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FIRST NOTE ON THE DINOSAURS OF BERNISSART

BY

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Plate IX.

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Named by the Director of the Musée Royal d'Histoire Naturelle to study the fossil bones recovered at Bernissart [1], notably the *Iguanodon*s, I will provide as complete a monograph as possible on the osteology of these animals at an opportune time. For the moment, I will restrict myself to a series of preliminary communications, whose object will be not to ignore any longer the treasures discovered by Mr. Fagès, which the generosity of the Council of Coal Administration of Bernissart has placed at our disposition.

However, before entering into a detailed description of our dinosaurs, I will have to research first whether there exists one or more forms among them. This research, which, in the entire study, is imposed the first rank on the naturalist, is the more necessary here, because on the one hand, the bones were found in the same locality and are intermixed, at least in appearance [2], and on the other hand, the material has already given cause for controversy [3].

But, in examining the materials whose preparation is currently finished, materials that include no fewer than fifteen individuals beyond the twenty-eight that have been extracted, the presence of two forms is clearly manifested. I continue therefore to demonstrate:

1st, that the taxonomic difference between these two forms is of specific value;

2nd, that one of them is identical with the classic species, *Iguanodon mantelli*;

3rd, that the other is clearly a new species, at the same time it has been recognized by Mr. G. A. Boulenger, who has proposed the name *I. bernissartensis* for it [1];

4th, finally, in as exact a manner as possible, I will determine the position that it is proper to give the genus *Iguanodon* within the order *Ornithopoda* [2].

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[1] On the circumstances of this discovery and for the stratigraphic part, see: É. DUPONT, *Sur la découverte d'ossements d'Iguanodon, de poissons et végétaux dans la fosse Sainte-Barbe du Charbonnage de Bernissart* (BULL. DE L'ACAD. ROY. DE BELG., 2nd Series, vol. XLVI, p. 387, 1878).

[2] I say in appearance because Mr. Dupont has demonstrated that there are several bone-bearing levels (*loc. cit.*). I come to learn, moreover, that this work will ultimately be completed by graphic documents on the distribution of the animals in the beds.

[3] G. A. BOULENGER, *Sur l'arc pelvien chez les Dinosauriens*. Report of Mr. P. J. Van Beneden (BULL. DE L'ACAD. ROY. DE BELG., 3rd Series, vol. I, p. 600, 1881).

[1] G. A. BOULENGER, *in* P. J. Van Beneden, *loc. cit*., p. 606.

[2] O. C. MARSH, *Amer. Journ. of science (Silliman)*, vol. XXI, p. 423, 1881; vol. XXIII, p. 84, 1882.

I.

At first the definitions of the two forms.

The first, whose total length is around 6 meters, is remarkable for its gracility. The second, in contrast, is much more massive in all its proportions and measures nearly 10 meters from the muzzle to the end of the tail. For the comvenienve of language and in order not to prejudge anything, we will call one "*large form*" and the other "*small form*".

The *skull* of the small form is much more elongate than that of the large; as a result, whereas in the latter its length is only double its height, it is triple in the former. Furthermore, the *nares*, which in this project over two-thirds of the lower jaw, in the other have only a projection equal at most to one-third. Finally, the *orbit*, which in the small form has its large diameter horizontal, has this same diameter vertical in the other. This disposition has the result that the temporal fossa, largely open in the latter, is reduced nearly to a cleft in the small form.

The *scapula* of is more slender and elongate in the large form. Thus, whereas the minimum width is contained more than eight times in its maximum length in the former, there are hardly six times in the second.

The *coracoid* of the small form is pierced by a foramen closed laterally by a suture, whereas the corresponding bone of the other offers a notch in its place. Further, the coracoid of the large form is evident on the posteroexternal side, so as to constitute a sort of peduncle with which it articulates with the sternum. In contrast, the posterior border of the coracoid of the small form is sensibly round.

The *sternum*, which consists of two symmetrical plates, also presents some differences. Its plates are wider and more indented interiorly in the large form.

The *forelimbs*, which in the small form represent a little more than half the hindlimbs, attain two-thirds of them in the other form. The *humerus* is relatively more elongated in the latter. The forearm does not present notable differences. As to the *manus*, it is contained at least four times in the total length of the forelimb for the larger, but nearly five times in the small. In other terms, the small form has more reduced forelimbs and a proportionally longer manus. The pollex has its ungual phalanx transformed into a sort of *spike* in both, but whereas it constitutes nearly half the longest digits in the large form, it only represents hardly a third in the small. Finally, whereas the metacarpals of the first have a subquadrangular cross-section, those of the second are laterally compressed, therefore indicating a relatively more slender manus.

The sacrum of the small form is composed of five vertebrae; that of the large six. It is well known that here they are true sacral vertebrae and not lumbars or caudals synostosed with the sacrum, as happens frequently enough [1].

The *pelvis* shows considerable differences. Thus, the ilium of the large form has a preacetabular projection equal to about one third of its total length. In the small form, in contrast, this projection forms nearly half the ilium. The pubis [2], which in the latter is short, thin and very elevated, is in the other long, massive and straight. This results in the following figures:

Maxiumum dimensions of the pubis.

	Small form.	Large form.
Length (from the blade to the acetabulum)	400 mm	700 mm
Height	200	170
Thickness	10	40

To finish, I note two more differences in the *hindlimbs.* The third trochanter, which in the large form is situated on the lower third of the femur, is elevated to the middle of this bone in the small. Finally, the *tibia* of this is proportionally longer.

All these divergences are moreover brought clearly into evidence by the plate that accompanies the present note.

Now what is the taxonomic value of these divergences? Three hypotheses are possible in this regard:

1st, either the small form is a young animal of which the large represents the adult stage;

2nd, or we find ourselves in the presence of either sexual or individual variations;

3rd, or we are concerned either with two distinct species, or two genera.

1st. I do not believe that it is possible to admit that there were young animals among the dinosaurs of Bernissart. It seems to me, on the contrary, that all are quite adult and here is why:

a) in *all* indistinctly the cranial sutures are obliterated;

b) the neurocentral suture of the vertebrae has equally disappeared;

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[1] O. C. MARSH, *Amer. Journ. of science (Silliman)*, vol. XXI, 1881; *American Jurassic Dinosaurs*, pl. VII, *l*, *l'*, and pl. XVI, *l*. M. Boulenger had equally noted a caudal sutured to the sacrum in his manuscript note.

[2] It has been argued, in these recent times, on the significance of different parts of the pelvis in reptiles. Not having any point in my possession, at least with regard to the present, elements capable of advancing the question, it seems useless to me to insist here on the works of Mssrs. Huxley, Gorski, Fürbringer, C. K. Hoffmann, Bunge, etc. I adopte temporarily the terminology of Marsh and designate like him under the name pubis the part situated in from of the acetabulum, reserving for the postacetabular portion the name postpubis. (O. C. MARSH, *Amer. Journ. of science (Silliman)*, vol. XVI, p. 415, 1878 and vol. XVII, p. 90, 1879.)

c) the bony tissue is dense in the two forms;

d) as I said above, the coracoid of the small form is pierced by a foramen about 15 millimeters from the border. Nevertheless, it is still easy to see that this foramen communicates laterally with the exterior while at a young age. In the large, inversely, there is no foramen but an indentation. If thus the transformation of the latter into a hole limited on all sides by the bony substance indicates a development of age, the small form would be more adult than the large, which excludes the idea of making it the young.

The large form therefore cannot represent the adult stage of the small.

2nd. Are we in the presence of individual or sexual variations? I do not think so any longer.

Individual variations. — Our large form is represented by a considerable number of animals and they offer remarkable divergences among them. Thus, one draws attention by its enormous size; another by the more or less great development of its spike; another still by its humerus a little longer or shorter than its neighbor's, etc.... In a word, here we observe variations analogous to those which are encountered today in individuals forming part of a single species. But, if we take, on the one hand, the two most different individuals of the large form and compare them to those of the small, we see that the variation that exists between the former is nothing in the presence of the distance that separates these latter. *In particular, we do not note a change in the number of sacral vertebrae.* This fact seems important because a great authority, Mr. P. J. Van Beneden, made known only individual differences in the variation of the number of these vertebrae. Here, moreover, how it is expressed in this respect [1]:..."the vertebrae vary frequently in the different regions of the body and above all in the sacral region; and, what is more, (that) this number increases in a normal manner in the class of Aves by addition of lumbar and caudal vertebrae. Instead of making distinct species, we say, along with diverse paleontologists, that the vertebrae of the sacrum of dinosaurs vary between four and six."

It seems to us that these anatomical data are not likely to receive as general an application as the wise professor of Louvain would like. In effect, if the number of vertebrae is subject to great variations in certain animals (ophidians, for example), in others this number is remarkably constant (anuran batrachians). With regard to the sacral vertebrae, if they are highly variable in birds, they are in contrast much less so in living reptiles. This proves to us simply that the number of vertebrae, or more generally any character whatsoever, cannot offer importance in a given group and have an extreme in another. Can not, with just reason, a *subclass* be founded to receive the *Odontornithes* [1], when among mammals one sees edentate forms placed in the same

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[1] *Op. cit.*, p. 607.

[1] O. C. MARSH, *Odontornithes: A monograph on the Extinct Toothed Birds of North America. Exploration of the 40th Parallel.* Vol. VII, p. 187, 1880.

order with others very richly toothed without (cetaceans, edentates) without the least protestation raised?

To return to our dinosaurs, we say:

a) that these animals were not birds but reptiles, thus it is to the latter that it will be preferable to compare them, and we have seen above that the number of sacral vertebrae is very constant in reptiles. It was thus necessary to infer that this number must be equally so in dinosaurs, rather than to take the inverse deduction;

b) that when the lumbar or caudal vertebrae are synostosed with the sacrum, it is always easy to distinguish them in dinosaurs [(2)];

c) that professor Marsh, who in the case of dinosaurs handled "several hundred individuals, many of them well preserved, and representing numerous general and species" [(3),] and who in this manner was in a position to study individual variations in these reptiles, used, among other characters, the number of sacral vertebrae to distinguish *genera* [(4)];

d) that another specialist, regarding the group with which we are occupied, Mr. J. W. Hulke, accorded the value of a specific disintction to the reduction of the number of sacral vertebrae [(5)];

e) that we cannot understand how the number six would be conserved in a constant manner among the individuals of our large form, and drop abruptly to five in the small. It seems to us that whatever animal, among the first, should well have offered either five or seven sacral vertebrae if here it was a matter of individual variations, which it does not.

It is therefore not possible to explain the two forms among the dinosaurs of Bernissart by individual variation.

Sexual variations. — By which characters are sexual differences indicated, in general, in the skeleton? It seems to us to be able to fall under five chief principals:

a) size and gracility of forms;

b) dentition;

c) cranial appendages;

d) special modifications of the limbs tending to transform them into weapons or accessory organs of coupling;

e) os penis.

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(2) see *above*, p. 3.
(3) *Amer. Journ. of science (Silliman)*, vol. XXIII, p. 81, 1882.
(4) "This genus (*Morosaurus*) is allied to *Apatosaurus* and *Atlantosaurus*, but may be distinguished from them by the sacrum, as well as by other characters. The former has but three sacral vertebrae while the present genus has four." (*Amer. Journ. of science (Silliman)*, vol. XV, p. 242, 1878.)
(5) *Quart. Journ. geol. Soc. of London*, vol. XXXVI, p. 433, 1880.

Do these secondary sexual characters render us able to understand the divergences existing between our two forms? In some fashion. Those which fall under the designations *a* and *d* could serve us by diminution of size, gracility of the skeleton, and reduction of the spike. But the different nature of the pelvis, the number of sacral vertebrae, etc., always remain. Furthermore, if it was admitted that the small form is but a female, would it not be at least strange that this female has never been encountered at the same level as the numerous males (large form) which we possess, and that it came to be isolated in a special bed? Finally, among the variations presented by the individuals of the large form, it is those that, according to us, demand to be interpreted as sexual variations. If we are in the truth, and we intend to develop shortly the reasons that come in support of our opinion, it is moreover clear that it would be proof of the specific or generic distinction of two types of dinosaurs recovered at Bernissart.

As a consequence, just as with individual variations, secondary sexual characters are insufficient to explain our two forms.

3rd. Therefore it remains to examine whether we have a matter of two distinct species or genera. This problem is easy to resolve. It is sufficient for us to look at what the characters are by which the genus *Iguanodon*, for example, is distinguished from other genera included in the order *Ornithopoda*. We thus will have a criterion that will allow judgement of whether the differences between our two forms are of a generic or specific nature.

Now the genus *Iguanodon* is distinguished:

From *Nanosaurus* [1], in which the femur is shorter than the tibia [2].

From *Laosaurus* [3], in which the cervical vertebrae are biplanar instead of opisthocoelous.

From *Camptonotus* [4], in which the pollex retains the normal form instead of being transfomed into an enormous spike, and also because the first toe, although reduced, is still composed of three segments instead of being represented by a styloid rudiment.

From *Hypsilophodon* [5], which has four functional digits in the pes instead of three.

From *Vectisaurus* [6], which has opisthocoelous instead of biplanar dorsal vertebrae.

From *Mochlodon* [7] by the form of the mandibular symphysis, which is recurved into a horsehoe in *Iguanodon*, whereas it is straight here, thus indicating a pointed muzzle.

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[1] O. C. MARSH, *Amer. Journ. of science (Silliman)*, vol. XIV, p. 254, 1877.
[2] Although this strong character comes to seem of little importance, it is in reality very good, because *Laosaurus* and *Compsognathus* are the only other dinosaurs, at least to our knowledge, that have it.
[3] O. C. MARSH, *Amer. Journ. of science (Silliman)*, vol. XVI, p. 415, 1878.
[4] O. C. MARSH, *ibid.*, vol. XVIII, p. 501, 1879.
[5] J. W. HULKE, *The Nature*, vol. XXV, p. 426, 1882.
[6] J. W. HULKE, *Quart. Journ. geol. Soc. of London*, vol. XXXV, p. 421, 1879.
[7] H. G. SEELEY, *Fauna of the Gosau Formation* (QUART. JOURN. GEOL. SOC. OF LONDON, vol. XXXVII, p. 624, 1881).

From *Hadrosaurus* [8], *Agathaumas* [9], and *Cionodon* [10], in which several rows of teeth are simultaneously in function.

Are divergences as accentuated as those enumerated above placed among the characters that separate our two forms? We do not believe so. In all cases, not one is identical. It looks to us therefore that instead we have the matter of a specific difference. To remain in the same order of the preceding ideas, we still utilize the genus *Iguanodon*, whose species we now pass in review. To our knowledge, seven have been mentioned up to the present. These are:

I. mantelli, Owen [1],
I. suessi, Bünzel [2],
I. precursor, Sauvage [3],
I. foxii (Huxley), Owen [4],
I. hoggii, Owen [5],
I. prestwichii, Hulke [6],
I. seelyi, Hulke [7].

Of this number, it is first necessary to abridge:

I. suessi, Bünzel = *Mochlodon suessi* [8] (Bünzel), Seeley,
I. foxii (Huxley), Owen = *Hypsilophodon foxii* [9], Huxley.

Regarding *I. hoggii*, Owen, its author only proposed it doubtfully and in light of some drawings made by Mr. Hulke, just as by its position in time, I think that it is advisable, at least temporarily, to subsume it with *I. prestwichii*, Hulke. Finally, as much as I judge by the figures, *I. precursor*, Sauvage seems to me founded on a tooth apparently from a dinosaur of the order *Sauropoda* [11] or *Stegosauria* [12].

What remains for us now? Three well-characterized species. These are:

I. mantelli, Owen,
I. prestwichii, Hulke,
I. seelyi, Hulke.

What are their distinctive signs? The following table will indicate for us:

I. mantelli, Ow.	5 sacr. vert.	preac. proj. = 1/2 ilium.
I. prestwichii, Hulke,	4 sacr. vert.	?

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[8] LEIDY, *Proc. Acad. Nat. Sc. Phil.*, p. 311, 1856.
[9] E. D. COPE, *Proc. Amer. Phil. Soc.*, p. 482, 1872.
[10] E. D. COPE, *Bull. U. S. geol. Surv. Terr.*, p. 2, 1874.
[1] *Paleontographical Society*, p. 105, pl. XXIII, 1851.
[2] *Abhandl. d. k. k. geol. Reichsanstalt, Wien*, p. 8, pl. III, fig. 7-9 and pl. VIII, dig. 2-4, 1871-1873.
[3] *Bull. de la Soc. géol. de France*, p. 438, pl. XII, fig. 5 and 5*a*, 1875-1876.
[4] *Paleontographical Society*, suppl. (no. V) to the *Mon. on the foss. Rept. of the Weald. and Purb. form. (Iguanodon)*, p. 4, pl. I, fig. 9, 9*a*, 10, pl. II, fig. 1, 5, 8-18, 1873.
[5] Ibid., p. 1, pl. I, fig. 1, 8.
[6] *Quart. Journ. geol. Soc. of London*, vol. XXXVI, p. 433, 1880.
[7] *Ibid.*, vol. XXXVIII, pp. 41 and 135, 1882.
[8] *Ibid.*, vol. XXXVII, p. 624, 1881.
[9] *The Nature*, vol. XXV, p. 426, 1882.
[11] *Amer. Journ. of science (Silliman)*, vol. XXIII, p. 83, 1880. Compare notably figures 5 and 5*a* of plate XII of Mr. Sauvage with figures 1 and 2 of plate V of Marsh in *Amer. Journ. of science (Silliman)*, vol. XVI, 1878 (*American Jurassic Dinosaurs*).
[12] *Amer. Journ. of science (Silliman)*, vol. XXIII, p. 83, 1882.

I. seelyi, Hulke,	?	preac. proj. = 1/3 ilium.

In summary, the characters by which the diverse species of *Iguanodon* have been separated until now are:

1st, the number of sacral vertebrae;

2nd, the length of the preacetabular projection of the ilium.

But, one will remember, these are precisely the points on which we have most insisted in our comparison of the two forms from Bernissart. We conclude therefore that they have a specific distinction.

II.

In this second section of my work, I am proposing to make known that the animal designated above under the name "small form" is none other than *I. mantelli*, Ow.

And first, what is *Iguanodon mantelli*? Bones of such diverse provenances were described under this name that above all it is important to be well fixed in this regard. In the same manner as Mssrs. J. W. Hulke [1] and G. A. Boulenger [2], we believe that it is convenient to adopt the Maidstone block as the type [3]. As a consequence, save indication to the contrary, all that is said in that which follows is applied to the stated block.

Here now is how I proceeded for my identification. After having compared our bones to the aforementioned plate of Owen, I returned to London furnished with natural-size drawings, and subjected my first examination to a counter-proof in the presence of the type-block. From these comparisons resulted, for me, the conviction that our small form corresponds well to *Iguanodon mantelli*. This conviction is based on the following motives:

1st, the proportion of the preacetabular projection to the total length of the ilium is the same for our small form and for the animal in the Maidstone block. We have seen the importance of this character in the discussion on the species of *Iguanodon*.

2nd, the ratio of forelimbs to hindlimbs (not including the manus and pes, for which the type-block does not provide any information) agrees equally. I find, in effect, for this ratio:

London	1.69
Brussells	1.72
DIFFERENCE	0.03

3rd, likewise, the ratio of bones of the forearm to those of the arm.

London	1.04
Brussells	1.10

(1) *Quart. Journ. geol. Soc. of London*, vol. XXXVIII, pp. 137 and 144, 1882.
(2) Verbal communication.
(3) *Paleontographical Society*, p. 105, pl. XXIII, 1851.

DIFFERENCE	0.06

4th, likewise, the ratio of tibia to femur:

London	1.08
Brussells	1.06
DIFFERENCE	0.02

5th, likewise, the position of the third trochanter, etc.

I could continue and show the agreement of the forms and dimensions of the teeth, humerus, ulna, ilium, ischium, pubis, femur, tibia, etc..., on which my observations are based. The following table will suffice, I think, to throw into relief *that the only difference that one can turn up between* I. MANTELLI *and our small form is a slight difference in size, our specimen being of slightly smaller volume*.

	Ilium	Femur	Tibia	Scapula	Humerus	Ulna
London	0.75	0.81	0.75	0.72	0.47	0.45
Brussells	0.71	0.71	0.67	0.62	0.43	0.37

Before closing this paragraph, it gives me pleasure to say that Mr. G. A. Boulenger recognized before me the identity between our small form and *I. mantelli*. This scientist had already acquired the certainty of it, for more than a year, after a careful comparison made between the Maidstone block and the cast of the pelvis and hindlimbs of the two types of dinosaurs from Bernissart.

III.

If our small form is none other than *I. mantelli*, what now is the large form?

By its teeth, fore- and hindlimbs, pectoral and pelvic girdles, and the structure of its vertebral column, it is an *Iguanodon*.

To which species does it belong? Nothing is easier to determine. In effect, it cannot be confounded with I. *prestwichii*, which has only four sacral vertebrae, and we have exposed in great detail how it is distinct from *I. mantelli*. It remains therefore to determine whether we are in the presence of *I. seelyi* or a new form. Here the question becomes a little more delicate. I recall that our large form presents a remarkable resemblance with the bones described by Mr. Hulke. However, this scientist is known to have found bony plates on the tibia of *I. seelyi* that he explained as dermal armor. On the other hand, we have parts that we have instead considered as integuments, both for *I. mantelli* and the large form. But the remains that are in our hands indicate skin that was naked or at the most covered with epidermal scales. In no case they could they permit supposing that the animal was protected by a cuirass. So that, in spite of the

numerous analogies mentioned above, I find myself in the impossible position of identifying *I. seelyi* with our large form. Not having seen Mr. Hulke's materials, it seems to me perfectly useless to insist on this point any longer. The English scientist, because of his experience and the exmination that he was able to make formerly of the bones of Bernissart, will be in a much better position than us to clear up this question. One sees, moreover, that it only plays a secondary role in the determination of our large form.

On February 5, 1881, our predecessor, Mr. G. A. Boulenger, deposited at the Academie royale de Belgique a note, *Sur l'arc pelvien chez les Dinosauriens de Bernissart* [1]. As a result of which circumstances this note did not appear at all, we do not need to recount here. Always it is that we learn by the aforementioned report of Mr. P. J. Van Beneden [1], that: "One of the most remarkable facts that results from the examination of the pelvis, according to the author (Mr. Boulenger), is the number of vertebrae that enter into the composition of the sacrum; this number reaches six in the *Iguanodon*s of Bernissart [2], whereas in that of the British Museum it only reaches five; in another *Iguanodon*, described by Mr. Hulke, only four. Instead of seeing individual differences in this variable number, Mr. Boulenger considers the *Iguanodon*s of Bernissart as having to form a species unknown until this day and, he adds, proposes, if the ultimate researches confirm it, the name *Iguanodon bernissartensis*."

Now at this date (May 10, 1881), *I. seelyi* was still not founded (this was a question for the first time at the meeting of February 2, 1882 of the Geological Society of London). As a result:

either *I. bernissartensis*, Boul., is clearly a new form and it must then be necessary to conserve this name;

or it is identical with all or part of the bones described as *I. seelyi* and, in this case, it incontestably has priority over it.

We conclude by saying:

The dinosaurs of Bernissart that we have designated by the expression "large form" should bear the name I. bernissartensis, *Boulenger, and they may or may not be identical with* I. seelyi.

IV.

Which position is it appropriate to give to the genus *Iguanodon* within the order *Ornithopoda*?

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[1] *Bull. de l'Acad. roy. de Belg.*, 3rd series, vol. I, p. 63, 1881.
[1] *Bull. de l'Acad. roy. de Belg.*, 3rd series, vol. I, p. 606, 1881.
[2] Our large form; the small had not yet been discovered at all at this time.

Marsh took up again, to receive it, the family *Iguanodontidae* [3] of Huxley, a family that he characterized as follows [4]:

1st, by clavicles;

2nd, incomplete postpubis;

3rd, edentulous premaxilla.

I regret to not having confirmed the diagnosis of the American paleontologist. In effect, his two first characters rest on an inexact interpretation of certain skeletal elements of *Iguanodon*. The aforementioned clavicles, which Mr. Marsh saw in Brussells and London, are nothing but sternal plates, as I will demonstrate in my next note. With regard to to the term "incomplete postpubis", it can only signify "postpubis not elongated beyond the ischial tuberosity". I know that this particularity was believed formerly, and that it was showed by Mr. Marsh at the Musée royal d'histoire naturelle de Belgique in drawings and photographs reproducing it. However, I recalled after (pl. IX, fig. 1 and 4), that the postpubis of *Iguanodon* is considerably elongated behind of the ischial tuberosity, without attaining the dimensions that it possessed in the genus *Camptonotus*, for example. Regarding Mr. Marsh's third character, it seems insufficient to found a family on it alone, above all in the presence of the structure of the distal end of the mandibles of *Laosaurus*. In addition, like the family Camptonotidae it is based only on negative characters, it is essential to proceed to new divisions within the order *Ornithopoda*. I believe that the following divisions are, in the current state of science, the most correct that can be obtained.

DINOSAURIA

Order III. — ORNITHOPODA.

Hoofed, digitigrade pes; five functional digits in the manus, and three to four in the pes. Pubis projected freely forwards; postpubis present. Solid vertebrae. Forelimbs reduced; limb bones hollow. Edentulous premaxillae, at least distally.

1. IGUANODONTIDAE. A single row of teeth. Three functional digits in the pes. Two symmetrical sternal plates.

Genera:

European: *Iguanodon, Vectisaurus*.
American: *Camptonotus, Laosaurus, Nanosaurus*.

2. HYPSILOPHODONTIDAE. A single row of teeth. Four functional digits in the foot. Rhomboidal, uneven sternum.

Genera:

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[3] *Quart. Journ. geol. Soc. of London*, vol. XXVI, p. 34, 1870.
[4] *Amer. Journ. of science (Silliman)*, vol. XXIII, p. 84, 1882.

European: *Hypsilophodon*.

3. HADROSAURIDAE. Several rows of teeth simulate the molars of living ungulates.

Genera:

American: *Hadrosaurus*, (?) *Agathaumas*, *Cionodon*.

SYNOPSIS OF GENERA OF THE FAMILY IGUANODONTIDAE.

1. Femur considerably shorter than the tibia	*Nanosaurus.*
Not	2.
2. Opisthocoelous dorsal vertebrae	*Vectisaurus.*
Not	3.
3. Biplanar cervical vertebrae	*Laosaurus.*
Not	4.
4. Postpubis as long as ischium	*Camptonotus.*
Not	*Iguanodon.*

IGUANODON [1].

1825. G. Mantell, *Phil. Trans*., p. 184.
1851. R. Owen, *Paleont. Soc. Foss. Rept. Cret. form*., p. 105.
1880. J. W. Hulke, *Quart. Journ. geol. Soc. of London*, p. 433.
1881. G. A. Boulenger, *in* P. J. Van Beneden, *Bull. de l'Acad. roy. de Belg*., p. 606.

Edentulous premaxilla. A single row of teeth in the maxillae and mandible. Opisthocoelous cervical vertebrae, biplanar dorsals, amphicoelous caudals. Even sternum. Reduced forelimbs. Five functional digits in the manus, the first transformed into a spike. Pubis is projected freely forward. Postpubis shorter than the ischium. Femur longer than the tibia. Three functional digits in the pes with styloid rudiment of the first toe [2].

Distribution in time: From the Kimmeridge Clay [1] to the Upper Greensand [2].

Geographic extent: England, Belgium, north of France, Germany, Austria.

SYNPOSIS OF SPECIES.

Four sacral vertebrae	*I. prestwichii*.

[1] It does not enter in our view to give here a complete bibliography on *Iguanodon*. Reserving this work for our monograph, we content ourselves to indicate the authors who have described the types of species that we have accepted.

[2] One will remark that we have not made to intervene at all the dentition in our diagnosis. Like professor Seeley (*Die Dinosaurier*, see *above*), we think that it is characteristic of families or orders, rather than of genera and species. Nobody will confound, in effect, a tooth of *Iguanodon* and *Megalosaurus*, or a tooth of *Cionodon* and *Morosaurus*. On the contrary, in lower divisions, the fantasy can be given free run and, to introduce the dentition to distinguish genera and species, this is, in the present state of science, to be exposed to be seen to create a multitude of new names that must pass later into synonymy. View the lack of information, an exception will be made however to what we come to say for *I. prestwichii*, already very well characterized however by its sacrum.

[1] *Quart. Journ. geol. Soc. of London*, p. 433, 1880.

[2] H. G. SEELEY, *Die Dinosaurier* (MONATSBL. DES WISSENSCH. CLUB IN WIEN, 1880).

Five sacral vertebrae *I. mantelli*.
Six sacral vertebrae *I. bernissartensis*.

I. prestwichii, Hulke.

1880. J. W. Hulke, *Quart. Journ. geol. Soc. of London*, p. 433, pl. XVIII-XX.

Four sacral vertebrae. Centra flattened below. Dorsal vertebral centra wedge-shaped. Total length 3 to 4 meters. Head around 20 centimeters. Plain serrations of teeth.

Formation: Kimmeridge Clay.

Locality: Cumnor.

I. mantelli, Owen.

1851. R. Owen, *Paleont. Soc. Foss. Rept. Cret. form*., p. 105, pl. XXXIII and XXXIV.

Skull three times as long as wide, measuring around 50 centimeters. *Nares projecting over two-thirds of the lower jaw*. Greater diameter of the orbit horizontal. Temporal fossa reduced to a cleft. Minimum width of the scapula more than eight times its maximum length. Coracoid pierced by a foramen closed laterally by a suture, with rounded posterior border. Sternal plates straight and slightly indented interiorly. Forelimbs representing fairly close to half the hindlimbs. Manus laterally compressed and elongated. Reduced spike. *Five vertebrae in the sacrum. Preacetabular projection of the ilium equal to around half the total length of this bone. Pubis short, thin, and very elevated.* Third trochanter situated near the middle of the femur. Total length 5 to 6 meters.

Formation: Wealden.

Locality: Maidstone, Bernissart.

I. bernissartensis, Boulenger.

1881. G. A. Boulenger, *in* P. J. Van Beneden, *Bull. de l'Acad. roy. de Belg*., p. 606.

Skull twice as long as wide, measuring around 65 centimeters. *Nares are projected over only one-third of the lower jaw*. Greater diameter of the orbit vertical. Temporal fossa largely open. Minimum width of the scapula contained nearly six times in its maximum length. Coracoid furnished with an indentation communicating laterally with the exterior. Sternal plates wide and strongly interiorly indented. Forelimbs representing nearly two-thirds of the hindlimbs. *Six vertebrae in the sacrum. Preacetabular projection of the ilium equal to about one-third of the*

total length of this bone. Pubis long, massive, and straight. Third trochanter situated near the lower third of the femur. Total length 8 to 10 meters.

Formation: Wealden.

Locality: Bernissart.

We have arrived here at the end of this notice, which, in spite of the care that we sought to bring there, without doubt still includes many imperfections. However, we held to publish it principally with the object of provoking criticisms that, we are persuaded, will be very useful to us at the time we drawing up our monograph. This is why we will continue the series of preliminary communications that we promised in our introduction, of which the next will treat the sternum.

That it is permitted me to thank again here publicly Mr. De Pauw, Controller of the artists, who agreed to make me profit from his experience of four years in the work on the *Iguanodon*s and who had directed the draftsman in the execution of the plate joined to the present note.

PLATE IX.

EXPLANATION OF PLATE IX.

(The same letters have an identical significance for all figures.)

a. Astragalus.
c. Ulna.
c'. Calcaneum.
c''. Coracoid.
f. Femur.
h. Humerus.
il. Ilium.
is. Ischium.
p. Pubis.
p'. Postpubis.
p''. Fibula.
r. Radius.
s. Scapula.
t. Tibia.

Figures 1-2 are at about 1/14 scale; 3-4 at 1/20.

1-2. IGUANODON MANTELLI, Ow.

3-4. IGUANODON BERNISSARTENSIS, Boul.