

Natural History of Vertebrates on the Brazilian
Islands of the Mid South Atlantic

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Natural History of Vertebrates on the Brazilian Islands of the Mid South Atlantic

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1409.* For study of the past and present vertebrate fauna, particularly birds, of Fernando de Noronha Island and for a study of the status of the living and fossil birds of Ilha da Trindade.

I. ZOOLOGY AND PALEONTOLOGY OF THE TERRESTRIAL VERTEBRATES OF FERNANDO DE NORONHA ISLAND, SOUTH ATLANTIC OCEAN

Because of the destruction of habitat and the introduction of exotic predators and grazing animals, terrestrial faunas now found on small oceanic islands are often considerably altered from those that existed before the arrival of man. For this reason I have conducted paleontological investigations on the islands of the mid South Atlantic Ocean in order to search for evidence of exterminated species, particularly of birds. On Ascension Island, I found remains of an extinct species of flightless rail (Olson, 1973) and also those of resident sea birds and a few vagrant land birds (Olson, 1977a). Extensive fossil deposits on St. Helena I found to contain remains of 6 species of extinct land birds and 3 new species of sea birds. At the same time, these revealed a nearly complete turnover of the sea-bird fauna of the island during the Pleistocene whereby subtropical petrels were largely replaced by tropical terns, boobies, and frigatebirds (Olson, 1973, 1975). Thus, I decided next to turn my attentions to Fernando de Noronha.

The archipelago of Fernando de Noronha lies 345 kilometers east of the easternmost point of Brazil (lat. 3° 50' S., long. 32° 25' W.) and consists of one main island and about 12 smaller islets, with a total area of 18.4 square kilometers. These islands are entirely volcanic in origin, are well vegetated, and have a mild climate. The archipelago was discovered in 1503 and has been inhabited for much of its subsequent history. It is presently a Federal Territory of Brazil and is administered by the Brazilian army. Roughly 1,200 people, both civilian and military, now live on Fernando de Noronha, and the Brazilian air force runs regularly scheduled flights to the island.

The earliest reference to the fauna of Fernando de Noronha is found in the account of the so-called fourth voyage of Amerigo Vespucci (Markham,

1894), who claimed to have visited the island in the year of its discovery, finding there "marine and land birds without number" and also "very large rats." No native rats are now found on Fernando de Noronha, and thus the possibility that an endemic rodent may have existed there at the time of the island's discovery is of considerable interest. Naturalists have visited Fernando de Noronha on a number of occasions, but almost always for very brief periods. In 1887, H. N. Ridley collected specimens on the island from August 14 to September 24, and his accounts of the botany and zoology have provided the groundwork for all subsequent biological studies there (Ridley, 1890a, 1890b).

Three species of land birds are native to Fernando de Noronha: a distinctive species of vireo (*Vireo gracilirostris*), an endemic subspecies of tyrannid flycatcher (*Elaenia spectabilis ridleyana*), and a subspecies of the eared dove (*Zenaida auriculata noronha*) first described from the island but later ascertained to occur in mainland Brazil as well. Sea birds known from the island include the magnificent frigatebird (*Fregata magnificens*), red-billed and white-tailed tropicbirds (*Phaethon aethereus* and *P. lepturus*), red-footed, brown, and masked boobies (*Sula sula*, *S. leucogaster*, and *S. dactylatra*), sooty tern (*Sterna fuscata*), brown noddies and black noddies (*Anous stolidus* and *A. tenuirostris*), and white terns (*Gygis alba*). No petrels (Procellariidae and Oceanitidae) have ever been reported from the island itself.

My primary interest in going to Fernando de Noronha was in searching for fossil deposits that might yield remains of Vespucci's rat, extinct land birds such as rails (Rallidae), and extirpated sea birds, particularly petrels. Also, I wished to determine the status of the existing land birds and to make observations on their habits, since little besides brief taxonomic descriptions has been published concerning these species.

In May 1973, authorization for a scientific expedition to Fernando de Noronha was granted by the Conselho Nacional de Pesquisas of Brazil. Funds were provided mainly by the National Geographic Society, with a small additional grant supplied by the International Council for Bird Preservation. I arrived on Fernando de Noronha on July 6, 1973, and remained until August 18, accompanied by O. A. Roppa and I. A. Cruz, who assisted in collecting specimens. Quarters were in quonset huts on the northern side of the island at Tres Paus, at the base of the distinctive phonolitic plug known as the Pico, the highest point on the island.

Attempts to find fossils were at first unsuccessful. Fernando de Noronha is comparatively level and there are no steep valleys with deep fossiliferous sediments like those found on St. Helena (Olson, 1975). Nor are there fumaroles or lava tunnels such as produced fossils on Ascension Island (Olson,

1973, 1976). A deep sea cave, the "Buraco de Captão Kidd" near Ponta da Pedra Alta, proved inaccessible, owing to the great waves rushing into its entrance. At last I discovered that the sandy area of Pleistocene dunes at the base of the Santo Antonio peninsula contained vertebrate fossils as well as those of terrestrial snails and land crabs. Fossils were usually found scattered on the surface of the dunes, but parts of skeletons were occasionally found in association. Many of the specimens are well mineralized, and these appear to have weathered out of a somewhat indurated layer of white nodules. This layer was exposed in position at a small sand-quarrying site near the road passing through the dunes. Only the shells of land snails were found in place in this exposed section. On the surface of the dunes, vertebrate fossils appeared to be most abundant where there were concentrations of the white nodules and snail shells. I made 12 collecting trips to the Santo Antonio site, spending most of the time gleaning fossils from the surface of the dunes, but also screening in areas where associated material was found.

The most frequently encountered fossils were those of a large rodent of the family Cricetidae, very different from the recent remains of the introduced rats (*Rattus*), which were also encountered on the dunes. This cricetid is almost certainly the rat mentioned by Vespucci. It is a new species, and possibly a new genus in the subfamily Sigmodontinae. The specimens are currently under study by Michael Carleton of the Smithsonian Institution.

Remains of a new species of rail (Rallidae) were also found, bringing the total known land-bird fauna to four species. Most of the elements of the skeleton, from several different individuals, are represented. This was a medium-size rail with the wings reduced, but to a lesser extent than in many flightless species. It does not appear to be particularly close morphologically to any of the species of rails from mainland Brazil. I have briefly alluded to this form elsewhere (Olson, 1977b), but it has yet to be formally described.

Well-mineralized bones of boobies and frigatebirds were collected fairly frequently. A single proximal end of a humerus of a frigatebird appears to belong to a small species the size of the lesser frigatebird *Fregata ariel*, which in the Atlantic now exists only at Ilha da Trindade, although subfossil remains of a frigatebird of this size have been found on St. Helena (Olson, 1975). The present record adds significantly to our information and raises a number of interesting questions about the distribution and relationships of the smaller forms of frigatebirds.

Resident species of Procellariiformes are not represented in the fossil material, yet some of the tropical species such as *Puffinus lherminieri*, *Oceanodroma castro*, or members of the *Pterodroma hasitata* group might be expected to have occurred on the island. The absence of these birds even from the fossil record

at Fernando de Noronha may perhaps be attributed to the presence of two predators, the extinct rodent and the land crab *Gecarcinus lagostomus*, both of which could have made reproduction difficult or impossible for petrels that customarily nest in burrows or on the ground.

The three living species of land birds on the island proved to be very common. The vireo and flycatcher were most abundant in the remaining areas of forest at the eastern end of the island and around the base of Morro do Pico, but both were found in scrubby areas and in trees along roadsides and around dwellings. As during Ridley's visit, flycatchers were present but vireos were absent on Ilha Rata, the largest of the subsidiary islands.

The vireos appeared to feed almost exclusively on small insects gleaned from the underside of leaves, from which the birds would very frequently suspend themselves upside down to feed. They almost never took larger prey from trunks or limbs, or hawked insects from the air, as most other vireos do to varying extents. The long, slender bill and very long tail of the Noronha vireo may well be correlated with its seemingly rather specialized feeding habits. Although now usually regarded as a subspecies of the red-eyed vireo complex (*Vireo olivaceus*), the morphology of *Vireo gracilirostris* is so divergent that it must be recognized as a full species.

I found fossilized remains of the dove, indicating its long presence on the island. That the insular population has not differentiated from that of parts of northeastern Brazil is probably a reflection of fairly frequent influxes of new individuals from the mainland.

The populations of sea birds at Fernando de Noronha seem to be thriving better than elsewhere in the tropical South Atlantic. Exceptions are *Sula dactylatra* and *Sterna fuscata*, both of which need flat open areas, little of which is available on the predator-free offshore islets where these birds must now nest at Fernando de Noronha. Black noddies were the most abundant birds at the island. All the species of sea birds appeared to be breeding during our visit, although we could not confirm breeding in the frigatebird or in the decidedly rare red-billed tropicbird.

I encountered relatively few migrants: a tern (*Sterna* sp.), skua (*Catbaracta* sp.), and whimbrel (*Numenius phaeopus*) have not been recorded previously from the island. Two specimens of whimbrel were collected—one of the North American race (*N. p. hudsonianus*) and the other of the European race (*N. p. phaeopus*), the first ever recorded for South America.

The most peculiar reptile on the island is the endemic worm-lizard *Amphisbaena ridleyi*, which on the slopes of Morro do Pico proved to be much more abundant than mainland populations of this genus usually are. Fossils of this species occurred in the dune deposits with the other vertebrate remains.

The endemic lizard *Mabuya maculata* was extremely common, and in the late afternoon more than 40 individuals catching the last rays of the evening sun could be seen on each utility pole along certain sections of road. Since Ridley's report in 1890, a toad (*Bufo paracnemis*), the tegu lizard (*Tupinambis teguixin*), and a caviomorph rodent (*Kerodon rupestris*) have been successfully introduced to the island.

On July 23 I used rotenone to collect fishes and marine invertebrates in a large tide pool at Saco de Atalaia. This pool yielded a wide variety of fishes and truly impressive numbers of moray eels. On the night of July 31 I collected needlefishes (*Platybelone*) and halfbeaks (*Hemiramphus*) with torches and dipnets at Baio do Sueste. These collections are under study by various specialists. Among the more interesting fishes collected is an apparently new genus and species of sand stargazer of the family Dactyloscopidae (C. E. Dawson, pers. comm.).

II. AVIFAUNA OF ILHA DA TRINDADE, SOUTH ATLANTIC OCEAN

The exploration of Ilha da Trindade completed my investigations into the past and present birdlife of the tropical and subtropical islands of the South Atlantic. The site of this study is known in much of the literature as South Trinidad or Trindade Island. The former has resulted in confusion with the Caribbean island of Trinidad and the latter is almost invariably misspelled "Trinidade," an orthography that cannot be justified in either English or Portuguese. Therefore it is probably best to use the complete Portuguese designation "Ilha da Trindade" when there is any possibility of confusion.

Ilha da Trindade lies in the South Atlantic Ocean at a distance of 620 miles east of Vitória, Brazil, and 765 miles east-northeast of Rio de Janeiro. The neighboring islets of Martin Vas lie 26 miles eastward and are visible from the island. Ilha da Trindade has an area of 8 square kilometers and a maximum elevation of 600 meters. It is entirely volcanic in origin and quite steep and rugged throughout.

The only transportation to Trindade is by a Brazilian naval vessel that calls every 2 months to replenish supplies and transfer half the garrison of 40 naval personnel, who operate a small weather and communications station on the northern shore of the island. At 10 a.m. on December 10, 1975, I boarded the corvette *Babiano* in Rio de Janeiro harbor. On the morning of December 12 I was still aboard the *Babiano* and still in Rio harbor, because of engine trouble. All personnel and supplies were transferred to the research vessel *Azmirante Saldanha*, which did eventually get under way after midday of the 13th. After 5 days at sea, we sighted Trindade in the moonlight at 2:30 a.m. of the 18th. A primitive landing was effected by means of a small barge, float-

ed on oil drums, that was pulled through the surf from the island to the ship, and back, with several hundred yards of heavy cable. The ship's end of the cable was hauled by a winch, but that on the island was powered by 30 or so straining sailors, at least half of whom had extra incentive because their 4-month tour was up and they would soon be leaving the pure but austere island existence for the delights of Rio. I set foot on Trindade shortly after noon of December 18, 1975, and remained there until February 10, 1976, departing in the corvette *Caboclo* and arriving in Rio on the 13th.

Trindade once had extensive forest cover, but the trees experienced a die-off early in the 19th century. Murphy (1915) summarized what was then known of the history of this forest, noting the accounts of several travelers in the early 1800's who had remarked on the melancholy groves of dead trees then to be met with on the island. A number of far-fetched hypotheses to explain this seemingly total eradication on Trindade have been advanced, including destruction by volcanic gases, introduced goats, or a drastic decrease in rainfall.

The earlier visitors, puzzled by the stands of trees that appeared to have been killed simultaneously, seem to have overlooked the simplest and most satisfactory explanation for their demise—fire. Weathered pieces of wood from these trees may still be found in the higher parts of the island and I saw evidence of fire on many of them. Although it is possible that the wood may have been burned in grass fires after the trees had died and fallen to the ground, the specimens I examined rarely showed evidence of external charring but rather had a layer of dark, apparently fire-hardened wood beneath a weathered exterior. Fires set by man would explain the simultaneous death of mature trees. Destruction by volcanic gases could not have occurred, as there is no evidence of any recent volcanic activity on the island. The hypothesis that invokes a drastic decrease in rainfall does not hold when one considers that there has continued to be sufficient rainfall to perpetuate growths of hydrophilic tree ferns.

At my instigation, Dr. Richard Eyde of the Department of Botany, Smithsonian Institution, has delved extensively into the literature on, and the identity of, the "extinct" trees of Trindade. Previously there had been five different identifications published for these trees—all erroneous. Wood samples that I collected were identified by Eng. Calvino Mainieri, of the Laboratório de Anatomia e Identificação de Madeiras, São Paulo, as belonging to the genus *Colubrina*. As it turns out, the species *Colubrina glandulosa* var. *reitzii* is among the plants still occurring on Trindade. *Colubrina* has a propensity to colonize oceanic islands, though the mechanism of its dispersal is not apparent. Thus the trees of Trindade are not extinct. Evidently, after the original forest cover

was destroyed, overgrazing by goats prevented the trees from regaining their former stature or extent.

Apart from fairly ubiquitous grasses and various trees, mostly exotic, that are found sparsely on the higher parts of the island, the principal native vegetation left on Trindade is tree-fern forest. Even this appears to have been reduced since the early part of the century, now being confined to two rather broad valleys on the southern side.

Goats are present in fair numbers. Feral cats are also met with on occasion and mice (*Mus*) are abundant. Trindade has somehow mercifully been spared invasion by rats (*Rattus*), probably because there are no beaches that would have been suited to careening a large vessel for scraping or repairs. One native organism that may have had an effect on the composition of the sea-bird fauna, the land crab *Gecarcinus lagostomus*, occurs in quantity in all parts of the island. These creatures, when properly prepared, are a delight to the human palate; so many are taken away alive in crates for home consumption by departing members of the garrison that large individuals are usually found only in the higher parts of the island and on the south side, which is reached solely by those persons inclined to traverse a vertiginous trail over the summit. Even small crabs become noticeably less abundant around the settlement in the week prior to the arrival of the supply ship.

Ornithological investigations of Trindade have usually been of short duration. In this century the island was visited briefly in 1905 by Nicoll (1906, 1909), and in 1901 and 1910 by Wilson (Wilson, 1904; Sharpe, 1904; Lowe and Kinnear, 1930). Murphy (1915), later to be regarded as the authority on Trindade, actually spent only one day in the waters around the island and was unable to go ashore. Preparators for the Museu Nacional do Rio de Janeiro spent 6 months on the island collecting various biological specimens in 1916, the ornithological results being published by Ribeiro (1919). The *Blossom* Expedition of the Cleveland Museum of Natural History visited Trindade from December 23, 1924, to January 26, 1925. No scientific report of this expedition was ever published, though some information may be gleaned from the popular writings of Simmons (1927) and Rockwell (1932, 1955). Finally, a small collection of birds was made in May 1950, again by members of the Museu Nacional, who were on the island for a week (Novaes, 1952). From these studies the avifauna was known to comprise eight or nine breeding species of sea birds, no land birds ever having been discovered. Subsequent to 1950 there has been no information on the birdlife of the island. Thus, in visiting Trindade I hoped to ascertain the present status of the sea birds and to search for fossils of exterminated species such as I found on Ascension, St. Helena, and Fernando de Noronha.

During my sojourn on Trindade I found that the populations of most species of sea birds had been greatly reduced in the 50 years since the *Blossom* visited the island. Unfortunately, I was not able to visit the islets of Martin Vas, the bird populations of which must be somewhat healthier, although I was told that these islets are used for target practice by the corvettes that service the Trindade garrison.

Trindade Petrel (*Pterodroma a. arminjoniana*). This species is found in the Atlantic Ocean only at Trindade, and in the Indian Ocean only on Round Island, off Mauritius. What is alleged to be a slightly smaller race, *P. a. heraldica*, is found on a number of Pacific islands. It was encouraging to find this species present and fairly abundant on several of the high peaks of Trindade. Although the birds could be seen entering inaccessible holes and crevices in the cliffs, there was no indication of breeding in any of the 24 specimens I collected. Two of these appeared to be recently fledged juveniles, however. Stomach contents consisted entirely of remains of squid, with the exception of a small individual of the mackerel *Scomber japonicus*.

Frigatebirds (*Fregata*). Both the greater and lesser frigatebirds (*F. minor* and *F. ariel*) are known from Trindade, the only place in the Atlantic where these otherwise Indo-Pacific species occur. Previously, I had found fossils of both a large and a small species on St. Helena (Olson, 1975) and assumed that they were probably the same two forms as represented at Trindade. However, because the bones of the smaller species from St. Helena were significantly stouter than in Indo-Pacific specimens of *F. ariel*, it seemed possible that the Atlantic populations might be specifically or subspecifically differentiated, something also suggested by the distinctive subadult plumage described for the Trindade birds (Lowe, 1924). Thus it became of considerable interest to learn more about these birds.

Unfortunately, the population of *F. ariel* at Trindade is now very small. I found this species only on a single, small steep islet at Ponta do Sul. Studies of birds in this area were limited; in order to reach this part of the island it was necessary to cross from sea level on one side, over the highest part of the island, to sea level on the other side. By wading and climbing over some of the connecting islets it was possible to reach the base of the islet on which the frigatebirds were breeding, but the vertical walls then encountered made it otherwise inaccessible and all observations of nesting birds had to be made with a telescope from an adjacent point of land several hundred meters away. On the west side of the islet I made out about 15 nests of *F. ariel*. There may have been a few more on the east side. These nests were situated on the bare rock or on clumps of vegetation on the steep sides of the islet. There were

probably no more than 50 individuals of *F. ariel* at Trindade at the time of my visit, although I saw only one subadult bird, so it is possible that nonbreeding birds remain at sea.

Fregata minor, once considered the more abundant species at Trindade, evidently no longer breeds there. Occasional individuals were seen at various times, and when the green turtles began hatching, the birds became more regular, up to four being seen at one time. I presumed these to have come from Martin Vas, which must now be the only breeding outpost of this species in the Atlantic.

The juvenal plumage of the Trindade populations of *F. ariel* was not previously known. With a telescope I was able to examine a well-feathered juvenile on a nest at Ponta do Sul. This had the reddish head characteristic of the other populations of *F. ariel*. I obtained skeletons of two males of *F. ariel* on Trindade, but these do not appear to differ markedly from Indo-Pacific specimens. The taxonomic status of the South Atlantic populations of small frigatebirds, both living and fossil, thus remains equivocal.

Masked Booby (*Sula dactylatra*). Murphy (1936) overlooked Ribeiro's (1919) record of this species at Trindade. I examined these specimens, the only ones known for the island, at the Museu Nacional in Rio. Neither I, nor other collectors, encountered this species.

Red-footed Booby (*Sula sula*). Once very common on Trindade, this species has been reduced to two very small colonies of 10 to 12 and about 75, respectively, on the tops of two inaccessible peaks. There were nearly fledged young in both colonies. Despite the fact that Murphy (1936) repeatedly insists that this species must nest in trees, these birds were nesting flat on the ground.

Brown Noddy (*Anous stolidus*). This species was present in fair numbers but was not particularly abundant. I found birds nesting at Ponta do Sul and others no doubt nest on various cliffs and stacks on the inaccessible portions of the southern coast.

Black Noddy (*Anous minutus*). I did not see a single example of this species. The only records for the area consist of one seen but not collected by Nicoll at Martin Vas (1906; *contra* Murphy [1936] who erroneously reported this as a specimen record) and mention by Rockwell (1932) of what was probably this species nesting at Martin Vas, but again no specimens were collected. There is no evidence that *A. minutus* ever occurred at Trindade proper.

White Tern (*Gygis alba*). To judge from previous accounts, the population of these birds is now greatly diminished. I encountered only scattered pairs from time to time, the only numbers of any consequence being observed by telescope on the Monumento or Ninepin.

Sooty Tern (*Sterna fuscata*). This species nests on an annual cycle at Trindade and apparently the *Blossom* was the only previous expedition to have been on the island at a time coincident with its breeding. Although Rockwell (1932) mentioned that sooty terns were found only on one offshore islet, it was the most frequently observed bird during my stay. I found a colony of about 450 pairs on a flat, fairly easily accessible plateau on the eastern end of the island. Elsewhere on the island there were probably less than 1,000 pairs. There were a few tiny colonies in little grassy pockets on the cliff face of Pão de Açúcar and somewhat larger colonies on the tops of tall isolated peaks near Cockscomb Point. I observed many over the Monumento, but at a distance too great to make any sort of estimate.

I collected specimens of the following four species of North American migrant shorebirds, all of which appear to be the first of their species recorded for the island, but none of which is unexpected: golden plover (*Pluvialis dominica*), black-bellied plover (*Pluvialis squatarola*), ruddy turnstone (*Arenaria interpres*), sanderling (*Calidris albus*).

The saffron finch (*Sicalis flaveola*) was introduced to Trindade in 1963, and there is a small population confined entirely to the houses and trees of the settlement. In the high, wilder parts of the island exist a few guinea hens (*Numida meleagris*), probably descendants of birds introduced more recently than those reported to have been released early in the 18th century.

To interject an encouraging note in the otherwise sad history of the depletion of the fauna of Trindade, I found the green turtle (*Chelonia mydas*) to be breeding plentifully. Females were laying throughout my stay and I found the first hatchlings on January 28. The turtles have no doubt benefited appreciably by the demise of the frigatebirds, which must have preyed heavily on the hatchlings. Land crabs still take a frightful toll. Turtles are completely protected at Trindade and the stricture against taking or molesting them was carefully observed by all members of the garrison.

In looking for fossils I located two likely deposits of wind-blown calcareous sand similar to those that yielded bones on Fernando de Noronha and St. Helena. Despite intensive searching, I found these to bear only the shells of land snails and the remains of land crabs.

Having gained some experience of Ilha da Trindade, I now consider that it is unlikely that any species of sea birds existed there in geologically recent time that have not already been recorded from the island. My observations further confirm those of other expeditions that tropicbirds (*Phaethon*), black noddies (*Anous minutus*), brown boobies (*Sula leucogaster*), and procellariiform birds other than *Pterodroma arminjoniana* are absent. The first three of these are cliff-nesting birds that have survived the introduction of predators and the

habitat destruction on other islands of the South Atlantic and which could well be expected to have survived at Trindade had they ever existed there, as there is certainly no shortage of cliffs.

I believe that the presence of land crabs on Trindade may have prevented burrowing or ground-nesting petrels from colonizing the island. While boobies and even terns could defend their nestlings against the attacks of crabs, petrels leave their helpless young unattended for long periods, during which time they would certainly be consumed if the voracious *Gecarcinus* were present. It is of interest that, apart from the crevice-nesting storm petrel *Oceanodroma castro* on Ascension, and the cliff-nesting *Pterodroma arminjoniana* on Trindade, no procellariiform birds are ever known to have bred on Ascension, Fernando de Noronha, or Trindade. *Gecarcinus* is found on all of these islands, whereas it is absent from St. Helena, where at least 6 species of Procellariiformes once thrived (Olson, 1975).

In my opinion, it is highly unlikely that there was not an endemic species of rail (Rallidae) on Trindade in the past, as there was ample habitat and these birds successfully colonized all the other South Atlantic islands (Olson, 1973). That I was unable to find any fossil remains of such a bird may perhaps be attributed to my usual good fortune temporarily running out. The great abundance of land crabs on Trindade may also have reduced the chances of any rail carcasses surviving long enough to be preserved, although this did not prevent rail bones from being fossilized on Fernando de Noronha, where land crabs also occur.

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