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LOW GENETIC DIVERSITY IN TEPUI SUMMIT VERTEBRATES

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MAIN TEXT

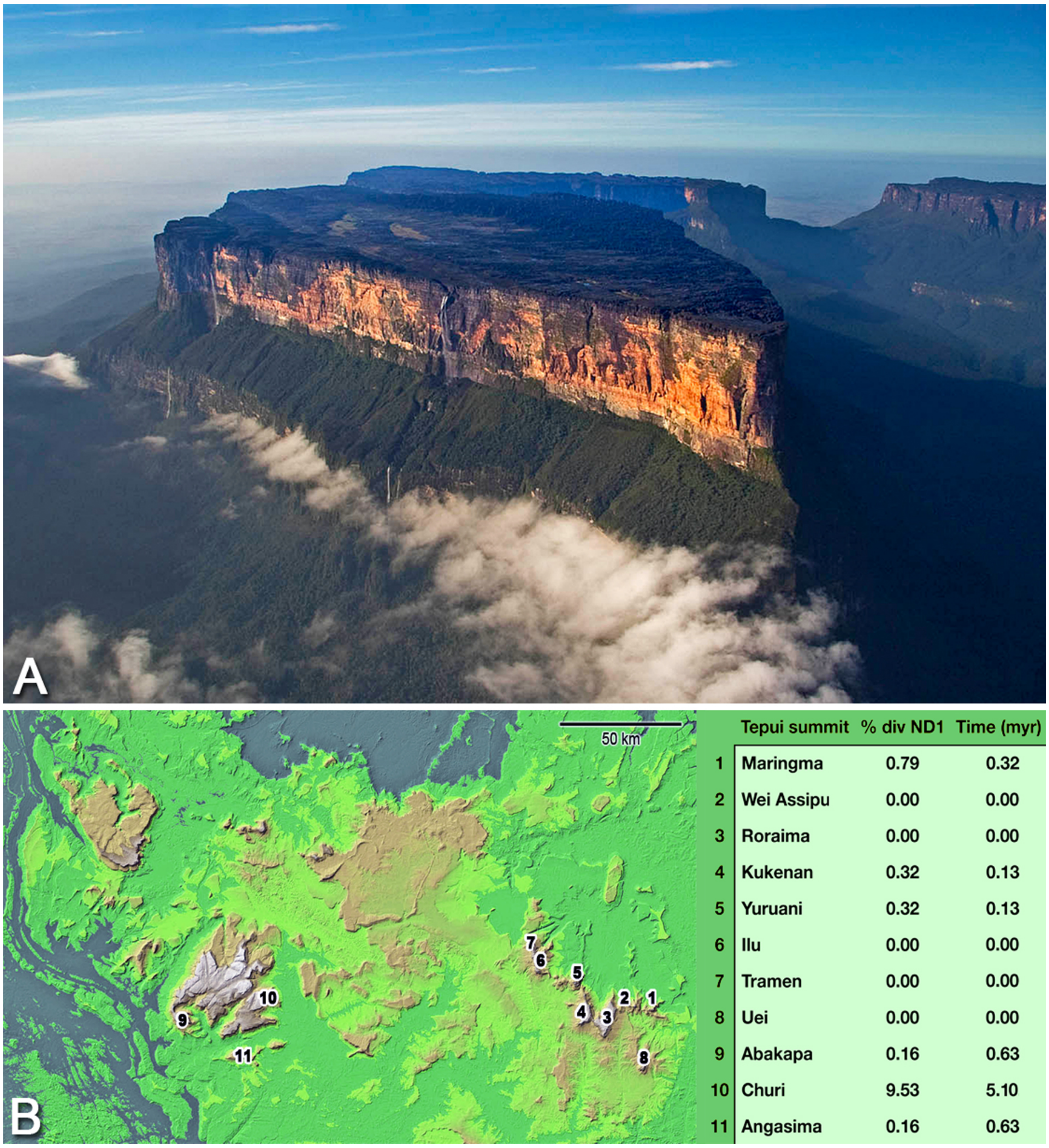
The Pantepui region of South America, located in southern Venezuela, northern Brazil, and western Guyana, is characterized by table mountains (tepuis) made of Proterozoic (> 1.5 billion years old) sandstone–the highest reaching nearly 3 km–that are isolated from their surroundings by up to 1000 m vertical cliffs (Fig. 1A). Tepuis are among the most inaccessible places on earth (Supplemental information), and the majority of their summits have been less visited than the moon. Due to its ancient age and topography [1, 2], this region has been assumed to be an ideal nursery of speciation and a potential inland counterpart to oceanic archipelagos [3, 4]. High endemism has been reported for the flora (25% in vascular plants) and fauna (68.5% in amphibians and reptiles) of single tepuis [5, 6], and an ancient origin has been postulated for some of these organisms. But, it has also been suggested that a few taxa living in habitats extending from lowlands to summits (e.g., savannah) invaded some of the more accessible tepuis only recently [6-8]. Taken at face value, the overall timing and extent of biotic interchange between tepui summits has remained unstudied. Here, we show that recent faunal interchange among currently isolated tepui summits has been extensive, and affected even taxa living in some of the most tepui-specific habitats and on the most inaccessible summits.

We used a comprehensive sampling of five Pantepui amphibian genera (*Anomaloglossus*, *Oreophrynella*, *Pristimantis*, *Stefania* and *Tepuihyla*) and one reptile family (Gymnophthalmidae)–the most conspicuous vertebrates on tepui summits–from 17 tepuis in the Eastern Pantepui region and surrounding uplands. If individual tepui summits were indeed reservoirs of ancient endemism, phylogenetic analyses of these taxa would identify genetically distinct populations on each tepui without close relatives elsewhere. Instead, analyses of two mitochondrial gene fragments evolving at different rates (16S rDNA and ND1 mtDNA; see Supplemental information) indicate that populations of a given species on individual summits are often closely related to those on other summits (e.g., *Oreophrynella*), or to those from the surrounding uplands (e.g., *Tepuihyla*). Uncorrected pairwise distances in both genes indicate unexpectedly low genetic divergence–as low as zero–among multiple tepui summit species or populations in five of the six groups (*Stefania* being the only exception), as well as among some summit species or populations and uplands populations described as distinct species (Fig. 1B, Supplemental information). Some of the lowest genetic distances are observed for populations that are currently recognized as distinct species and show striking phenotypic differences. For instance, the inconspicuously black ventral coloration in the toad *Oreophrynella nigra* (Yuruani-tepui and Kukenan-tepui) differs markedly from the potentially aposematic yellow–orange–black color contrasts in *O. quelchii* (Mt. Roraima and Wei Assipu-tepui), despite pairwise distances of 0.63–0.95% in ND1 and zero in 16S between both taxa.

The absence of genetic uniqueness suggests that the majority of these summit populations were only recently isolated. To provide an approximate estimate of the timing of their isolation, we used a nonlinear regression analysis that corrects for substitutional saturation and the systematic underestimation of evolutionary rates in recent divergences (Supplemental information). Our analyses suggest that 10 of the 11 most inaccessible tepuis studied show evidence for one or multiple instances of gene flow with other summits or with surrounding areas as recent as the late Pleistocene-Holocene (< 1.8 myr; Fig. 1B).

If the tepuis are indeed as ancient as often stated, the young age of extant summit fauna can only be explained by active dispersal among summits with subsequent extinction in the intervening uplands, e.g., during ice ages, or by passive dispersal, e.g., by birds or storms. The highly specific ecological niche preferences of some taxa restricted to tepui summits are likely to have limited active dispersal. Most *Oreophrynella* species for example exclusively occupy rocky habitats with extremely impoverished flora, which are absent in the intervening areas. Time estimates for the isolation of individual tepuis range from the Cretaceous [7, 8] to the Quaternary [2, 9]. The youngest estimates, although widely neglected in biological studies, could be compatible with the low genetic diversity and leave vicariance as a possible mechanism for speciation.

Regardless of the mechanism, our study shows that, even in small vertebrates restricted to summit-specific habitats, gene flow has been maintained until recently, making single-tepui endemism an exception rather than a rule. Nevertheless, as several of the taxa studied here (e.g., *Oreophrynella* and *Stefania*; Supplemental information) represent phylogenetically distinct lineages restricted to the Pantepui region, this area as a whole may still act as a reservoir of high-level endemism.



	Tepui summit	% div ND1	Time (myr)
1	Maringma	0.79	0.32
2	Wei Assipu	0.00	0.00
3	Roraima	0.00	0.00
4	Kukenan	0.32	0.13
5	Yuruani	0.32	0.13
6	Ilu	0.00	0.00
7	Tramen	0.00	0.00
8	Uei	0.00	0.00
9	Abakapa	0.16	0.63
10	Churi	9.53	5.10
11	Angasima	0.16	0.63

Figure **1. (A)** Mount Roraima, an emblematic tepui. **(B)** Map showing part of the Eastern Pantepui region, highlighting the highest and most isolated tepuis sampled in this study (numbered from 1 to 11), and table indicating estimates of divergence time among these tepuis, or between these tepuis and the surrounding uplands, based on genetic divergences in ND1 [see Supplemental Information for details].

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SUPPLEMENTAL INFORMATION

Supplemental Materials and Methods

Area of study and taxon sampling. Many tepui summit taxa are apparently rare, or at least difficult to collect, and many summit species are known only from very few specimens, often only the type series. Technical (most of these flat-topped mountains are only reachable by helicopter) and financial aspects have always seriously hindered extensive sampling for detailed and in-depth phylogenetic analyses of large datasets.

Over the past years, we managed to visit a total of 17 tepui summits/massifs and numerous uplands/lowlands localities in the Eastern Pantepui region and in other areas within the Guiana Shield, and obtained specimens and tissue samples of a considerable number of tepui taxa of almost all families represented on tepui tops. Some additional material was obtained from colleagues (see Acknowledgments). All specimens collected during our field surveys are housed in the collections of the Royal Belgian Institute of Natural Sciences, Belgium, the Royal Ontario Museum, Canada, and the National Museum of Natural History, USA. Tissue samples were deposited in the Amphibian Evolution Lab, Biology Department, Vrije Universiteit Brussel and in the Royal Ontario Museum. Additionally, we included useful sequences from GenBank in our phylogenetic analyses. A list of taxa and GenBank accession numbers is given in Supplemental Table 1.

Choice of markers. The mitochondrial 16S rDNA gene was first selected because it is reported as performing well for DNA barcoding in amphibians and to detect candidate species [S2, S3, S4, S5]. Because genetic divergences were surprisingly low among summit species/populations and among summit/uplands species/populations we also sequenced a faster protein-coding gene. Protein-coding genes are powerful markers for inferring evolutionary history in lower taxonomic categories such as families, genera and species [S6] and the subunit 1 of the NADH gene, shown to evolve at least 4 times faster than 16S, was therefore convenient for our purpose.

DNA extraction, PCR, sequencing and sequence alignment. Tissue samples (thigh muscle or liver) were taken in the field and stored in 95% ethanol. Total genomic DNA was extracted and purified using the Qiagen DNeasy® Tissue Kit following manufacturer's instructions. Fragments of the mitochondrial ribosomal gene 16S (*ca.* 550 bp) and of the protein-coding gene NADH subunit 1 (ND1, *ca.* 650-730 bp) were amplified and sequenced using the primers listed in Supplemental Table 2 under previously described PCR conditions [S7]. PCR products were checked on a 1% agarose gel and purified with the Qiagen PCR purification kit following manufacturer's instructions. PCR fragments were sequenced on both strands using the BigDye cycle sequencing kit (Applied Biosystems) on an ABI 3100 automated sequencer. Chromatograms were read using the Staden package [S8] and a consensus sequence was assembled from the forward and reverse primer sequences. ClustalX 2.0.11 [S9] was used to perform preliminary alignment using default parameters. Minor alignment corrections were made using MacClade 4.06 [S10] and the protein-coding gene ND1 was translated into amino-acid sequences to check for unexpected stop codons that would indicate the presence of pseudogenes. When present, ambiguous regions were excluded from subsequent analyses.

Phylogenetic Analyses. Uncorrected pairwise distances were estimated using PAUP* 4.0b10 [S11] (Supplemental Tables 3–10). For each of the six taxa studied, their closest known relatives according to previous phylogenetic studies were selected as outgroup taxa: *Rheobates* and *Dendrobates* for *Anomaloglossus* [S12], *Atelopus* for *Oreophrynella* [S7], *Eleutherodactylus* and *Stefania* for *Pristimantis* [S13], *Pristimantis* and *Gastrotheca* for *Stefania* [S14], *Osteocephalus* for *Tepuihyla* [S15], and *Ameiva* for the Gymnophthalmidae [S16]. Maximum Parsimony (MP) analyses of the concatenated 16S+ND1 dataset were performed in PAUP* as a heuristic search with TBR branch swapping and 1,000 random addition sequence replicates; bootstrap support was estimated with full heuristic search and 10,000 replicates. Maximum Likelihood (ML) analyses were conducted in PAUP* for the 16S+ND1 dataset under the model of nucleotide substitution selected by jModelTest 0.1.1 [S17]; bootstrap support was estimated with "fast" stepwise-addition and 500 replicates. Clade credibility was also estimated by Bayesian posterior probabilities (BPP) in MrBayes 3.2.1 [S18]. The Bayesian analyses implemented a mixed general time-reversible model (GTR + G + I) partitioned over the different gene fragments, flat Dirichlet priors for base frequencies and substitution rate matrices and uniform priors for among-site rate parameters. Two parallel Markov chain Monte Carlo (MCMC) runs of four incrementally heated (temperature parameter = 0.2) chains were performed, with a length of 6,000,000 generations, a sampling frequency of 1 per 1,000 generations, and a burn-in corresponding to the first 1,000,000 generations. Convergence of the parallel runs was confirmed by split frequency SDs (<0.01) and potential scale reduction factors (~1.0) for all model parameters, as reported by MrBayes. Adequate posterior sampling was verified using Tracer 1.4 [S19] if the runs had reached effective sampling sizes >200 for all model parameters. MrBayes trees are provided in Supplemental Figure 2.

Estimation of divergence times. Recent phylogenetic studies have indicated that some taxa endemic to the Pantepui region originated in the Tertiary [e.g. S7, S20, S21]. However, the dynamics of faunal interchange among tepui summits has never been studied with molecular data. Molecular clock estimation of recent divergence times poses certain problems that are not addressed by the dating methods implemented in any of the frequently used computer programs like R8s [S22], Multidivtime [S23], and BEAST [S24]. Mitochondrial gene fragments that are commonly used to estimate divergence ages for ancient nodes may fail to provide accurate age estimates for very recent divergences due to an apparent time-dependency of evolutionary rates [S25–S27]. Moreover, fast-evolving genes are likely to show substitutional saturation towards the past [S28], resulting in a nonlinear relationship between sequence divergence and the actual time since divergence. The likelihood models implemented in the commonly used molecular clock methods [S22–24] are supposed to partially correct for substitutional saturation (by being capable to detect more "hidden" homoplasy than e.g. the maximum parsimony method). However, in the absence of recent calibration points, these molecular clock methods may still lead to considerable overestimation of recent divergence times as a result of saturation [S29].

The lack of a linear correlation between sequence divergence and time since divergence can be corrected by using correction curves [e.g. S25]. We used a saturation curve to correct substitutional saturation in the NADH-subunit 1 (ND1) fragment. This curve is described by the following function:

$d(t) = D_{sat} \times (1- e^{-t/T})$, where d is the uncorrected genetic distance between a pair of sequences, t is the divergence time between these sequences, D_{sat} is the sequence divergence at substitutional saturation (i.e. the maximum expected divergence between two DNA sequences), and T is the time required to reach a sequence divergence of $D_{sat} \times (1 - e^{-1}) = 63.2\%$ of D_{sat}. In other words, the shape of the saturation curve is determined by a parameter describing the expected sequence divergence at saturation (D_{sat}) and a parameter determining the rate at which the curve approaches saturation through time (T). This is analogous to saturation curves used in e.g. Michaelis-Menten enzyme kinetics. A saturation function allows us to obtain divergence time estimates for very recent nodes based on a fast-evolving gene by using divergence time estimates for older nodes that were based on slowly evolving genes. We proceeded through the following steps to obtain divergence times:

First, we plotted uncorrected pairwise distances for the ND1 gene fragment of 260 Hyloidea representatives (in this case bufonid taxa) against their divergence times inferred from relaxed clock analyses of two nuclear and nine mitochondrial genes in a previous study [S7]. The resulting scatter plot clearly indicates substitutional saturation in the ND1 gene, with genetic distances levelling out at approximately 20% divergence (Supplemental Figure 3).

Second, we used nonlinear regression based on the abovementioned function to estimate the best-fitting saturation curve through this scatter plot. This was done by searching the optimal values for D_{sat} and T using the Solver add-in in MS Excel (Microsoft, 2008). The best fitting saturation curve ($R^2 = 0.641$) corresponds to $D_{sat} = 19.67\%$ and $T = 7.732$ myr. Because the abovementioned time dependency of mitochondrial evolutionary rates may have also affected most recent divergence times in Van Bocxlaer *et al*. [S7] we additionally estimated a saturation curve on a scatter plot excluding all bufonid sequence divergences below 10%. Although this resulted in a reduced fit ($R^2 = 0.256$), the resulting curve was nearly identical to the original one, with $D_{sat} = 19.71\%$ and $T = 7.867$ myr.

Third, we used the obtained saturation curve and optimized parameters to convert uncorrected pairwise distances between two sequences from different tepui summits (we selected the highest and most isolated ones from which we have samples) and between a sequence from a tepui summit and the nearest sequence from upland into approximate divergence times. For each of the observed distances, the approximate divergence time using our saturation function corresponds to: $t = T \times -\ln[1-(d/D_{sat})]$.

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Next 5 pages: Supplemental Table **1.** List of taxa used in this study and GenBank accession numbers. Sequences newly generated are in **boldface**. * These taxa are swapped in the GenBank database.

Tissue sample n°	Museum n°	16S	ND1	Order	Genus	Species	Locality	Country	Coordinates	Elevation (m)
VUB3321	IRSNB15863	**JQ742236**	**JQ742403**	Amphibia	"*Hyla*"	*warreni*	Maringma Tepui	Guyana	N 5°12'15" W 60°34'38"	1376
VUB3735	Uncatalogued	**JQ742102**	**JQ742283**	Amphibia	*Anomaloglossus*	"*verbeeksnyderorum*"	Tobogán de la Selva	Venezuela	N 5°23' W 67°34'	56
VUB3568	IRSNB15849	**JQ742125**	**JQ742302**	Amphibia	*Anomaloglossus*	aff. *degranvillei*	Kaw Mountain	French Guiana	N 4°32'41" W 52°09'09"	221
VUB3570	IRSNB15848	**JQ742126**	**JQ742303**	Amphibia	*Anomaloglossus*	*baeobatrachus*	Angoulême	French Guiana	N 5°24'38" W 53°39'23"	22
VUB3730	IRSNB13741	**JQ742107**	#####	Amphibia	*Anomaloglossus*	*beebei*	Kaieteur National Park	Guyana	N 5°10' W 59°29'	440
VUB3731	IRSNB13752	**JQ742108**	#####	Amphibia	*Anomaloglossus*	*beebei*	Kaieteur National Park	Guyana	N 5°08' W 59°24'	580
VUB3732	ROM39635	**JQ742109**	**JQ742287**	Amphibia	*Anomaloglossus*	*beebei*	Mt Ayanganna	Guyana	N 5°24' W 59°57'	1490-1550
VUB3054	IRSNB14454	**JQ742110**	#####	Amphibia	*Anomaloglossus*	*kaiei*	Kaieteur National Park	Guyana	N 5°08' W 59°24'	580
VUB3106	ROM43327	**JQ742116**	**JQ742293**	Amphibia	*Anomaloglossus*	*kaiei*	Wokomung Massif	Guyana	N 5°06'35" W 59°48'37"	700
VUB3107	ROM43333	**JQ742117**	**JQ742294**	Amphibia	*Anomaloglossus*	*kaiei*	Wokomung Massif	Guyana	N 5°06'35" W 59°48'37"	700
VUB3530	ROM44102	**JQ742123**	**JQ742300**	Amphibia	*Anomaloglossus*	*kaiei*	Meamu River	Guyana	N 6°16'21" W 60°29'59"	664
VUB3531	ROM44104	**JQ742124**	**JQ742301**	Amphibia	*Anomaloglossus*	*kaiei*	Meamu River	Guyana	N 6°11'44" W 60°28'48"	781
VUB3055	IRSNB1986	#####	**JQ742285**	Amphibia	*Anomaloglossus*	*megacephalus*	Maringma Tepui	Guyana	N 5°12'37" W 60°33'59"	1060
VUB3056	IRSNB14410	#####	**JQ742286**	Amphibia	*Anomaloglossus*	*praderioi*	Maringma Tepui	Guyana	N 5°12'16" W 60°34'39"	1376
Genbank	CPI10198	DQ502255	#####	Amphibia	*Anomaloglossus*	*praderioi*	Roraima Tepui	Guyana	N 5°16'30" W 60°43'00"	1310
Genbank	CPI10208	DQ502256	#####	Amphibia	*Anomaloglossus*	*praderioi*	Roraima Tepui	Guyana	N 5°16'30" W 60°43'00"	1310
VUB3057	IRSNB15864	#####	**JQ742288**	Amphibia	*Anomaloglossus*	*roraima*	Maringma Tepui	Guyana	N 5°12'59" W 60°35'05"	2147
VUB3086	IRSNB15865	#####	**JQ742289**	Amphibia	*Anomaloglossus*	*roraima*	Wei Assipu Tepui	Guyana	N 5°12'58" W 60°42'16"	2216
VUB3087	IRSNB15851	#####	**JQ742290**	Amphibia	*Anomaloglossus*	*roraima*	Wei Assipu Tepui	Guyana	N 5°12'58" W 60°42'16"	2216
Genbank	CPI10216	DQ502258	#####	Amphibia	*Anomaloglossus*	*roraima*	Roraima Tepui	Guyana	N 5°15'30" W 60°43'30"	1860-2350
Genbank	CPI10217	DQ502259	#####	Amphibia	*Anomaloglossus*	*roraima*	Roraima Tepui	Guyana	N 5°15'30" W 60°43'30"	1860-2350
Genbank	Untagged tadpoles	DQ502260	#####	Amphibia	*Anomaloglossus*	*roraima*	Roraima Tepui	Guyana	N 5°15'30" W 60°43'30"	1860-2350
VUB3733	Uncatalogued	**JQ742101**	#####	Amphibia	*Anomaloglossus*	*rufulus*	Churi Tepui	Venezuela	N 5°16' W 62°00'	ca. 2325
GenBank	UTAA56469	DQ502249	#####	Amphibia	*Anomaloglossus*	sp "Brownsberg"	Brownsberg	Suriname	N 5°04' W 54°58'	80
GenBank	UTAA56710	DQ502254	#####	Amphibia	*Anomaloglossus*	sp "Tomasing"	Mt Tomasing	Guyana	N 5°44'22" W 60°17'51"	550
VUB3128	ROM43892	**JQ742119**	**JQ742296**	Amphibia	*Anomaloglossus*	sp A	Wokomung Massif	Guyana	N 5°06'35" W 59°48'37"	700
VUB3126	ROM43902	**JQ742118**	**JQ742295**	Amphibia	*Anomaloglossus*	sp A	Wokomung Massif	Guyana	N 5°05'33" W 59°50'35"	1411
VUB3092	ROM43320	#####	**JQ742291**	Amphibia	*Anomaloglossus*	sp B	Wokomung Massif	Guyana	N 5°07'46" W 59°49'16"	1234
VUB3093	ROM43323	**JQ742115**	**JQ742292**	Amphibia	*Anomaloglossus*	sp B	Wokomung Massif	Guyana	N 5°05'33" W 59°50'35"	1400
VUB3527	ROM44110	**JQ742122**	**JQ742299**	Amphibia	*Anomaloglossus*	sp C	Seroun River	Guyana	N 6°08'11" W 60°22'46"	695
VUB3525	ROM44112	**JQ742120**	**JQ742297**	Amphibia	*Anomaloglossus*	sp C	Merume Mountain	Guyana	N 5°56'03" W 60°09'24"	950
VUB3526	ROM44113	**JQ742121**	**JQ742298**	Amphibia	*Anomaloglossus*	sp C	Meamu River	Guyana	N 6°11'44" W 60°28'48"	781
GenBank	MJH3950	DQ502108	#####	Amphibia	*Anomaloglossus*	*stepheni*	Manaus	Brazil	S 2°57' W 59°55'	100
VUB3734	Uncatalogued	**JQ742104**	#####	Amphibia	*Anomaloglossus*	*tepuyensis*	Auyantepui	Venezuela	N 5°46' W 62°33'	ca. 2100
VUB3736	Uncatalogued	**JQ742103**	**JQ742284**	Amphibia	*Anomaloglossus*	*wothuja*	Cerro Sipapo	Venezuela	N 5°05' W 67°27'	150
VUB3737	IRSNB15781	**JQ742148**	**JQ742324**	Amphibia	*Atelopus*	aff. *hoogmoedi*	Iwokrama Forest	Guyana	N 4°19'60" W 58°48'00"	67
VUB3573	PK3306	**JQ742150**	#####	Amphibia	*Atelopus*	*franciscus*	Angoulême	French Guiana	N 5°24'38" W 53°39'23"	22
VUB3132	IRSNB14477	**JQ742149**	#####	Amphibia	*Atelopus*	*hoogmoedi*	Kaieteur National Park	Guyana	N 5°08' W 59°24'	580
GenBank	TNHC64416	HQ290991	HQ290991	Amphibia	*Dendrobates*	*tinctorius*	Sipaliwini	Suriname	N 2°00' W 56°04'	300
VUB1624	Uncatalogued	FJ882750	FJ882750	Amphibia	*Eleutherodactylus*	*coqui*	El Verde	Puerto Rico	no data	350
VUB1036	Uncatalogued	FJ882745	FJ882745	Amphibia	*Eleutherodactylus*	*marnockii*	no data	USA	no data	no data
Genbank	JLG09	AY843592	#####	Amphibia	*Gastrotheca*	*fissipes*	Guarapari, ES	Brazil	N 20°39' W 40°30'	24

Tissue sample n°	Museum n°	16S	ND1	Order	Genus	Species	Locality	Country	Coordinates	Elevation (m)
VUB985	Uncatalogued	AY948744	AY948744	Amphibia	*Melanophryniscus*	*stelzneri*	no data (pet trade)	"South America"	no data	no data
VUB3372	IRSNB15870	**JQ742239**	**JQ742406**	Amphibia	*Myersiohyla*	*kanaima*	Maringma Tepui	Guyana	N 5°12'37" W 60°33'59"	1060
VUB3532	ROM39651	**JQ742139**	**JQ742316**	Amphibia	*Oreophrynella*	"*dendronastes*"	Mt Ayanganna	Guyana	N 5°21' W 59°57'	1490
VUB3533	ROM46402	**JQ742140**	**JQ742317**	Amphibia	*Oreophrynella*	*macconnelli*	Wokomung Massif	Guyana	N 5°06' W 59°51'	1400
VUB3065	IRSNB14364	**JQ742141**	#####	Amphibia	*Oreophrynella*	*macconnelli*	Roraima Tepui	Guyana	N 5°15'30" W 60°43'30"	1830
VUB3067	IRSNB14366	**JQ742142**	**JQ742318**	Amphibia	*Oreophrynella*	*macconnelli*	Mt Kopinang	Guyana	N 5°00'08" W 59°52'47"	1524
VUB3142	IRSNB14334	**JQ742143**	**JQ742319**	Amphibia	*Oreophrynella*	*macconnelli*	Maringma Tepui	Guyana	N 5°12'16" W 60°34'39"	1376
VUB3534	ROM46405	**JQ742144**	**JQ742320**	Amphibia	*Oreophrynella*	*macconnelli*	Wokomung Massif	Guyana	N 5°05' W 59°50'	1700
VUB3535	ROM46413	**JQ742145**	**JQ742321**	Amphibia	*Oreophrynella*	*macconnelli*	Wokomung Massif	Guyana	N 5°08' W 59°49'	1234
VUB3537	ROM46429	**JQ742147**	**JQ742323**	Amphibia	*Oreophrynella*	*macconnelli*	Merume Mountain	Guyana	N 5°56' W 60°09'	950
VUB3536	ROM46432	**JQ742146**	**JQ742322**	Amphibia	*Oreophrynella*	*macconnelli*	Wokomung Massif	Guyana	N 6°19' W 60°32'	700
VUB3635	CPI10594	**JQ742135**	**JQ742312**	Amphibia	*Oreophrynella*	"*nigra*"	Kukenan Tepui	Venezuela	N 5°13'28" W 60°49'43"	2600
VUB3068	IRSNB14389	**JQ742136**	**JQ742313**	Amphibia	*Oreophrynella*	"*nigra*"	Kukenan Tepui	Venezuela	N 5°13'28" W 60°49'43"	2600
VUB3698	IRSNB15704	**JQ742137**	**JQ742314**	Amphibia	*Oreophrynella*	"*nigra*"	Yuruani Tepui	Venezuela	N 5°18'50" W 60°51'50"	2303
VUB3713	IRSNB15732	**JQ742138**	**JQ742315**	Amphibia	*Oreophrynella*	"*nigra*"	Yuruani Tepui	Venezuela	N 5°18'50" W 60°51'50"	2303
VUB3061	IRSNB14347	**JQ742133**	**JQ742310**	Amphibia	*Oreophrynella*	*quelchii*	Roraima Tepui	Guyana	N 5°12'00" W 60°44'00"	2590
VUB3145	IRSNB15866	**JQ742134**	**JQ742311**	Amphibia	*Oreophrynella*	*quelchii*	Wei Assipu Tepui	Guyana	N 5°13'03" W 60°42'23"	2207
VUB3146	IRSNB1979	**JQ742132**	**JQ742309**	Amphibia	*Oreophrynella*	*seegobini*	Maringma Tepui	Guyana	N 5°12'59" W 60°35'05"	2088
VUB3058	IRSNB1980	**JQ742131**	**JQ742308**	Amphibia	*Oreophrynella*	*seegobini*	Maringma Tepui	Guyana	N 5°12'59" W 60°35'05"	2088
VUB3069	IRSNB14398	**JQ742130**	**JQ742307**	Amphibia	*Oreophrynella*	*vasquezi*	Ilu Tepui	Venezuela	N 5°24'20" W 61°00'23"	2680
VUB3738	IRSNB15760	**JQ742128**	**JQ742305**	Amphibia	*Oreophrynella*	*vasquezi*	Tramen Tepui	Venezuela	N 5°26'40" W 61°01'20"	2371
VUB3739	IRSNB15761	**JQ742129**	**JQ742306**	Amphibia	*Oreophrynella*	*vasquezi*	Tramen Tepui	Venezuela	N 5°26'40" W 61°01'20"	2371
VUB3740	Uncatalogued	**JQ742127**	**JQ742304**	Amphibia	*Oreophrynella*	*vasquezi*	Ilu Tepui	Venezuela	N 5°24' W 61°00'	ca. 2600
VUB3387	IRSNB14673	**JQ742235**	**JQ742402**	Amphibia	"*Osteocephalus*"	*exophthalmus*	Kaieteur National Park	Guyana	N 5°10' W 59°30'	430
VUB3380	IRSNB14656	**JQ742237**	**JQ742404**	Amphibia	*Osteocephalus*	*leprieurii*	Kaieteur National Park	Guyana	N 5°10' W 59°30'	430
VUB3382	IRSNB14657	**JQ742238**	**JQ742405**	Amphibia	*Osteocephalus*	*oophagus*	Kaieteur National Park	Guyana	N 5°08' W 59°25'	540
VUB3674	IRSNB15634	**JQ742165**	#####	Amphibia	*Pristimantis*	aff. *pulvinatus*	La Escalera	Venezuela	N 5°54'57" W 61°26'05"	1416
VUB3751	IRSNB15786	**JQ742164**	**JQ742338**	Amphibia	*Pristimantis*	aff. *pulvinatus*	Iwokrama Forest	Guyana	N 4°20'11" W 58°46'54"	950
VUB3485	IRSNB14471	**JQ742166**	#####	Amphibia	*Pristimantis*	aff. *pulvinatus*	Kaieteur National Park	Guyana	N 5°08' W 59°24'	580
VUB3491	IRSNB12862	**JQ742167**	**JQ742339**	Amphibia	*Pristimantis*	aff. *pulvinatus*	Maringma Tepui	Guyana	N 5°12'15" W 60°34'38"	1376
VUB3741	IRSNB15643	**JQ742151**	**JQ742325**	Amphibia	*Pristimantis*	*aureoventris*	Roraima Tepui	Guyana	N 5°15' W 60°43'	2305
VUB3742	IRSNB15820	**JQ742153**	**JQ742327**	Amphibia	*Pristimantis*	*aureoventris*	Wei Assipu Tepui	Guyana	N 5°13'04" W 60°42'21"	2196
VUB3743	IRSNB15821	**JQ742158**	**JQ742332**	Amphibia	*Pristimantis*	*aureoventris*	Wei Assipu Tepui	Guyana	N 5°13'03" W 60°42'21"	2219
VUB3744	IRSNB15824	**JQ742155**	**JQ742329**	Amphibia	*Pristimantis*	*aureoventris*	Wei Assipu Tepui	Guyana	N 5°13'04" W 60°42'21"	2196
VUB3745	IRSNB15825	**JQ742156**	**JQ742330**	Amphibia	*Pristimantis*	*aureoventris*	Wei Assipu Tepui	Guyana	N 5°13'04" W 60°42'21"	2196
VUB3746	IRSNB4152	**JQ742157**	**JQ742331**	Amphibia	*Pristimantis*	*aureoventris*	Wei Assipu Tepui	Guyana	N 5°13'05" W 60°42'15"	2210
VUB3499	IRSNB4153	**JQ742159**	**JQ742333**	Amphibia	*Pristimantis*	*aureoventris*	Wei Assipu Tepui	Guyana	N 5°13'05" W 60°42'15"	2210
VUB3747	IRSNB4154	**JQ742154**	**JQ742328**	Amphibia	*Pristimantis*	*aureoventris*	Wei Assipu Tepui	Guyana	N 5°13'04" W 60°42'21"	2196
VUB3748	Uncatalogued (egg)	**JQ742152**	**JQ742326**	Amphibia	*Pristimantis*	*aureoventris*	Wei Assipu Tepui	Guyana	N 5°13'04" W 60°42'21"	2196
VUB3626	Uncatalogued	**JQ742170**	**JQ742342**	Amphibia	*Pristimantis*	cf. *marmoratus*	Cacao Mountain	French Guiana	N 4°33'42" W 52°27'09"	107
VUB3493	IRSNB15867	**JQ742169**	**JQ742341**	Amphibia	*Pristimantis*	*jester*	Maringma Tepui	Guyana	N 5°12'16" W 60°34'39"	1376
GenBank	KU181015	EU186723	#####	Amphibia	*Pristimantis*	*pulvinatus*	La Escalera	Venezuela	N 5°59' W 61°24'	1250
VUB3490	IRSNB12859	**JQ742168**	**JQ742340**	Amphibia	*Pristimantis*	*saltissimus*	Maringma Tepui	Guyana	N 5°12'38" W 60°33'60"	1060

Tissue sample n°	Museum n°	16S	ND1	Order	Genus	Species	Locality	Country	Coordinates	Elevation (m)
VUB3749	IRSNB15868	**JQ742162**	**JQ742336**	Amphibia	*Pristimantis*	sp "Abakapa"	Abakapa Tepui	Venezuela	N 5°11'21" W 62°17'40"	2160
VUB3750	IRSNB15869	**JQ742163**	**JQ742337**	Amphibia	*Pristimantis*	sp "Angasima"	Angasima Tepui	Venezuela	N 5°02'35" W 62°04'51"	2121
GenBank	SBH268110	EU186721	#####	Amphibia	*Pristimantis*	sp "Aprada"	Aprada Tepui	Venezuela	N 5°24' W 62°26'	2540
VUB3717	IRSNB15640	**JQ742160**	**JQ742334**	Amphibia	*Pristimantis*	*yuruaniensis*	Yuruani Tepui	Venezuela	N 5°18'50" W 60°51'50"	2303
VUB3720	IRSNB15641	**JQ742161**	**JQ742335**	Amphibia	*Pristimantis*	*yuruaniensis*	Yuruani Tepui	Venezuela	N 5°18'50" W 60°51'50"	2303
VUB3624	IRSNB15850	**JQ742171**	#####	Amphibia	*Pristimantis*	*zeuctotylus*	Cacao Mountain	French Guiana	N 4°33'42" W 52°27'09"	107
GenBank	TNHCFS4955	HQ290967	HQ290967	Amphibia	*Rheobates*	*palmatus*	Boyaca	Colombia	N 5°38'16" W 73°32'08"	2118
VUB3538	ROM39475	**JQ742208**	**JQ742376**	Amphibia	*Stefania*	"*ackawaio*"	Mt Ayanganna	Guyana	N 5°21' W 59°57'	1490
VUB3539	ROM42811	**JQ742209**	**JQ742377**	Amphibia	*Stefania*	"*ackawaio*"	Wokomung Massif	Guyana	N 5°08' W 59°49'	1234
VUB3558	ROM39470	**JQ742190**	**JQ742361**	Amphibia	*Stefania*	"*scalae*"	Mt Ayanganna	Guyana	N 5°21' W 59°57'	1550
VUB3299	PK1846	**JQ742194**	**JQ742365**	Amphibia	*Stefania*	aff. *evansi*	Wayalayeng	Guyana	N 5°14'11" W 60°31'04"	678
VUB3555	ROM44254	**JQ742195**	**JQ742366**	Amphibia	*Stefania*	aff. *evansi*	Kurupung River	Guyana	N 6°02' W 60°16'	614
VUB3557	ROM44264	#####	**JQ742367**	Amphibia	*Stefania*	aff. *evansi*	Merume Mountain	Guyana	N 5°56' W 60°09'	950
VUB3302	IRSNB15871	**JQ742199**	**JQ742371**	Amphibia	*Stefania*	aff. *evansi*	Maringma Tepui	Guyana	N 5°12'37" W 60°33'59"	1060
VUB3540	ROM39640	**JQ742210**	**JQ742378**	Amphibia	*Stefania*	*ayangannae*	Mt Ayanganna	Guyana	N 5°21' W 59°57'	1490
VUB3542	ROM42906	**JQ742212**	**JQ742380**	Amphibia	*Stefania*	*ayangannae*	Wokomung Massif	Guyana	N 5°06' W 59°51'	1400
VUB3541	ROM42925	**JQ742211**	**JQ742379**	Amphibia	*Stefania*	*ayangannae*	Wokomung Massif	Guyana	N 5°05' W 59°50'	1700
VUB3543	ROM39478	**JQ742179**	**JQ742350**	Amphibia	*Stefania*	*coxi*	Mt Ayanganna	Guyana	N 5°21' W 59°57'	1490
VUB3544	ROM42856	**JQ742180**	**JQ742351**	Amphibia	*Stefania*	*coxi*	Wokomung Massif	Guyana	N 5°05' W 59°50'	1700
VUB3277	IRSNB14588	**JQ742192**	**JQ742363**	Amphibia	*Stefania*	*evansi*	Kaieteur National Park	Guyana	N 5°10' W 59°29'	440
VUB3294	IRSNB14595	**JQ742193**	**JQ742364**	Amphibia	*Stefania*	*evansi*	Kaieteur National Park	Guyana	N 5°08' W 59°25'	530
VUB3551	ROM39450	**JQ742196**	**JQ742368**	Amphibia	*Stefania*	*evansi*	Mt Ayanganna	Guyana	N 5°25' W 59°58'	870
VUB3553	ROM42862	**JQ742198**	**JQ742370**	Amphibia	*Stefania*	*evansi*	Mt Ayanganna	Guyana	N 5°18' W 59°50'	676
VUB3552	ROM42882	**JQ742197**	**JQ742369**	Amphibia	*Stefania*	*evansi*	Wokomung Massif	Guyana	N 5°07' W 59°49'	700
VUB3752	PK3566	**JQ742173**	**JQ742344**	Amphibia	*Stefania*	*ginesi*	Abakapa Tepui	Venezuela	N 5°11'23" W 62°17'52"	2137
VUB3753	PK3580	**JQ742174**	**JQ742345**	Amphibia	*Stefania*	*ginesi*	Abakapa Tepui	Venezuela	N 5°11'07" W 62°17'21"	2209
VUB3754	Uncatalogued	**JQ742172**	**JQ742343**	Amphibia	*Stefania*	*riae*	Sarisarinama Tepui	Venezuela	N 4°41' W 64°13'	ca. 1100
VUB3697	IRSNB15703	**JQ742177**	**JQ742348**	Amphibia	*Stefania*	*riveroi*	Yuruani Tepui	Venezuela	N 5°18'50" W 60°51'50"	2303
VUB3705	IRSNB15716	**JQ742178**	**JQ742349**	Amphibia	*Stefania*	*riveroi*	Yuruani Tepui	Venezuela	N 5°18'50" W 60°51'50"	2303
VUB3545	ROM39469	**JQ742213**	**JQ742381**	Amphibia	*Stefania*	*roraimae*	Mt Ayanganna	Guyana	N 5°21' W 59°57'	1490
VUB3546	ROM42843	**JQ742214**	**JQ742276**	Amphibia	*Stefania*	*roraimae*	Wokomung Massif	Guyana	N 5°08' W 59°49'	1234
VUB3309	IRSNB15872	**JQ742203**	**JQ742372**	Amphibia	*Stefania*	*roraimae*	Maringma Tepui	Guyana	N 5°12'15" W 60°34'38"	1376
VUB3310	IRSNB15873	**JQ742204**	**JQ742373**	Amphibia	*Stefania*	*roraimae*	Maringma Tepui	Guyana	N 5°12'15" W 60°34'38"	1376
VUB3311	IRSNB15874	**JQ742205**	**JQ742374**	Amphibia	*Stefania*	*roraimae*	Maringma Tepui	Guyana	N 5°12'15" W 60°34'38"	1376
VUB3312	IRSNB15875	**JQ742206**	**JQ742375**	Amphibia	*Stefania*	*roraimae*	Maringma Tepui	Guyana	N 5°12'15" W 60°34'38"	1376
VUB3315	IRSNB15876	**JQ742207**	**JQ742275**	Amphibia	*Stefania*	*roraimae*	Maringma Tepui	Guyana	N 5°12'15" W 60°34'38"	1376
VUB3549	ROM44271	**JQ742202**	**JQ742274**	Amphibia	*Stefania*	*roraimae*	Seroun River	Guyana	N 6°08' W 60°23'	700
VUB3633	ROM44277	**JQ742200**	**JQ742272**	Amphibia	*Stefania*	*roraimae*	Partang	Guyana	N 5°49'07" W 60°13'26"	728
VUB3548	ROM44279	**JQ742201**	**JQ742273**	Amphibia	*Stefania*	*roraimae*	Apakai River	Guyana	N 5°54' W 60°07'	984
VUB3755	IRSNB15839	**JQ742175**	**JQ742346**	Amphibia	*Stefania*	*satelles*	Angasima Tepui	Venezuela	N 5°02'36" W 62°04'51"	2122
VUB3756	IRSNB15844	**JQ742176**	**JQ742347**	Amphibia	*Stefania*	*satelles*	Angasima Tepui	Venezuela	N 5°02'36" W 62°04'51"	2122
VUB3280	PK2060V	**JQ742191**	**JQ742362**	Amphibia	*Stefania*	*scalae*	El Danto	Venezuela	N 5°57'52" W 61°23'31"	1208
Genbank	MNHN2002.692	AY843768	#####	Amphibia	*Stefania*	*schuberti*	Auyantepui	Venezuela	N 5°46' W 62°33'	2325

Tissue sample n°	Museum n°	16S	ND1	Order	Genus	Species	Locality	Country	Coordinates	Elevation (m)
VUB3266	IRSNB15853	**JQ742181**	**JQ742352**	Amphibia	*Stefania*	sp "Wei-Assipu"	Wei Assipu Tepui	Guyana	N 5°12'58" W 60°42'16"	2216
VUB3269	IRSNB15854	**JQ742182**	**JQ742353**	Amphibia	*Stefania*	sp "Wei-Assipu"	Wei Assipu Tepui	Guyana	N 5°12'58" W 60°42'16"	2216
VUB3274	IRSNB15855	**JQ742183**	**JQ742354**	Amphibia	*Stefania*	sp "Wei-Assipu"	Wei Assipu Tepui	Guyana	N 5°12'58" W 60°42'16"	2216
VUB3282	IRSNB13799	**JQ742185**	**JQ742356**	Amphibia	*Stefania*	*woodleyi*	Kaieteur National Park	Guyana	N 5°08' W 59°24'	580
VUB3307	IRSNB15877	**JQ742186**	**JQ742357**	Amphibia	*Stefania*	*woodleyi*	Maringma Tepui	Guyana	N 5°12'37" W 60°33'59"	1060
VUB3308	IRSNB15878	**JQ742187**	**JQ742358**	Amphibia	*Stefania*	*woodleyi*	Maringma Tepui	Guyana	N 5°12'37" W 60°33'59"	1060
VUB3550	ROM20570	**JQ742189**	**JQ742360**	Amphibia	*Stefania*	*woodleyi*	Tukeit, KNP	Guyana	N 5°12' W 59°27'	205
VUB3547	ROM39465	**JQ742188**	**JQ742359**	Amphibia	*Stefania*	*woodleyi*	Mt Ayanganna	Guyana	N 5°25' W 59°58'	870
VUB3757	ROM42833	**JQ742184**	**JQ742355**	Amphibia	*Stefania*	*woodleyi*	Wokomung Massif	Guyana	N 5°07' W 59°49'	700
VUB3401	IRSNB15856	**JQ742218**	**JQ742385**	Amphibia	*Tepuihyla*	"*galani*"	Wei Assipu Tepui	Guyana	N 5°12'58" W 60°42'16"	2216
VUB3402	IRSNB15857	**JQ742219**	**JQ742386**	Amphibia	*Tepuihyla*	"*galani*"	Wei Assipu Tepui	Guyana	N 5°13'05" W 60°42'23"	2244
VUB3403	IRSNB15858	**JQ742220**	**JQ742387**	Amphibia	*Tepuihyla*	"*galani*"	Wei Assipu Tepui	Guyana	N 5°13'05" W 60°42'23"	2244
VUB3405	IRSNB15859	**JQ742221**	**JQ742388**	Amphibia	*Tepuihyla*	"*galani*"	Wei Assipu Tepui	Guyana	N 5°13'05" W 60°42'23"	2244
VUB3406	IRSNB15860	**JQ742222**	**JQ742389**	Amphibia	*Tepuihyla*	"*galani*"	Wei Assipu Tepui	Guyana	N 5°13'05" W 60°42'23"	2244
VUB3407	IRSNB15861	**JQ742223**	**JQ742390**	Amphibia	*Tepuihyla*	"*galani*"	Wei Assipu Tepui	Guyana	N 5°12'52" W 60°42'13"	2184
VUB3408	IRSNB15862	**JQ742224**	**JQ742391**	Amphibia	*Tepuihyla*	"*galani*"	Wei Assipu Tepui	Guyana	N 5°13'05" W 60°42'23"	2244
VUB3761	IRSNB15765	**JQ742215**	**JQ742382**	Amphibia	*Tepuihyla*	"*galani*"	Uei Tepui	Venezuela	N 5°01' 01" W 60°36'59"	2065
VUB3762	IRSNB15769	**JQ742216**	**JQ742383**	Amphibia	*Tepuihyla*	"*galani*"	Uei Tepui	Venezuela	N 5°01' 01" W 60°36'59"	2065
VUB3763	IRSNB15770	**JQ742217**	**JQ742384**	Amphibia	*Tepuihyla*	"*galani*"	Uei Tepui	Venezuela	N 5°01' 01" W 60°36'59"	2065
VUB3695	IRSNB15701	**JQ742225**	**JQ742392**	Amphibia	*Tepuihyla*	"*galani*"	Guadacapiapu Tepui	Venezuela	N 5°17'24" W 60°55'06"	1242
VUB3696	IRSNB15702	**JQ742226**	**JQ742393**	Amphibia	*Tepuihyla*	"*galani*"	Guadacapiapu Tepui	Venezuela	N 5°17'24" W 60°55'06"	1242
VUB3417	IRSNB14752	**JQ742227**	**JQ742394**	Amphibia	*Tepuihyla*	"*talbergae*"	Kaieteur National Park	Guyana	N 5°10' W 59°29'	440
VUB3418	IRSNB14753	**JQ742228**	**JQ742395**	Amphibia	*Tepuihyla*	"*talbergae*"	Kaieteur National Park	Guyana	N 5°10' W 59°29'	440
VUB3758	IRSNB15879	**JQ742232**	**JQ742399**	Amphibia	*Tepuihyla*	aff. *edelcae*	Abakapa Tepui	Venezuela	N 5°11'24" W 62°17'49"	2172
VUB3759	IRSNB15880	**JQ742233**	**JQ742400**	Amphibia	*Tepuihyla*	aff. *edelcae*	Abakapa Tepui	Venezuela	N 5°11'24" W 62°17'49"	2172
VUB3760	IRSNB15881	**JQ742234**	**JQ742401**	Amphibia	*Tepuihyla*	aff. *edelcae*	Abakapa Tepui	Venezuela	N 5°11'17" W 62°17'30"	2193
GenBank	MNHN1998.311	AY843770	#####	Amphibia	*Tepuihyla*	*edelcae*	Auyantepui	Venezuela	N 5°52' W 62°34'	2015
VUB3651	IRSNB15655	**JQ742230**	**JQ742397**	Amphibia	*Tepuihyla*	*rodriguezi*	Gran Sabana	Venezuela	N 5°49'21" W 61°25'42"	1330
VUB3653	IRSNB15658	**JQ742231**	**JQ742398**	Amphibia	*Tepuihyla*	*rodriguezi*	Gran Sabana	Venezuela	N 5°49'21" W 61°25'42"	1330
VUB3634	ROM44135	**JQ742229**	**JQ742396**	Amphibia	*Tepuihyla*	sp	Ayangaik	Guyana	N 6°04'54" W 60°36'30"	1310
GenBank	LSUMZH13856	AF420746	#####	Reptilia	*Alopoglossus*	*atriventris*	Porto Walter	Brazil	no data	no data
GenBank	LG1026	AF420744	#####	Reptilia	*Alopoglossus*	*carinicaudatus*	Guajara Mirim	Brazil	no data	no data
GenBank	LSUMZH12692	AF420745	#####	Reptilia	*Alopoglossus*	*copii*	RPF Cuyabeno	Ecuador	no data	no data
GenBank	ENS10011	HM012699	#####	Reptilia	*Ameiva*	*undulata*	Chamela-Cuixmala BR	Mexico	no data	no data
VUB3764	IRSNB2674	**JQ742263**	**JQ742425**	Reptilia	*Anadia*	*mcdiarmidi*	Abakapa Tepui	Venezuela	N 5°10'50" W 62°17'50"	2242
VUB3222	PK2066V	**JQ742259**	#####	Reptilia	*Arthrosaura*	aff. *reticulata*	Puerto Ayacucho	Venezuela	N 5°37' W 67°28'	200
VUB3224	ROM42976	**JQ742261**	**JQ742279**	Reptilia	*Arthrosaura*	aff. *reticulata*	Wokomung Massif	Guyana	N 5°05'33" W 59°50'35"	1411
VUB3218	IRSNB17342	**JQ742258**	**JQ742422**	Reptilia	*Arthrosaura*	*guianensis*	Kaieteur National Park	Guyana	N 5°11' W 59°28'	480
VUB3220	ROM39471	#####	**JQ742423**	Reptilia	*Arthrosaura*	*guianensis*	Mt Ayanganna	Guyana	N 5°21' W 59°57'	1490
VUB3221	IRSNB2653	**JQ742257**	**JQ742421**	Reptilia	*Arthrosaura*	*hoogmoedi*	Maringma Tepui	Guyana	N 5°12'60" W 60°35'06"	2112
VUB3591	PK3272	**JQ742262**	**JQ742280**	Reptilia	*Arthrosaura*	*kockii*	Kaw Mountain	French Guiana	N 4°32'41" W 52°09'09"	221
GenBank	MRT978011	AF420721	#####	Reptilia	*Arthrosaura*	*kockii*	Vila Rica	Brazil	no data	no data
GenBank	MRT976977	AF420722	#####	Reptilia	*Arthrosaura*	*reticulata*	Juruena	Brazil	no data	no data

Tissue sample n°	Museum n°	16S	ND1	Order	Genus	Species	Locality	Country	Coordinates	Elevation (m)
VUB3223	PK2068V	**JQ742260**	**JQ742424**	Reptilia	*Arthrosaura*	sp "Chimanta"	Churi Tepui	Venezuela	N 5°16' W 62°00'	ca. 2300
VUB3592	PK3261	**JQ742271**	**JQ742282**	Reptilia	*Bachia*	*flavescens*	Kaw Mountain	French Guiana	N 4°32'41" W 52°09'09"	221
VUB3226	ROM28532	**JQ742264**	**JQ742426**	Reptilia	*Cercosaura*	*ocellata*	Paramakatoi	Guyana	N 4°43'00" W 59°42'00"	970
GenBank	ROM22892	AF206584	#####	Reptilia	*Echinosaura*	*sulcarostrum*	Baramita	Guyana	N 7°22' W 60°29'	100
GenBank	LG1356	AF420738	#####	Reptilia	*Ecpleopus*	*gaudichaudii*	Boissucanga	Brazil	no data	no data
GenBank	LSUMZH12697	AF101370	#####	Reptilia	*Iphisa*	*elegans*	RPF Cuyabeno	Ecuador	S 0°0' W 76°10'	250
VUB3232	IRSNB17322	**JQ742265**	**JQ742281**	Reptilia	*Kaieteurosaurus*	*hindsi*	Kaieteur National Park	Guyana	N 5°11' W 59°28'	480
VUB3594	PK3264	**JQ742269**	**JQ742430**	Reptilia	*Leposoma*	*guianensis*	Kaw Mountain	French Guiana	N 4°32'41" W 52°09'09"	221
VUB3233	PK2065V	**JQ742270**	**JQ742431**	Reptilia	*Leposoma*	*hexalepis*	Puerto Ayacucho	Venezuela	N 5°37' W 67°28'	200
GenBank	MRT977435	AF420723	#####	Reptilia	*Leposoma*	*oswaldoi*	Aripuana	Brazil	no data	no data
VUB3234	IRSNB17840	**JQ742267**	**JQ742428**	Reptilia	*Leposoma*	*percarinatum*	Kaieteur National Park	Guyana	N 5°11' W 59°28'	480
VUB3236	IRSNB17853	**JQ742268**	**JQ742429**	Reptilia	*Leposoma*	*percarinatum*	Kaieteur National Park	Guyana	N 5°08' W 59°25'	530
GenBank	USNM531665	AF420735	#####	Reptilia	*Leposoma*	*percarinatum*	Iwokrama Forest	Guyana	no data	no data
GenBank	LG1409	AY217954	#####	Reptilia	*Leposoma*	*scincoides*	Una	Brazil	no data	no data
VUB3238	IRSNB17344	**JQ742242**	**JQ742409**	Reptilia	*Neusticurus*	aff. *rudis*	Kaieteur National Park	Guyana	N 5°08'44" W 59°25'31"	515
VUB3239	IRSNB17345	**JQ742243**	#####	Reptilia	*Neusticurus*	aff. *rudis*	Kaieteur National Park	Guyana	N 5°08' W 59°24'	580
VUB3243	IRSNB18146	**JQ742244**	**JQ742410**	Reptilia	*Neusticurus*	aff. *rudis*	Maringma Tepui	Guyana	N 5°12'37" W 60°33'59"	1060
VUB3245	IRSNB18147	**JQ742245**	**JQ742411**	Reptilia	*Neusticurus*	aff. *rudis*	Maringma Tepui	Guyana	N 5°12'16" W 60°34'39"	1376
VUB3247	PK2058V	**JQ742246**	**JQ742412**	Reptilia	*Neusticurus*	aff. *rudis*	Chivaton	Venezuela	N 5°35'15" W 61°40'50"	1400
VUB3598	IRSNB18149	**JQ742250**	**JQ742278**	Reptilia	*Neusticurus*	aff. *rudis*	Kaw Mountain	French Guiana	N 4°32'41" W 52°09'09"	221
VUB3249	ROM20514	**JQ742247**	**JQ742277**	Reptilia	*Neusticurus*	aff. *rudis*	Tukeit, KNP	Guyana	N 5°12' W 59°27'	205
VUB3250	ROM39498	**JQ742248**	**JQ742413**	Reptilia	*Neusticurus*	aff. *rudis*	Mt Ayanganna	Guyana	N 5°21'06" W 59°57'24"	1490
VUB3251	ROM42644	**JQ742249**	**JQ742414**	Reptilia	*Neusticurus*	aff. *rudis*	Wokomung Massif	Guyana	N 5°07'46" W 59°49'16"	1234
VUB3666	IRSNB18109	**JQ742251**	**JQ742415**	Reptilia	*Neusticurus*	aff. *rudis*	El Danto	Venezuela	N 5°57'52" W 61°23'31"	1208
VUB3667	IRSNB18110	**JQ742252**	**JQ742416**	Reptilia	*Neusticurus*	aff. *rudis*	La Escalera	Venezuela	N 5°57' W 61°23'	1100
VUB3668	IRSNB18111	**JQ742253**	**JQ742417**	Reptilia	*Neusticurus*	aff. *rudis*	La Escalera	Venezuela	N 5°57' W 61°23'	1100
GenBank	MRT926008	AF420709	#####	Reptilia	*Neusticurus*	aff. *rudis*	Serra do Navio	Brazil	no data	no data
VUB3765	IRSNB18150	**JQ742240**	**JQ742407**	Reptilia	*Neusticurus*	aff. *rudis*	Abakapa Tepui	Venezuela	N 5°11'06" W 62°17'28"	2156
VUB3766	IRSNB18151	**JQ742241**	**JQ742408**	Reptilia	*Neusticurus*	aff. *rudis*	Angasima Tepui	Venezuela	N 5°02'30" W 62°04'54"	2162
GenBank	MRT968462	AF420708	#####	Reptilia	*Neusticurus*	*bicarinatus*	Apiacas	Brazil	no data	no data
VUB3253	IRSNB2650	**JQ742266**	**JQ742427**	Reptilia	*Pantepuisaurus*	*rodriguesi*	Maringma Tepui	Guyana	N 5°12'57" W 60°35'07"	2080
GenBank	LG1006	AF420734	#####	Reptilia	*Placosoma*	*cordylinum*	Teresopolis	Brazil	no data	no data
GenBank	MRT0472	AF420748	#####	Reptilia	*Potamites*	*ecpleopus*	Apiacas	Brazil	no data	no data
GenBank	LSUMZH13823	AF420757*	#####	Reptilia	*Potamites*	*juruazensis*	Porto Walter	Brazil	no data	no data
GenBank	KU21677	AY507866	#####	Reptilia	*Potamites*	*strangulatus*	no data	no data	no data	no data
GenBank	LSUMZH13603	AF420758*	#####	Reptilia	*Ptychoglossus*	*brevifrontalis*	Porto Walter	Brazil	no data	no data
GenBank	MRT887336	AF420737	#####	Reptilia	*Rachisaurus*	*brachylepis*	Serra do Cipo	Brazil	no data	no data
VUB3263	IRSNB18152	**JQ742256**	**JQ742420**	Reptilia	*Riolama*	*leucosticta*	Maringma Tepui	Guyana	N 5°12'39" W 60°35'30"	1942
VUB3254	IRSNB18153	**JQ742255**	**JQ742419**	Reptilia	*Riolama*	*leucosticta*	Wei Assipu Tepui	Guyana	N 5°13'03" W 60°42'21"	2219
VUB3767	Uncatalogued	**JQ742254**	**JQ742418**	Reptilia	*Riolama*	*leucosticta*	Yuruani Tepui	Venezuela	N 5°18'54" W 60°51'44"	2346

Supplemental Table **2.** Primers used in this study.

Name	Gene	Sequence 5'-3'	Reference
16S-A	16S	CGCCTGTTTAYCAAAAACAT	Simon *et al*. (1994)
16S-B	16S	CCGGTYTGAACTCAGATCAYGT	Simon *et al*. (1994)
NDH-AA	ND1	TACATACAACTACGNAARGGYCC	This study
NDH-AB	ND1	AAGGTGTATTAGTTGRTCRTANCG	This study
NDH-J	ND1	TTTACGACCTCGATGTTGGA	Roelants & Bossuyt (2005)
NDH-L	ND1	AAACTATTTAYYAAAGARCC	Roelants & Bossuyt (2005)
NDH-M	ND1	GGGTATGANGCTCGNACTCA	Roelants & Bossuyt (2005)
NDH-Q	ND1	TAAAACTATTCATNAARGAACC	Roelants & Bossuyt (2005)
NDH-R	ND1	TAAAACTATTCATNAARGAGCC	Roelants & Bossuyt (2005)
NDH-S	ND1	GGGTATGANGCTCGNATCCA	Roelants & Bossuyt (2005)
NDH-W	ND1	GGGTATGANGCTCGNATTCA	Roelants & Bossuyt (2005)

Supplemental Table **3.** Lowest uncorrected pairwise distances in 16S (below diagonal) and in ND1 (above diagonal) between *Oreophrynella* species/populations from tepui summits and uplands in the Eastern Pantepui Region.

	Maringma	Wei Assipu	Roraima	Kukenan	Yuruani	Ilu	Tramen	Uplands
Maringma		0.1054	0.1054	0.1054	0.1054	0.1134	0.1134	0.1615
Wei Assipu	0.0250		0.0000	0.0063	0.0095	0.0649	0.0649	0.1472
Roraima	0.0250	0.0000		0.0063	0.0095	0.0649	0.0649	0.1472
Kukenan	0.0250	0.0000	0.0000		0.0032	0.0665	0.0665	0.1487
Yuruani	0.0250	0.0000	0.0000	0.0000		0.0665	0.0665	0.1519
Ilu	0.0192	0.0153	0.0153	0.0153	0.0153		0.000	0.1424
Tramen	0.0196	0.0156	0.0156	0.0156	0.0156	0.0000		0.1424
Uplands	0.0556	0.0421	0.0421	0.0421	0.0421	0.0487	0.0487	

Supplemental Table **4.** Lowest uncorrected pairwise distances in 16S (below diagonal) and in ND1 (above diagonal) between *Tepuihyla* species/populations from tepui summits and uplands in the Eastern Pantepui Region; n.d. = no data.

	Wei Assipu	Uei	Auyantepui	Abakapa	Uplands
Wei Assipu		0.0000	n.d.	0.0491	0.0000
Uei	0.0018		n.d.	0.0506	0.0000
Auyantepui	0.0089	0.0125		n.d.	n.d.
Abakapa	0.0054	0.0089	0.0071		0.0459
Uplands	0.0000	0.0018	0.0106	0.0071	

Supplemental Table **5.** Lowest uncorrected pairwise distances in 16S (below diagonal) and in ND1 (above diagonal) between *Pristimantis* species/populations from tepui summits and uplands in the Eastern Pantepui Region; n.d. = no data.

	Wei Assipu	Yuruani	Aprada	Abakapa	Angasima	Uplands
Wei Assipu		0.0812	n.d.	0.1204	0.1189	0.0114
Yuruani	0.0082		n.d.	0.1402	0.1386	0.1202
Aprada	0.0329	0.0329		n.d.	n.d.	n.d.
Abakapa	0.0309	0.0350	0.0165		0.0016	0.1315
Angasima	0.0288	0.0463	0.0144	0.0062		0.1300
Uplands	0.0036	0.0268	0.0498	0.0391	0.0517	

Supplemental Table **6.** Lowest uncorrected pairwise distances in 16S (below diagonal) and in ND1 (above diagonal) between *Stefania* species/populations from tepui summits and uplands in the Eastern Pantepui Region; n.d. = no data.

	Wei Assipu	Yuruani	Auyantepui	Abakapa	Angasima	Uplands
Wei Assipu		0.1669	n.d.	0.2422	0.2163	0.1434
Yuruani	0.0409		n.d.	0.2532	0.2159	0.1645
Auyantepui	0.0702	0.0682		n.d.	n.d.	n.d.
Abakapa	0.0916	0.0955	0.0682		0.1833	0.2305
Angasima	0.0838	0.0838	0.0663	0.0721		0.2021
Uplands	0.0391	0.0234	0.0604	0.0858	0.0731	

Supplemental Table **7.** Lowest uncorrected pairwise distances in 16S (below diagonal) and in ND1 (above diagonal) between *Anomaloglossus* species/populations from tepui summits and uplands in the Eastern Pantepui Region; n.d. = no data.

	Maringma	Wei Assipu	Auyantepui	Churi	Uplands
Maringma		0.0079	n.d.	n.d.	n.d.
Wei Assipu	0.0019		n.d.	n.d.	n.d.
Auyantepui	0.0478	0.0459		n.d.	n.d.
Churi	0.0344	0.0325	0.0363		n.d.
Uplands	0.0019	0.00000	n.d.	n.d.	

Supplemental Table **8.** Lowest uncorrected pairwise distances in 16S (below diagonal) and in ND1 (above diagonal) between *Riolama* species/populations from tepui summits in the Eastern Pantepui Region.

	Maringma	Wei Assipu	Yuruani
Maringma		0.0075	0.1045
Wei Assipu	0.0000		0.1003
Yuruani	0.0096	0.0096	

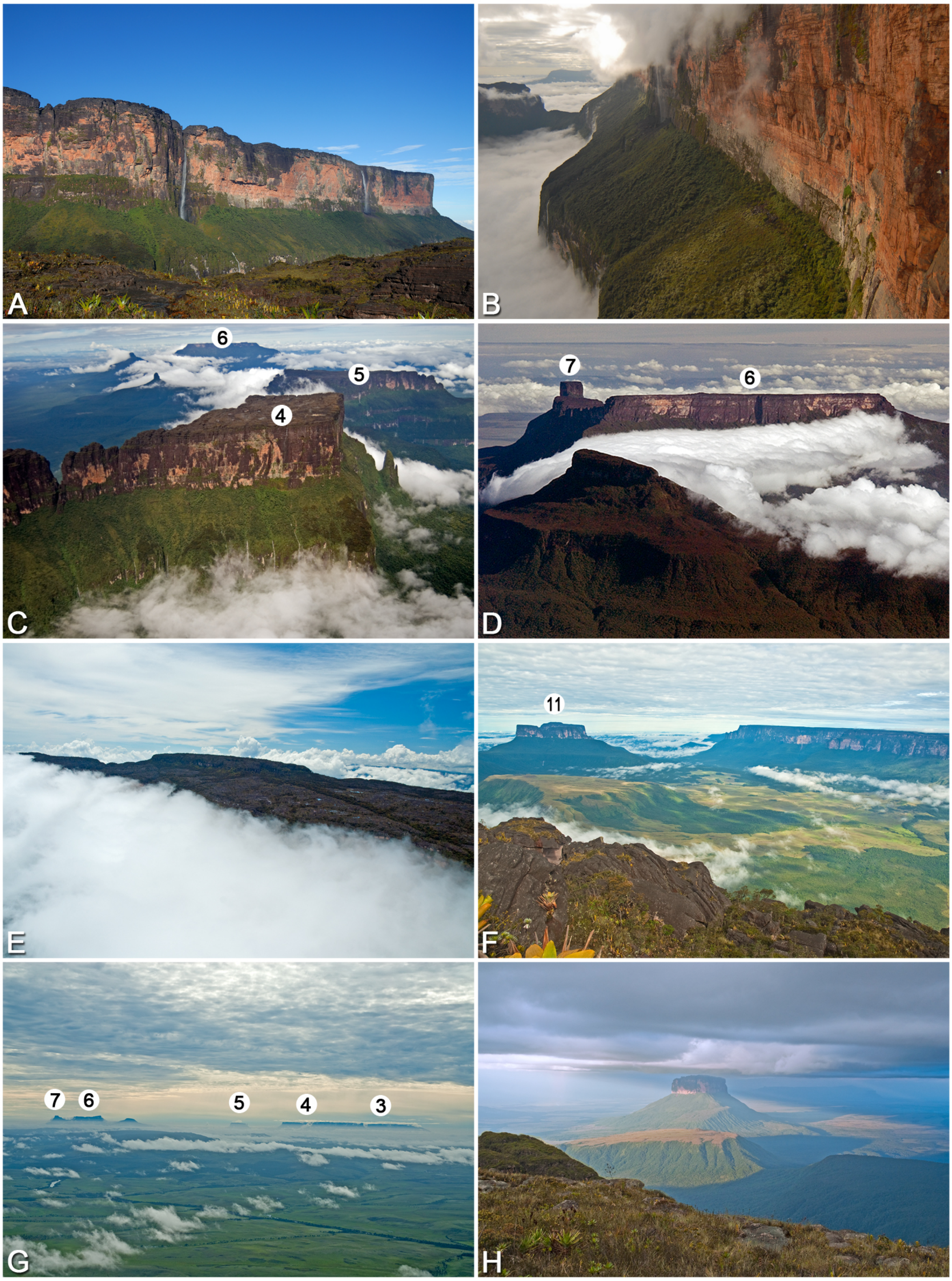
Supplemental Table **9.** Lowest uncorrected pairwise distances in 16S (below diagonal) and in ND1 (above diagonal) between *Arthrosaura* species/populations from tepui summits and uplands in the Eastern Pantepui Region.

	Maringma	Churi	Uplands
Maringma		0.1024	0.0057
Churi	0.0120		0.0953
Uplands	0.0000	0.0416	

Supplemental Table **10.** Lowest uncorrected pairwise distances in 16S (below diagonal) and in ND1 (above diagonal) between *Neusticurus* species/populations from tepui summits and uplands in the Eastern Pantepui Region.

	Abakapa	Angasima	Uplands
Abakapa		0.0469	0.0129
Angasima	0.0162		0.0433
Uplands	0.0022	0.0198	

Supplemental Figure **1.** [Next page] Typical tepui landscapes showing vertical cliffs and tepui summit isolation. Numbers above tepuis correspond to those provided in Fig. 1B (main text). A: Mount Roraima, photographed from Wei Assipu-tepui (photo by PJR Kok). B: Spectacular vertical cliffs of Mount Roraima, photographed from the air (photo by DB Means). C: Kukenan-tepui, Yuruani-tepui and Ilu-tepui, photographed from the air flying over Mount Roraima (photo by DB Means). D: Ilu-tepui and Tramen-tepui, photographed from the air (photo by DB Means). E: Aprada-tepui above the clouds, photographed from the air (photo by PJR Kok). F: Angasima-tepui (left) and Akopan-tepui (right), photographed from Upuigma-tepui (photo by PJR Kok). G. Part of the Eastern Tepui Chain rising above the Gran Sabana, photographed from the air (photo by PJR Kok). H: Upuigma-tepui, photographed from Angasima-tepui (photo by PJR Kok).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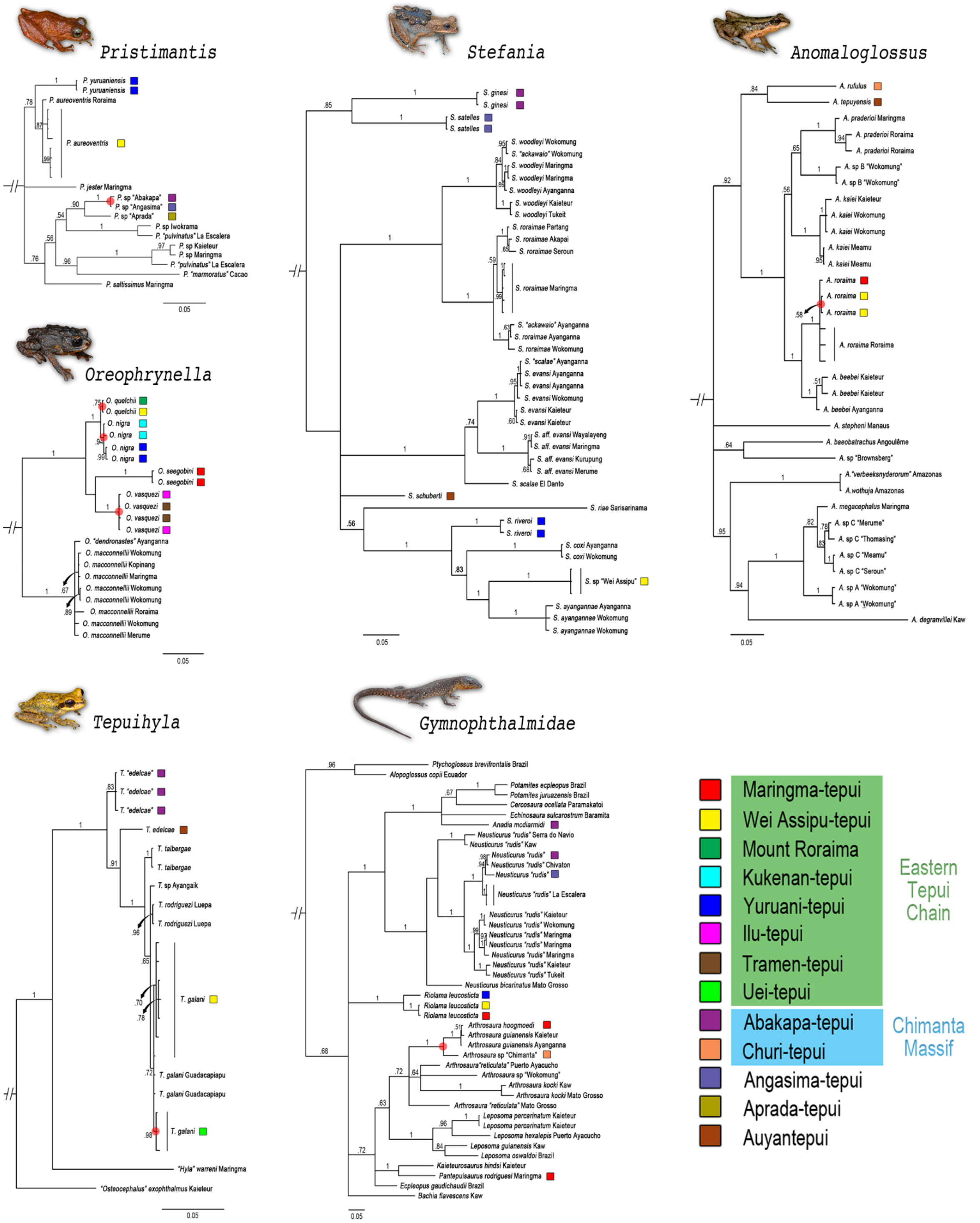
Supplemental Figure **2.** Phylogenetic relationships among tepui summit populations and their upland-lowland relatives in six typical Pantepui taxa. Taxa labelled by colored blocks represent summit populations, with differently colored blocks indicating different tepuis, as listed in the legend. Taxa without labels represent upland/lowland populations. The trees represent Bayesian consensus phylograms based on the analysis of the concatenated data set of 16S and ND1. Numbers above branches are Bayesian posterior probabilities. Internal nodes labelled by red dots represent divergences between tepui populations and their closest sampled relatives (either from another tepui or from the upland/lowland) for which approximate divergence times were inferred (see supplemental text). Outgroups (see supplemental text) were removed for presentation purposes.



Supplemental Figure **3.** Saturation curve (red line) obtained by nonlinear regression to estimate approximate divergence times based on observed pairwise sequence divergences in the ND1 fragment (dotted lines). The curve is based on a scatter plot (grey circles) of ND1 sequence divergences against reported divergence ages in the toad family Bufonidae [S7]. See supplemental text for full details.