



A view of the storage facilities at the Natural History Museum of Denmark. Parts of the P.W. Lund collection were stored here between 1963-2010.

REVISITING THE P.W. LUND COLLECTION

The Peter Wilhelm Lund Collection is a large and important Late Pleistocene collection of subfossil bone remains, primarily consisting of mammal bones from Minas Gerais, Brazil. Unearthed from limestone caves, the collection includes more than 50 mammalian type-specimens. The collection that today resides in the Zoological Museum, part of the Natural History Museum of Denmark is now being reexamined, digitalized and repacked. During this process, the most spectacular specimens have been reviewed and several forgotten specimens have been rediscovered. Also, in preparation for the future, newly discovered hair samples and coprolites are being evaluated for potential ancient DNA retrieval.

The Danish naturalist Peter Wilhelm Lund (1801-1880) is famous for having explored more than 800 limestone caves near the village of Lagoa Santa in the Brazilian State of Minas Gerais. In 60 of these caves he discovered substantial amounts of subfossil, Late Pleistocene bones, mainly from mammals. P.W. Lund was very diligent and thorough while working with the many bones and bone fragments from the caves, and he managed to identify more than 100 extinct species of mammals. Many of the species were new to science, such as the saber-toothed cat *Smilodon populator* and numerous types of ground sloths, all of which Lund was the first to describe and name. Very fittingly, P.W. Lund is often described as “The Father of Brazilian Paleontology”.

P.W. Lund’s scientific results were written down and sent home to Denmark as a series of articles on Brazil’s prehistoric fauna (*Blik på Brasiliens Dyreverden for sidste Jordomvæltning*, 1837-1846). In 1845 he donated his entire collection to King Christian the 8th of Denmark and today the collection is an important and integral part of the Quaternary Zoology Collections at the Natural History Museum of Denmark.



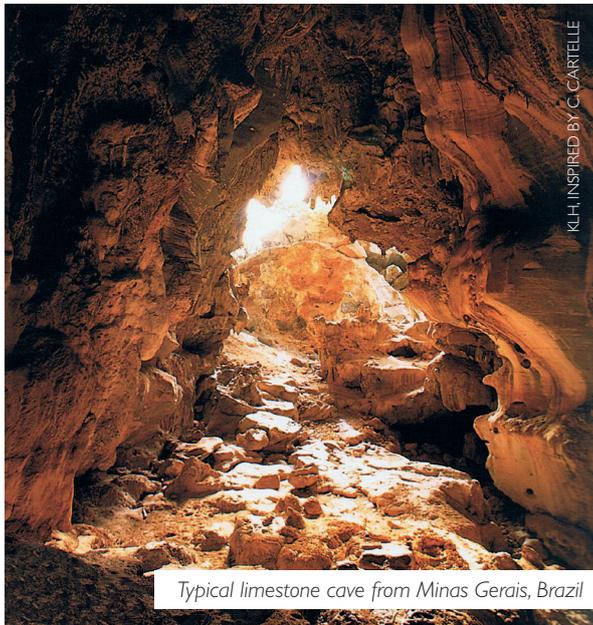
NATURAL HISTORY
MUSEUM OF
DENMARK

Peter Wilhelm Lund
(1801-1880)

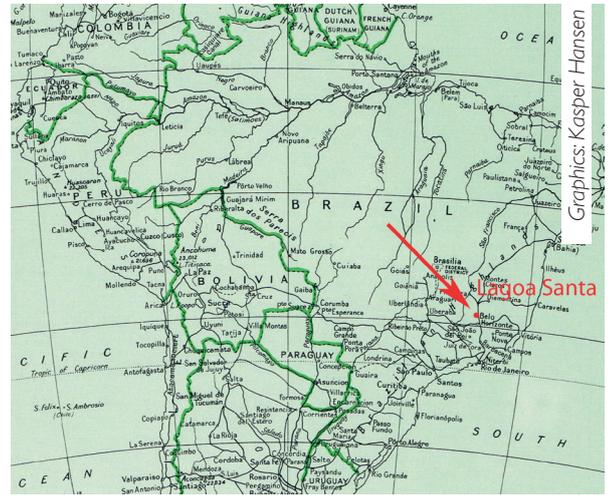
AUTEUR
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OVERVIEW OF THE COLLECTION

The P.W. Lund subfossil collection is vast and consists of more than 100.000 specimens, (bones and breccias of



Typical limestone cave from Minas Gerais, Brazil



The village of Lagoa Santa where P.W. Lund lived, is situated app. 400 km north of Rio de Janeiro in the State of Minas Gerais, Brazil. The limestone caves Lund investigated lay within a 40 km radius of Lagoa Santa.

Late Pleistocene age) and a further 2.000.000 smaller bones from samples of owl regurgitation. Many of the specimens suffer from fractures and/or missing parts and it is estimated that only 10% of the bones are more or less intact. Having been stored in relatively unprotected and outdated drawers and cabinets, all of the specimens are now being transferred to modern containers and protected with cotton wool. Apart from this repacking, the collection is also being digitalized. A new electronic database has been implemented for easier access and overview of the collection.

During the process of upgrading the collection, it has been interesting

to revisit some of the most famous specimens, as well as rediscovering some of the lesser known and all but forgotten items in the storage facilities of the museum. It is important to mention here, that the collection only has been on public display for a limited number of years in the middle of the previous century. Solely the museum's scientific personnel and visiting researchers can gain access to the collection on a daily basis. Here follows a description of some of the most spectacular and interesting specimens.

Smilodon populator

During his earliest excavations Lund discovered a very large canine. The

tooth was approximately 20 cm long but was missing the distal pointy end. Initially he thought that it originated from an extinct form of bear. Later, Lund changed his mind and speculated that the tooth originated from a giant hyena. Eventually, after more bones where uncovered, he settled for a new genus of saber-toothed cat. He named it *Smilodon populator*, the "scalpel-toothed destroyer".

Interestingly, the incomplete canine was pictured in one of Lund's articles, with a drawn silhouette of the imagined shape of the pointy distal end. After its publication Lund actually succeeded in finding the matching fragment and it fits his picture from the article



A sample of owl regurgitation



Canines and mandibles of *Smilodon populator*. Type specimen is the canine on the right.



Some of the human remains excavated by P.W. Lund in the Sumidouro cave systems.

perfectly. Today this type specimen is one of the main attractions of the collection.

Homo sapiens

Another important discovery by Lund was made in the Sumidouro cave systems. Here, the skeletons of 30 early humans in relatively good condition were found. Various specimens have been radiocarbon dated and their ages are between 7.580 to 11.260 years before present (calibrated). This places the members of the so-called Lagoa Santa race as some of the earlier humans in South America, but not among the initial colonizing groups that are several thousand years older.

Recently, an investigation into the morphological character traits of the skulls of 81 individuals from the Lagoa Santa race (including those of the P.W. Lund Collection), where combined with radiocarbon dating data (Neves & Hubbe, 2005). Somewhat surprisingly, the results suggested an

Australo-Melanesian origin and not the typical northern Asian origin normally associated with early human settlers of the Americas. Earlier investigations had hinted that this could be the case, but not until now had so many skulls been examined and compared. These fascinating results imply a parallel colonization of the New World and will hopefully spur on attempts to extract ancient-DNA from the human bones in the collection to further investigate this theory. Unfortunately the chemical composition of most of the specimens in the collection complicates this undertaking.

Edentata

This order of placental mammals that includes today's anteaters, armadillos, and sloths, was once the dominating group of large animals in South America. P.W. Lund excavated numerous bones, many of them broken or fragmented, from relatively many now extinct species of ground sloths and glyptodonts. Approximately one



1cm

Two very well preserved skulls of the Brazilian Horned Frog, *Ceratophrys aurita*.

third of the entire collections volume consists of various edentates.

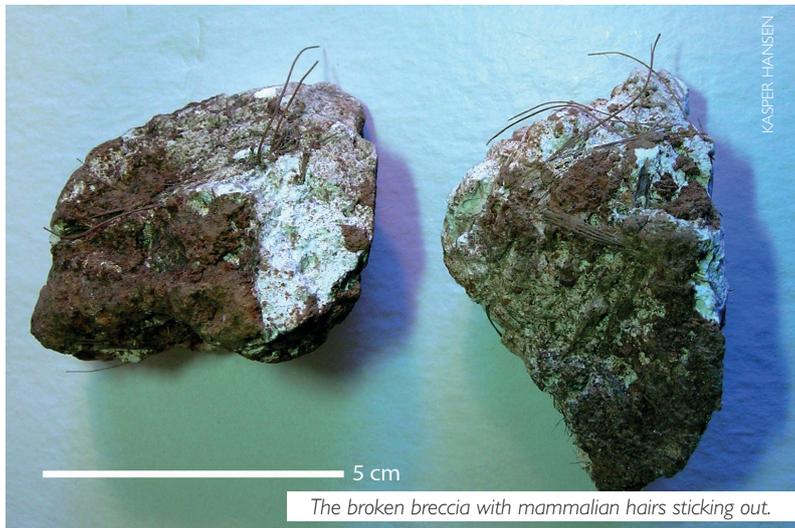
It is quite amazing to consider how difficult Lund's work with these animals must have been. Lund used George Cuvier's principles of comparative anatomy, but in Lund's time, only the large species of ground sloth *Megatherium* had been described and thus, Lund had virtually nothing to compare his bones with. And not only did he lack a comparative collection, but practically all his specimens were broken or shattered. Still, Lund's final list of 20 extinct species of edentates is impressive, albeit not without a few misidentifications.

Breccias

Lund's scientific methods also impress in other areas. For the sake of preserving samples of how the many bones were found in the hardened clay and limestone matrix in the caves, Lund collected 1.337 breccias. They were collected from the most



Recently rediscovered coprolites, possibly from a ground sloth.



The broken breccia with mammalian hairs sticking out.

often visited caves and contain bones representing a broad spectrum of species, such as Edentates, deer, capybara, peccary, rodents, marsupials, horned frogs, birds, snails and even humans.

Rediscovered reptiles, amphibians and fish

Some years after Lund had shipped his collection to Copenhagen, zoologist Herluf Winge (1857-1923) began studying the material. Winge published a five volume series of books named “E Museo Lundii” (1888-1915), describing all the mammals and birds of the collection. For various reasons, amphibians, reptiles and fish were never included in this work, and no articles have ever been published about them. One could say that they had been forgotten. Thus it came as quite a surprise when five dusty old drawers full of subfossil bones from snakes, crocodiles, frogs and freshwater fish were recently discovered.

Some of the rediscovered extant species included the voracious Brazilian Horned Frog *Ceratophrys aurita*. This colorful animal can reach

sizes of up to 15 cm long and 2 kg! The most numerous species represented was the Broad-snouted Caiman *Caiman latirostris*. Also found were boas, rattlesnakes, several lizards and catfish.

ANCIENT DNA IN HAIR AND COPROLITES

While handling the many breccias, one particularly fragile specimen suddenly fell apart and split into two pieces. On closer examination thirty hair-like threads were revealed as the culprits of the weakness in this otherwise solid breccia. Under magnification the long structures were identified as quite thick hairs, approximately 2-3 cm long. This finding is unique for the Lund collection – no other hairs have emerged.

With regards to extracting ancient DNA, these hairs could potentially yield some information on the origins of a ground sloth or other extinct mammal, since hair is a relatively effective medium for conserving DNA.

Another potential source for DNA extractions are coprolites (fossilized excrements). Lund himself mentions excrements from a ground sloth that he collected, and these have been located recently. Hopefully they can be

analyzed sometime in the not so distant future.

THE NEW MUSEUM AND THE FUTURE OF THE P.W. LUND COLLECTION

In 2004 the Natural History Museum of Denmark was created by merging the Botanical Gardens, the Botanical Museum, the Zoological Museum, and the Geological Museum - all parts of the Copenhagen University, Denmark (www.snm.ku.dk). It is the ambition to build a new joint “mega-museum” in the Botanical Gardens within the next 6-7 years, depending on funding. The museum’s leadership has appointed the P.W. Lund Collection as one of dozen key elements to be put on permanent display in this new museum.

Regarding scientific research, the future of the collection could develop along several paths. One of the more obvious paths is the extraction of ancient DNA from human and other mammalian specimens. But also a study of the vast amounts of owl regurgitation could almost certainly reveal new species of rodents. Or the bones in the breccias could be freed from their hardened matrix for further examination. Last but not least, new publications on the rediscovered reptiles, amphibians and fish are one of the personal ambitions of this author.

All in all, the future of this magnificent collection looks bright.

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- Neves, W. A., M. Hubbe (2005) Cranial morphology of early Americans from Lagoa Santa, Brazil: Implications for the settlement of the New World. *PNAS* vol. 102-51, 18309-18314.
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A look at part of the collection in new cabinets and boxes after digitalization and repacking.

NEDERLANDSE SAMENVATTING

De Peter Wilhelm Lund Collectie is een grote en belangrijke collectie van subfossiele Laat-Pleistocene faunaresten, die grotendeels bestaat uit zoogdierresten uit Minas Gerais, Brazilië. De resten zijn in krijtsteengrotten opgegraven en bevatten meer dan 50 zoogdiertype-exemplaren. De collectie is gehuisvest in het Zoölogisch Museum, onderdeel van het Natuurhistorisch Museum van Denemarken en wordt opnieuw bekeken, gedigitaliseerd en verpakt. Gedurende dit proces zijn de meest spectaculaire exemplaren herbekeken en een aantal vergeten exemplaren zijn herontdekt. In voorbereiding op verder onderzoek worden van nieuw ontdekte haarmonsters en coprolieten bekeken of ze geschikt zijn voor oud-DNA analyse.