Alfred Russel Wallace went to South America with Henry Walter Bates in 1848; both men intended to collect plants, but both rapidly chose to focus on insects and birds. Wallace returned to England in 1852; however, a fire on his ship destroyed all of his collections en route. Upon his return he published a small book on palms, based upon the few drawings he had rescued from the burning ship. We here demonstrate that Wallace also successfully dispatched a few specimens of Amazonian palms to Sir William Jackson Hooker at the Royal Botanic Gardens, Kew, for use in the Museum of Economic Botany, where they have lain largely unnoticed for many years. These specimens are not only the important physical evidence of Wallace’s interest in palms, but are also exciting clues to his early development as a field naturalist.
before, in Amazonia. In 1848, Wallace and his friend Henry Walter Bates decided to set off to explore the Amazon and to investigate the question of “the origin of species,” intending to collect and sell specimens in order to finance their adventure (Bates 1863, Wallace 1905). Before they left, they consulted widely in the scientific community of London, making frequent trips to the British Museum (today’s Natural History Museum) for advice on collecting butterflies, beetles and birds, and to the Royal Botanic Gardens at Kew for advice from the director, Sir William Jackson Hooker, on the collection of plants. Hooker wrote a letter of introduction for both men to use in Brazil (Bates & Wallace 1848), which would be useful for opening doors that would otherwise be closed to two impecunious young Englishmen.

Wallace explored the Amazon and upper Rio Negro and Rio Uaupes for four years, reaching places where no European had ever been. Bates stayed for another seven years after Wallace had returned to England (Bates 1863, Beddell 1969), travelling as far as Rio Solimões while mainly...
collecting butterflies and beetles. Many of Bates’ collections are in the Entomology Department of the Natural History Museum in London; they remain among the first and finest from those parts of the world. Wallace too collected many insects and also birds, but the bulk of his collections met a quite different and regrettable fate.

After four years of collecting, largely alone or in the company of hired guides, Wallace decided to return to his family. He discovered that all of his collections had been impounded by Customs in Barra (present-day Manaus) and had not been sent on to be sold in England as he had wished. He reclaimed them, and quite ill with what was probably malaria, made his way down the Amazon to Pará (present-day Belem). He booked passage on the trading ship Helen, which was carrying a cargo of balsam of capivi, tree sap used in the manufacture of varnish. He was ready to return home, and hoped to see his friends and family before long. Halfway across the Atlantic, however, disaster struck. The Helen caught fire, probably due to irresponsible packing of the highly flammable balsam, and was beyond saving. All hands, including Wallace, evacuated to lifeboats and were eventually picked up many days afterwards – nearly out of drinking water and close to death. All Wallace's specimens and diaries were packed in the Helen's hold and so were lost.

As the ship was sinking, Wallace raced back to his cabin and grabbed a small tin box containing some drawings he was working on during the voyage, together with his watch and a few shirts. He left a large portfolio of sketches and most of his clothes – something he had trouble explaining to himself and others later (Wallace 1852, 1853b). The small drawings he saved were of fishes, native implements and of palms, with which he had become fascinated while in the forests of the Rio Negro. Once back in England, Wallace had to recover something more than the insurance his agent Samuel Stevens had taken out on his behalf, so he set about publishing some of his experiences (Sanders & Knapp in prep.). His book about his voyage, Travels on the Amazon and Rio Negro (Wallace 1853b), was written from memory – he had no notes to remind him of daily happenings. He published a few papers on the geography of the Rio Negro (Wallace 1853c), electric eels (Wallace 1853d), insects (Wallace 1854a, b) and, at his own expense, a small book about the palms of the Amazon and their uses (Wallace 1853a). The book was illustrated with lithographs prepared from his pencil sketches saved from the sinking of the Helen, and rather than complicated Latin botanical diagnoses, contained broad descriptions of each palm, focusing on the aspects of the plant easily seen and appreciated by the non-specialist, along with accounts of their native uses and ecology. Whether or not Wallace collected botanical specimens in the Amazon has always been in doubt, partly because the loss of most of his Amazonian collections destroyed any possible evidence. However, he did collect some plants – but not specimens as botanists know them today.

In this paper, we catalogue the palm specimens held at the Royal Botanic Gardens, Kew. These palm specimens are among the very few plants Wallace collected either in the Amazon or in Southeast Asia (although the relatively small, but still incompletely documented, fern collections he made in Borneo are held both at Kew and the NHM), and as such are of considerable historical importance. The material sent to Hooker differs radically from today’s typical palm herbarium specimens, but is the only solid evidence of Wallace’s plant collecting in the Amazon. These specimens also comprise evidence upon which Wallace based his Palm Trees of the Amazon, in addition to his drawings rescued from the sinking Helen. Wallace’s contribution to knowledge of the palms of the Amazon has occasionally been overlooked (but see Balick 1980, Henderson 1995, Kahn 1997). We hope that by elucidating the material he used to produce the book, his contribution can be properly appreciated.

Wallace the botanist

Natural historians have assumed that Wallace did collect specimens of palms, in the manner of a trained botanist (Henderson 1995, Prance 1999, G. Nelson pers. comm. 1999), and that they were of course all lost in the sinking of the Helen. However, there is ample evidence that Wallace and Bates soon gave up trying to collect plants (see below), collecting only a few specimens for Hooker’s Museum of Economic Botany.

Wallace and Bates arrived in Pará in late May of 1848. They spent about a year together, travelling in the vicinity of Pará and up the Rio Tocantins, during which time they sent specimens back both to their agent Samuel Stevens, and to Sir William Hooker at Kew. In a letter dated August 20th, 1848, sent from Pará, Wallace told Hooker, “we send to you by the “Windsor” from hence to Liverpool a box of dried specimens, principally palms & we trust they will arrive in good order & prove acceptable.” These specimens were destined for use in the Museum and Hooker apparently had agreed to pay £10 plus freight costs for the specimens. The Museum’s entry book at Kew records their arrival on 28th December 1848, as entry number 77-1848; “A box containing stems and leaves of palms as per list. also some pods and
leaves.” The term “pods” most likely refers to the large pod-like peduncular bract, which is present in one of the nine surviving specimens (Table 1).

Although leaf sheaths are present in some of the specimens, none of the specimens includes full leaf material. Perhaps the reference to “leaves” in
the Catalogue note refers to material that has
disappeared in the century and a half since the
specimens arrived at Kew. Alternatively, the
“leaves” of the Museum entry could have been
not palms, but ferns. In a postscript to his August
letter Wallace wrote, “I send the few dried plants
(a few hundred specimens) principally ferns.– You
can perhaps dispose of them or allow what you
consider them to be worth.” Nothing is known of
the fate of the fern specimens, as we have been
unable to locate them in the collections at Kew.
It is tempting to think that Hooker did exactly as
Wallace suggested and disposed of them, although
we have no evidence for this.

Hooker had opened his Museum of Economic
Botany in 1847, and was actively accessioning
material of economic value and interest for public
display from all over the world. At that time he
also maintained a private herbarium, which may
have been the logical destination for W allace's
fern specimens. The public herbarium at Kew was
not founded until 1852, and even then Hooker's
herbarium was not incorporated until 1866, when
it was purchased by the British Government after
Hooker's death in 1865. Thus, Wallace's palms
survived perhaps by being intended for public
display, rather than being specimens of purely
“scientific” value.

Later in his August 1848 letter to Hooker, Wallace
stated, “We have hitherto found quite enough to
do attending almost entirely to Insects only. – we
are now commencing also at Birds so that it will
be quite impossible to find time to make any thing
of a general collection of plants,” and again, “I fear
I shall find no time to collect plants but shld I meet
with any thing very curious I will endeavor to
preserve it.” It seems quite clear from this letter
that Wallace did not intend to collect plants in any
comprehensive or coherent way during his four-
year stay in Brazil, whatever his intentions may
have been before leaving England. Yet, despite this
concentration on birds and insects, Wallace’s
interest and imagination was quickly captured by
the beauty and magnificence of the “virgin forest”
(Wallace 1905), and the palms in particular drew
his admiration:

“everywhere too rise the graceful Palms, true
denizens of the tropics, of which they are the
most striking and characteristic feature. In the
districts which I visited they were everywhere
abundant, and I soon became interested in
them, from their great variety and beauty of
form and the many uses to which they are
applied.” (Wallace 1853a, p. iii)

The collections made by Wallace and Bates and
sent to Hooker are far from conventional in
comparison to modern botanical specimens (Fig.
1A, B, C). To understand how they differ, we must
provide some details of current herbarium
methods. A herbarium is a botanical museum
which houses preserved plant specimens for
scientific purposes. A typical specimen consists of
representative plant parts (e.g. leaves, stems and,
ideally, both flowers and fruit) which are pressed
and dried over a gentle heat source shortly after
they have been collected. When a specimen is
brought to a herbarium, it is usually mounted on
a rectangular sheet of card which provides support
to the specimen, space to attach both field notes
and annotations, and which is readily filed away
in a herbarium cupboard. There is some variation
among institutions in the size of the sheets but in
general, the size of the sheet limits the size of the
specimen itself. Palms defy the standard herbarium
method on account of their bulk and complexity.
A palm specimen must be collected very carefully

<table>
<thead>
<tr>
<th>Kew Catalog No.</th>
<th>Current Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>38854</td>
<td>Acrocomia aculeata (Jacq.) Lodd. ex Mart.</td>
<td>Peduncular bract enclosing juvenile inflorescence</td>
</tr>
<tr>
<td>35050</td>
<td>Acrocomia aculeata (Jacq.) Lodd. ex Mart.</td>
<td>Inflorescence</td>
</tr>
<tr>
<td>35069</td>
<td>Astrocarum aculeatum G.Mey.</td>
<td>Inflorescences</td>
</tr>
<tr>
<td>34981</td>
<td>Astrocarum gynacanthum Mart.</td>
<td>Fruits</td>
</tr>
<tr>
<td>38748</td>
<td>Bactris maraja Mart.</td>
<td>Petiole</td>
</tr>
<tr>
<td>38868</td>
<td>Bactris maraja Mart.</td>
<td>Stem apex with leaf sheaths</td>
</tr>
<tr>
<td>35170</td>
<td>Bactris maraja Mart.</td>
<td>Stem apex with leaf sheaths and inflorescences</td>
</tr>
<tr>
<td>38749</td>
<td>Euterpe oleracea Mart.</td>
<td>Stem apex with leaf sheaths and inflorescences</td>
</tr>
<tr>
<td>38782</td>
<td>Mauritiella armata (Mart.) Burret</td>
<td>Stem apex with leaf sheaths and inflorescences</td>
</tr>
</tbody>
</table>
and with copious notes to be both useful to botanists and compact enough for storage in a herbarium (Dransfield 1986). However, even the highest quality palm specimens can present herbarium staff with severe curatorial problems. Although many botanical institutions continue to mount palm specimens on their standard-sized sheets, others use extra-large sheets for some specimens. The sheet mounting of palm specimens has been abandoned altogether at Kew, in favour of loose storage in standard-size boxes of assorted depths (Fig. 1D), a technique developed at Cornell University by Liberty Hyde Bailey (1933). This method suits well the awkward shapes and sizes of such material and avoids the need to mount the individual components of a single complex specimen on numerous sheets. Nevertheless, the specimens collected by Wallace and Bates do not even submit to this sort of treatment. Some are up to 100 cm in length and include large portions of stem, complete inflorescences, leaf sheaths, spiny petioles and bracts (Fig. 1A, B, C). They are far too cumbersome to be curated by any method described above and are now stored in large plastic bags with fragile parts protected with padding.

In addition to their curatorial peculiarities, all the specimens are very incomplete, consisting of very few organs in each case. This begs the question: are the specimens of Wallace and Bates of any scientific significance at all? Before judging the specimens too harshly, however, we should reflect
on the motivation of the collectors so as to understand why the specimens are the way they are. Wallace and Bates primarily collected animal specimens and, as indicated above, they were more than occupied by that task.

In fact, neither of the two had any particular plant collecting expertise; despite Wallace’s early interest in the British flora, he had not collected specimens, preferring instead to identify plants in the field (Wallace 1905). In this light, their collecting decisions are not surprising if one imagines the dismay that they might have felt when confronted by a monumental palm from which they planned to make a specimen. It is also possible that they selected only bulky parts for collection, knowing that they would survive rough handling during the expedition and journey home better than fragile specimens. Furthermore, in his letter to Hooker, Wallace is clearly aware that their specimens were destined for the Museum of Economic Botany and possible public display, rather than Hooker’s herbarium. They may well have chosen large pieces which would make striking curiosities for a museum display cabinet.

Wallace’s own interest in economic botany is very evident in his *Palm Trees of the Amazon* (Wallace 1853a) which contains numerous references to local uses of palms. In the book, Wallace lists local uses for four of the six species represented by the nine specimens known today (Tables 1, 2).

The entire holdings of palms in the Economic Botany collections at Kew were the subject of a recent review by Dr. Sasha Barrow. The study revealed a total of more than 1600 accessions, ranging from specimens through raw materials to processed products (Barrow 1998). During the
Table 2. Comparison of the palm names used by Wallace in his *Palm Trees of the Amazon* and their currently accepted names according to Henderson (1995). Taxa described by Wallace and still known by those names are in bold.

<table>
<thead>
<tr>
<th>Wallace 1853</th>
<th>Henderson 1995</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Leopoldinia pulchra</em> Martius</td>
<td><em>Leopoldinia pulchra</em> Mart.</td>
</tr>
<tr>
<td><em>Leopoldinia major</em>, n. sp.</td>
<td></td>
</tr>
<tr>
<td><em>Leopoldinia piassaba</em>, n. sp.</td>
<td></td>
</tr>
<tr>
<td><em>Euterpe oleracea</em> Martius</td>
<td><em>Leopoldinia major</em> Wallace</td>
</tr>
<tr>
<td><em>Euterpe catinga</em>, n. sp.</td>
<td><em>Leopoldinia piassaba</em> Wallace</td>
</tr>
<tr>
<td><em>Œnocarpus baccâba</em> Martius</td>
<td></td>
</tr>
<tr>
<td><em>Œnocarpus batawá</em> Martius</td>
<td></td>
</tr>
<tr>
<td><em>Œnocarpus minor</em> Martius</td>
<td></td>
</tr>
<tr>
<td><em>Œnocarpus distichus</em> Martius</td>
<td></td>
</tr>
<tr>
<td><em>Iriartea exorhiza</em> Martius</td>
<td><em>Socratée exorrhiza</em> (Mart.) H.Wendl.</td>
</tr>
<tr>
<td><em>Iriartea ventricosa</em> Martius</td>
<td></td>
</tr>
<tr>
<td><em>Iriartea setigera</em> Martius</td>
<td></td>
</tr>
<tr>
<td><em>Raphia taedigera</em> Martius</td>
<td></td>
</tr>
<tr>
<td><em>Mauritia flexuosa</em> Linnaeus</td>
<td><em>Mauritia carana</em> (Kunth) Burret</td>
</tr>
<tr>
<td><em>Mauritia carana</em>, n. sp.</td>
<td></td>
</tr>
<tr>
<td><em>Mauritia aculeata</em> Humboldt</td>
<td><em>Mauritia aculeata</em> (Kunth) Burret</td>
</tr>
<tr>
<td><em>Mauritia gracilis</em>, n. sp.</td>
<td><em>Mauritia armata</em> (Mart.) Burret</td>
</tr>
<tr>
<td><em>Mauritia pumila</em>, n. sp.</td>
<td><em>Lepidocaryum tenue</em> Mart.</td>
</tr>
<tr>
<td><em>Lepidocaryum tenue</em> Martius</td>
<td><em>Geonoma multiflora</em> Martius</td>
</tr>
<tr>
<td><em>Geonoma paniculigera</em> Martius</td>
<td><em>Geonoma maxima</em> Mart.</td>
</tr>
<tr>
<td><em>Geonoma rectifolia</em>, n. sp.</td>
<td><em>Geonoma deversa</em> (Poit.) Kunth</td>
</tr>
<tr>
<td><em>Manicaria saccifera</em> Gærtner</td>
<td><em>Desmoncus polyacanthos</em> Mart.</td>
</tr>
<tr>
<td><em>Bactris pectinata</em> Martius</td>
<td><em>Bactris maraja</em> Mart.</td>
</tr>
<tr>
<td><em>Bactris elatior</em>, n. sp.</td>
<td><em>Bactris maraja</em> Mart.</td>
</tr>
<tr>
<td><em>Bactris macrocarpa</em>, n. sp.</td>
<td><em>Bactris simplicifrons</em> Mart.</td>
</tr>
<tr>
<td><em>Bactris tenuis</em>, n. sp.</td>
<td><em>Bactris simplicifrons</em> Mart.</td>
</tr>
<tr>
<td><em>Bactris simplicifrons</em> Martius</td>
<td><em>Bactris maraja</em> Mart.</td>
</tr>
<tr>
<td><em>Bactris maraja</em> Martius</td>
<td><em>Bactris hirta</em> Mart.</td>
</tr>
<tr>
<td><em>Bactris integrifolia</em>, n. sp.</td>
<td><em>Bactris gasipae</em> Kunth</td>
</tr>
<tr>
<td><em>Guillemia speciosa</em> Martius</td>
<td><em>Acrocomia aculeata</em> (Jacq.) Lodd.</td>
</tr>
<tr>
<td><em>Acrocomia lasiospatha</em> Martius</td>
<td><em>Astrocaryum murumuru</em> Martis</td>
</tr>
<tr>
<td><em>Astrocaryum gynacanthum</em> Martius</td>
<td><em>Astrocaryum gynacanthum</em> Mart.</td>
</tr>
<tr>
<td><em>Astrocaryum vulgare</em> Martius</td>
<td><em>Astrocaryum vulgare</em> Mart.</td>
</tr>
<tr>
<td><em>Astrocaryum tucuma</em> Martius</td>
<td><em>Astrocaryum aculeatum</em> G.Mey.</td>
</tr>
<tr>
<td><em>Astrocaryum jauari</em> Martius</td>
<td><em>Astrocaryum aculeatum</em> G.Mey.</td>
</tr>
<tr>
<td><em>Astrocaryum aculeatum</em> ? Meyer.</td>
<td></td>
</tr>
<tr>
<td><em>Astrocaryum acaule</em> Martius</td>
<td><em>Astrocaryum acaule</em> Mart.</td>
</tr>
<tr>
<td><em>Astrocaryum humile</em>, n. sp.</td>
<td><em>Bactris acanthocarpa</em> Mart.</td>
</tr>
<tr>
<td><em>Attalea speciosa</em> Martius</td>
<td><em>Attalea speciosa</em> Mart.</td>
</tr>
<tr>
<td><em>Attalea excelsa</em> (as mention in section about <em>A. speciosa</em>)</td>
<td><em>Attalea phalerata</em> Mart. ex Spreng.</td>
</tr>
<tr>
<td><em>Attalea spectabilis</em> (as mention in section about <em>A. speciosa</em>)</td>
<td></td>
</tr>
<tr>
<td><em>Maximiliana regia</em> Martius</td>
<td><em>Attalea spectabilis</em> Mart.</td>
</tr>
</tbody>
</table>
review, some herbarium-type specimens, including the Wallace and Bates collections, were transferred to the Herbarium at Kew. Many of these specimens are very large and are not easy to store, but all are invaluable scientific specimens. At times, even the best modern palm specimen does not contain all the information that a botanist might require because relevant parts have been trimmed to fit the curatorial method. Important features are often preserved in oversized specimens. For example, the Wallace and Bates specimens include entire inflorescences and large bracts, parts which would be otherwise unobservable without access to living material.

Wallace's contribution to knowledge of palms of the Amazon

It has been suggested that Wallace contributed little to the scientific study of Amazonian palms (Hooker 1854, Spruce 1855, Balick 1980). However, his contributions can be judged substantial in two areas; firstly, in the identification and naming of palm species new to science, and secondly, in the production of the first field guide to tropical palms.

In *Palm Trees of the Amazon*, Wallace identified 14 species as new to science and coined names for 12 of these (Table 2, column 1). Four of these names are still in use today, indicating that Wallace was the first scientist to name the species (Table 2, column 2). In the naming of plants, botanists adhere to the *International Code of Botanical Nomenclature* (Greuter et al. 2000), one of whose rules is that the scientific names coined first takes priority and takes precedence over names coined later – one reason for name changes in plants can be the finding of an older name. That four of Wallace’s new species are still known by the names he gave them testifies to his more than superficial knowledge of palm taxonomy. He was the first “botanist” to correctly identify the source of piassaba fibre, commonly used in brooms in Wallace’s day. He commemorated the palm’s native name in the scientific name he gave it – *Leopoldinia piassaba*.

Wallace relied heavily on the works of two German noblemen, Alexander von Humboldt (1818) and Carl von Martius (1823–1853). Humboldt, who with his companion Aimé de Bonpland, was the first great European explorer of the Rio Negro, and was fascinated by palms, though he never described any botanically. Martius was a Prussian botanist who explored Brazil at the behest of the Brazilian government (for a account of Martius’ importance to palm taxonomy see Henderson 1995); in his monumental work on Brazilian palms he described 85 species as new, 54 of which are still known by his names today (Henderson 1995). While in the Amazon, Wallace may have had a copy of Martius’ work, or at least had access to a copy – some of Wallace’s pencil sketches held at the Linnean Society of London have identifications in pencil, perhaps done in the field.

Wallace clearly knew about the details of palm identification, otherwise he would not have been able to accurately and correctly place species in genera. Today, when botanists describe new species, the rules of the Code (Greuter et al. 2000) say that a Latin diagnosis (distinguishing the new species from all others in the genus) and a type specimen designation must be provided. Thus, a single collection serves as the point of reference for the name, allowing all future botanists to examine unequivocally authentic material. In Wallace’s day, however, the International Code of Botanical Nomenclature did not exist (it came into being formally in 1905), and so type specimens were not required. Thus, the names he coined must be typified using authentic material, which in the case of these sorts of older names can either be an illustration or a specimen. Consequently, in the absence of any specimens directly named by Wallace, the illustrations in his *Palm Trees of the Amazon* (1853a) are the types of the names he coined. Palm taxonomists have usually referred to the lithographs in Wallace’s book as the types of his names (Henderson 1995), thus they become the lectotypes (a type designated by a later botanist, see Articles 8 and 9 of ICBN) and are the reference material tied to the species names (Fig. 3). The lithographs are thus important scientifically as lectotypes, but Wallace’s original drawings are more accurate and convey more clearly the palms themselves (see Fig. 2). Unfortunately, none of the palm specimens held at Kew relates to any of the taxa described by Wallace, so cannot serve as type material.

Wallace’s book *Palm Trees of the Amazon* (1853a) was not intended as a turgid botanical tome. His interest in palms was sparked in part by his interest in their uses by local peoples, and this relationship between people and palms is at the centre of the book. People then, as now, were interested in far-away cultures and peoples. Wallace was much more interested in ethnobotany than in botanical detail, and his descriptions of the uses of palms bring them alive, even today. In a way, Wallace’s little palm book was the first real field guide to palms, a popular book intended for the general public. Unfortunately, only 250 copies of the palm book were ever printed, making it among the rarest of books on Amazonian botany (Ewan 1992). Even though the book was reprinted (Wallace 1971), it is still difficult to obtain. Palms
are ideal organisms for field guides; large and stately, they are easily distinguishable from the rest of the forest foliage, and they have captured the imaginations of botanists and enthusiasts alike for centuries. The tradition of accessible books about palms begun by Wallace has continued, the field guides of Henderson, Galeano & Bernal (1995) and Kahn (1997) being the most recent examples from the Amazon region. The production of field guides for the non-specialist is more important now than ever before, as the biodiversity crisis deepens.

The Wallace and Bates specimens are far more than oversized museum curios. They are undeniably important as scientific specimens, but perhaps more significantly, they are rare physical remains of Wallace’s early development as one of the premier natural historian and biological thinkers of his age. His admittedly somewhat anecdotal account of the palms of the Amazon and their uses, written from memory due to the loss of his collections, can be considered to have begun a tradition of producing field guides to palms. Rather than being an amateur with little knowledge of the niceties of palm taxonomy, Wallace was ahead of his time in using palms to convey the importance and beauty of the Amazon forests themselves, something for which all palm enthusiasts can be grateful.

**Acknowledgments**

We thank the Council of the Linnean Society of London for permission to reproduce drawings held in their care; Gina Douglas of the Linnean Society of London for help in the library; the Natural History Museum Photographic Unit, especially Harry Taylor for taking photographs of the specimens at Kew; Kate Pickering for assistance in the Archives of the Royal Botanic Gardens, Kew; Sasha Barrow and Fred Stauffer for advice on the correct naming of Wallace’s palms; and John Dransfield for suggesting that we write this article.

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