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1 **First records of modified snake bones in the Pre-Columbian archaeological**  
2 **record of the Lesser Antilles: cultural and paleoecological implications**

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8

9 The past distribution of *Boa* snakes and their interactions with Pre-Columbian human populations in  
10 the Lesser Antilles (Caribbean) remain enigmatic. These snakes currently have a patchy distribution in  
11 the islands and are nearly absent from archaeological deposits. This raises questions about whether  
12 their absence from Pre-Columbian contexts should be interpreted from a biological or a cultural point  
13 of view. In this study, I provide three new references to *Boa* remains from archaeological and natural  
14 deposits on the islands of Guadeloupe and Martinique, most of which were manufactured into beads.  
15 These are the first objects in the Lesser Antilles known to be manufactured using snake bones and all  
16 appear to be made from *Boa*, despite a wider diversity of snakes occurring in this region. Using these  
17 new observations and combined pieces of evidence from archaeological, historical, and biological data  
18 sources, I propose that the extreme scarcity of *Boa* in zooarchaeological assemblages reflects their  
19 prominent status in Pre-Columbian Amerindian communities.

20 Keywords: modified bone, Martinique, squamate, zooarchaeology, Guadeloupe.

## 21 **Introduction**

22 In zooarchaeological studies, the absence of a species from an archaeological assemblage can be  
23 explained by past species distributions, taphonomic factors, or lack of interaction with human  
24 communities. As a result, it is necessary to assess archaeological evidence alongside additional  
25 sources of data to adequately explain a species' absence from the archaeological record. Clues may  
26 surface through comparison with additional archaeological bone assemblages, but may also come from  
27 historical and biological (e.g., biogeography, paleontology, modern distribution, etc.) data sources,  
28 when available, for the studied periods, areas, and taxa. Such a multidisciplinary approach allows for  
29 the study of both past human behaviors toward animals and changes in animal diversity and  
30 distribution through time, two topics that are still generally understudied in tropical areas, despite their  
31 critical scientific importance in understanding the current mass extinction crisis (Barnosky et al., 2017;  
32 Ceballos et al., 2017). Though islands have certainly garnered attention in this regard (Nogué et al.,  
33 2017; Steadman, 2006), including those in the Caribbean (e.g., Brace et al., 2015; Cooke et al., 2017;  
34 Steadman et al., 2015; Stoetzel et al. 2016), most studies have focused only on mammals. Among the  
35 less investigated taxa are terrestrial reptiles, which remain poorly known at a regional scale (but see

36 Bochaton et al., 2016a; Etheridge, 1964; Pregill et al. 1994). Of indigenous reptiles, *Boa* Linnaeus,  
37 1758 and other snakes are among the most poorly documented given that they are only known from a  
38 few islands (see background section). As such, their diversity and degree of interaction with past  
39 human populations remains enigmatic.

40 In this paper I describe several archaeological objects, probably beads, made of *Boa* snake  
41 vertebrae discovered on two islands in the Lesser Antilles: Basse-Terre (Guadeloupe) and Martinique.  
42 I also present a new record of *Boa* from a natural deposit on La Désirade Island (Guadeloupe). These  
43 finds provide a means for discussing the nature of interactions between Pre-Columbian Amerindians  
44 and *Boa* snakes, the reason for their extreme scarcity in prehistoric archaeological deposits, and add to  
45 the list of animals that native groups in the Caribbean used for ornamentation.

46

## 47 **Background section**

### 48 *The Lesser Antilles*

49 The Lesser Antilles is a chain of medium to very small islands (less than 1000 km<sup>2</sup>) situated in the  
50 Atlantic Ocean between South America and the Greater Antilles (Figure 1A). The archaeological  
51 record of the Lesser Antilles is known to varying degrees from island to island, with some islands  
52 having been intensively investigated (Keegan et al., 2013). Existing archaeological data document the  
53 earliest human colonization of this region between 7000 and 5500 cal. BP by aceramic (Archaic)  
54 Amerindian groups (Fitzpatrick, 2015; Napolitano et al. 2019; Siegel et al., 2015). The first  
55 populations producing ceramics arrived around 2500 cal. BP and formed the Saladoid cultural  
56 assemblage. A second cultural assemblage called Troumassoid evolved from the Saladoid and  
57 gradually replaced it around 1500 cal. BP. This last culture survived until the arrival of Europeans in  
58 the Lesser Antilles in 1493 and the emergence of a new ceramic style called Cayo. Amerindians were  
59 nearly eradicated from the Lesser Antilles in the 17<sup>th</sup> century during European colonization. These  
60 different periods of occupation are represented at numerous archaeological sites in the Lesser Antilles,  
61 which have yielded many different kinds of faunal assemblages (e.g., Newsom and Wing, 2004).

62 These zooarchaeological assemblages document the subsistence strategies of past human populations  
63 but also, to a certain extent, past species distributions. These data are of special interest in the Lesser  
64 Antilles, a region whose terrestrial biodiversity was impacted by a massive extinction crisis starting in  
65 the 17<sup>th</sup> century. This crisis affected several taxa, including terrestrial and flying mammals (Cooke et  
66 al., 2017), birds (e.g., Gala and Lenoble, 2015; Olson, 1978), and squamates (e.g., Bochaton et al.,  
67 2015; Pregill et al., 1994). Zooarchaeological assemblages also indicate environmental disturbances  
68 related to Pre-Columbian populations and their introduction of exogenous taxa to the islands  
69 (Bochaton et al., 2016b; Giovas, 2017).

### 70 ***Snakes in the Lesser Antillean archaeological record***

71 Snake remains are recorded in around half of the zooarchaeological studies of Lesser Antillean  
72 Amerindian deposits. These taxa are, however, are often represented by very few remains (e.g.,  
73 Bochaton et al., 2019; Giovas, 2016; Healy et al., 2003; Newsom and Wing, 2004; Reitz, 1994), do  
74 not indicate consumption by Amerindians and thus appear to reveal little about past economy and  
75 subsistence (Bochaton et al., 2019). In addition, the lack of comparative collections has hampered  
76 taxonomic identification, such that snake remains discovered in archaeological contexts are rarely  
77 identified beyond the family level (Colubridae *sensu lato*). Some authors nevertheless have attributed  
78 snake remains to the genus *Alsophis* Fitzinger, 1843 (Carder et al., 2007; Crock and Carder, 2011;  
79 Wing et al., 1968) which is, along with the genus *Erythrolamprus* Wagler, 1830, one of the two genera  
80 of colubrid snakes occurring in the Lesser Antilles. Some of the rare species-level identifications come  
81 from Saint-Martin, where the endemic species *Alsophis rijgersmaei* Cope, 1869 was recorded  
82 (Newsom and Wing, 2004), and from Guadeloupe, where two species of *Alsophis* (*Alsophis antillensis*  
83 (Schlegel, 1837) and *Alsophis* sp. 2) and one species of *Erythrolamprus* (*Erythrolamprus juliae* cf.  
84 *copeae* (Parker, 1936) were recorded (Bochaton et al., 2019). Much work is still needed to better  
85 understand the diversity of colubrid snakes in the archaeological record of the Lesser Antilles, but the  
86 data concerning other snake families and especially boid snakes are even scarcer. Indeed, the rare  
87 traces of their past occurrences have only been found on Marie-Galante, where an endemic species  
88 was present at least during the Pleistocene (*Boa blanchardensis*, Bochaton & Bailon, 2018), and

89 Antigua where putative *Boa constrictor* remains were discovered in two Holocene deposits (Pregill et  
90 al., 1988). *Boa* snakes currently occur on two islands in the Lesser Antilles, St. Lucia and Dominica,  
91 where they are represented by two endemic species, *Boa orophias* Linnaeus, 1758 and *Boa nebulosa*  
92 (Lazell, 1964) (see Henderson and Powell, 2009). Additionally, there are historical sources describing  
93 possible *Boa* snakes on Martinique (Labat, 1724) and possibly St. Vincent (Moreau de Jonnès, 1816),  
94 but these records were never supported by historical specimens or fossil evidence.

### 95 ***The past distribution of Boa snakes in the Lesser Antilles***

96 Modern, historical and fossil records provide a patchwork view of the past distribution of *Boa* snakes  
97 in the Lesser Antilles (see Table. 1). However, since *Boa* snakes colonized the Lesser Antilles from  
98 South America and reached at least as far north as Antigua, they likely colonized most, if not all, of  
99 the islands between Tobago and Antigua. Indeed, most Lesser Antillean squamates of South American  
100 origin colonized the different islands using rafts of floating vegetation, which lead to their progressive  
101 dispersal from the southern islands to the northern islands following marine currents (Calsbeek and  
102 Smith, 2003; Hedges, 2006; Lescure, 1987). The most likely hypothesis is thus that the current patchy  
103 distribution of *Boa* in the Lesser Antilles reflects numerous relatively recent extirpation or extinction  
104 events. Following this hypothesis, we would expect to recover *Boa* remains in Pre-Columbian Lesser  
105 Antillean archaeological deposits. This is, however, not the case, and *Boa* snakes were never identified  
106 in any Lesser Antillean archaeological deposits with the exception of a putative occurrence (cf. *Boa*  
107 *constrictor*) at the Indian Creek site in Antigua (Steadman et al., 1984a). This absence is very difficult  
108 to understand because we currently do not know if *Boa* snakes were present on the different islands  
109 during Pre-Columbian periods or if they were only absent from coastal areas where most of the  
110 archaeological deposits are situated. There is also a possibility that they were avoided by Amerindians  
111 and thus absent in archaeological deposits.

## 112 **Materials and Methods**

### 113 ***Archaeological***

114 The archaeological/subfossil material of *Boa* investigated in this study corresponds to vertebrae  
115 collected on Martinique and Guadeloupe (French West Indies). Seven of these remains were collected  
116 from the site of Dizac Beach on Martinique, one is from the site of Basse-Terre Cathedral on  
117 Guadeloupe Basse-Terre Island, and one was discovered at the site of Pointe-Gros Rempart 6 on La  
118 Désirade Island.

119 The archaeological open-air site of Dizac Beach is located on the southern coast of la  
120 Martinique (Figure 1C) on the Dizac Beach (14° 28'29.276" N, 61° 2'18.016" W, WGS84). This site  
121 was the object of several excavations, the last one conducted by N. Vidal between 1989 and 1992  
122 (Vidal, 1991, 1998, 2003). These last excavations reveal that the site was a culturally homogenous  
123 middle/late Cedrosan Saladoid settlement (Berthé and Bérard, 2013). The four <sup>14</sup>C dates obtained on  
124 queen conch (*Eustrombus gigas*) shells indicate an occupation period between cal. AD 415 and 690  
125 (ARC-999, ARC-1016, ARC-1017, and ARC-1018, see Vidal, 2003). The zooarchaeological material  
126 of this site was previously studied by Grouard (Grouard and Bérard, 2005), but the *Boa* remains  
127 presented here were not previously identified. *Boa* remains in this assemblage were discovered in  
128 2017 during a re-analysis of the faunal material. The seven recovered vertebrae were recovered from  
129 squares I4, J4, and J5 at depths between 208 and 234 cm in the undisturbed Cedrosan Saladoid layer.

130 The archaeological site of Basse-Terre Cathedral (BTC) (15° 59'43.191" N, 61° 43'47.662"  
131 W, WGS84) is located in downtown Basse-Terre on Basse-Terre Island (Guadeloupe) (Figure 1B). It  
132 is an open-air deposit corresponding to a colonial cemetery and earlier Huecan/Cedrosan Saladoid  
133 Amerindian settlement. This site was first assessed by T. Romon in 2001 (Romon, 2001) and  
134 extensively excavated by D. Bonnissent in 2002 (Bonnissent and Romon, 2004). The site yielded  
135 several Pre-Columbian layers, dated to the Early Saladoid, which contained a rich assemblage of  
136 vertebrate and invertebrate faunal remains previously investigated by Grouard (2007). As at Dizac,  
137 *Boa* remains were not previously identified. The newly identified *Boa* vertebra fragment recovered  
138 from this site was recovered from the Cedrosan Saladoid stratigraphic unit 1086.

139 The site of Pointe Gros Rempart 6 (PGR6) (16° 19' 41.56"N, 61° 0' 49.18"W, WGS84) is a  
140 pit cave deposit located near the southern coast of La Désirade Island (Guadeloupe) (Figure 1B). This

141 site was first excavated by M. Boudadi-Maligne in 2011 (Boudadi-Maligne et al., 2016) and was the  
142 object of a second excavation in 2016 by A. Lenoble. Unlike the two previous sites, PGR6 is not an  
143 archaeological deposit. The accumulation was mostly formed by biotic activity, which led to the  
144 inclusion of some artifacts that likely fell into the cavity from an archaeological deposit located above.  
145 The sedimentary infilling of PGR6 consists of four layers dated to the Pre-Columbian ceramic periods  
146 (Layers 4 and 3), to the Colonial period (Layer 2), which on la Désirade starts with permanent French  
147 settlement in AD 1728 and extends to modern times (Layer 1). A ceramic sherd recovered in a Pre-  
148 Columbian layer is not diagnostic enough to derive a precise estimate of the age of the basal part of  
149 the deposit. Nonetheless, a radiocarbon date of 1443–1651 cal BP (1960±30 BP, Beta-407191;  
150 Boudadi-Maligne et al., 2016) obtained from Layer 3 indicates that the final part of the Pre-Columbian  
151 period is represented at the site. The faunal material recovered during the first excavation of this site  
152 was recently studied and contains many remains of several squamate taxa, but no *Boa* remains  
153 (Boudadi-Maligne et al., 2016). The *Boa* vertebra presented here was recovered from layer 4 during  
154 the second excavation of the site.

### 155 *Study methodology*

156 The full faunal assemblage of each reported deposit was investigated to search for *Boa* remains.  
157 Investigated remains were analyzed using a binocular microscope NIKON SMZ 445 to observe their  
158 surface condition. Taxonomic identification of the remains was performed using the published  
159 anatomical criteria of the Boidae family (Hsiou and Albino, 2009; Rage, 2001; Szyndlar and Rage,  
160 2003), the *Boa* genus (Albino, 2011, 2012), and the Lesser Antillean *Boa* species (Bochaton and  
161 Bailon, 2018). The nomenclature used to describe the anatomical structure of the vertebrae follows  
162 Hoffstetter and Gasc (1969) and Szyndlar (1984).

163

## 164 **Results**

### 165 *Taxonomic identification and morphology of the remains*



166 The investigated vertebrae have been attributed to an undetermined species of the genus *Boa*, as they  
167 conform to several osteological criteria of Boine snake vertebrae: they are strongly built, short and  
168 wide, with a non-depressed neural arch that has a strongly notched posterior margin, a thick  
169 zygosphene, low inclination of the articular facet of the prezygapophyses, a vertebral centrum shorter  
170 than neural arch width, and well defined precondylar constriction (Albino, 2011; Hsiou and Albino,  
171 2009; Rage, 2001; Szyndlar and Rage, 2003). Investigated vertebrae also feature small paracotylar  
172 foramina and present a zygosphene wider than the cotyle, which are characteristics of the genus *Boa*  
173 (Albino, 2011, 2012). A specific attribution of investigated specimens is out of reach due to poor  
174 preservation of other diagnostic features. The anterior margin of the zygosphene is straight in all  
175 vertebrae, but this condition cannot be assessed on the vertebra from La Désirade. This feature is  
176 characteristic of continental *Boa constrictor*, and *Boa nebulosa* from Dominica, but is absent in the  
177 fossil *Boa blanchardensis* described on Marie-Galante (Bochaton and Bailon, 2018). The vertebra  
178 from La Désirade presents a relatively low neural spine similar to those observed in *B. nebulosa* and  
179 *B. blanchardensis*, but not in continental *B. constrictor* (Figure 2).

180         Regarding the sizes of the investigated vertebrae, the bone from La Désirade was the only one  
181 well-preserved enough to derive a measurement of its centrum length (5.48 mm), and thus estimate the  
182 total length of the complete individual at around 1.35 m. This bone, however, is too fragmented to be  
183 included in a morphometric analysis, as are all the other vertebrae investigated. The vertebrae  
184 collected on the Dizac Beach site, though impossible to measure accurately, all seem to be of similar  
185 size, indicating they could all correspond to a single individual. This individual is roughly estimated at  
186 180 cm in total length based on the overall size of the vertebrae. The single vertebra from Basse-Terre  
187 is likely to have been part of an individual around 150 cm in total length, but a precise estimation is  
188 also impossible. The sizes of the investigated *Boa* individuals (below 180 cm of total length) fall  
189 within the size range of *Boa nebulosa*, which currently occurs on Dominica.

190

191 ***Surface alterations***

192 Among the investigated vertebrae, the specimens collected in Basse-Terre and Martinique  
193 archaeological deposits present alteration marks suggesting the remains were worked. Such traces  
194 were absent on the vertebra collected at PGR6 (Figure 2).

195 The bone from Basse-Terre Cathedral is a well-preserved vertebral neural arch presenting  
196 asymmetric and irregular fracture planes, which indicates the vertebra was probably unintentionally  
197 broken (Figure 3A). The bone likely was, however, intentionally polished, as indicated by the perfect  
198 flatness of its dorsal and lateral margins. Dorsally, the polishing has erased the neural spine and the  
199 posterodorsal part of the roof of the neural arch, which makes the zygosphenic facets visible in dorsal  
200 view. Abrasions on the left and right lateral sides are asymmetrical. On the left side, a small part of the  
201 posteromedial area of the prezygapophyseal facet is still visible, but the lateral area of the neural arch  
202 has been erased. On the right side, the abrasion seems to have been a little stronger. but the  
203 anterolateral part of the fragment is broken. These abrasions give the neural arch a sub-circular shape  
204 in anterior view. An ochre color residue of unknown nature is present on the preserved parts of the  
205 prezygapophyseal, zygantrum, and zygosphenic facets. This well-marked residue is exclusively  
206 localized in the above-mentioned articulation areas, which could indicate sustained contact with other  
207 vertebrae throughout the deposition process. Indeed, if this ochre deposit was originally present on the  
208 whole vertebra, there is a possibility that it could have been protected from contact with soils on  
209 contact areas between several vertebrae. It is possible that the ventral part of the Basse-Terre object  
210 was also polished, as observed on the Dizac specimens (see below), but this part of the vertebra was  
211 not preserved. I propose a reconstruction of what could have been the shape of the complete object  
212 (Figure 3B).

213 The seven vertebrae from Dizac Beach are poorly preserved and were subject to much  
214 dissolution, probably because of the acidic nature of Martinique's volcanic sediment (Figure 3C). As a  
215 result, their surface is strongly altered and the vertebrae are partly broken, despite being mostly  
216 complete. Such dissolution alterations could also correspond to digestion activity; however, the  
217 occurrence of strictly flat polished areas on all the remains is not consistent with digestion processes.  
218 Indeed, Dizac vertebrae present, to a variable extent, polished surfaces similar to the specimen from

219 Basse-Terre, yet these vertebrae seem to have been the object of less work than the fragment from the  
220 BTC site. Indeed, polished surfaces are only present on the dorsal and/or ventral surfaces of these  
221 vertebrae and seem absent from the other parts of the bone. It is unclear, however, whether the lateral  
222 sides of all the vertebrae were altered considering their poor level of preservation. Six of the seven  
223 vertebrae were polished on their dorsal part, which erased their neural spine and sometimes the  
224 posterodorsal part of the neural arch. Ventral abrasion was unambiguously observed on two  
225 specimens, but impossible to assess on five of the vertebrae. Such abrasion erased the hemal keel as  
226 well as the anterior part of the condyle, which gives the centrum a flat ventral margin (Figure 3C, 3D).

227         This intentional shaping of the vertebrae to give them a more circular or quadrangular shape  
228 could indicate that these remains were used as beads and that people took advantage of the natural  
229 shape of the objects to string them together. A string could indeed be inserted in the neural canal,  
230 making it unnecessary to perforate the bones. This kind of object has not previously been described in  
231 any Antillean Pre-Columbian archaeological context. However, the historical chronicler J.-B. Du  
232 Tertre (1654, p. 356) testifies that Amerindians “boiled [snakes] so they could retrieve their vertebrae  
233 to make nice cordons” (personal translation from French). As such, it seems unsurprising that  
234 archaeological snake vertebrae may have been worked into beads, and in fact, beads made from other  
235 materials (bone, shell and stone) were also observed at the BTC site (Bonnissent and Romon,  
236 unpublished data).

237

## 238 **Discussion**

239 These three occurrences of *Boa* are the first reported identifications of the genus on the islands of  
240 Martinique, Basse-Terre, and La Désirade. On Martinique, the past presence of a now-extinct *Boa* was  
241 strongly suspected considering historical mentions of the snake on the island (Labat, 1724), but direct  
242 evidence of this was lacking until now. The situation on Guadeloupe’s islands is more complex  
243 considering that *Boa* snakes were never mentioned by chroniclers who described the 17<sup>th</sup> century  
244 fauna of these islands (Du Tertre, 1654; de Rochefort, 1658) (see Table. 1). This taxon was also never  
245 recorded in the numerous zooarchaeological assemblages of Guadeloupe (Grouard, 2001, 2007). A

246 fossil *Boa* did occur on Marie-Galante Island, but was restricted to the Pleistocene period and never  
247 identified in any Holocene natural or archaeological assemblages (Bochaton and Bailon, 2018). The  
248 vertebrae recently collected at PGR6 on La Désirade and at BTC on Basse-Terre are thus the first  
249 Holocene record of *Boa* on Guadeloupe.

250 A prerequisite to any archaeological interpretation of these newly discovered *Boa* bones is to  
251 discuss their origins. Indeed, as far as rare taxa and manufactured bones are concerned, the possibility  
252 of human introduction of exogenous non-living animals or animal parts must to be considered  
253 (Giovas, 2017; Laffoon et al., 2014). The vertebra collected at PGR6 was part of an assemblage  
254 accumulated by a nocturnal raptor, probably a medium-sized owl. It is thus very likely that the *Boa*  
255 individual recovered at this site was caught on La Désirade. Indeed, the nearest island currently  
256 inhabited by *Boa* (Dominica) is 90 km away from La Désirade, which is inconsistent with the usual  
257 hunting range of owls (e.g., within 5 km of its nest for the Barn owl; Taylor 2004). However, the  
258 origin of the worked vertebrae recovered on the Basse-Terre and Martinique cannot be demonstrated.  
259 This is not a major issue for Martinique since the past occurrence of *Boa* on this island is supported by  
260 historical descriptions (see Table. 1). However, assessing the potential past occurrence of *Boa* snakes  
261 on Basse-Terre Island requires attention to biogeographic data.

262 The genus *Boa* is a South-American taxon that colonized at least part of the Lesser Antillean  
263 islands from south to north following the direction of ocean currents (Hedges, 2006). This colonization  
264 was probably prior to the Late Pleistocene since *Boa* occurred during this period on Marie-Galante and  
265 given the morphological divergences between Lesser Antillean and continental species (Bochaton and  
266 Bailon, 2018). At that time, La Désirade, Grande-Terre, and Basse-Terre islands formed a single  
267 island. Consequently, if *Boa* snakes occurred on la Désirade during the Holocene, they were likely  
268 also present on the other islands, at least during the Late Pleistocene. The Late Holocene occurrence of  
269 *Boa* on Antigua north of Guadeloupe is an additional argument that these snakes traveled across  
270 Guadeloupe's islands in the past (see Table. 1). These lines of evidence support the Pre-Columbian  
271 occurrence of *Boa* on Basse-Terre Island. If we accept the past occurrences of *Boa* snakes on  
272 Martinique, Guadeloupe, as well as on other Lesser Antillean islands south of Antigua, then past

273 distribution can no longer be an explanation for their near absence in Pre-Columbian archaeological  
274 assemblages.

275         The data presented here suggest that in addition to being very rare in archaeological deposits,  
276 *Boa* vertebrae were manufactured into beads. This treatment seems specific to *Boa* snakes as such  
277 bone modifications have never been reported on the more numerous colubrid snake vertebrae  
278 recovered from deposits in the region (e.g., Bochaton et al., 2019). Does this mean *Boa* snakes had  
279 special meaning for Lesser Antillean Pre-Columbian Saladoid populations? Snakes feature  
280 prominently in the beliefs of many cultures around the world (Hasting, 1920), but in the absence of  
281 historical sources, it is extremely difficult to infer symbolic behaviors of Pre-Columbian populations.  
282 However, by combining Cedrosan Saladoid archaeological evidence with historical records describing  
283 the behaviors of the last Amerindians in the Lesser Antilles, it is possible to formulate some  
284 hypotheses regarding the status of *Boa* snakes in these communities. First, considering that *Boa* snakes  
285 are mostly absent from archaeological contexts, it is reasonable to extrapolate that they were probably  
286 not hunted or killed by Amerindians in the vicinity of their settlements. Indeed, in contrast to *Boa*,  
287 small and large colubrid snakes are often represented in archaeological assemblages (Bochaton et al.,  
288 2019). Second, considering there is no evidence for the consumption of snakes by Amerindians, the  
289 occurrence of snake vertebrae in Guadeloupe deposits was interpreted as evidence of synanthropic  
290 behavior of snakes looking for food near human settlements. The absence of evidence of snake  
291 consumption by Saladoid and Troumassoid Amerindians is supported by the testimony of a 16<sup>th</sup>  
292 century chronicler. The Carpentras anonymous chronicle mentions that “[t]here are a lot of eels that  
293 they (Amerindians) named “marssy”, but they never eat them saying in their language that they are  
294 sisters of snakes” (Grunberg, 2013 p. 18; personal translation from French). This mention implies that  
295 Taínos did not consume snakes. The same author also reports that “[...] our Indians who see them  
296 (*Boa* snakes) say that, if they kill them, the harm they will do to them will be done to their  
297 grandchildren, and they (Amerindians) made us (Europeans) kill them, because they said we had no  
298 grandchildren” (Grunberg, 2013 p. 21; personal translation from French). Taíno Amerindians seem to  
299 have had a reluctance to kill *Boa* snakes and this animal was also the object of beliefs. Indeed, Charles

300 de Rochefort (1658) tells a story about a large snake from Dominica (certainly *Boa*): “The numerous  
301 Caribs inhabiting this Island (Dominica) have long told those visiting this island a tale about a large  
302 and monstrous snake that had its den in a cave. They said it carries on its head a shining stone like a  
303 dark red garnet of inestimable worth. The snake usually hides its rich ornament with a small moving  
304 skin similar to the eyelid but when it goes to drink or when it moves in its deep abyss it shows its stone  
305 and all around is brightened by a wonderful fire glow emanating from this precious crown” (de  
306 Rochefort, 1658 p.21; personal translation from French). These mentions suggest that *Boa* snakes had,  
307 among all snakes, a special status and were especially feared and respected, which could explain their  
308 scarcity in archaeological deposits.

309         The identification of *Boa* snakes in Lesser Antillean archaeological deposits also raises a  
310 concern about the lack of snake remains identified at the genus and species level in this region (see  
311 background section). In that regard, it is interesting to note that the only records of *Boa* snakes in  
312 archaeological contexts originate from the few assemblages partly studied by trained  
313 paleoherpetologists (this study, and G. K. Pregill in Antigua). The issue of the lack of archaeological  
314 mentions of *Boa* in the Lesser Antilles, as well as for other squamate taxa (e.g., *Diploglossus* see  
315 Bochaton et al., 2016a), can thus also be related to the small attention paid to rare taxa, which are often  
316 difficult to identify and of minor zooarchaeological interest. It is difficult for a single specialist to be  
317 an expert in each of the broad diversity of taxa occurring in zooarchaeological assemblages, especially  
318 in tropical regions. Collaboration between several trained specialists on a single assemblage (e.g.,  
319 Pregill et al., 1988; Steadman et al., 1984b; Watters et al., 1984), would probably improve the  
320 precision of zooarchaeological data. Such collaborative investment may seem costly since rare taxa are  
321 of minor interest for the study of subsistence, but these should not be neglected considering their  
322 potential to address cultural and biological questions, as is the case in this work. These new data  
323 concerning *Boa* snakes also raise questions about the use of archaeological data to reconstruct past  
324 biogeography by showing that the absence of taxa in archaeological deposits is not evidence of their  
325 absence in the surrounding environment. The investigation of a combination of different types of  
326 deposits formed by different accumulation processes can help to clarify this issue. Indeed, the

327 comparison of different types of deposits (e.g., natural and archaeological) can be immensely helpful  
328 to sort out whether the absence of a taxon can be considered significant or related to a specific cultural  
329 or natural bias.

330 This investigation demonstrates how different lines of evidence—archaeological, historical  
331 and biological—can be used to propose an interpretation of the absence or extreme scarcity of a taxon  
332 in zooarchaeological assemblages. Using several data sources, this work sheds light on the putative  
333 status of *Boa* snakes for Pre-Columbian Lesser Antillean Amerindians, which could explain their  
334 scarcity in deposits and use in the production of beads. These new occurrences also demonstrate the  
335 past occurrence of *Boa* snakes on several islands on which they no longer occur today. The timing of  
336 the extinction of these snakes remains largely unknown and additional samples from well-dated  
337 contexts are needed to investigate whether or not they fit within the general model of squamate  
338 extinctions related to modern anthropogenic impact. From a more general zooarchaeological point of  
339 view, few data document the history of interactions between snakes and humans despite these animals  
340 playing an important role in the belief systems of numerous societies around the world (Morris and  
341 Moris, 1965; Mundkur, 1983).

342

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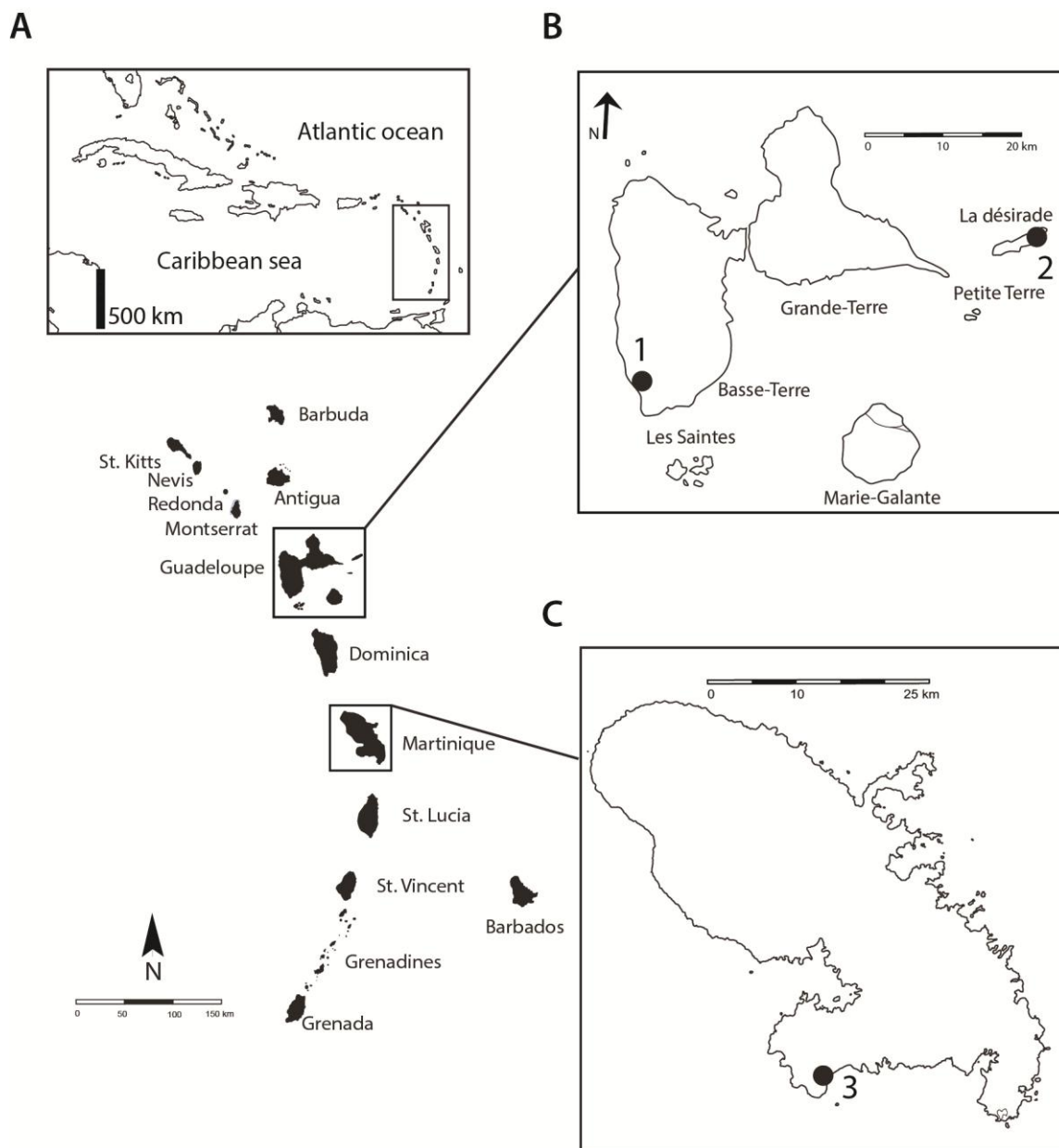
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546 Table 1: Summary of the fossil, archaeological, historical, and modern occurrence data of the genus

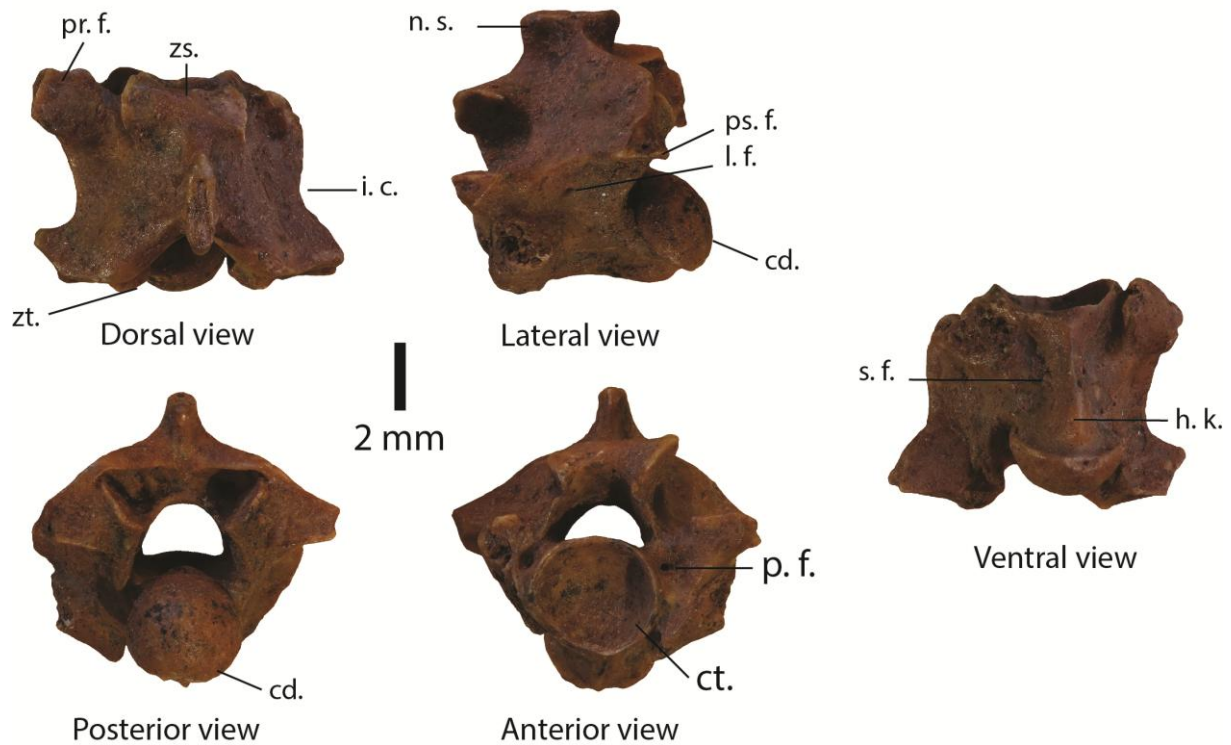
547 *Boa* in the Lesser Antilles (islands between Trinidad and Barbuda) with the two new occurrence data

548 added by the present study.



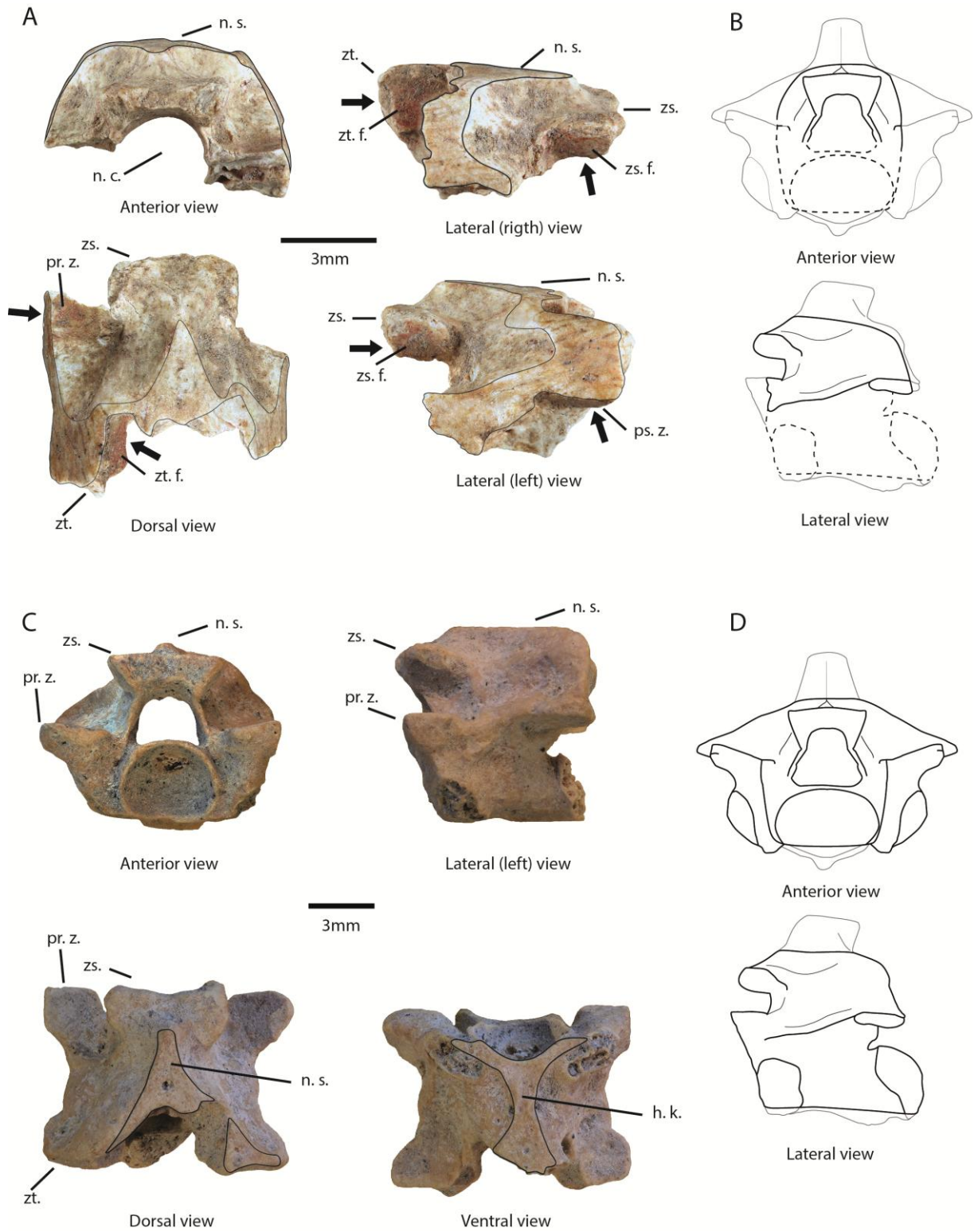
549

550 Figure 1: Location of the deposits from which *Boa* remains were recovered. A) Map of the Lesser-  
 551 Antilles, B) Map of Guadeloupe islands, C) Map of Martinique Island. List of sites: **1**: Site of Basse-  
 552 Terre Cathedral; **2**: Site of Pointe Gros Rempart 6; **3**: Site of Dizac Beach.



553  
 554 Figure 2: The *Boa* vertebra recovered from the site of Pointe Gros Rempart 6. **Abbreviations:** **ct.:**  
 555 cotyle; **cd.:** condyle; **h. k.:** hemal keel; **i. c.:** interzygapophyseal constriction; **n. s.:** neural spine; **p. f.:**  
 556 paracotylar foramen; **pr. f.:** prezygapophyseal facet; **ps. f.:** postzygapophyseal facet; **zs.:** zygosphene;  
 557 **zt.:** zygantrum.





558

559 Figure 3: A) The *Boa* vertebra fragment recovered in the US 1086 of the Basse-Terre Cathedral site.

560 Black arrows indicate the occurrence area of the ochre color deposit. C) One of the seven *Boa*

561 vertebrae recovered in the site of Dizac Beach on Martinique. Shaded parts indicate the polishing

562 areas. B, D) Hypothetic reconstruction of what the complete objects may have looked like and which

563 parts of the original vertebra were preserved after it was manufactured (B – the vertebra from Basse-  
564 Terre, C- the vertebra from Martinique). Not preserved parts are indicated in dash lines to represent  
565 the hypothetic shape of the full objects. Abbreviations: **h. k.:** hemal keel; **n. c.:** neural canal; **n. s.:**  
566 neural spine; **pr. z.:** prezygapophysis; **ps. z.:** postzygapophysis; **zs.:** zygosphene; **zs. f.:** zygosphene  
567 articular facet; **zt.:** zygantrum; **zt. f.:** zygantrum articular facet.