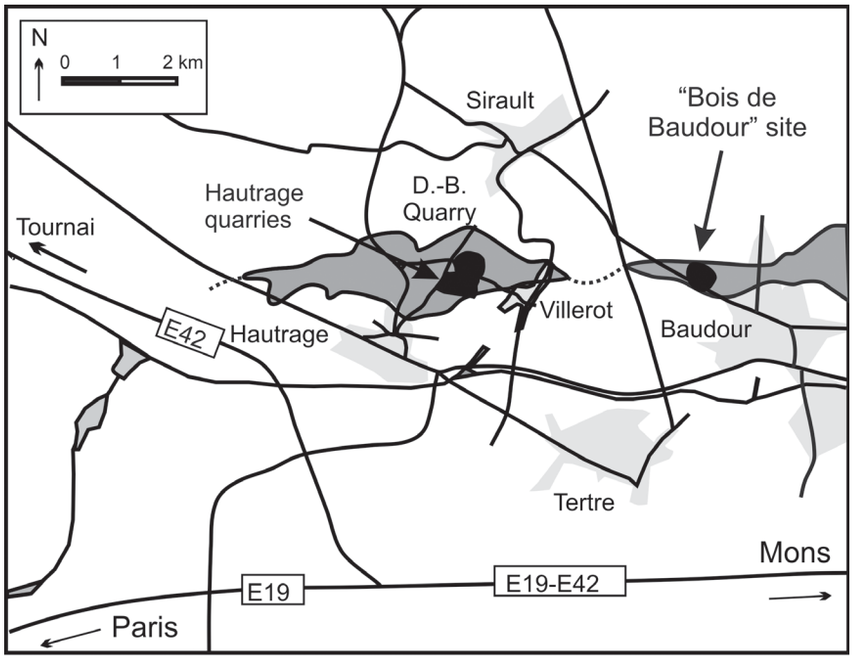


13.1. Location of the "Bois de Baudour" site (modified from Spagna, 2010).

Early Cretaceous Dinosaur Remains from Baudour (Belgium)

13

Pascal Godefroit*, Jean Le Loeuff, Patrick Carlier, Stéphane Pirson, Johan Yans, Suravech Suteethorn, and Paul Spagna

We describe two dinosaur bones found in the Bois de Baudour clay quarries (Mons Basin, Belgium) of the Baudour Clays Formation (middle Barremian to earliest Aptian) during their exploitation period. Apart from the numerous skeletons found in the Sainte-Barbe pit at Bernissart, these are the only dinosaur fossils discovered in Wealden deposits in the Mons Basin. The first bone is a left coracoid that can confidently be attributed to the ornithopod *Iguanodon bernissartensis*. The second bone is a left tibia belonging to an indeterminate sauropod. This is the first sauropod bone from Cretaceous deposits in Belgium. Recent drillings in the Baudour Clays Formation at Bois de Baudour suggest that the Baudour and Hautrage areas were probably parts of the same floodplain environment. A bone fragment, probably a fragment of a vertebral centrum, was found in the drilling core about 14 m below the ground surface. Paleoecological conditions in the Baudour and Hautrage formations were apparently not favorable at all for the preservation of in situ complete skeletons, like those from the Bernissart Sinkhole. However, drilling through a bone does suggest a high concentration of fossils.

Introduction

Although vertebrate fossils are extraordinarily abundant in the Sainte-Barbe Clays Formation from the Iguanodon Sinkhole at Bernissart, they have never been described from other Wealden deposits in the Mons Basin, although clay quarries were—and are still—intensively exploited in this area from the nineteenth century.

Here we describe two dinosaur bones discovered at Bois de Baudour (Fig. 13.1). Small clay quarries were actively exploited in this area during the twentieth century for their aluminium-rich clay content, mainly intended for the manufacture of bricks, ceramics, and refractories (Fig. 13.2). Nowadays the exploitation is totally abandoned, and the site, covered by forest and lakes that mark the flooded former clay pits, is protected by regional authorities as a zone of biological interest.

In 1952, a worker discovered a fossil bone about 10 m below the ground surface in the Degand-Dutalys clay quarry in Bois de Baudour. Victor Degand, the owner of the quarry, was aware of the importance of the paleontological discoveries at Bernissart and kept this precious bone in a shed of his house at Sirault, believing that it belonged to an *Iguanodon*. After his death in 1983, the bone was kept at Jemeppes-sur-Sambre in the garage of his daughter, Anne-Marie Dufrane-Degand, where it was used for blocking

13.2. Exploitation of the Baudour Clays Formation in the Dutalys quarries at "Bois-de-Baudour" (Belgium). From Casier (1978).

a window. From 1995 to 1999, Patrick Carlier, the son-in-law of Anne-Marie Dufrane-Degand, exhibited the fossil in the local museum of Sainte-Croix and Notre-Dame College in Hannut. Since 1999, this specimen is housed in the Paleontological collections of the Royal Belgian Institute of Natural Sciences (RBINS), under the catalog number RBINS R267.

A second dinosaur bone (RBINS R268), with the label "Wealdien de Baudour (Hainaut)," was found in the Coupatez-Wouters collections, also housed in the paleontological department of the RBINS. Unfortunately, the circumstances of the discovery of this fossil remain unknown. However, the preservation and patina of this bone are nearly identical to those of RBINS R267, so it is likely that this fossil also comes from a clay quarry at Bois de Baudour.

Geological Context

Geological information from the active exploitation period of the clay quarries at Bois de Baudour is limited. Some indications in the publications of Cornet (1927) and Casier (1978) simply confirm the presence of black, gray, white, and reddish clays (this latter Fe-rich clay was named *bolus* by the exploiters) in the exploited raw materials.

In their recent stratigraphic synthesis, Robaszynski et al. (2001) define the Baudour Clays Formation, formerly outcropping in the Bois de Baudour quarries, as one of the three Wealden formations in the western part of the Mons Basin, the two other being the Hautrage Clays Formation (Hautrage) and the Sainte-Barbe Clays Formation (Bernissart). These formations have been recently dated by matching palynological and geochemical

Unit	Depth (m)	Lithological description
1	0 to 7.4	Packing
2	7.4 to 10	Dark brown clay, becoming lighter and silty at the bottom
3	10 to 11.7	Whitish fine sands and thin brown clayey layers alternation
4	11.7 to 13.5	Light brown and dark gray variegated clays, with pyritized wood fragments; indurated centimetric level at the bottom
5	13.5 to 14.7	Dark gray sandy clays, rich in lignite and wood fragments, with one bone fragment (Fig. 13.4)
6	14.7 to 19.8	Light gray silty clay
7	19.8 to 21	Light gray clay rich in millimetric nodules of siderite
8	21 to 23.5	Brownish clay to light gray silty clay

Table 13.1. Lithological content of the BAUD1 borehole

Note: From Spagna (2010).

studies as middle Barremian to earliest Aptian (Dejax et al., 2007a, 2007b, 2008), the Sainte-Barbe Clays Formation being most probably younger than the Hautrage Clays Formation (Schnyder et al., 2009; see Chapter 8 in this book).

In 2003, the Faculté Polytechnique de Mons (Belgium) and the Bureau de Recherches Géologiques et Minières (France) dug an auger drilling (called BAUD1) at Bois de Baudour. More than 20 m of the Baudour Clays Formation succession were crossed and studied on this occasion (Table 13.1 and Fig. 13.3).

The few lithological data collected from the Baudour Clays Formation series were compared with the more extensive observations on the Hautrage Clay Formation (see Chapter 9 in this book) and suggest that the Baudour area was part of the same floodplain environment. Should a lithological continuity between both sites be attested, the BAUD1 sediments could probably be compared with those at the transition between units A and B or those from the units C to E interval at Hautrage.

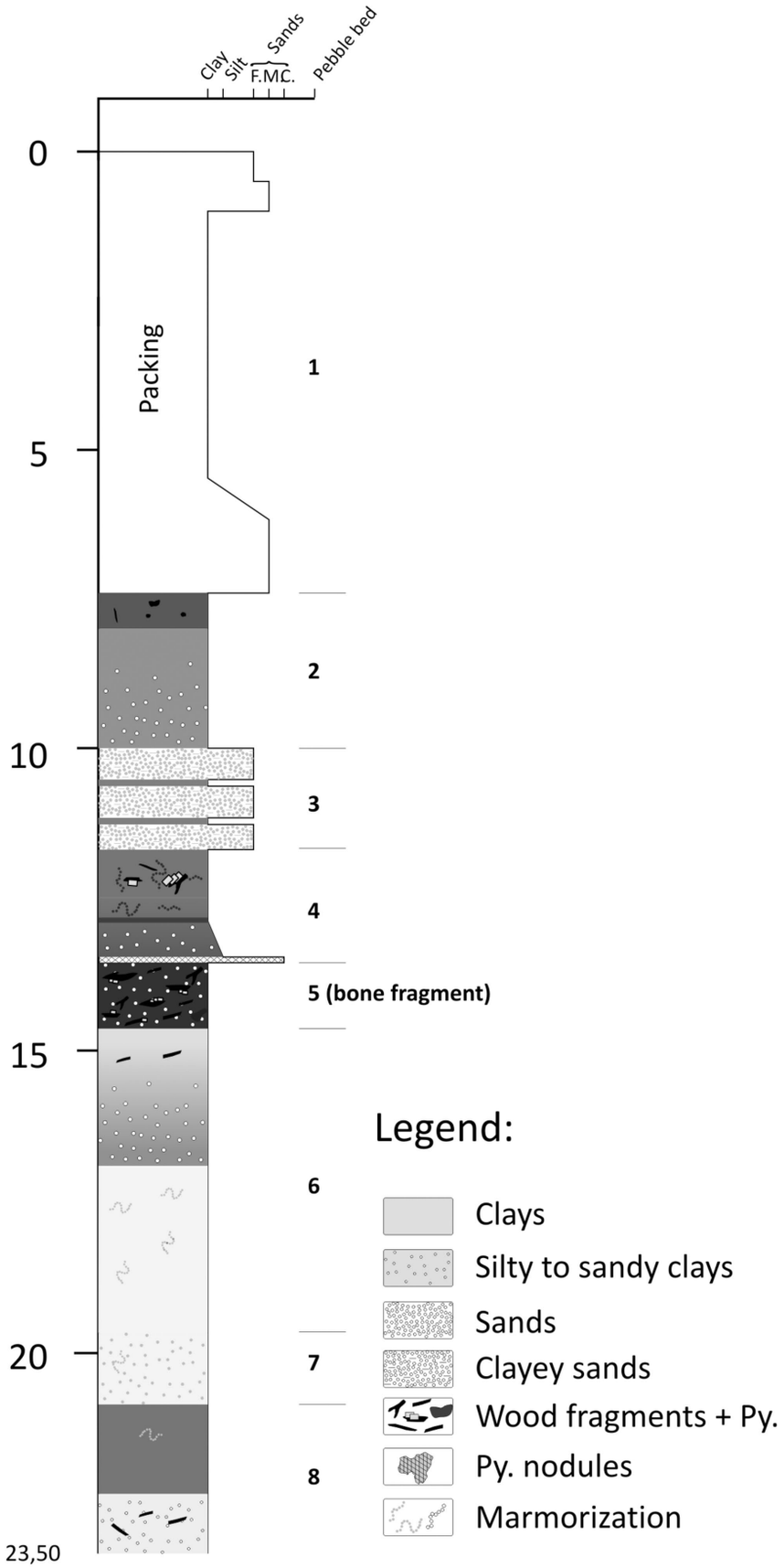
A fragmentary bone was found in the drilling core, about 14 m below the ground's surface (Fig. 13.4). The important expansion of cancellous bone and the thin cortical bone suggest that this fragment belongs to the vertebral centrum of a large vertebrate. The sandy composition of the sediments around this bone seems typical for a channel environment deposit, and it is therefore likely that this fossil was transported. The chances of having touched an in situ complete skeleton during this drilling are consequently quite small. However, this discovery might reveal the presence of a bonebed accumulation in the Baudour Clays Formation.

Dinosaur Remains from Baudour

Iguanodon bernissartensis Boulenger in Van Beneden, 1881

RBINS R268 is a massive and dish-shaped element. On the dorsal edge of the coracoid, the suture with the scapula is straight, thick, and rugose. The coracoid foramen forms a notch positioned on the caudal portion of the scapulocoracoid suture in lateral view. The lower half of the glenoid forms a wide and cup-shaped depression at the caudal end of the scapulocoracoid suture. Beneath the glenoid, the caudal edge of the coracoid is embayed, and at the junction with the cranial edge, it forms a blunt hooklike process. The lateral side of the coracoid is marked by a large muscle scar for Musculus costo-coracoideus along the caudoventral embayment. The cranial

13.3. BAUD1 lithological log (modified from Spagna, 2010).



edge of the coracoid is convex and rugose. At midheight, it is notably thickened by a raised ridge on the lateral surface of the bone, which probably articulated against an ossification in the sternal cartilage (Norman, 1980).

RBINS R268 is identical in size and morphology to the left coracoid of the ornithopod *Iguanodon bernissartensis* Boulenger *in* Van Beneden, 1881 (Fig. 13.5). Because *I. bernissartensis* is particularly abundant in the neighboring and contemporaneous Sainte-Barbe Sinkhole at Bernissart (24 more or less complete skeletons, as well as several partly preserved individuals), it can confidently be referred to this taxon.

Sauropoda indet.

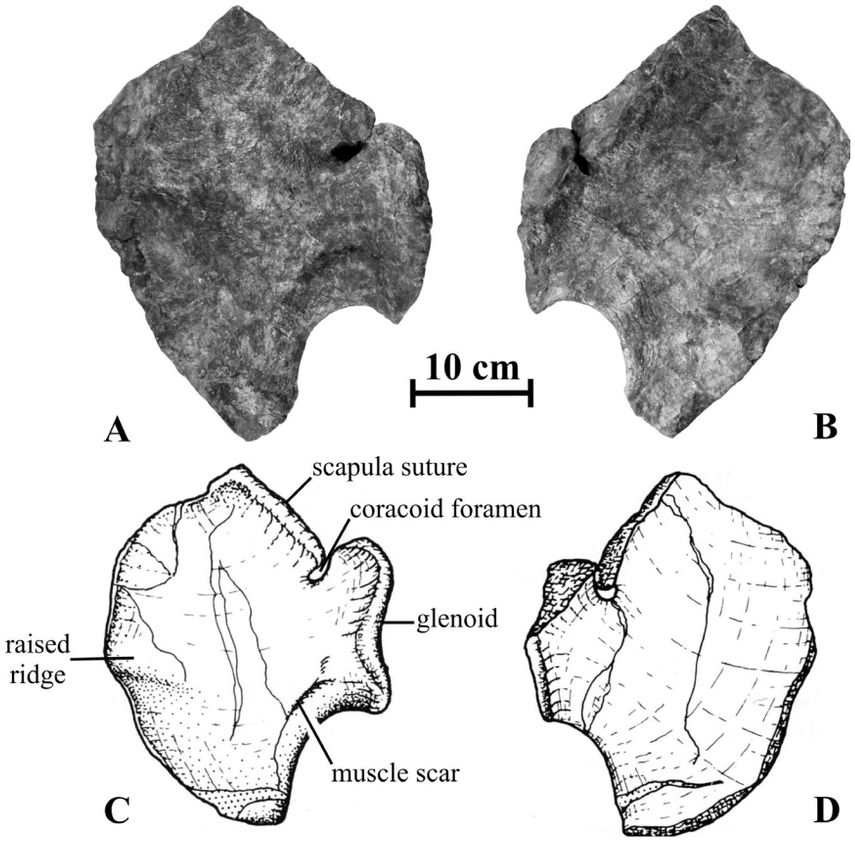
RBINS R267 is a left tibia with incompletely preserved proximal and distal ends (Fig. 13.6). It is a straight bone with a cranially well-developed cnemial crest (C/D = 0.9: cf. Royo Torres, 2009). The bone is rather slender with a tibial robustness index of 0.21 and a distal tibia robustness index of 0.14. In lateral view, the cnemial crest is located in the upper third of the bone. It is triangular in shape, but its proximal end is not preserved. In cranial view, a sharp crest runs distally from the basis of the cnemial crest and stops some centimeters before the distal end. Distally, the craniolateral process for the articulation of the fibula is preserved, but the caudolateral process is broken off. Thus, the caudal part of the distal extremity is missing. However, the articular surface for the ascending process of the astragalus can be observed.

In Europe, Barremian–Aptian sauropods are mostly known from fragmentary material, with the exception of *Tastavinsaurus sanzi*, a sauropod from the Early Aptian of Spain recently referred by Royo Torres (2009) to the new clade Laurasiformes. Laurasiformes include *Aragosaurus* (Aptian of Spain) as well as the Early Cretaceous American genera *Cedarosaurus* and *Venenosaurus*. Other sauropods from the same time interval in Spain include a rebbachisaurid (Pereda-Suberbiola et al., 2003) and Titanosauriformes. The Wessex Formation of England (Barremian) has also yielded an abundant sauropod assemblage with various Titanosauriformes, putative diplodocids and camarasaurids as well as rebbachisaurids (see Mannion, 2009). Although the general aspect of the tibia is reminiscent of some Titanosauriformes more than of diplodocids and camarasaurids, the available material from Baudour is too fragmentary to warrant a precise identification, and we regard it as an indeterminate Sauropoda.

13.4. Bone fragment found during the drilling in Bois de Baudour.

Conclusions

Two dinosaur bones were unearthed during the exploitation period of the Bois de Baudour clay quarries. The first one is a left coracoid that undoubtedly belongs to the ornithopod *Iguanodon bernissartensis*, known by more than 24 complete skeletons in the neighboring and contemporaneous Sainte-Barbe Sinkhole at Bernissart. The second one is a left tibia that belongs to an indeterminate sauropod. This is the first sauropod specimen from Cretaceous deposits in Belgium, and the second sauropod fossil from Belgium (one isolated tooth was described from the Upper Triassic of Habay-la-Vieille; Godefroit and Knoll, 2003). A fragment of bone, probably the vertebral centrum of a large vertebrate, was found about 14 m below



13.5. Left coracoids of *Iguanodon bernissartensis* in lateral (A, C) and medial (B, D) views. A, B, Photographs of RBINS R268, from the Wealden of Bois de Baudour. C, D, Interpretative drawings of RBINS R51 (holotype of *I. bernissartensis*) from the Iguanodon Sinkhole at Bernissart (modified after Norman, 1980, fig. 53).

the ground surface on the occasion of a recent drilling campaign. During Wealden times, the Baudour and Hautrage areas were probably parts of the same floodplain environment. These paleoecological conditions were apparently not at all favorable for the preservation of complete in situ skeletons, as in the Iguanodon Sinkhole. Indeed, vertebrate fossils are extremely rare in the Baudour and Hautrage clay quarries, although they were intensively exploited during the twentieth century and the quarrymen were aware of the importance of the paleontological discoveries at Bernissart.

Acknowledgments

The authors are grateful to E. Buffetaut for reviewing this chapter and T. Hubin for the photographs of the specimens.

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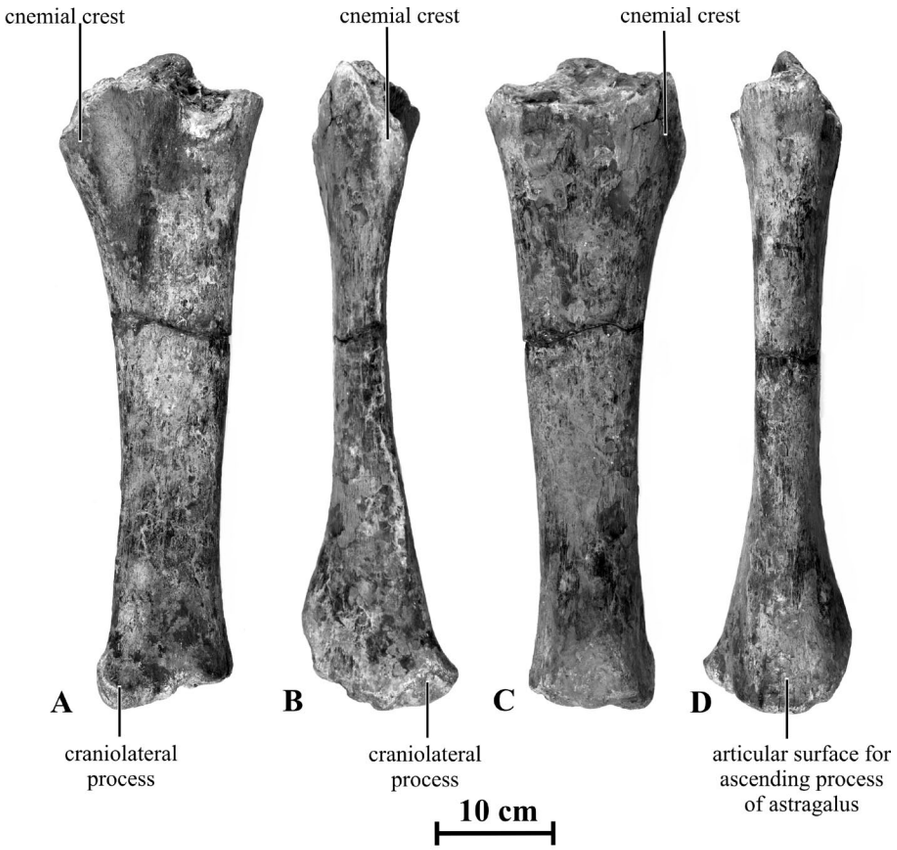

13.6. Left tibia of Sauropoda indet. from the Wealden of Bois de Baudour in lateral (A), cranial (B), medial (C), and caudal (D) views.

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