conservative iteration our Alroy-based analysis with the prior:

$$P(E) = -\log(0.5)/2R$$

This is not an issue for the Solow (2016) method, which employs a prior determined independently of range data.

Results of this additional analysis accord with those of the previous Solow- and Alroy-based analyses: the probabilities of a singular Adamanian extinction event, singular Revueltian origination event, and synchronous A/R turnover are infinitesimal across all three (Tables S8-S11; Figures S3, S4).

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TABLE S1. GEOCHRONOLOGIC DATA USED FOR BCHRON AGE-DEPTH MODEL OF NORTHERN PETRIFIED FOREST NATIONAL PARK.

id	ages	ageSds	position	thickness	calCurves
BFB	209926	72	0	1.25	normal
GPU	213124	69	101.01	0.75	normal
KWI	213870	78	109.545	1.28	normal
GPL	218017	88	140.045	1.92	normal
SBJ	219317	80	154.32	0.37	normal
SS-7	220123	68	185.075	0.5	normal
TPS	223036	59	189.125	0.76	normal
SS-28	225185	79	241.075	0.5	normal

TABLE S2. GEOCHRONOLOGIC DATA USED FOR BCHRON AGE-DEPTH MODEL OF SOUTHERN PETRIFIED FOREST NATIONAL PARK.

id	ages	ageSds	position	thickness	calCurves
BFB	209926	72	0	1.25	normal
GPU	213124	69	101.01	0.75	normal
P57-C	213630	130	109.575	0.5	normal
GPL	218017	88	140.045	1.92	normal
SBJ	219317	80	154.32	0.37	normal
SS-7	220123	68	185.075	0.5	normal
TPS	223036	59	189.125	0.76	normal
SS-28	225185	79	241.075	0.5	normal

TABLE S3. DIAGNOSTICS OF NORTHERN PEFO AGE-DEPTH MODEL.

Convergence check		Posterior outlier probability by date	
Item	p-value	Date	Probability
SS-28	0.01079	BFB	0.011
BFB	0.04959		
Outlier 1	0.05388	GPU	0.007
KWI	0.05895		
GPU	0.06749	KWI	0.009
SBJ	0.10622		
RateVar	0.10981	GPL	0.017
Outlier 5	0.16353		
GPL	0.26781	SBJ	0.014
Outlier 4	0.27108		
TPS	0.31382	SS-7	0.012
Outlier 7	0.33808		
Outlier 2	0.35450	TPS	0.008
Outlier 8	0.35450		
Outlier 6	0.35820	SS-28	0.007
RateMean	0.41734		
Outlier 3	0.42872		
SS-7	0.43179		

TABLE S4. DIAGNOSTICS OF SOUTHERN PEFO AGE-DEPTH MODEL.

Convergence check		Posterior outlier probability by date	
Item	p-value	Date	Probability
Outlier 7	0.01391	BFB	0.010
TPS	0.01578		
Outlier 2	0.02498	GPU	0.011
GPL	0.03077		
SS-7	0.04116	P57-C	0.008
Outlier 3	0.04132		
P57-C	0.10662	GPL	0.010
SS-28	0.21414		
RateMean	0.29593	SBJ	0.009
Outlier 6	0.29694		
RateVar	0.30071	SS-7	0.012
Outlier 4	0.30129		
Outlier 8	0.35820	TPS	0.011
GPU	0.37987		
BFB	0.39042	SS-28	0.014
SBJ	0.39612		
Outlier 1	0.42872		
Outlier 5	0.49709		

TABLE S5. GEOCHRONOLOGIC DATA USED FOR MODELING AGE OF *PLACERIAS* QUARRY IN BCHRON.

id	ages	ageSds	position	calCurves
AB0513-2	219390	120	0	normal

TABLE S6. GEOCHRONOLOGIC DATA USED FOR MODELING AGE OF HAYDEN QUARRY IN BCHRON.

id	ages	ageSds	position	calCurves
Hayden 2	211900	700	0	normal

TABLE S7. VOUCHER SPECIMENS AND ASSOCIATED FOSSIL LOCALITIES.

Taxon	Locality	Bchron model	Position in age-depth model (m)	Voucher #
Acaenasuchus geoffreyi (Aetosauria)	PFV122	Southern PEFO	190.44 ± 1.35	PEFO 20358
	PFV211	Southern PEFO	175.55 ± 2.54	PEFO 16621
	Placerias Quarry	*Placerias* Quarry	0.00	MNA V36668
Calyptosuchus wellesi (Aetosauria)	PFV111	Southern PEFO	203.13 ± 1.67	UCMP 126856
	PFV112	Southern PEFO	204.66 ± 2.02	UCMP 126854
	PFV161	Southern PEFO	170.98 ± 3.57	UCMP 139492
	PFV162	Southern PEFO	169.61 ± 1.81	UCMP 126844
	PFV165	Southern PEFO	164.51 ± 2.81	UCMP 126943
	PFV167	Southern PEFO	146.76 ± 3.3	UCMP 126882
	PFV396	Southern PEFO	204.39 ± 4.38	PEFO 38265
	PFV445	Southern PEFO	201.52 ± 4.33	PEFO 38612
Desmatosuchus spurensis (Aetosauria)	PFV113	Southern PEFO	185.945 ± 2.92	PEFO 5038
	PFV167	Southern PEFO	146.755 ± 3.30	UCMP 126885
	PFV178	Southern PEFO	127.275 ± 3.51	UCMP 126976
	PFV198	Southern PEFO	202.47 ± 5.56	PEFO 31177
	PFV202	Southern PEFO	190.47 ± 1.83	PEFO 23338
	PFV211	Southern PEFO	175.55 ± 2.54	PEFO 38402
	PFV212	Southern PEFO	173.90 ± 1.62	PEFO 26668
	PFV267	Southern PEFO	161.03 ± 0.47	PEFO 34935
	Placerias Quarry	*Placerias* Quarry	0.00	UCMP 78748
Paratypothorax (Aetosauria)	PFV037	Northern PEFO	96.60 ± 1.32	UCMP 139486
	PFV071	Southern PEFO	71.19 ± 0.35	UCMP 139958
	PFV097	Northern PEFO	137.73 ± 1.32	UCMP 129995
	PFV167	Southern PEFO	146.755 ± 3.30	PEFO 35003
	PFV272	Southern PEFO	117.34 ± 1.82	PEFO 31206
	PFV366	Southern PEFO	101.76 ± 2.81	PEFO 35263
Typothorax coccinarum (Aetosauria)	PFV037	Northern PEFO	96.60 ± 1.32	PEFO 5039
	PFV040	Northern PEFO	19.91 ± 3.28	PEFO 36757
	PFV060	Southern PEFO	91.83 ± 1.42	PEFO 34882

Taxon	Locality	Bchron model	Position in age-depth model (m)	Voucher #
Typothorax coccinarum (Aetosauria)	PFV070	Southern PEFO	71.19 ± 0.35	PEFO 23388
	PFV071	Southern PEFO	71.19 ± 0.35	PEFO 34851
	PFV075	Southern PEFO	92.12 ± 2.14	PEFO 36779
	PFV089	Southern PEFO	112.69 ± 1.28	PEFO 34869
	PFV092	Southern PEFO	102.98 ± 3.99	PEFO 34214
	PFV094	Southern PEFO	105.35 ± 2.76	UCMP 126855
	PFV097	Northern PEFO	137.73 ± 1.32	PEFO 34918
	PFV121	Southern PEFO	173.87 ± 3.29	PEFO 34213
	PFV215	Northern PEFO	15.30 ± 2.97	PEFO 16668
	PFV227	Southern PEFO	113.06 ± 1.06	PEFO 35018
	PFV231	Northern PEFO	25.00 ± 2.30	PEFO 33980
	PFV268	Southern PEFO	117.845 ± 1.15	PEFO 26702
	PFV290	Southern PEFO	120.54 ± 2.35	PEFO 34884
	PFV295	Southern PEFO	107.77 ± 1.58	PEFO 34280
	PFV326	Northern PEFO	34.75 ± 1.49	PEFO 38654
	PFV349	Southern PEFO	93.24 ± 1.31	PEFO 34847
	PFV367	Northern PEFO	129.49 ± 0.97	PEFO 34918
	PFV371	Northern PEFO	97.75 ± 2.38	PEFO 35131
	Hayden Quarry	Hayden Quarry	0.00	GR 229
Machaeroprosopus (Phytosauria)	PFV037	Northern PEFO	96.60 ± 1.32	PEFO 5034
	PFV040	Northern PEFO	19.91 ± 3.28	UCMP 126726
	PFV042	Northern PEFO	28.79 ± 2.37	PEFO 31219
	PFV075	Southern PEFO	92.12 ± 2.14	UCMP 126993
	PFV271	Southern PEFO	94.29 ± 1.81	PEFO 31205
	PFV295	Southern PEFO	107.77 ± 1.58	PEFO 31207
Smilosuchus (Phytosauria)	PFV097	Northern PEFO	137.73 ± 1.32	UCMP 26688
	PFV098	Northern PEFO	133.43 ± 1.19	UCMP 27181a
	PFV113	Southern PEFO	185.95 ± 2.92	UCMP 139554

Taxon	Locality	Bchron model	Position in age-depth model (m)	Voucher #
Smilosuchus (Phytosauria)	PFV122	Southern PEFO	190.44 ± 1.34	PEFO 5083
	PFV150	Southern PEFO	165.23 ± 2.29	PEFO 34869
	PFV142	Southern PEFO	201.61 ± 5.40	PEFO 31156
	PFV161	Southern PEFO	170.98 ± 3.57	PEFO 34921
	PFV177	Southern PEFO	129.49 ± 2.54	UCMP 129809
	PFV178	Southern PEFO	127.28 ± 3.51	PEFO 34866
	PFV182	Southern PEFO	201.055 ± 1.38	PEFOF 26682
	PFV268	Southern PEFO	117.845 ± 1.15	PEFO 31203
Chindesaurus bryansmalli (Dinosauria)	PFV018	Northern PEFO	21.12 ± 1.04	PEFO 4849
	PFV020	Northern PEFO	29.15 ± 0.51	PEFO 10395
	PFV089	Southern PEFO	112.69 ± 1.28	PEFO 34875
	PFV231	Northern PEFO	25.00 ± 2.30	PEFO 33982
	PFV332	Northern PEFO	23.67 ± 7.62	PEFO 34583
	Hayden Quarry	Hayden Quarry	0.00	GR 226
Revueltosaurus callenderi (Archosauria)	PFV040	Northern PEFO	19.91 ± 3.28	PEFO 34169
	PFV089	Southern PEFO	112.69 ± 1.28	PEFO 36759
	PFV215	Northern PEFO	15.30 ± 2.97	PEFO 16671
	PFV231	Northern PEFO	25.00 ± 2.30	PEFOF 33991
	PFV297	Northern PEFO	22.98 ± 0.38	PEFO 33787
Trilophosaurus (Archosauria)	PFV122	Southern PEFO	190.44 ± 1.35	PEFO 3893
	PFV191	Southern PEFO	151.58 ± 1.21	PEFO 31165
	PFV396	Southern PEFO	204.39 ± 4.38	PEFO 38355
	Placerias Quarry	*Placerias* Quarry	0.00	UCMP 32390
Placerias hesternus (Dicynodonta)	PFV098	Northern PEFO	133.43 ± 1.19	UCMP 26682
	PFV113	Southern PEFO	185.945 ± 2.92	UCMP 139463
	PFV124	Southern PEFO	188.795 ± 2.29	UCMP 27095
	Placerias Quarry	*Placerias* Quarry	0.00	MNA PI 2770

TABLE S8. POSTERIOR PROBABILITY OF SYNCHRONOUS ADAMANIAN EXTINCTION EVENT, REVUELTIAN ORIGINATION EVENT, AND A/R TURNOVER CALCULATED WITH ALROY (2014) METHOD ASSUMING UNDERSAMPLING OF ALL TAXA

Event	Posterior Probability
Adamanian extinction	$2.02\ x\ 10^{-10}$
Revueltian origination	$2.93\ x\ 10^{-4}$
A/R turnover	$5.91\ x\ 10^{-14}$

TABLE S9. AVERAGE POSTERIOR EXTINCTION PROBABILITIES GENERATED FOR *ACAENASUCHUS*, *TRILOPHOSAURUS*, *CALYPOTSUCHUS*, AND *PLACERIAS* BY ALROY (2014) AND SOLOW (2016) METHODS. "NO UNDERSAMPLING" AND "UNDERSAMPLING" DENTOED RESPECTIVELY BY "NU" AND "U".

Interval (Ma)	*Acaenasuchus*			*Trilophosaurus*			*Calyptosuchus*			*Placerias*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
225.185	0	0	0	0	0	0	0	0	0	0	0	0
225.085	0	0	0	0	0	0	0	0	0	0	0	0
224.985	0	0	0	0	0	0	0	0	0	0	0	0
224.885	0	0	0	0	0	0	0	0	0	0	0	0
224.785	0	0	0	0	0	0	0	0	0	0	0	0
224.685	0	0	0	0	0	0	0	0	0	0	0	0
224.585	0	0	0	0	0	0	0	0	0	0	0	0
224.485	0	0	0	0	0	0	0	0	0	0	0	0
224.385	0	0	0	0	0	0	0	0	0	0	0	0
224.285	0	0	0	0	0	0	0	0	0	0	0	0
224.185	0	0	0	0	0	0	0	0	0	0	0	0
224.085	0	0	0	0	0	0	0	0	0	0	0	0
223.985	0	0	0	0	0	0	0	0	0	0	0	0
223.885	0	0	0	0	0	0	0	0	0	0	0	0
223.785	0	0	0	0	0	0	0	0	0	0	0	0
223.685	0	0	0	0	0	0	0	0	0	0	0	0
223.585	0	0	0	0	0	0	0	0	0	0	0	0
223.485	0	0	0	0	0	0	0	0	0	0	0	0
223.385	0	0	0	0	0	0	0	0	0	0	0	0
223.285	0	0	0	0	0	0	0	0	0	0	0	0
223.185	0	0	0	0	0	0	0	0	0	0	0	0
223.085	0	0	0	0	0	0	0	0	0	0	0	0
222.985	0	0	0	0	0	0	0	0	0	0	0	0
222.885	0	0	0	0	0	0	0	0	0	0	0	0

Interval (Ma)	*Acaenasuchus*			*Trilophosaurus*			*Calyptosuchus*			*Placerias*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
222.785	0	0	0	0	0	0	0	0	0	0	0	0
222.685	0	0	0	0	0	0	0	0	0	0	0	0
222.585	0	0	0	0	0	0	0	0	0	0	0	0
222.485	0	0	0	0	0	0	0	0	0	0	0	0
222.385	0	0	0	0	0	0	0	0	0	0	0	0
222.285	0	0	0	0	0	0	0	0	0	0	0	0
222.185	0	0	0	0	0	0	0	0	0	0	0	0
222.085	0	0	0	0	0	0	0	0	0	0	0	0
221.985	0	0	0	0	0	0	0	0	0	0	0	0
221.885	0	0	0	0	0	0	0	0	0	0	0	0
221.785	0	0	0	0	0	0	0	0	0	0	0	0
221.685	0	0	0	0	0	0	0	0	0	0	0	0
221.585	0	0	0	0	0	0	0	0	0	0	0	0
221.485	0	0	0	0	0	0	0	0	0	0	0	0
221.385	0	0	0	0	0	0	0	0	0	0	0	0
221.285	0	0	0	0	0	0	0	0	0	0	0	0
221.185	0	0	0	0	0	0	0	0	0	0	0	0
221.085	0	0	0	0	0	0	0	0	0	0	0	0
220.985	0	0	0	0	0	0	0	0	0	0	0	0
220.885	0	0	0	0	0	0	0	0	0	0	0	0
220.785	0	0	0	0	0	0	0	0	0	0	0	0
220.685	0	0	0	0	0	0	0	0	0	0	0	0
220.585	0	0	0	0	0	0	0	0	0	0	0	0
220.485	0	0	0	0	0	0	0	0	0	0	0	0
220.385	0	0	0	0	0	0	0	0	0	0	0	0

Interval (Ma)	*Acaenasuchus*			*Trilophosaurus*			*Calyptosuchus*			*Placerias*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
220.285	0	0	0	0	0	0	0	0	0	0	0	0
220.185	0	0	0	0	0	0	0	0	0	0	0	0
220.085	0	0	0	0	0	0	0	0	0	0	0	0
219.985	2.11E-05	2.09E-05	1.20E-05	0	0	0	0	0	0	0	0	0
219.885	0.000187	0.000181	0.000104	0	0	0	0	0	0	0	0	0
219.785	0.000207	0.000197	0.000114	0	0	0	1.98E-05	1.69E-05	8.91E-06	0	0	0
219.685	0.000368	0.000343	0.000199	0	0	0	4.04E-05	3.33E-05	1.76E-05	0	0	0
219.585	0.001105	0.00104	0.0006	0	0	0	8.09E-05	6.77E-05	3.59E-05	0	0	0
219.485	0.004326	0.00415	0.002399	5.70E-05	4.64E-05	2.54E-05	0.000104	8.75E-05	4.67E-05	4.46E-05	4.90E-05	3.10E-05
219.385	0.010628	0.010483	0.006125	9.52E-05	7.56E-05	4.15E-05	0.000145	0.000124	6.67E-05	6.72E-05	7.06E-05	4.49E-05
219.285	0.01598	0.015453	0.009026	0.000337	0.000274	0.00015	0.00015	0.00013	7.06E-05	0.00024	0.000251	0.000159
219.185	0.018792	0.017988	0.010561	0.002044	0.001671	0.000914	0.000246	0.000209	0.000113	0.000286	0.000298	0.000191
219.085	0.019614	0.018651	0.011042	0.00707	0.005797	0.003174	0.000346	0.000291	0.000157	0.00029	0.000302	0.000195
218.985	0.019861	0.018799	0.011238	0.013433	0.010966	0.006018	0.000714	0.000599	0.000321	0.000292	0.000304	0.000199
218.885	0.02002	0.018884	0.011405	0.016988	0.013877	0.007655	0.001966	0.00165	0.000876	0.000295	0.000307	0.000203
218.785	0.020126	0.018938	0.01156	0.018004	0.014725	0.008187	0.004443	0.003696	0.001956	0.000297	0.000308	0.000207
218.685	0.020198	0.018976	0.011713	0.018672	0.015305	0.008582	0.00713	0.005947	0.003155	0.000298	0.00031	0.000211
218.585	0.020234	0.018999	0.011863	0.019272	0.015848	0.008968	0.010333	0.008626	0.004591	0.000299	0.000311	0.000215
218.485	0.020238	0.019005	0.01201	0.019719	0.016291	0.009311	0.013386	0.01123	0.006006	0.000299	0.000311	0.000218
218.385	0.020208	0.018995	0.012154	0.020124	0.016717	0.009655	0.016271	0.013728	0.007388	0.000299	0.000312	0.000222
218.285	0.020147	0.018968	0.012293	0.020486	0.017125	0.010001	0.018559	0.015797	0.008573	0.000299	0.000311	0.000225
218.185	0.020056	0.018924	0.012427	0.020709	0.017442	0.01031	0.020019	0.017239	0.009458	0.000298	0.00031	0.000228
218.085	0.019935	0.018863	0.012557	0.020901	0.017751	0.010626	0.021017	0.018353	0.010204	0.000296	0.000309	0.000231
217.985	0.019787	0.018785	0.012682	0.021047	0.018037	0.010942	0.021861	0.019387	0.01094	0.000294	0.000307	0.000234
217.885	0.019614	0.01869	0.012801	0.021131	0.018287	0.01125	0.022586	0.020359	0.011682	0.000327	0.000346	0.000262

Interval (Ma)	*Acaenasuchus*			*Trilophosaurus*			*Calyptosuchus*			*Placerias*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
217.785	0.019416	0.018579	0.012914	0.021168	0.018512	0.011557	0.023238	0.021306	0.012449	0.000446	0.000457	0.000335
217.685	0.019195	0.018451	0.013021	0.021161	0.01871	0.01186	0.023811	0.022215	0.013239	0.000686	0.00067	0.000472
217.585	0.018954	0.018307	0.013121	0.021109	0.01888	0.01216	0.024297	0.023073	0.014047	0.001113	0.001059	0.000718
217.485	0.018694	0.018148	0.013215	0.021014	0.01902	0.012455	0.024691	0.023867	0.014867	0.001511	0.001417	0.000948
217.385	0.018417	0.017973	0.013301	0.020879	0.01913	0.012744	0.025004	0.024596	0.015699	0.001961	0.001846	0.001223
217.285	0.018124	0.017784	0.013379	0.020706	0.019209	0.013026	0.025206	0.025225	0.016523	0.002996	0.002787	0.001817
217.185	0.017817	0.017581	0.01345	0.020496	0.019257	0.0133	0.025309	0.025756	0.017337	0.005413	0.004956	0.003175
217.085	0.017498	0.017365	0.013513	0.020252	0.019273	0.013564	0.025315	0.026178	0.018133	0.008829	0.008033	0.005103
216.985	0.017169	0.017136	0.013568	0.019977	0.019258	0.013818	0.025226	0.026487	0.018901	0.01207	0.010923	0.006929
216.885	0.016831	0.016895	0.013615	0.019673	0.019211	0.014061	0.025045	0.026676	0.019631	0.013964	0.012634	0.008043
216.785	0.016485	0.016643	0.013653	0.019343	0.019132	0.014292	0.024778	0.026743	0.020315	0.01457	0.013207	0.008466
216.685	0.016133	0.01638	0.013682	0.018991	0.019023	0.014509	0.024431	0.02669	0.020943	0.014982	0.013622	0.008799
216.585	0.015776	0.016108	0.013702	0.018617	0.018884	0.014712	0.02401	0.026518	0.021507	0.015438	0.014079	0.009167
216.485	0.015416	0.015827	0.013714	0.018226	0.018715	0.014899	0.023523	0.026231	0.021998	0.01576	0.01442	0.009471
216.385	0.015054	0.015539	0.013717	0.01782	0.018519	0.01507	0.022991	0.025847	0.022417	0.016078	0.014765	0.009785
216.285	0.014691	0.015243	0.01371	0.017401	0.018296	0.015224	0.022396	0.025355	0.022747	0.016406	0.015122	0.010116
216.185	0.014327	0.014941	0.013695	0.016972	0.018048	0.01536	0.02176	0.024774	0.022989	0.016658	0.015426	0.010422
216.085	0.013965	0.014634	0.013671	0.016535	0.017777	0.015478	0.021088	0.024113	0.023142	0.016987	0.0158	0.01078
215.985	0.013604	0.014322	0.013638	0.016092	0.017483	0.015577	0.020391	0.023385	0.023204	0.017213	0.016081	0.01109
215.885	0.013245	0.014007	0.013596	0.015645	0.017169	0.015656	0.019673	0.022599	0.023176	0.017419	0.016352	0.011402
215.785	0.01289	0.013688	0.013545	0.015196	0.016836	0.015715	0.018942	0.021769	0.02306	0.017576	0.016586	0.0117
215.685	0.012539	0.013367	0.013486	0.014747	0.016487	0.015754	0.018204	0.020903	0.022861	0.017711	0.016801	0.011995
215.585	0.012192	0.013044	0.013418	0.014299	0.016122	0.015773	0.017464	0.020014	0.022582	0.017838	0.017014	0.012298
215.485	0.011849	0.012721	0.013342	0.013854	0.015745	0.015771	0.016728	0.019109	0.022229	0.017931	0.017193	0.012587
215.385	0.011513	0.012397	0.013258	0.013413	0.015357	0.015749	0.015999	0.018199	0.021809	0.018016	0.017365	0.01288

Interval (Ma)	*Acaenasuchus*			*Trilophosaurus*			*Calyptosuchus*			*Placerias*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
215.285	0.011182	0.012074	0.013166	0.012976	0.014959	0.015707	0.015282	0.01729	0.021328	0.018054	0.017499	0.013158
215.185	0.010857	0.011752	0.013066	0.012547	0.014554	0.015645	0.014578	0.01639	0.020794	0.01806	0.017602	0.013423
215.085	0.010538	0.011431	0.012958	0.012124	0.014142	0.015563	0.013892	0.015505	0.020215	0.018095	0.017726	0.013707
214.985	0.010226	0.011113	0.012844	0.011709	0.013727	0.015462	0.013224	0.014639	0.019597	0.018062	0.017789	0.01396
214.885	0.00992	0.010797	0.012722	0.011302	0.013309	0.015343	0.012577	0.013797	0.018949	0.01801	0.017831	0.014206
214.785	0.009622	0.010485	0.012594	0.010904	0.01289	0.015206	0.011952	0.012983	0.018276	0.017952	0.017863	0.014449
214.685	0.009331	0.010175	0.01246	0.010516	0.012471	0.015052	0.01135	0.012199	0.017586	0.017841	0.017847	0.014668
214.585	0.009046	0.00987	0.012319	0.010138	0.012053	0.014881	0.010772	0.011446	0.016885	0.017713	0.01781	0.014877
214.485	0.008769	0.009569	0.012173	0.009769	0.011638	0.014695	0.010217	0.010726	0.016178	0.01757	0.017754	0.015076
214.385	0.008499	0.009273	0.012022	0.009411	0.011227	0.014494	0.009686	0.01004	0.015471	0.0174	0.01767	0.01526
214.285	0.008237	0.008981	0.011865	0.009063	0.010821	0.014279	0.009178	0.009389	0.014768	0.017262	0.017605	0.015456
214.185	0.007981	0.008695	0.011704	0.008726	0.010421	0.014052	0.008694	0.008771	0.014073	0.017066	0.017485	0.015618
214.085	0.007733	0.008414	0.011538	0.008399	0.010027	0.013813	0.008233	0.008187	0.01339	0.016857	0.017346	0.015767
213.985	0.007491	0.008139	0.011368	0.008083	0.009641	0.013563	0.007795	0.007636	0.012722	0.016638	0.017192	0.015905
213.885	0.007257	0.007869	0.011195	0.007777	0.009262	0.013304	0.007378	0.007118	0.01207	0.016408	0.01702	0.01603
213.785	0.007029	0.007605	0.011018	0.007482	0.008892	0.013036	0.006982	0.006631	0.011438	0.016169	0.016834	0.016142
213.685	0.006808	0.007348	0.010839	0.007196	0.008531	0.01276	0.006607	0.006173	0.010826	0.015922	0.016633	0.01624
213.585	0.006594	0.007096	0.010656	0.006921	0.008179	0.012479	0.006252	0.005745	0.010236	0.015667	0.016419	0.016325
213.485	0.006386	0.00685	0.010472	0.006655	0.007836	0.012191	0.005915	0.005344	0.009669	0.015406	0.016192	0.016395
213.385	0.006185	0.006611	0.010285	0.0064	0.007504	0.011899	0.005597	0.004969	0.009125	0.015139	0.015952	0.016452
213.285	0.00599	0.006378	0.010096	0.006153	0.007182	0.011603	0.005295	0.00462	0.008605	0.014867	0.015703	0.016494
213.185	0.005801	0.006151	0.009907	0.005916	0.006869	0.011305	0.00501	0.004293	0.008108	0.014591	0.015443	0.016523
213.085	0.005618	0.005931	0.009716	0.005687	0.006567	0.011005	0.004741	0.003989	0.007634	0.014312	0.015174	0.016537
212.985	0.005441	0.005716	0.009524	0.005468	0.006275	0.010704	0.004487	0.003706	0.007184	0.01403	0.014897	0.016536
212.885	0.00527	0.005508	0.009332	0.005257	0.005994	0.010403	0.004247	0.003442	0.006757	0.013746	0.014613	0.016522

Interval (Ma)	*Acaenasuchus*			*Trilophosaurus*			*Calyptosuchus*			*Placerias*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
212.785	0.005104	0.005306	0.00914	0.005054	0.005722	0.010103	0.00402	0.003197	0.006352	0.013461	0.014323	0.016493
212.685	0.004944	0.00511	0.008947	0.004859	0.00546	0.009803	0.003806	0.002969	0.005968	0.013176	0.014027	0.016451
212.585	0.004788	0.00492	0.008755	0.004671	0.005209	0.009506	0.003604	0.002757	0.005606	0.01289	0.013727	0.016395
212.485	0.004638	0.004736	0.008564	0.004491	0.004967	0.009211	0.003413	0.002561	0.005263	0.012605	0.013424	0.016326
212.385	0.004493	0.004558	0.008373	0.004318	0.004735	0.008919	0.003233	0.002378	0.00494	0.012321	0.013117	0.016244
212.285	0.004353	0.004385	0.008183	0.004152	0.004512	0.008631	0.003063	0.002208	0.004636	0.012038	0.012809	0.016149
212.185	0.004217	0.004219	0.007995	0.003993	0.004298	0.008347	0.002903	0.002051	0.004349	0.011757	0.012499	0.016041
212.085	0.004086	0.004057	0.007807	0.00384	0.004093	0.008068	0.002751	0.001905	0.004079	0.011479	0.012189	0.015922
211.985	0.003959	0.003902	0.007622	0.003693	0.003897	0.007793	0.002608	0.00177	0.003826	0.011203	0.011878	0.015792
211.885	0.003837	0.003751	0.007438	0.003552	0.003709	0.007524	0.002474	0.001644	0.003587	0.01093	0.011569	0.01565
211.785	0.003718	0.003606	0.007256	0.003417	0.00353	0.007259	0.002346	0.001527	0.003363	0.01066	0.01126	0.015498
211.685	0.003604	0.003465	0.007075	0.003288	0.003358	0.007001	0.002226	0.001419	0.003153	0.010394	0.010954	0.015336
211.585	0.003493	0.00333	0.006898	0.003163	0.003194	0.006748	0.002113	0.001319	0.002956	0.010132	0.01065	0.015165
211.485	0.003386	0.003199	0.006722	0.003044	0.003037	0.006502	0.002006	0.001226	0.002771	0.009873	0.010348	0.014985
211.385	0.003282	0.003074	0.006549	0.00293	0.002888	0.006262	0.001904	0.00114	0.002597	0.009619	0.01005	0.014796
211.285	0.003183	0.002952	0.006378	0.00282	0.002745	0.006027	0.001809	0.00106	0.002435	0.009369	0.009756	0.0146
211.185	0.003086	0.002835	0.00621	0.002714	0.002609	0.0058	0.001718	0.000986	0.002282	0.009123	0.009465	0.014397
211.085	0.002993	0.002723	0.006045	0.002613	0.00248	0.005579	0.001633	0.000917	0.00214	0.008882	0.009179	0.014187
210.985	0.002902	0.002614	0.005882	0.002516	0.002356	0.005364	0.001552	0.000853	0.002006	0.008646	0.008898	0.013971
210.885	0.002815	0.00251	0.005722	0.002423	0.002238	0.005155	0.001476	0.000794	0.001881	0.008414	0.008621	0.013749
210.785	0.002731	0.002409	0.005565	0.002334	0.002126	0.004953	0.001404	0.000739	0.001763	0.008187	0.008349	0.013523
210.685	0.002649	0.002313	0.005411	0.002248	0.00202	0.004758	0.001336	0.000688	0.001654	0.007965	0.008083	0.013292
210.585	0.002571	0.00222	0.00526	0.002166	0.001918	0.004568	0.001271	0.000641	0.001551	0.007748	0.007822	0.013057
210.485	0.002495	0.00213	0.005112	0.002087	0.001822	0.004385	0.00121	0.000597	0.001455	0.007535	0.007567	0.012819
210.385	0.002421	0.002044	0.004966	0.002011	0.00173	0.004209	0.001152	0.000556	0.001365	0.007328	0.007317	0.012578

Interval (Ma)	*Acaenasuchus*			*Trilophosaurus*			*Calyptosuchus*			*Placerias*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
210.285	0.00235	0.001962	0.004824	0.001939	0.001643	0.004038	0.001098	0.000518	0.00128	0.007125	0.007073	0.012335
210.185	0.002281	0.001882	0.004685	0.001869	0.001559	0.003873	0.001046	0.000483	0.001202	0.006927	0.006835	0.01209
210.085	0.002214	0.001806	0.004549	0.001802	0.001481	0.003714	0.000997	0.00045	0.001128	0.006734	0.006603	0.011843
209.985	0.00215	0.001733	0.004416	0.001738	0.001406	0.003561	0.00095	0.00042	0.001059	0.006546	0.006377	0.011596

TABLE S10. AVERAGE POSTERIOR EXTINCTION AND ORIGINATION PROBABILITIES GENERATED FOR *DESMATOSUCHUS*, *SMILOSUCHUS*, *TYPOTHORAX*, AND *PARATYPOTHORAX* BY ALROY (2014) AND SOLOW (2016) METHODS. "NO UNDERSAMPLING" AND "UNDERSAMPLING" DENTOED RESPECTIVELY BY "NU" AND "U".

Interval (Ma)	*Desmatosuchus*			*Smilosuchus*			*Typothorax*			*Paratypothorax*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
225.185	0	0	0	0	0	0	0.000521	0.000247	0.000552	0.005568	0.004483	0.009239
225.085	0	0	0	0	0	0	0.000592	0.000293	0.000653	0.005809	0.00476	0.009675
224.985	0	0	0	0	0	0	0.000673	0.000348	0.000771	0.006059	0.005052	0.010123
224.885	0	0	0	0	0	0	0.000765	0.000414	0.000911	0.00632	0.00536	0.010582
224.785	0	0	0	0	0	0	0.000872	0.000491	0.001077	0.00659	0.005683	0.011052
224.685	0	0	0	0	0	0	0.000993	0.000584	0.001272	0.006871	0.006023	0.011531
224.585	0	0	0	0	0	0	0.001133	0.000694	0.001503	0.007163	0.00638	0.012017
224.485	0	0	0	0	0	0	0.001293	0.000824	0.001775	0.007465	0.006753	0.012511
224.385	0	0	0	0	0	0	0.001477	0.000979	0.002095	0.007778	0.007143	0.01301
224.285	0	0	0	0	0	0	0.001688	0.001163	0.002473	0.008102	0.007551	0.013512
224.185	0	0	0	0	0	0	0.00193	0.001382	0.002916	0.008438	0.007976	0.014016
224.085	0	0	0	0	0	0	0.002208	0.001641	0.003438	0.008784	0.008419	0.01452
223.985	0	0	0	0	0	0	0.002528	0.001948	0.004048	0.009141	0.008878	0.015022
223.885	0	0	0	0	0	0	0.002895	0.002312	0.004763	0.009509	0.009355	0.015519
223.785	0	0	0	0	0	0	0.003316	0.002743	0.005597	0.009888	0.009847	0.016008
223.685	0	0	0	0	0	0	0.003801	0.003252	0.006566	0.010277	0.010355	0.016488
223.585	0	0	0	0	0	0	0.004356	0.003853	0.007688	0.010676	0.010878	0.016955
223.485	0	0	0	0	0	0	0.004993	0.00456	0.008982	0.011085	0.011415	0.017407
223.385	0	0	0	0	0	0	0.005721	0.005391	0.010464	0.011503	0.011964	0.017841
223.285	0	0	0	0	0	0	0.006554	0.006363	0.012152	0.01193	0.012524	0.018254
223.185	0	0	0	0	0	0	0.007505	0.007497	0.014058	0.012364	0.013093	0.018642
223.085	0	0	0	0	0	0	0.008586	0.008813	0.016191	0.012805	0.01367	0.019005
222.985	0	0	0	0	0	0	0.009812	0.010332	0.018551	0.013252	0.014252	0.019337
222.885	0	0	0	0	0	0	0.011196	0.012075	0.021128	0.013704	0.014836	0.019638

Interval (Ma)	*Desmatosuchus*			*Smilosuchus*			*Typothorax*			*Paratypothorax*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
222.785	0	0	0	0	0	0	0.012752	0.014058	0.023899	0.01416	0.01542	0.019903
222.685	0	0	0	0	0	0	0.01449	0.016292	0.026825	0.014618	0.016001	0.020132
222.585	0	0	0	0	0	0	0.016418	0.018782	0.029848	0.015076	0.016575	0.020322
222.485	0	0	0	0	0	0	0.018538	0.02152	0.03289	0.015533	0.01714	0.020471
222.385	0	0	0	0	0	0	0.020845	0.024484	0.035853	0.015988	0.017691	0.020578
222.285	0	0	0	0	0	0	0.023326	0.02763	0.038624	0.016437	0.018226	0.020642
222.185	0	0	0	0	0	0	0.025952	0.030897	0.041079	0.01688	0.018739	0.020661
222.085	0	0	0	0	0	0	0.028685	0.034195	0.043092	0.017314	0.019228	0.020635
221.985	0	0	0	0	0	0	0.031468	0.037413	0.044548	0.017736	0.019688	0.020565
221.885	0	0	0	0	0	0	0.034227	0.04042	0.045355	0.018144	0.020115	0.020451
221.785	0	0	0	0	0	0	0.036875	0.043073	0.045452	0.018536	0.020507	0.020293
221.685	0	0	0	0	0	0	0.03931	0.045227	0.044823	0.01891	0.020858	0.020092
221.585	0	0	0	0	0	0	0.041424	0.046751	0.043494	0.019261	0.021166	0.01985
221.485	0	0	0	0	0	0	0.043111	0.047541	0.041537	0.019589	0.021428	0.01957
221.385	0	0	0	0	0	0	0.044264	0.04753	0.039056	0.01989	0.021641	0.019252
221.285	0	0	0	0	0	0	0.044825	0.046722	0.036187	0.020162	0.021803	0.0189
221.185	0	0	0	0	0	0	0.044738	0.045153	0.033065	0.020402	0.021912	0.018515
221.085	0	0	0	0	0	0	0.043991	0.042915	0.029827	0.020608	0.021966	0.018102
220.985	0	0	0	0	0	0	0.042613	0.04014	0.026594	0.020778	0.021966	0.017662
220.885	0	0	0	0	0	0	0.040668	0.03698	0.023466	0.02091	0.021909	0.017199
220.785	0	0	0	0	0	0	0.038251	0.033591	0.020518	0.021002	0.021798	0.016716
220.685	0	0	0	0	0	0	0.035476	0.030123	0.017802	0.021053	0.021632	0.016217
220.585	0	0	0	0	0	0	0.032456	0.026696	0.015344	0.021061	0.021414	0.015704
220.485	0	0	0	0	0	0	0.029333	0.023426	0.01316	0.021026	0.021145	0.01518
220.385	0	0	0	0	0	0	0.026206	0.020378	0.011245	0.020947	0.020827	0.014649

Interval (Ma)	*Desmatosuchus*			*Smilosuchus*			*Typothorax*			*Paratypothorax*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
220.285	0	0	0	0	0	0	0.023166	0.017597	0.009584	0.020824	0.020464	0.014113
220.185	0	0	0	0	0	0	0.020286	0.015106	0.008159	0.020657	0.020059	0.013575
220.085	0	0	0	0	0	0	0.017526	0.012846	0.006915	0.020446	0.019615	0.013038
219.985	0	0	0	0	0	0	0.014661	0.010625	0.005734	0.020193	0.019136	0.012504
219.885	0	0	0	0	0	0	0.011177	0.008064	0.004409	0.019899	0.018627	0.011975
219.785	0	0	0	0	0	0	0.005065	0.003719	0.002194	0.019565	0.018091	0.011453
219.685	0	0	0	0	0	0	0.001799	0.001421	0.00103	0.019193	0.017532	0.01094
219.585	0	0	0	0	0	0	0.001048	0.000901	0.000771	0.018786	0.016955	0.010437
219.485	0	0	0	0	0	0	0.000623	0.000615	0.000627	0.018346	0.016364	0.009946
219.385	0	0	0	0	0	0	0.000468	0.000519	0.000573	0.017876	0.015763	0.009468
219.285	0	0	0	0	0	0	0.000479	0.00054	0.000573	0.017378	0.015156	0.009004
219.185	0	0	0	0	0	0	0.000511	0.000572	0.000572	0.016795	0.014499	0.008528
219.085	0	0	0	0	0	0	0.000536	0.000593	0.000563	0.016192	0.01384	0.008066
218.985	0	0	0	0	0	0	0.000554	0.000604	0.000547	0.015386	0.013036	0.007537
218.885	1.88E-05	1.65E-05	8.98E-06	0	0	0	0.000564	0.000605	0.000525	0.01394	0.011735	0.006743
218.785	3.87E-05	3.36E-05	1.84E-05	0	0	0	0.000565	0.000595	0.000499	0.011638	0.009758	0.005585
218.685	5.95E-05	5.14E-05	2.83E-05	0	0	0	0.000558	0.000577	0.000469	0.009311	0.007793	0.004447
218.585	0.000117	0.0001	5.51E-05	0	0	0	0.000544	0.000552	0.000437	0.006713	0.005608	0.003196
218.485	0.000161	0.000135	7.51E-05	0	0	0	0.000523	0.000522	0.000403	0.004402	0.003689	0.002104
218.385	0.00019	0.000162	9.08E-05	0	0	0	0.000498	0.000488	0.000367	0.002374	0.002001	0.001149
218.285	0.000203	0.000177	0.0001	0	0	0	0.00047	0.000451	0.00033	0.000981	0.000835	0.000491
218.185	0.000216	0.000192	0.00011	0	0	0	0.000439	0.000413	0.000293	0.00039	0.000339	0.000212
218.085	0.000245	0.00022	0.000128	0	0	0	0.000406	0.000374	0.000257	0.000223	0.000196	0.000131
217.985	0.000258	0.000237	0.000141	0	0	0	0.000373	0.000335	0.000222	0.00016	0.00014	9.97E-05
217.885	0.00027	0.000253	0.000154	0	0	0	0.000314	0.000278	0.00018	0.000157	0.000136	9.78E-05

Interval (Ma)	*Desmatosuchus*			*Smilosuchus*			*Typothorax*			*Paratypothorax*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
217.785	0.000297	0.000283	0.000174	0	0	0	0.000259	0.000226	0.000143	0.000138	0.000119	8.83E-05
217.685	0.000324	0.000312	0.000196	0	0	0	0.000195	0.000166	0.000104	7.63E-05	6.92E-05	6.08E-05
217.585	0.000381	0.000366	0.000232	0	0	0	0.00015	0.000125	7.63E-05	7.53E-05	6.89E-05	6.09E-05
217.485	0.000502	0.000469	0.000296	0	0	0	0.000135	0.000107	6.26E-05	5.92E-05	5.50E-05	5.31E-05
217.385	0.000613	0.00057	0.00036	0	0	0	0.000119	8.97E-05	5.07E-05	4.34E-05	4.26E-05	4.61E-05
217.285	0.000743	0.000685	0.000433	0	0	0	8.87E-05	6.44E-05	3.58E-05	4.38E-05	4.41E-05	4.67E-05
217.185	0.000953	0.000866	0.000543	3.08E-05	2.38E-05	1.31E-05	7.58E-05	5.31E-05	2.87E-05	4.4E-05	4.57E-05	4.71E-05
217.085	0.001188	0.001068	0.000667	3.36E-05	2.63E-05	1.46E-05	6.34E-05	4.32E-05	2.29E-05	2.83E-05	3.39E-05	3.98E-05
216.985	0.001462	0.001304	0.000811	9.62E-05	7.58E-05	4.21E-05	5.20E-05	3.48E-05	1.82E-05	2.91E-05	3.59E-05	4.00E-05
216.885	0.001818	0.001609	0.000995	0.000149	0.00012	6.69E-05	4.20E-05	2.78E-05	1.44E-05	2.98E-05	3.78E-05	3.99E-05
216.785	0.002121	0.001879	0.001163	0.000206	0.000168	9.40E-05	1.87E-05	1.23E-05	6.32E-06	3.05E-05	3.94E-05	3.95E-05
216.685	0.002558	0.002263	0.001396	0.000296	0.000244	0.000137	0	0	0	3.1E-05	4.08E-05	3.88E-05
216.585	0.00334	0.002919	0.001778	0.000465	0.000382	0.000215	0	0	0	3.14E-05	4.18E-05	3.79E-05
216.485	0.004157	0.003616	0.002188	0.000548	0.000456	0.000259	0	0	0	3.17E-05	4.25E-05	3.67E-05
216.385	0.005476	0.004712	0.00282	0.000606	0.000514	0.000295	0	0	0	3.19E-05	4.29E-05	3.53E-05
216.285	0.007052	0.006019	0.003573	0.000764	0.000654	0.000377	0	0	0	3.19E-05	4.28E-05	3.37E-05
216.185	0.008632	0.007354	0.004353	0.000958	0.000824	0.000479	0	0	0	3.18E-05	4.24E-05	3.19E-05
216.085	0.010251	0.008742	0.005173	0.001124	0.000978	0.000574	0	0	0	3.15E-05	4.16E-05	3.01E-05
215.985	0.011638	0.009972	0.005924	0.001391	0.001215	0.000717	0	0	0	3.11E-05	4.05E-05	2.82E-05
215.885	0.01314	0.011317	0.006753	0.001619	0.001428	0.000851	0	0	0	3.06E-05	3.90E-05	2.63E-05
215.785	0.014521	0.012588	0.007562	0.001883	0.001674	0.001008	0	0	0	2.99E-05	3.73E-05	2.44E-05
215.685	0.015938	0.013914	0.008422	0.00217	0.001945	0.001184	0	0	0	2.9E-05	3.54E-05	2.25E-05
215.585	0.016868	0.014891	0.009118	0.002455	0.00222	0.001369	0	0	0	2.81E-05	3.34E-05	2.07E-05
215.485	0.01771	0.015822	0.009815	0.002673	0.002448	0.001534	0	0	0	2.7E-05	3.12E-05	1.90E-05
215.385	0.01847	0.016709	0.010515	0.002917	0.002702	0.001721	0	0	0	2.59E-05	2.90E-05	1.73E-05

Interval (Ma)	*Desmatosuchus*			*Smilosuchus*			*Typothorax*			*Paratypothorax*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
215.285	0.019219	0.017607	0.011249	0.003262	0.003037	0.00196	0	0	0	2.47E-05	2.68E-05	1.57E-05
215.185	0.019906	0.018473	0.011997	0.003651	0.003411	0.00223	0	0	0	2.34E-05	2.46E-05	1.43E-05
215.085	0.020606	0.019359	0.012787	0.004244	0.003944	0.002596	0	0	0	0	0	0
214.985	0.02127	0.020224	0.013596	0.005832	0.005239	0.00339	0	0	0	0	0	0
214.885	0.021848	0.021028	0.014404	0.008243	0.007175	0.004548	0	0	0	0	0	0
214.785	0.022336	0.021761	0.015206	0.010818	0.009259	0.005803	0	0	0	0	0	0
214.685	0.022717	0.022404	0.01599	0.013026	0.011089	0.006936	0	0	0	0	0	0
214.585	0.023075	0.023017	0.016784	0.014488	0.012381	0.007791	0	0	0	0	0	0
214.485	0.023312	0.023521	0.017547	0.015683	0.013501	0.008571	0	0	0	0	0	0
214.385	0.023458	0.023932	0.018282	0.016869	0.014642	0.009382	0	0	0	0	0	0
214.285	0.023543	0.02427	0.018996	0.01807	0.015821	0.010234	0	0	0	0	0	0
214.185	0.023537	0.024507	0.019669	0.019171	0.016956	0.011087	0	0	0	0	0	0
214.085	0.023473	0.024663	0.020307	0.020265	0.018114	0.011978	0	0	0	0	0	0
213.985	0.023332	0.024723	0.020897	0.021279	0.019244	0.012883	0	0	0	0	0	0
213.885	0.023117	0.024685	0.021431	0.022199	0.020334	0.013796	0	0	0	0	0	0
213.785	0.022842	0.02456	0.021908	0.023046	0.021396	0.014729	0	0	0	0	0	0
213.685	0.02251	0.024348	0.022323	0.023828	0.022432	0.015686	0	0	0	0	0	0
213.585	0.022127	0.024055	0.022671	0.024536	0.02343	0.016661	0	0	0	0	0	0
213.485	0.021697	0.023684	0.022949	0.02517	0.024384	0.017656	0	0	0	0	0	0
213.385	0.021224	0.023243	0.023155	0.025722	0.025279	0.018663	0	0	0	0	0	0
213.285	0.020715	0.022736	0.023286	0.026184	0.026101	0.019677	0	0	0	0	0	0
213.185	0.020175	0.022171	0.023341	0.026551	0.026836	0.02069	0	0	0	0	0	0
213.085	0.019607	0.021555	0.023321	0.026816	0.027469	0.021691	0	0	0	0	0	0
212.985	0.019018	0.020896	0.023226	0.026978	0.027989	0.02267	0	0	0	0	0	0
212.885	0.018412	0.0202	0.02306	0.027035	0.028383	0.023617	0	0	0	0	0	0

Interval (Ma)	*Desmatosuchus*			*Smilosuchus*			*Typothorax*			*Paratypothorax*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
212.785	0.017793	0.019476	0.022824	0.026986	0.028643	0.024518	0	0	0	0	0	0
212.685	0.017166	0.01873	0.022523	0.026833	0.028762	0.025362	0	0	0	0	0	0
212.585	0.016535	0.017969	0.02216	0.02658	0.028737	0.026134	0	0	0	0	0	0
212.485	0.015903	0.0172	0.02174	0.026231	0.028568	0.026821	0	0	0	0	0	0
212.385	0.015273	0.016427	0.02127	0.025793	0.028257	0.027413	0	0	0	0	0	0
212.285	0.014648	0.015657	0.020753	0.025274	0.02781	0.027897	0	0	0	0	0	0
212.185	0.014031	0.014893	0.020197	0.02468	0.027236	0.028264	0	0	0	0	0	0
212.085	0.013424	0.01414	0.019606	0.02402	0.026544	0.028506	0	0	0	0	0	0
211.985	0.012829	0.013402	0.018988	0.023305	0.025749	0.028619	0	0	0	0	0	0
211.885	0.012247	0.012682	0.018346	0.022542	0.024864	0.028599	0	0	0	0	0	0
211.785	0.011681	0.011981	0.017687	0.021742	0.023904	0.028446	0	0	0	0	0	0
211.685	0.011131	0.011303	0.017017	0.020913	0.022885	0.028163	0	0	0	0	0	0
211.585	0.010597	0.010648	0.016339	0.020063	0.02182	0.027754	0	0	0	0	0	0
211.485	0.010081	0.010018	0.015658	0.019201	0.020725	0.027228	0	0	0	0	0	0
211.385	0.009584	0.009413	0.014978	0.018333	0.019614	0.026594	0	0	0	0	0	0
211.285	0.009105	0.008835	0.014304	0.017467	0.018498	0.025862	0	0	0	0	0	0
211.185	0.008644	0.008283	0.013637	0.016608	0.01739	0.025045	0	0	0	0	0	0
211.085	0.008202	0.007757	0.012981	0.015762	0.016298	0.024156	0	0	0	0	0	0
210.985	0.007778	0.007258	0.012339	0.014933	0.015231	0.023207	0	0	0	0	0	0
210.885	0.007373	0.006785	0.011713	0.014125	0.014196	0.022213	0	0	0	0	0	0
210.785	0.006986	0.006336	0.011103	0.013341	0.013199	0.021186	0	0	0	0	0	0
210.685	0.006617	0.005913	0.010512	0.012582	0.012244	0.020139	0	0	0	0	0	0
210.585	0.006265	0.005514	0.009941	0.011852	0.011333	0.019082	0	0	0	0	0	0
210.485	0.005929	0.005137	0.009391	0.011152	0.01047	0.018026	0	0	0	0	0	0
210.385	0.005611	0.004783	0.008861	0.010482	0.009654	0.016979	0	0	0	0	0	0

Interval (Ma)	*Desmatosuchus*			*Smilosuchus*			*Typothorax*			*Paratypothorax*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
210.285	0.005308	0.004451	0.008353	0.009843	0.008887	0.015951	0	0	0	0	0	0
210.185	0.00502	0.004139	0.007866	0.009235	0.008169	0.014948	0	0	0	0	0	0
210.085	0.004747	0.003847	0.007402	0.008658	0.007497	0.013974	0	0	0	0	0	0
209.985	0.004488	0.003573	0.006958	0.008111	0.006872	0.013036	0	0	0	0	0	0

TABLE S11. AVERAGE POSTERIOR ORIGINATION PROBABILITIES GENERATED FOR *REVUELTOSAURUS, CHINDESAURUS,* AND *MACHAEROPROSOPUS* BY ALROY (2014) AND SOLOW (2016) METHODS. "NO UNDERSAMPLING" AND "UNDERSAMPLING" DENTOED RESPECTIVELY BY "NU" AND "U".

Interval (Ma)	*Revueltosaurus*			*Chindesaurus*			*Machaeroprosopus*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
225.185	0.00033	0.000349	0.000797	0.000191	0.000123	0.000309	3.65E-05	1.91E-06	8.2E-06
225.085	0.000342	0.000362	0.000825	0.000199	0.000129	0.000323	3.82E-05	2.08E-06	8.86E-06
224.985	0.000354	0.000376	0.000854	0.000207	0.000136	0.000337	3.99E-05	2.27E-06	9.57E-06
224.885	0.000367	0.000391	0.000884	0.000216	0.000142	0.000352	4.17E-05	2.48E-06	1.04E-05
224.785	0.00038	0.000407	0.000915	0.000225	0.00015	0.000368	4.37E-05	2.70E-06	1.12E-05
224.685	0.000394	0.000423	0.000948	0.000234	0.000157	0.000385	4.57E-05	2.95E-06	1.21E-05
224.585	0.000409	0.00044	0.000981	0.000244	0.000165	0.000403	4.79E-05	3.21E-06	1.31E-05
224.485	0.000424	0.000458	0.001017	0.000254	0.000173	0.000421	5.02E-05	3.51E-06	1.42E-05
224.385	0.00044	0.000476	0.001054	0.000265	0.000182	0.000441	5.26E-05	3.83E-06	1.54E-05
224.285	0.000456	0.000496	0.001092	0.000276	0.000192	0.000461	5.51E-05	4.19E-06	1.67E-05
224.185	0.000473	0.000516	0.001132	0.000288	0.000202	0.000483	5.78E-05	4.57E-06	1.81E-05
224.085	0.000491	0.000538	0.001174	0.0003	0.000212	0.000506	6.06E-05	5.00E-06	1.96E-05
223.985	0.00051	0.00056	0.001217	0.000313	0.000223	0.00053	6.36E-05	5.47E-06	2.12E-05
223.885	0.00053	0.000584	0.001263	0.000327	0.000235	0.000555	6.68E-05	5.98E-06	2.3E-05
223.785	0.000551	0.000609	0.00131	0.000342	0.000248	0.000582	7.01E-05	6.54E-06	2.5E-05
223.685	0.000572	0.000635	0.00136	0.000357	0.000261	0.00061	7.37E-05	7.16E-06	2.71E-05
223.585	0.000595	0.000662	0.001412	0.000373	0.000275	0.00064	7.75E-05	7.84E-06	2.94E-05
223.485	0.000618	0.000691	0.001466	0.00039	0.00029	0.000671	8.14E-05	8.58E-06	3.2E-05
223.385	0.000643	0.000721	0.001523	0.000407	0.000306	0.000704	8.57E-05	9.40E-06	3.47E-05
223.285	0.000669	0.000753	0.001582	0.000426	0.000323	0.000739	9.01E-05	1.03E-05	3.77E-05
223.185	0.000697	0.000786	0.001643	0.000446	0.000341	0.000776	9.49E-05	1.13E-05	4.1E-05
223.085	0.000725	0.000821	0.001708	0.000467	0.00036	0.000815	9.99E-05	1.24E-05	4.46E-05
222.985	0.000755	0.000858	0.001775	0.000488	0.00038	0.000856	0.000105	1.36E-05	4.86E-05
222.885	0.000787	0.000897	0.001846	0.000512	0.000402	0.0009	0.000111	1.49E-05	5.29E-05

Interval (Ma)	*Revueltosaurus*			*Chindesaurus*			*Machaeroprosopus*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
222.785	0.00082	0.000938	0.00192	0.000536	0.000425	0.000946	0.000117	1.64E-05	5.76E-05
222.685	0.000854	0.000981	0.001997	0.000562	0.000449	0.000994	0.000123	1.80E-05	6.27E-05
222.585	0.000891	0.001026	0.002078	0.000589	0.000475	0.001046	0.00013	1.98E-05	6.83E-05
222.485	0.000929	0.001073	0.002163	0.000618	0.000502	0.0011	0.000138	2.17E-05	7.44E-05
222.385	0.000969	0.001124	0.002252	0.000648	0.000532	0.001157	0.000145	2.39E-05	8.12E-05
222.285	0.001011	0.001177	0.002345	0.00068	0.000563	0.001218	0.000154	2.63E-05	8.85E-05
222.185	0.001056	0.001232	0.002442	0.000714	0.000596	0.001282	0.000162	2.89E-05	9.66E-05
222.085	0.001102	0.001291	0.002544	0.00075	0.000632	0.00135	0.000172	3.19E-05	0.000105
221.985	0.001152	0.001353	0.002651	0.000788	0.00067	0.001422	0.000182	3.51E-05	0.000115
221.885	0.001203	0.001418	0.002763	0.000828	0.00071	0.001498	0.000192	3.87E-05	0.000126
221.785	0.001258	0.001487	0.00288	0.00087	0.000753	0.001578	0.000204	4.26E-05	0.000137
221.685	0.001315	0.00156	0.003003	0.000915	0.000799	0.001664	0.000216	4.70E-05	0.00015
221.585	0.001375	0.001637	0.003133	0.000963	0.000848	0.001754	0.000229	5.19E-05	0.000164
221.485	0.001439	0.001718	0.003268	0.001014	0.0009	0.00185	0.000243	5.73E-05	0.00018
221.385	0.001506	0.001804	0.00341	0.001067	0.000956	0.001951	0.000258	6.32E-05	0.000197
221.285	0.001577	0.001894	0.003559	0.001124	0.001015	0.002059	0.000274	6.98E-05	0.000216
221.185	0.001651	0.00199	0.003715	0.001184	0.001079	0.002173	0.000291	7.72E-05	0.000236
221.085	0.00173	0.002091	0.003879	0.001249	0.001146	0.002294	0.00031	8.53E-05	0.000259
220.985	0.001813	0.002198	0.004051	0.001317	0.001219	0.002422	0.00033	9.44E-05	0.000284
220.885	0.001901	0.002311	0.004232	0.001389	0.001296	0.002558	0.000351	0.000104	0.000311
220.785	0.001994	0.002431	0.004421	0.001466	0.001379	0.002702	0.000374	0.000116	0.000341
220.685	0.002091	0.002557	0.00462	0.001547	0.001468	0.002856	0.000398	0.000128	0.000374
220.585	0.002195	0.002691	0.004828	0.001634	0.001562	0.003018	0.000425	0.000142	0.000411
220.485	0.002304	0.002833	0.005047	0.001726	0.001664	0.003191	0.000454	0.000157	0.000451
220.385	0.002419	0.002983	0.005276	0.001825	0.001772	0.003374	0.000484	0.000174	0.000496

Interval (Ma)	*Revueltosaurus*			*Chindesaurus*			*Machaeroprosopus*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
220.285	0.002542	0.003142	0.005516	0.001929	0.001888	0.003569	0.000518	0.000194	0.000545
220.185	0.002671	0.00331	0.005767	0.00204	0.002013	0.003776	0.000553	0.000215	0.000599
220.085	0.002807	0.003488	0.00603	0.002159	0.002146	0.003996	0.000592	0.000239	0.000659
219.985	0.002952	0.003677	0.006306	0.002285	0.002289	0.00423	0.000634	0.000265	0.000725
219.885	0.003105	0.003877	0.006595	0.00242	0.002442	0.004478	0.000679	0.000295	0.000798
219.785	0.003267	0.004089	0.006896	0.002563	0.002606	0.004742	0.000728	0.000328	0.000879
219.685	0.003439	0.004313	0.007211	0.002716	0.002782	0.005023	0.000781	0.000365	0.000967
219.585	0.003621	0.004551	0.00754	0.002879	0.002971	0.005321	0.000838	0.000406	0.001066
219.485	0.003814	0.004803	0.007884	0.003053	0.003173	0.005637	0.000901	0.000452	0.001174
219.385	0.004019	0.00507	0.008241	0.003239	0.00339	0.005973	0.000968	0.000503	0.001294
219.285	0.004235	0.005352	0.008613	0.003437	0.003624	0.006329	0.001042	0.000561	0.001427
219.185	0.004465	0.005651	0.009	0.003649	0.003875	0.006707	0.001122	0.000625	0.001573
219.085	0.004709	0.005968	0.009402	0.003875	0.004144	0.007108	0.001209	0.000697	0.001735
218.985	0.004968	0.006303	0.009818	0.004117	0.004433	0.007533	0.001303	0.000778	0.001914
218.885	0.005242	0.006657	0.010248	0.004375	0.004743	0.007983	0.001406	0.000868	0.002112
218.785	0.005533	0.007031	0.010692	0.004651	0.005077	0.008458	0.001519	0.00097	0.00233
218.685	0.005841	0.007426	0.01115	0.004946	0.005435	0.00896	0.001641	0.001083	0.002571
218.585	0.006169	0.007843	0.01162	0.005261	0.00582	0.00949	0.001775	0.00121	0.002837
218.485	0.006516	0.008283	0.012101	0.005598	0.006233	0.010048	0.001922	0.001352	0.00313
218.385	0.006885	0.008745	0.012593	0.005958	0.006676	0.010634	0.002082	0.001511	0.003453
218.285	0.007275	0.009232	0.013094	0.006344	0.007151	0.011249	0.002257	0.00169	0.003809
218.185	0.00769	0.009744	0.013601	0.006756	0.007661	0.011892	0.002449	0.00189	0.004201
218.085	0.008129	0.01028	0.014114	0.007196	0.008206	0.012564	0.002659	0.002114	0.004632
217.985	0.008594	0.010841	0.014629	0.007667	0.00879	0.013262	0.00289	0.002365	0.005106
217.885	0.009087	0.011427	0.015144	0.00817	0.009414	0.013986	0.003142	0.002645	0.005625

Interval (Ma)	*Revueltosaurus*			*Chindesaurus*			*Machaeroprosopus*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
217.785	0.009608	0.012038	0.015656	0.008707	0.01008	0.014734	0.00342	0.00296	0.006194
217.685	0.010159	0.012673	0.016161	0.009281	0.010789	0.015502	0.003725	0.003311	0.006815
217.585	0.010741	0.013331	0.016656	0.009892	0.011543	0.016287	0.004059	0.003704	0.007494
217.485	0.011355	0.014011	0.017137	0.010544	0.012342	0.017086	0.004427	0.004142	0.008232
217.385	0.012002	0.014711	0.0176	0.011238	0.013187	0.017892	0.004832	0.004631	0.009033
217.285	0.012683	0.015429	0.01804	0.011976	0.014079	0.018701	0.005277	0.005177	0.009901
217.185	0.013384	0.016152	0.018449	0.012745	0.015006	0.019498	0.005766	0.005783	0.010836
217.085	0.014134	0.016896	0.01883	0.013576	0.015986	0.020287	0.006303	0.006457	0.011842
216.985	0.014888	0.017625	0.019164	0.014425	0.016983	0.021042	0.006894	0.007204	0.012918
216.885	0.015691	0.018369	0.019464	0.015336	0.01803	0.021771	0.007543	0.008031	0.014063
216.785	0.016541	0.019122	0.019725	0.016311	0.019119	0.022462	0.008256	0.008943	0.015277
216.685	0.017421	0.019865	0.019936	0.017331	0.020231	0.023099	0.009039	0.009947	0.016554
216.585	0.018313	0.020583	0.02009	0.018379	0.021347	0.023664	0.009896	0.011047	0.017889
216.485	0.019243	0.022303	0.021228	0.019483	0.022477	0.024157	0.010834	0.012249	0.019273
216.385	0.020129	0.02193	0.020222	0.02056	0.02355	0.024535	0.011859	0.013556	0.020695
216.285	0.021028	0.022521	0.020183	0.021665	0.024604	0.024817	0.012976	0.01497	0.022143
216.185	0.021964	0.023092	0.020097	0.022823	0.025642	0.025003	0.014191	0.01649	0.023598
216.085	0.022899	0.023608	0.019949	0.02399	0.026623	0.025074	0.015507	0.018115	0.025042
215.985	0.023837	0.024074	0.019747	0.02517	0.027542	0.025031	0.016927	0.019837	0.026452
215.885	0.024752	0.02447	0.019483	0.02633	0.028364	0.024863	0.018453	0.021648	0.027803
215.785	0.025544	0.024726	0.019129	0.027366	0.029006	0.024536	0.020083	0.023532	0.029071
215.685	0.026376	0.024962	0.018752	0.028433	0.029582	0.024122	0.021813	0.025471	0.030226
215.585	0.027072	0.025057	0.018296	0.029351	0.029956	0.023563	0.023635	0.02744	0.031244
215.485	0.027728	0.025083	0.017805	0.030205	0.03019	0.022907	0.025535	0.029409	0.032098
215.385	0.028271	0.025	0.017264	0.030915	0.030232	0.022143	0.027495	0.031344	0.032767

Interval (Ma)	*Revueltosaurus*			*Chindesaurus*			*Machaeroprosopus*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
215.285	0.028727	0.024826	0.01669	0.031497	0.030102	0.021296	0.02949	0.033205	0.033231
215.185	0.029002	0.024521	0.016066	0.031852	0.029752	0.020356	0.031488	0.03495	0.033477
215.085	0.029183	0.024144	0.015428	0.03206	0.029245	0.019371	0.03345	0.036536	0.033498
214.985	0.029199	0.023652	0.01476	0.032045	0.028545	0.018333	0.035331	0.037921	0.033294
214.885	0.029023	0.024069	0.015104	0.031777	0.027656	0.017254	0.037078	0.039063	0.032869
214.785	0.028608	0.022332	0.013348	0.03121	0.026551	0.016127	0.038636	0.039929	0.032232
214.685	0.028081	0.021561	0.012638	0.030472	0.025365	0.015027	0.039947	0.040489	0.031398
214.585	0.027401	0.020741	0.011939	0.029529	0.024087	0.013949	0.040954	0.040721	0.030377
214.485	0.02653	0.019834	0.01123	0.02835	0.022689	0.012875	0.041605	0.040609	0.029179
214.385	0.025252	0.018703	0.010437	0.026729	0.021051	0.011741	0.041836	0.040123	0.027799
214.285	0.023093	0.017	0.009374	0.024215	0.018847	0.01037	0.041641	0.039258	0.026237
214.185	0.01872	0.013678	0.007481	0.019504	0.015021	0.008202	0.041031	0.038028	0.024506
214.085	0.01301	0.01057	0.006237	0.013522	0.010438	0.005693	0.039988	0.036392	0.022606
213.985	0.007615	0.005601	0.003039	0.007951	0.006146	0.003377	0.038486	0.034311	0.020554
213.885	0.003315	0.002454	0.001331	0.003543	0.002758	0.001571	0.036519	0.031808	0.018418
213.785	0.00095	0.00065	0.000353	0.001144	0.000905	0.000594	0.033471	0.028449	0.016006
213.685	0.000292	0.000166	9.08E-05	0.000484	0.000426	0.000351	0.02765	0.023135	0.012756
213.585	0.000122	3.51E-05	1.97E-05	0.000324	0.000321	0.000305	0.017551	0.014575	0.007958
213.485	9.94E-05	1.38E-07	3.54E-07	0.000313	0.00032	0.000308	0.007119	0.006044	0.003311
213.385	0.000108	2.2E-07	5.49E-07	0.000331	0.000348	0.00032	0.002151	0.0018	0.000998
213.285	0.000117	3.51E-07	8.53E-07	0.00035	0.000362	0.000322	0.000732	0.000584	0.000333
213.185	0.000126	5.58E-07	1.32E-06	0.000368	0.000362	0.000317	0.000569	0.000447	0.000252
213.085	0.000137	8.87E-07	2.05E-06	0.000387	0.000355	0.000312	0.000505	0.000393	0.000217
212.985	0.000149	1.41E-06	3.17E-06	0.000373	0.000267	0.000258	0.000274	0.000223	0.000123
212.885	0.000162	2.24E-06	4.90E-06	0.000393	0.00029	0.000279	0.000121	0.000101	5.6E-05

Interval (Ma)	*Revueltosaurus*			*Chindesaurus*			*Machaeroprosopus*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
212.785	0.000176	3.55E-06	7.53E-06	0.000378	0.00029	0.000285	7.82E-05	6.80E-05	3.74E-05
212.685	0.000191	0.001019	0.001046	0.000364	0.000292	0.000289	0	0	0
212.585	0.000169	8.82E-06	1.74E-05	0.000388	0.000322	0.000305	0	0	0
212.485	0.000185	1.38E-05	2.61E-05	0.000331	0.000296	0.000287	0	0	0
212.385	0.000202	2.13E-05	3.81E-05	0.000357	0.000323	0.00029	0	0	0
212.285	0.00022	3.23E-05	5.42E-05	0.000379	0.00034	0.000283	0	0	0
212.185	0.00024	4.78E-05	7.38E-05	0.000396	0.000346	0.000267	0	0	0
212.085	0.000261	6.82E-05	9.50E-05	0.000406	0.001343	0.001255	0	0	0
211.985	0.000282	9.22E-05	0.000114	0.000358	0.000328	0.000233	0	0	0
211.885	0.000305	0.000116	0.000125	0.000299	0.000279	0.000224	0	0	0
211.785	0.000218	0.001147	0.001159	0.000234	0.000298	0.000286	0	0	0
211.685	0.000184	0.000139	0.000114	0.000163	0.000337	0.000333	0	0	0
211.585	0.000216	0.000131	9.62E-05	8.65E-05	0.000313	0.000262	0	0	0
211.485	0.000256	0.000113	7.93E-05	7.95E-05	0.000196	0.000138	0	0	0
211.385	0.000307	9.66E-05	7.28E-05	0	0	0	0	0	0
211.285	0.000302	3.5E-05	5.84E-05	0	0	0	0	0	0
211.185	0.00041	0.000106	0.000166	0	0	0	0	0	0
211.085	0.000543	0.000284	0.000388	0	0	0	0	0	0
210.985	0.000686	0.000556	0.000608	0	0	0	0	0	0
210.885	0.000802	0.000633	0.000538	0	0	0	0	0	0
210.785	0.000848	0.00141	0.001316	0	0	0	0	0	0
210.685	0.000398	0.001014	0.001034	0	0	0	0	0	0
210.585	0.00026	0.001014	0.001034	0	0	0	0	0	0
210.485	0.000111	0	0	0	0	0	0	0	0
210.385	0.000271	0	0	0	0	0	0	0	0

Interval (Ma)	*Revueltosaurus*			*Chindesaurus*			*Machaeroprosopus*		
	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)	Solow	Alroy (NU)	Alroy (U)
210.285	0.000529	0.001014	0.001034	0	0	0	0	0	0
210.185	0	0	0	0	0	0	0	0	0
210.085	0	0	0	0	0	0	0	0	0
209.985	0	0	0	0	0	0	0	0	0

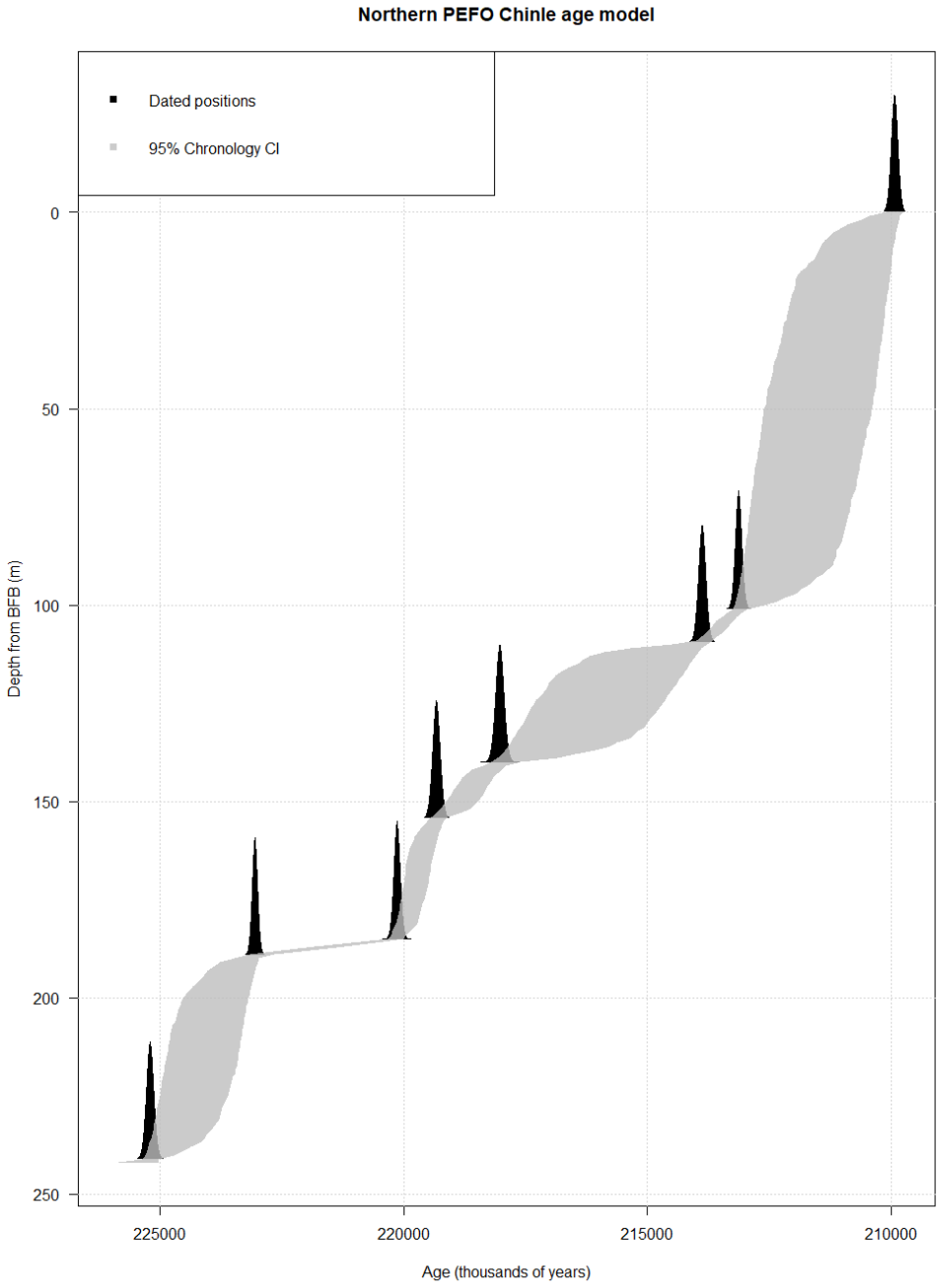

Figure S1. A Bayesian age-depth model of northern PEFO. Normal distributions (black) represent U-Pb dates, with width proportional to analytical uncertainty, while the grey field between them represents a 95% credible interval on the sedimentation history of the Chinle in PEFO. Temporal control over the system is proportional to the width of that field at a given stratigraphic level. Depth is given relative to the Black Forest Bed (upper Petrified Forest Member), the source of the youngest U-Pb date in the model. A separate age model (Figure S2) is used for southern PEFO, differing only in the substitution of the date P57-C (213.63 $\pm$ 0.130 Ma) for KWI (213.87 $\pm$ 0.078 Ma). See Table S1 for model inputs, and Table S3 for diagnostics.

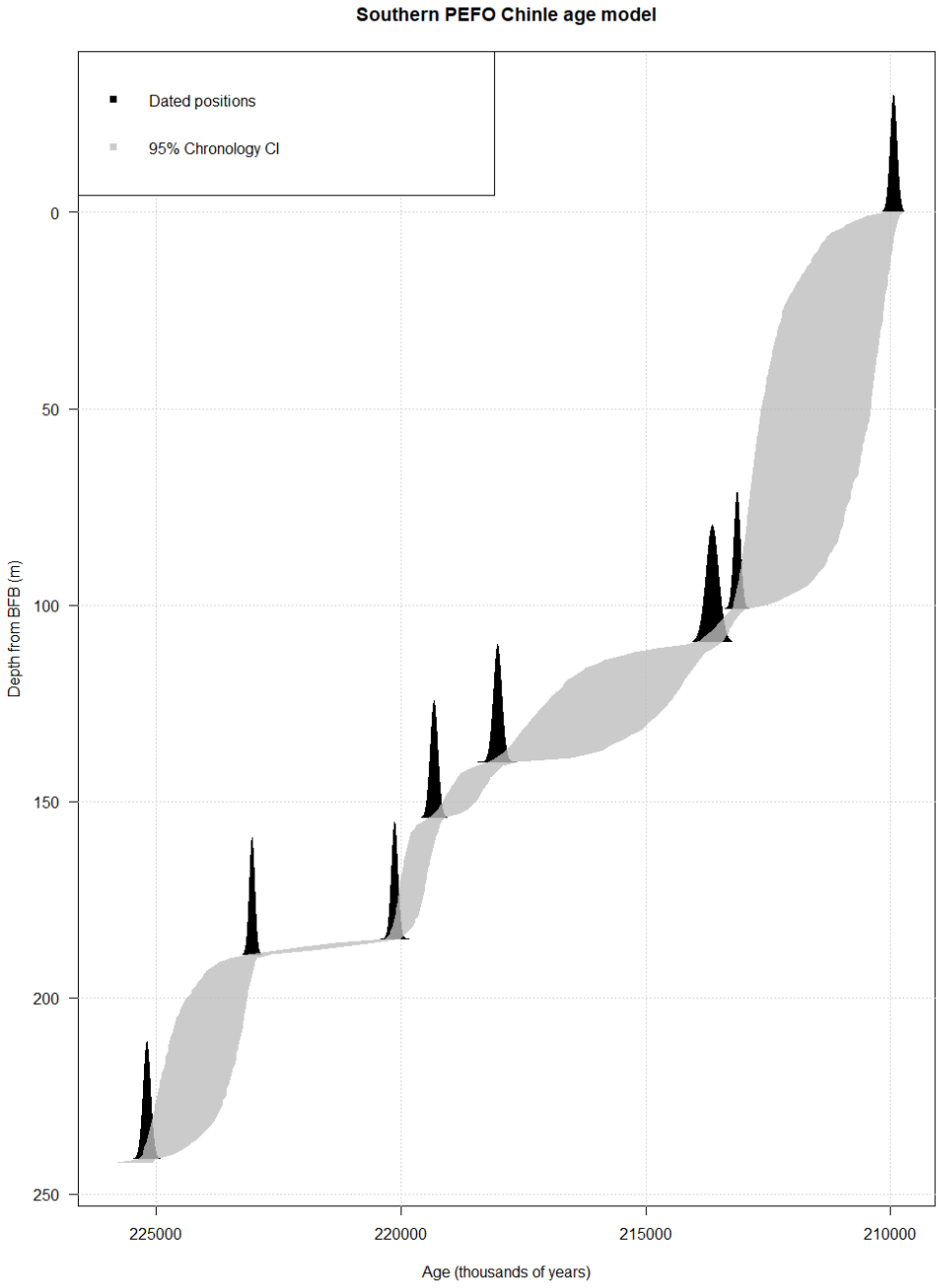

Figure S2. A Bayesian age-depth model of southern PEFO. Normal distributions (black) represent U-Pb dates, with width proportional to analytical uncertainty, while the grey field between them represents a 95% credible interval on the sedimentation history of the Chinle in PEFO. Temporal control over the system is proportional to the width of that field at a given stratigraphic level. Depth is given relative to the Black Forest Bed (upper Petrified Forest Member), the source of the youngest U-Pb date in the model. A separate age model (Figure S1) is used for northern PEFO, differing only in the substitution of the date KWI (213.87 $\pm$ 0.078 Ma) for P57-C (213.63 $\pm$ 0.130 Ma). See Table S2 for model inputs, and Table S4 for diagnostics.

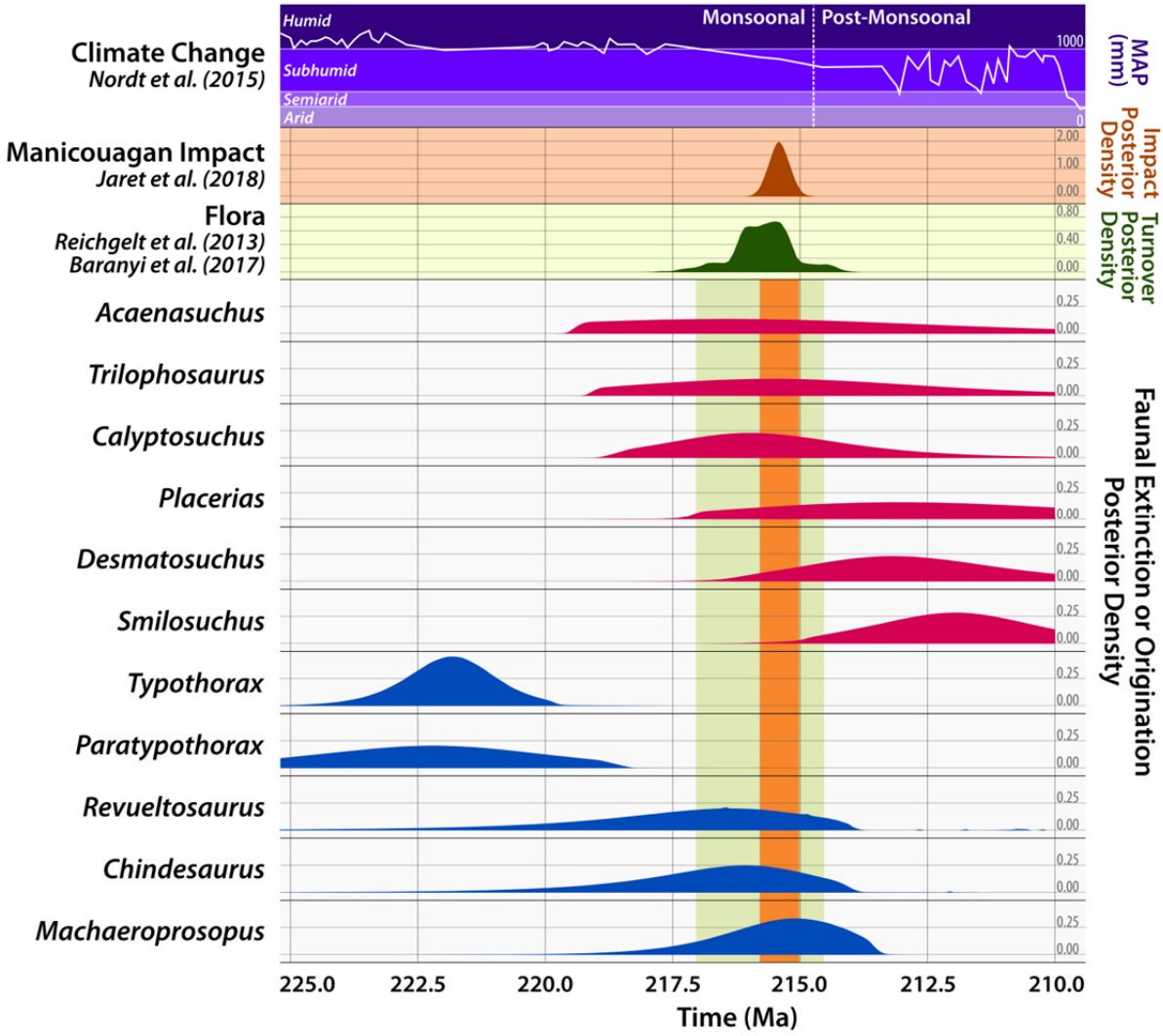

Figure S3. Posterior probability density functions of extinction and origination produced by the Alroy (2014) algorithm assuming undersampling applied in 1000 simulations to 11 PEFO tetrapod genera. Pink and blue densities respectively refer to extinction and origination. Temporal overlap between taxon densities indicates a non-zero probability that extinctions and/or originations were synchronous; Table S8 and Figure S4 list these probabilities. Chinle mean annual precipitation (MAP) record of Nordt et al. (2015) shown above. Also above are posterior probability densities of floral turnover (green; Reichgelt et al., 2013; Baranyi et al., 2017) and Manicouagan impact (orange); vertically-oriented green and orange fields (below) delineate respective 95% highest posterior density regions.

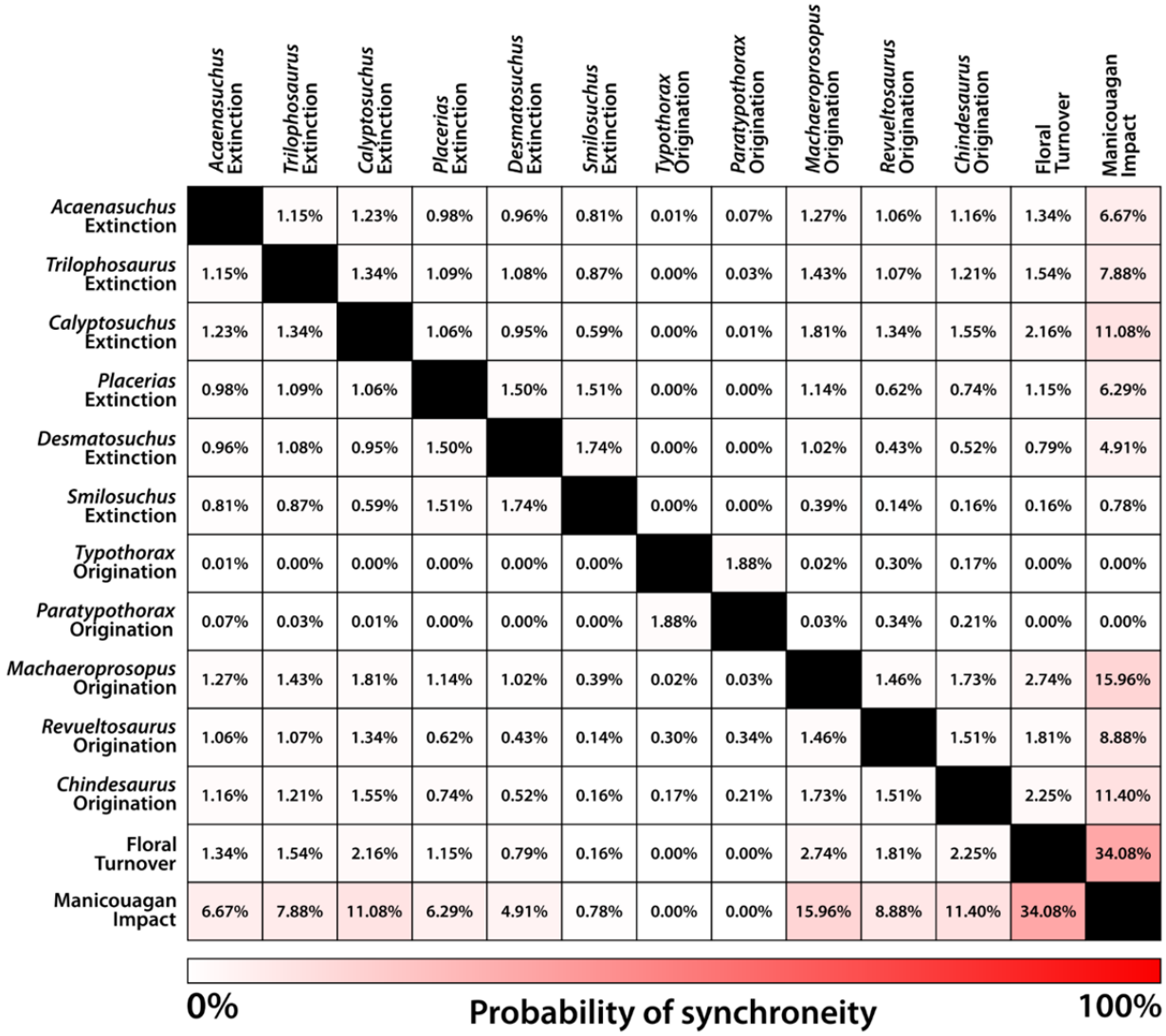

Figure S4. Probability of synchroneity of paired Chinle biotic events calculated with Alroy (2014) method assuming undersampling of taxa. Probability of synchroneity with Manicouagan impact is posterior probability at 215.40 ± 0.20 Ma; all others are summation of joint probabilities across full time series.