Iguanodon 2.0

Shepherding the “Belle-Epoque” Bernissart Iguanodon collection into the 21st Century

DURATION
15/03/2021 – 15/03/2025

BUDGET
794 488 €

PROJECT DESCRIPTION

In 1878, the now world-famous Bernissart mine produced one of the greatest palaeontological discoveries ever: more than 25 complete and articulated skeletons of the dinosaur Iguanodon. As the first complete skeletons ever discovered, they gave scientists and the public an impressive demonstration of what dinosaurs really looked like. As early as 1878, the Bernissart treasure became a major asset of the Belgian scientific patrimony and was entrusted to the care of the Belgian State and deposited at the ‘Musée royal d’Histoire naturelle de Belgique’ (MRHNB: now, Royal Belgian Institute of Natural Sciences, RBINS) in Brussels. The astonishing array of Iguanodon skeletons remains one of the most impressive displays of dinosaurs worldwide, and the main attractor for visitors in the RBINS Museum.

Despite their huge size and robust morphology, the skeletons of the Bernissart Iguanodons are extremely fragile. After their death around a swamp 125 million years ago, carcasses were rapidly covered by clay sediments and their decomposition occurred in an oxygen-free environment. In such conditions, sulphate-reducing bacteria produced hydrogen sulphide by hydrolysis of the organic matter present in this environment, and its combination with detritic and biologic iron led to the crystallization of abundant pyrite in bone pores. In contact with damp air, the pyrite oxidises and inevitably led to the disintegration of the surrounding bone. As soon as the bones were extracted from the Bernissart pit, this process led to their embrittlement. Once they arrived in Brussels, the bones were impregnated with a carpenter’s glue-based gelatine and the pyrite was systematically curetted from the bones.

From 1902 onwards, the whole Bernissart exhibition was permanently installed in the newly constructed Janlet Wing of the Musée royal d’Histoire naturelle de Belgique. Eleven complete specimens were exhibited in a lifelike gait, while twelve more-or-less complete and eight fragmentary individuals were displayed in situ within the rock matrix.

Between 1933 and 1937, all the skeletons were dismantled to treat important damages resulting from 30 years of exposure to varying temperatures and humidity sustained as museum exhibits. From 2004 until 2007, all the Iguanodon skeletons were again completely restored. On that occasion, the RBINS realized that previous restoration campaigns, at the end of the 19th century and in the 1930’s had not been documented, which led to an uncomfortable feeling of working in the dark.
The present project aims at ensuring the long-term preservation and storage of this unique and fantastic collection, while augmenting its scientific value, and rejuvenating its potential for science communication. We will use a battery of cutting-edge methods to understand the nature and extent of past restorations, evaluate the current physical integrity of the specimens, propose a new and consistent protocol to monitor, and carry out the first digital restoration of the Bernissart Iguanodons.

We propose:

(1) Detailed, macro and micro-scale 3D cartographies of selected specimens to identify the restored zones, the preferential accumulation areas of pyrite inside the bones, and the restoration techniques used from the end of the 19th Century; for this we will use X–ray imaging, CT and µCT scans.

(2) Palaeohistological analyses of the fossilized bone tissue using non-destructive methods (micro- and nano-CT scans) for assessing nano-scale damage caused by pyrite and its derivative minerals to the bone microstructure. To document restoration techniques used at various times in history, and catalogue the damage done by pyrite decay, high resolution (25 µm) major and trace element geochemical maps will be produced with non-invasive and non-destructive techniques such as micro-X-ray fluorescence (µXRF), Laser induced breakdown spectroscopy (LIBS) and Infrared spectroscopy coupled atomic force microscopy (AFM-IR).

(3) In parallel with (2), full quantitative geochemical characterization of the 'fresh' and treated bones, using XRD and infrared spectroscopy (FTIR, AFM-IR) will be carried out, using XRD and FTIR spectroscopy. Also coupled with virtual histological analyses, an investigation into whether the different treatments really stabilized the bone microstructure and the damages done by pyrite will be conducted.

(4) A bone prosthesis protocol, where large and heavy bones will be surface scanned, retro-deformed where necessary and 3D printed in their accurate in-vivo shape. Protheses and retro-deformed bones will be 3D printed and added to exhibit specimens to ensure optimal conservation of bones at risk and maintain the public displays.

(5) Identification of the preferential fragility zones in the fossilized Iguanodon bones. The data from the CT, µCT scans, and surface scans will be subjected to mechanical numerical modelling. These analyses will be used to identify preferential fragility zones in the Bernissart Iguanodon skeletons, to be treated in priority by further restoration programs. This approach will lead in the future to more targeted and focused conservation measures.

(6) Those analyses will serve to establish a preventive and curative conservation protocol to ensure the long-term preservation of the entire Bernissart collection, which also contains dozens of turtles, crocodiles, fish, and plants. In the same time, fragilized Iguanodon bones will be moved to safer repositories and replaced by printed 3D models. This project will establish a benchmark for curative conservation of dinosaur skeletons across the globe.

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LINKS