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A New Species of Living Peccary (Mammalia: Tayassuidae) from the Brazilian Amazon

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Abstract. Here we report on the existence of a new species of even-toed ungulate in the Brazilian Amazon, which we name *Pecari maximus*, the giant peccary. It represents the largest of living peccary species. One complete mitochondrial D-loop and two nuclear SINE PRE-1 DNA sequences of giant peccary compared with that of the sympatric and morphologically most similar collared peccary (*Pecari tajacu*) support full species status. The divergence time is estimated at 1.0–1.2 million years before present. In contrast to other peccaries, which are gregarious and range semi-nomadically in large home ranges, giant peccaries appear to live in family groups containing only a pair of adults, with or without 1–2 offspring. In view of recent developments in the interfluves where it lives and due to its limited distribution, we consider the giant peccary endangered.

Keywords. New species, Artiodactyla, Tayassuidae, *Pecari maximus*, giant peccary, Brazilian Amazon.

1. INTRODUCTION

Until recently only three extant species in the New World Artiodactyla family Tayassuidae (peccaries) were known to science, belonging to three genera (GRUBB 2005): the collared peccary *Pecari tajacu* (Linnaeus 1758), the white-lipped peccary *Tayassu pecari* (Link 1795), and the Chacoan peccary *Catagonus wagneri* (Rusconi 1930). A living population of the latter which was thought to have gone extinct was discovered in 1974 in the Chaco region on the borders of Bolivia, Paraguay and Argentina (WETZEL et al. 1975). During transect surveys of megafauna and fruits conducted in January 2000 in the Rio Aripuanã basin, the first author saw a group of three peccaries, not belonging to any of the known peccary species. Since then, the first author has had several encounters with such peccaries and collected some basic ecological and behavioural data. In March 2003, the first two authors succeeded in filming a group of four such peccaries and collecting zoological material from game brought into the village of Arauazinho.

2. DESCRIPTION OF SPECIES

Class Mammalia
Order Artiodactyla
Family Tayassuidae Palmer, 1897
Genus *Pecari* Reichenbach, 1835

Pecari maximus sp. nov. (Figs. 1–3)

Material. Five skins in the possession of hunters along the lower Rio Aripuanã and a complete skull without exact locality data obtained from them (MR316); an incomplete skull with skin (MR315) from an adult specimen killed in December 2003 along the Rio Arauazinho; a complete skull (INPA4272) from an adult male killed by locals on March 12, 2003, along the left bank of the Rio Aripuanã near the settlement of Arauazinho. Several skulls and mandible parts of all three peccary species occurring in the area were examined as found in the kitchen middens of some local communities.

Diagnosis and discussion. A species of *Pecari* differing from the only other known species in this genus, *Pecari tajacu*, in being much larger but less robust, with much longer legs and a proportionally small head only slightly



Fig. 1. Wild giant peccary *Pecari maximus* sp. nov. visiting a pond in the middle of continuous high rain forest; **a.** and **b.** show two different adult individuals belonging to the same family of four giant peccaries (Copyright NDR Naturfilm/Roland Gockel).



Fig. 2. **a.** (left) Hunters with freshly killed adult male specimen of *Pecari maximus*. The skull of this individual was saved and is here designated as the holotype (INPA4272). (Copyright by Frieder Salm); **b.** (right) Skin of *Pecari maximus* paratype specimen MR315, lacking even a faint collar.

bigger than that of *Pecari tajacu*. Most of the body thinly bristle-haired, overall colour brown mixed with dirty white, a black mid-dorsal mane running from between the ears as far as the rudimentary tail. Ears small and whitish at distal surface. Nasal disc pinkish, relatively small and soft. Collar running over the shoulders very faint, dirty white, or absent (Figs. 1 and 2). Whitish, thinly haired circum-ocular rings (Fig. 1). Distinguished from all other peccary species by its larger size; thin fur; proportionally longer legs giving it a more gracious general appearance; proportionally smaller head - skull length one fifth of total body length in *Pecari maximus*, one quarter in *Pecari tajacu* and *Tayassu pecari* (WOODBURNE 1968), and

nearly one third in *Catagonus wagneri* (WETZEL 1977; WRIGHT 1989); less developed nasal disc; smaller ears. The new species is assigned to the genus *Pecari*, because it possesses a number of traits – in particular cranial features (Fig. 3 and Table 1) – in common with sympatric *Pecari tajacu*, from which it differs by its much larger size and weight (40–50 versus 22 kg), less stocky and longer-legged general appearance, thin, grizzled brown and white fur (instead of thick, dense, strongly speckled dark blackish-grey fur), blacker on the limbs and along the dorsal crest, and a very poorly expressed, sometimes absent, dirty white instead of strikingly contrasting bright white collar passing across the chest from shoulder to shoulder (BOD-



Fig. 3. a. Lateral view of the complete skulls of an adult male *Pecari tajacu* from Rio Demeni (INPA283) (left) and an adult male *Pecari maximus* from Rio Aripuanã (holotype INPA4272) (right). b. Dorsal view of the same skulls, *Pecari tajacu* (top), *Pecari maximus* (bottom). c. Ventral view of the crania of the same skulls (in same arrangement). d. Dorsal view of mandibles of the same skulls (in same arrangement).

MER & SOWLS 1993; GRUBB & GROVES 1993). Distinguished from *Tayassu pecari*, with which it is also sympatric, by its larger body size and weight (40–50 vs. 28 kg), and grizzled-brown thin fur instead of thick, long, evenly coloured blackish brown fur becoming grizzled or light-coloured only in the pectoral and inguinal regions. The forelimbs and legs are only distally black, while they are grizzled black and tan on the lateral and hind surfaces of the forelimbs in *Tayassu pecari* (GRUBB & GROVES 1993; MARCH 1993). In contrast to the general blackish brown body colour, the chin, cheeks and sides of the muzzle are white or yellowish-white in white-lipped peccaries. Distinguished from *Catagonus wagneri*, with which it is allopatric, by its larger body size and weight (40–50 vs. 29–38 kg), grizzled-brown thin fur with or without a faint dirty white collar instead of brownish-grey thick fur with a distinct bright white collar (WETZEL 1977; WRIGHT 1989; GRUBB & GROVES 1993).

Overall, the cranium of *Pecari maximus* seems more related to that of *Pecari tajacu* than that of *Tayassu pecari* or *Catagonus wagneri*, but it differs in the following characters: it is clearly longer, wider and more robust; the frontal bone between the postorbital processes is wider; the rostrum behind the canines is wider, the dorsal surface is broader and flatter; the canine buttresses are larger; and the canines are more pointed with sharper edges. Comparing the cranial morphometrics of *Pecari maximus* with *Pecari tajacu* from Brazil (i.e., INPA283, MR317, MR318), where the species appears to grow bigger, especially where it is sympatric with *Pecari maximus*, it may be noted that breadth measurements in general differ more significantly between the species than length measurements. For example, length of cranium, mandible, and mandibular diastema do not show much difference, whereas breadth across zygomatic arches and between postorbital processes of frontals are much greater in *Pecari maxi-*

Table 1. Cranial and dental measurements [mm] of *Pecari maximus* sp. nov., *Pecari tajacu* and *Tayassu pecari*, following WOODBURN (1968). *Pecari maximus* is represented by the holotype INPA4272 and the paratypes MR316 and MR315 (incomplete skull); *Pecari tajacu* is represented by INPA283, an adult male from Rio Demeni, MR317, an adult male (head-body length: 1100 mm) from Rio Arauazinho, and MR318, an adult female (head-body length: 1080 mm) from Rio Arauazinho. The second column of measurements of *Pecari tajacu* is of specimens collected outside Brazil in the northern part of the species' range where individuals are on average smaller than those from central Amazonia; these and the measurements for *Tayassu pecari* were taken from WOODBURN (1968)

Cranium	<i>P. maximus</i> sp. nov. (N=3)	<i>P. tajacu</i> (N=3)	<i>P. tajacu</i> mean (N=71)	<i>T. pecari</i> mean (N=41)
Length of cranium (= length anterior tip of I ¹ to rear of condyles)	262;260;---	230;255;258	202	235
Length of diastema from C to P ² (distance from rear edge of alveolus of C)	31;30;---	21;25;26	18	26
Width between alveoli of P ²	18;20;---	14;17;16	18	21
Width between alveoli of M ³	20;19;19	18;18;18	18	20
Least width of rostrum behind canines	39,5;40;---	35;35;35	31	53
Height from condyles to nuchal crest	85;85;85	73;80;80	81	99
Breadth across zygomatic arches	119;120;119	104;110;95	101	118
Breadth between postorbital processes of frontals	88;88;89	78;78;71	73	92
Mandible				
Length of mandible (= length from I ¹ to rear of condyles)	185;180;182	165;170;173	162	198
Length of diastema from C to P ₂	40;35;36	31;37;37	25	34
Depth from tip of coronoid process to ventral angle	88;85;84	73;82;77	75	93
Depth below P ₂	36;39;40	32;40;37	32	36
Depth below rear of M ₃	45;45;45	32;33;35	34	41
Width between alveoli of P ₂	20;25;24	20;22;21	22	26
Width between alveoli of M ₃	25;25;24	26;27;26	27	31
Width between condyles	49;55;---	52;47;48	49	58
Length from P ₂ to M ₃	65;68;68	63;62;64	69	85

mus. The width between alveoli of M³ is slightly greater in *Pecari maximus* implying a differently shaped palate. Whereas the depth below P₂ is the same in the two species, the depth below rear of M₃ is much greater in *Pecari maximus*, so that the lower jaw deepens posteriorly (for a more detailed comparison, see Table 1).

GRUBB (2005) lists the following 19 synonyms for *Pecari tajacu*: *angulatus*, *bangsi*, *caitetu*, *crassus*, *crusnigrum*, *humeralis*, *macrocephalus*, *minor*, *modestus*, *nanus*, *nel-*

soni, *niger*, *nigrescens*, *patira*, *sonoriensis*, *tajassu*, *torquatus*, *torvus*, *yucatanensis*. Three subspecies groups have been differentiated in the past – the grey forms ('*angulatus*' group) from Central America (Texas, Mexico and Honduras), the blackish forms with poorly expressed collar and dorsal stripe ('*patira*' group) from the Guianas, Colombia, Ecuador and Panama, and the buff forms with clearly marked pale collar and black dorsal stripe from South America (the nominate '*tajacu*' group). The synonyms of the South American forms apply to specimens

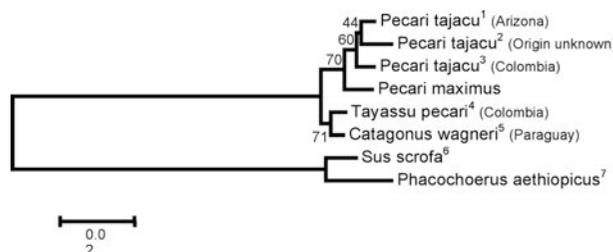


Fig. 4. Neighbour-joining tree of combined nuclear PRE-1 P27 and P642 sequences. The tree was constructed with MEGA3 (KUMAR et al. 2004), assuming the TN93 Gamma model (shape parameter alpha = 0.6). Bootstrap values (10,000 replicates) are indicated on branches. Geographic origins are mentioned between brackets. The superscripts refer to Genbank accession numbers. 1: AY546529/AY726778, 2: AB000378/379, 3: AY546532/AY726779, 4: AY546528/31, 5: AY546527/30, 6: AB000365/370, 7: AB000377/678.

collected in Colombia, Ecuador and the Guianas, areas north of the Amazon River, being geographically too distant from the range of the new taxon, *Pecari maximus*, for these synonyms to be taken into account. Linnaeus' name *Sus tajacu* is based on the tajacu of Marcgraf (GRUBB 2005), from the State of Pernambuco, Brazil, a region that is not considered part of Amazonia.

Measurements. Five skins from hunters along the lower Rio Aripuanã were measured, total length 120, 127, 133, 135 and 137 cm. Collar when present 35 cm. Nasal disc 5.3 x 4.0 cm. Mane bristles 10.5–12.0 cm, proximally with 2–3 white bands at the lower half and 3 brown bands, distally with 3 white and 4 brown bands, the white bands only on lower half of bristles. Bristles to the side of the mane 6–7 cm, the dorsal ones with 3 whitish bands, the more ventral ones 4.7 cm, with only 2 whitish bands. Collar bristles 3.6–4.3 cm, with or without 1–2 white bands on distal part. The upper legs have black, fine, non-annulated, 4.0 cm long hairs. Belly almost naked, the hairs vaguely banded or only with one whitish band at the base. Bristles on nape 8.5 cm, with one whitish band only. Proximal bristles 8.0 cm, with one whitish narrow band only. Based on film and photo material of wild animals we estimated the following average measurements for adults: total body length 127 cm; ear length 13 cm; shoulder height 85 cm. Body weight was not taken but according to local hunters ranges from 40–50 kg. Mean skull length 261 mm, mean mandible length 182 mm. For additional skull measurements of *Pecari maximus* n.sp., *P. tajacu* and *Tayassu pecari* and definitions of measurements see Table 1.

Type Material. Holotype: INPA4272 (Mammal Collection of the National Institute for Amazon Research, Manaus, Amazonas, Brazil): complete cranium and mandible of an adult male (Fig. 3), killed for food by a local hunter,

Luís Corrêa Bastos, on March 12, 2003, along the left bank of the Rio Aripuanã near the settlement of Arauazinho. Figure 2a shows the freshly hunted animal from which only the skull could be saved that is here designed as the holotype.

Paratypes: MR315, an incomplete skull with skin (Fig. 2b), obtained from hunters who had killed the animal in December 2003 along the Rio Arauazinho; MR316, a complete cranium and mandible collected from hunters living along the lower Rio Aripuanã, but lacking exact locality data (both paratype specimens kept by the first author).

Type locality. Left bank of the Rio Aripuanã, close to the settlement of Arauazinho, situated at the mouth of the Rio Arauazinho, a left bank tributary of the lower Rio Aripuanã, State of Amazonas, Brazil (06°16'94''S, 60°20'87''W).

Etymology. The name is Latin meaning 'the largest', referring to the size of the new species that is the largest among living peccaries. The gender is masculine.

Vernacular name. *Pecari maximus* is locally known as 'caitetú-mundê'. Locals claim that in the Tupi-Indian tongue (*lingua geral*) it means "the collared peccary that is bigger and goes in pairs". This allows them to distinguish it from *Pecari tajacu* commonly known as 'caitetú-de-bando' ("the collared peccary that goes in herds").

3. PHYLOGENY

Mitochondrial cytochrome *b* (THEIMER & KEIM 1998), control region and 12S r RNA sequences, and nuclear SINE PRE-1 sequences (GONGORA & MORAN 2005) indicate that *Tayassu pecari* and *Catagonus wagneri* are more closely related to each other than to *Pecari tajacu*. A complete mitochondrial D-loop sequence (1383 bp) and two nuclear SINE PRE-1 sequences (P27, 322 bp and P642, 386 bp) (homologous sequences described in SULLANDARI et al. [1997] and GONGORA & MORAN [2005]) from our skin sample (MR315) support the status of the new peccary species as belonging to the genus *Pecari*, closely related to *Pecari tajacu*. Sequences are deposited in GenBank under the accession numbers: DQ009006, DQ016371 and DQ016372. Net maximum likelihood (TN93) sequence divergence with *Pecari tajacu* is 2.0 % (Colombia, GenBank accession numbers: AY546522, AF276938) and 1.1 % (GenBank accession numbers: AY26778-79, AY546529/32, AB000378-79), respectively. For the D-loop it is of the same order as observed between the European and Asian pig (1.7 %) (KIM et al. 2002), for which the divergence time has been estimated

where there are many open savannahs and extensive floodplains. We have observed the species in the wild only along both banks of the Rio Aripuanã (Fig. 6); it swims well (pers. obs.). The species might also occur in the upper Rio Madeira, State of Acre (Fig. 5). This assumption is based on the story of an American, John C. Yungjohann, who worked as a rubber cutter in the Rio Xapurí area from 1906–1919, written down in the book “White Gold” (YUNGJOHANN 2003). He describes three types of ‘bush pigs’. The description of one of these closely resembles *Pecari maximus*: “there is a great, big one *porcão*, they travel in pairs, and are very lively. They will attack on sight – either you have to be swift and a sure shot or climb a tree”. This behaviour – going in pairs and being really aggressive when attacked – is also reported by the hunters along the Rio Aripuanã.

Ecology

Both *Pecari tajacu* and *Tayassu pecari* roam semi-nomadically in a highly variable landscape in noisy, widely spread herds of up to 30, respectively 200 individuals, which stay in permanent contact by loud tooth-clicking. In strong contrast, *Pecari maximus* seems to walk silently through its preferred habitat – dense *terra firme* climax forest – in small family groups that contain only an adult pair with or without 1–2 offspring. *Pecari maximus* appears to perform little or no uprooting, whereas the gregarious peccary species largely forage for subsoil seed shadows, seedlings, roots and tubers. Instead, it has been seen feeding predominantly on freshly fallen fruits and seeds exposed on the forest floor. If this is its predominant foraging technique, its different dietary specialisation might well explain the fact that among the several skull and mandible parts of the three local species combined, the molars of *Pecari maximus* invariably showed a less dramatic wearing pattern. This could reflect its much smaller intake of sand and dirt during feeding. It appears that the larger *Pecari maximus* has abandoned social groupings, group defence and territorial scent marking. Its scent gland is thought to be rudimentary. None of the skins examined emitted the typical peccary scent, suggesting that if any secretory liquid is produced it is scentless, at least for the human nose.

Conservation status

All three peccary species occurring sympatrically in the Rio Aripuanã region are the favourite game of the locals, but only *Pecari maximus* is hunted with dogs since it does not go in herds like the other peccaries which are known to defend themselves fiercely. Although human occupation in this part of the Amazon is presently very low, this situation might soon change. In the Rio Aripuanã region unprecedented illegal extraction of timber and gravel is

taking place. Recent road building through the area is intended to connect the town of Manicoré on the right bank of the Rio Madeira with the boomtown of Apuí at the border of the Tenharim Savannah and the State of Mato Grosso, areas of large-scale soybean agriculture. In view of these recent developments, we fear that commercial hunters using trained dogs will focus first on *Pecari maximus* to feed hungry settlers. Taking increasing hunting pressure and the species’ limited distribution into account, we consider *Pecari maximus* endangered. We recommend inclusion of this new species in the IUCN Global Red List, based on criterion D (very small or restricted population). Besides the giant peccary, the Rio Aripuanã region is thought to harbour a number of floral and faunal elements new to science. The first author has identified so far a new species of dwarf porcupine, *Coendu roosmalenorum* Voss & da Silva, 2001 (VOSS & DA SILVA 2001), and seven new primate species, four of which are already described (VAN ROOSMALEN et al. 1998; VAN ROOSMALEN et al. 2000; VAN ROOSMALEN et al. 2002; VAN ROOSMALEN & VAN ROOSMALEN 2003). Among these primates, the dwarf marmoset *Callibella humilis*, represents a new genus never collected before. Most surprisingly, not a single area protected by Brazilian environmental law exists in the region. Given the uniqueness of the region in terms of biodiversity and its current status of biological *terra incognita*, we here encourage UNESCO to urge the Brazilian government to declare the entire region a World Heritage Site.

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REFERENCES

- BODMER, R. E. & SOWLS, L. K. 1993. The collared peccary (*Tayassu tajacu*): status and action plan summary. Pp. 7–13 in: OLIVER, W. L. R. (ed.) Pigs, Peccaries and Hippos. Status Survey and Conservation Action Plan. IUCN, Gland.
- GONGORA, J. & MORAN, C. 2005. Nuclear and mitochondrial evolutionary analyses of Collared, White-lipped, and Chacoan peccaries (*Tayassuidae*). *Molecular Phylogenetics and Evolution* **34**: 181–189.
- GRUBB, P. 2005. Family Tayassuidae. Pp. 643–644 in: WILSON, D. E. & REEDER, D. M. (eds.) *Mammal Species of the World*. John Hopkins University Press, Baltimore.
- GRUBB, P. & GROVES, C. P. 1993. The Neotropical tayassuids *Tayassu* and *Catagonus*: Taxonomy and description. Pp. 5–7 in: OLIVER, W. L. R. (ed.) Pigs, Peccaries and Hippos. Status Survey and Conservation Action Plan. IUCN, Gland.
- KLIAS, J. M. H. & ANDERSSON, L. 2001. A phylogenetic study of the origin of the domestic pig estimated from the near-com-

- plete mtDNA genome. *Journal of Molecular Evolution* **52**: 302–308.
- KIM, K. I., LEE, J. H., LI, K., ZHANG, Y. P., LEE, S. S., GONGRO-RA, J. & MORAN, C. 2002. Phylogenetic relationships of Asian and European pig breeds determined by mitochondrial DNA D-loop sequence polymorphism. *Animal Genetics* **33**: 19–25.
- KUMAR, S., TAMURA, K. & NEI, M. 2004. MEGA3: Integrated software for molecular evolutionary genetics analysis and sequence alignment. *Briefings in Bioinformatics* **5**: 150–163.
- MARCH, I. J. 1993. The white-lipped peccary (*Tayassu pecari*): status and action plan summary. Pp. 13–22 in: OLIVER, W. L. R. (ed.) *Pigs, Peccaries and Hippos*. Status Survey and Conservation Action Plan. IUCN, Gland.
- SULANDARI, S., HARUMI, T., WADA, Y. & YASUE, H., MULADNO & YANAI, S. 1997. Localization of swine PRE-1 homologues in 13 loci of *Phacochoerus aethiopicus* and *Tayassu tajacu* genomes, and their sequence divergence. *Animal Genetics* **28**: 210–215.
- THEIMER, T. C. & KEIM, P. 1998. Phylogenetic relationships of peccaries based on mitochondrial cytochrome b DNA sequences. *Journal of Mammalogy* **79**: 566–572.
- VAN ROOSMALEN, M. G. M., VAN ROOSMALEN, T., MITTERMEIER, R. A. & DE FONSECA, G. A. B. 1998. A new and distinctive species of marmoset (Callitrichidae, Primates) from the lower Rio Aripuanã, State of Amazonas, central Brazilian Amazonia. *Goeldiana Zoologia* **22**: 1–27.
- VAN ROOSMALEN, M. G. M., VAN ROOSMALEN, T., MITTERMEIER, R. A. & RYLANDS, A. B. 2000. Two new species of marmoset, genus *Callithrix* Erxleben, 1777 (Callitrichidae, Primates) from the Tapajós/Madeira interfluvium, south central Amazonia, Brazil. *Neotropical Primates* **8**: 2–18.
- VAN ROOSMALEN, M. G. M., VAN ROOSMALEN, T., MITTERMEIER, R. A. 2002. A taxonomic review of the titi monkeys, genus *Callicebus* Thomas, 1903, with the description of two new species, *Callicebus bernhardi* and *Callicebus stephennashi*, from Brazilian Amazonia. *Neotropical Primates* **10**, Supplement: 1–52.
- VAN ROOSMALEN, M. G. M., VAN ROOSMALEN, T. 2003. The description of a new marmoset genus, *Callibella* (Callitrichinae, Primates), including its molecular phylogenetic status. *Neotropical Primates* **11**: 1–10.
- VOSS, R. S. & DA SILVA, M. N. F. 2001. Revisionary notes on Neotropical porcupines (Rodentia: Erethizontidae). 2. Review of the *Coendu vestitus* Group with descriptions of two new species from Amazonia. *American Museum Novitates* **3351**: 1–36.
- WETZEL, R. M. 1977. The Chacoan peccary, *Catagonus wagneri* (Rusconi). *Bulletin of Carnegie Museum of Natural History* **3**: 1–36.
- WETZEL, R. M., DUBOS, R. E., MARTIN, R. L. & MYERS, P. 1975. *Catagonus*, an 'extinct' peccary, alive in Paraguay. *Science* **189**: 379–381.
- WOODBURNE, M. O. 1968. The cranial myology and osteology of *Dicotyles tajacu*, the collared peccary, and its bearing on classification. *Memoirs of the Southern California Academy of Sciences* **7**: 1–48.
- WRIGHT, B. 1989. Phylogenetic relationships of *Catagonus wagneri*: sister taxa from the Tertiary D of North America. Pp. 281–308 in: REDFORD, K. H. & EISENBERG, J. F. (eds.) *Advances in Neotropical Mammalogy*. Sandhill Crane Press, Gainesville.
- YUNGJOHANN, J. C. 2003. *White Gold: The Diary of a Rubber Cutter in the Amazon 1906–1916*. Synergetic Press, Santa Fe.

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