

Supplement to the Ichnology of New England
Edward Hitchcock
1865

Commonwealth of Massachusetts, 96 pp.

This facsimile © Emma C. Rainforth, 2000.

Notes:

All paginations remain true to the original.

A single font has been used throughout ("Times").

Text is not justified, but line breaks are as they appear in the original.

Figures are included at original sizes. Large figures are additionally included reduced to fit on one page, with reduction stated.

Figures are digitally scanned but have not been cleaned up.

SUPPLEMENT
TO THE
ICHTHOLOGY OF NEW ENGLAND.

A REPORT
TO THE
GOVERNMENT OF MASSACHUSETTS,
IN
1863.

BY EDWARD HITCHCOCK, D. D., LL. D.,
LATE PROFESSOR OF GEOLOGY IN AMHERST COLLEGE.

BOSTON:
WRIGHT & POTTER, STATE PRINTERS, No. 4 SPRING LANE.
1865.

Commonwealth of Massachusetts

EXECUTIVE DEPARTMENT, BOSTON, January 13th, 1864.

To the Honorable the House of Representatives:

I have the honor to transmit to the General Court, a Supplement by Professor Edward Hitchcock, to his Report on the Ichnology of New England, which was published by the Legislature of 1858. This Supplement was communicated to me by the learned author at the close of the last year, and is accompanied by valuable drawings and photographs illustrating the subject which it treats.

JOHN A. ANDREW.

Commonwealth of Massachusetts

[RESOLVES OF 1864 - Chapter 14]

RESOLVE IN RELATION TO PROFESSOR HITCHCOCK'S SUPPLEMENTARY REPORT ON THE ICHNOLOGY OF NEW ENGLAND.

Resolved, That one thousand copies of Professor Edward Hitchcock's Supplement to his Report on the Ichnology of New England, with the drawings and photographs connected therewith, be printed at the expense of the Commonwealth, under the direction of the Committee on the Library; that one hundred copies of said Supplementary Report be given to Professor Hitchcock; three copies to the State library, and one copy to each free public library established under the statutes of the Commonwealth; twelve copies to the trustees of the State library, to be used for the purpose of international exchanges; and one copy furnished to each member of the executive and legislative departments of the government for the present political year, and one copy to each town and city in the Commonwealth. —*Approved by the Governor, March 2, 1864.*

JOINT STANDING COMMITTEE OF THE LEGISLATURE ON THE LIBRARY,
For 1864.

Messrs. OTIS CARY, of Foxborough,
LEWIS J. DUDLEY, of Northampton,
THOMAS L. CHAPMAN, of Longmeadow,
Of the Senate.

Messrs. CHARLES BECK, of Cambridge,
JOSEPH ALLEN, of Northborough,
ABEL WETHERBEE, of Adams,
Of the House.

CONTENTS

	PAGE		PAGE
Legislative Enactment	iv	Papillary impressions,	24
Letter from the Author	vii	Plectropterna,	24
Preface by the Editor	ix	Arachnichnus,	25
Additions to the Ichnological Cabinet,	1	Supposed mistake as to the number of Phalanges in some of the Lithichnozoa,	25
Species of the Ichnology not reliable,	2	Another development as to the Phalanges,	26
Doubtful species,	2	How far do the Protuberances on the Feet of Animals correspond with the Phalanges ?	27
New species,	2	The feathered fossil of Solenhofen,	28
Anomœpus	2	Professor Dana's views,	33
Anisopus,	6	Postscript,	35
Brontozoum,	7	Plesiornis,	35
Grallator,	7	Second Postscript,	37
Leptonyx,	8	Appendix [A.],	39
Comptichnus,	9	Megadactylus,	39
Trihamus,	9	Appendix [B.],	41
Anticheiropus,	10	Descriptive Catalogue of the Specimens in the Hitchcock Ichnological Cabinet,,	43
Exocampe,	11	Explanations,	44
Harpedactylus,	12	Wall No. 1, Table No. 2,	44
Toxichnus,	12	Tables Nos. 3, 4,	45
Tracks of Insects,	13	Tables Nos. 5, 6,	46
Tracks of Myriapods,	17	Tables Nos. 7, 8, 9,	47
Lunula,	17	Table No. 10,	48
Trails of Annelids,	18	Tables Nos. 11, 12, 13,	49
Bisulcus,	18	Table No. 14,	50
Trisulcus,	18	Tables Nos. 15, 16,	51
Specimens of doubtful origin and character,	19	Tables Nos. 17, 18, 19,	53
Grammichnus,	19	Table No. 20,	54
Ampelichnus,	19	Tables Nos. 21, 22, 23,	56
Climacodichnus,	20	Walls Nos. 24, 25,	57
Ænigmichnus,	21	Table No. 26,	58
Miscellaneous items,	22		
Brontozoum,	23		

	PAGE		PAGE
Case No. 27,	59	Walls Nos. 45, 46,	79
Table No. 28,	60	Table No. 47,	80
Table No. 29, Wall No. 30,	61	Table No. 48, Walls Nos. 49, 50, 51,	82
Case No. 31,	62	Wall No. 52	83
Case No. 32,	64	Wall No. 53,	84
Case No. 33,	66	Wall No. 54, Case No. 55,	85
Case No. 34,	68	Table No. 56,	87
Case No. 35,	69	Tables Nos. 57, 58, Wall No. 59,	88
Case No. 36,	70		
Case No. 37,	72	Appendix [C.],	89
Cases Nos. 38, 39,	73		
Case No. 40,	74	Description of the Plates	91
Case No. 41,	76		
Wall No. 42,	77	Index	95
Walls Nos. 43, 44,	78		

LETTER FROM THE AUTHOR.

To His Excellency JOHN A. ANDREW, *Governor of Massachusetts*:

Honored Sir, — Quite unexpectedly I have an opportunity to present to your Excellency a Supplement to the Ichnology of New England, published by the Legislature of 1858. The facts and conclusions have been mostly obtained by me since my confinement in a sick-room, and since the time when I had given over all expectation of any farther researches on this subject. But, as will be explained more fully in the paper, access to new specimens has brought out thirty-seven new species, many of which are very anomalous and instructive, leading to conclusions of great importance in Ichnology, fully confirming the principal conclusions of that Report, and in the opinion of learned friends tending to other inferences of the deepest interest in relation to the animals of Sandstone days that occupied the Connecticut Valley. As the Government of the State, in a very generous and liberal spirit, brought out the full details of the facts known in 1858, it has seemed to me that they would feel desirous of adding those of the sequel also. It will form a pamphlet of the quarto size, of between thirty and forty pages, with twenty plates of the same size, some of the latter, however, doubled, and the principal expense will be in the plates. Yet the whole will not be large, and my fear has been lest the Government might regard even the whole of my paper as almost too small to deserve a formal presentation to their notice. But the intimate connection of the facts and conclusions with my Report of 1858, has determined me to offer the Supplement.

The high reputation, as patrons of science, which the Government of Massachusetts acquired among the savans and scientific journals, by the promptness and style in which they brought out my Ichnology in 1858, (leaving its real merits out of the account,) must be gratifying to every friend of learning in the States. For, as a matter of mere science, probably no other popular government on the globe would do it, under the circumstances. If they should repeat the experiment, even on so small a scale as to bring out in similar style the Supplement, at a time when the public expenses are necessarily very great, it would be an example yet more worthy of imitation, evincing a determination not to allow the cause of learning to suffer, even in the midst of a most disastrous war.

With high respect,

Your obedient servant,

EDWARD HITCHCOCK.

AMHERST, MASS, December, 1863.

PREFACE BY THE EDITOR.

THE EDITOR of the following pages deems it important to make a brief statement respecting their preparation. The "Supplement to the Ichnology of New England" was prepared by his late honored father during the last few months of his life, and was accepted for publication by the Legislature of Massachusetts in 1864, shortly after his decease. Expecting a favorable response to his application, he had requested the Editor — his youngest son, formerly Curator of the Cabinets of Natural History belonging to Amherst College — to correct and supervise the publication of his manuscript, to label anew his Ichnological Cabinet according to the revised nomenclature, and to prepare a descriptive catalogue of all the specimens — a work commenced but not completed by himself — to be appended to the Supplement. The Editor was also requested to perfect the list of species as much as possible, either by dropping old names or adding new ones, particularly upon the basis of the modified doctrines distinguishing between the Birds and Reptilian Birds.

The Editor has endeavored faithfully to carry out the wishes of his dying parent. Printed labels, giving the localities of the slabs, as well as the names of the Lithichnozoa, have been attached to every specimen, and a descriptive catalogue is presented as an Appendix in this volume. A few additions have been made to the text of the Supplement in the form of Notes. Only one old name has been changed and two new species added, though others perhaps might have been presented.

It should be stated for the guidance of students of Ichnology, that the originals of a few of the new species of *Acanthichnus* described in the Supplement could not be found. Whenever new examples of them are discovered, they can be identified by their representations in the plates.

The statement in the Note on page 199 of the Ichnology, that all the species described but one were in the Cabinet, should be corrected. The Cabinet now contains examples of every species of footmark described in the Ichnology and the Supplement, and generally the types of the descriptions.

The Lithographs in this volume were executed by A. Meisel, of Boston, and are faithful copies of the original drawings. The Photographs were executed by J. L. Lovell, of Amherst, who has attained a high degree of efficiency in this department of photography.

The Trustees of Amherst College, in commemoration of the originator and successful expounder of the science of Ichnology, have voted to call the collection of Footmarks the *Hitchcock Ichnological Cabinet*; applying the name *Appleton* to the whole building, which contains the *Adams Cabinet* in the second, and the *Hitchcock Cabinet* in the first story.

C. H. HITCHCOCK.

No. 37 Park Row, New York,
June 20th, 1865

SUPPLEMENT
TO THE
ICHOLOGY OF NEW ENGLAND.

FOR more than two years past, I have spent a considerable time in making out a descriptive Catalogue of the large collection of Fossil Footmarks in Amherst College. Although I had described the most prominent features of the specimens in the "Ichnology" published by the Government of the State, yet when I came carefully to study them, I found several new species, and reasons for giving up some of the old ones; also, some disclosures that throw light on the fundamental principles of Ichnology.

A still more fruitful source of new information has been the purchase from Mr. ROWEL FIELD, of a large collection of footmarks made by him at Turner's Falls, some of which exhibit great perfection. A new room has been fitted up for them in the College. The whole number of individual tracks previously in the Cabinet was over twelve thousand. The new purchase will add several thousand more, bringing up the whole number above twenty thousand: several thousand of which, however, are the tracks of insects.

I began this Cabinet twenty-five years ago, and have received great assistance from the benefactions of generous friends of science. Three rooms are now devoted to it, the largest of which is one hundred feet by thirty: the second, a side room, is twenty-seven feet by eleven, and the third, also a side room, twenty-two feet by eleven: all of which are as full as desirable. Large as the collections may seem, I am satisfied of the great importance of increasing them to almost any extent, in order to furnish materials for those who are investigating the subject of footmarks, and to prevent their making serious blunders. The late addition has already brought out disclosures amply compensating the thousand dollars paid for it by liberal friends of science.

Species of the Ichnology not reliable.

I am satisfied that the following six species, most of which are given as doubtful in the Ichnology, ought not to be retained. It is hardly necessary to offer here the particular reasons which led to their rejection.

Brontozoum isodactylum.

Platypterna gracillima.

Batrachoides antiquior.

Ptilichnus typographus.

Ptilichnus pectinatus.

Grammepus uniordinatus.

Doubtful Species.

I suspect that the tracks of the following species may be imperfect developments of peculiar forms of other species; such forms as sometimes occur on layers of rock above or below that on which the animals trod. As to the two first-named species, however, my doubts result from an apprehension that the rounded form of the claw on the track, which gives the character of the genus, may originate from other causes than the rounded or winged character of the claw itself.

Amblonyx giganteus.

Amblonyx Lyellianus.

Argozoum Redfieldianum.

Platypterna Deaniana.

Tridentipes unicus.

New Species.

Even if all the eleven preceding species should be rejected, I shall be obliged to propose treble the number of new ones. I rather regret this than rejoice at it. For I would prefer to see the number of species in the Ichnology reduced rather than increased. Yet if I follow the principles laid down in that work, whose correctness I have not yet seen reason to doubt, I must add the following species, thirty-seven in number.

1. ANOMÆPUS INTERMEDIUS. (Nov. Sp.)

[In the Cabinet, Nos. $\frac{16}{3}$, $\frac{19}{14}$, $\frac{21}{3}$, $\frac{26}{10}$, $\frac{32}{57}$, $\frac{48}{1}$, $\frac{50}{1}$, $\frac{50}{2}$, $\frac{51}{1}$, $\frac{51}{2}$, $\frac{51}{5}$, $\frac{51}{9}$, $\frac{51}{14}$, $\frac{52}{4}$, $\frac{53}{5}$, $\frac{53}{10}$, $\frac{54}{13}$, $\frac{55}{112}$.]

This is the most remarkable and instructive of all the genera of the Lithichnozoa. I propose three new species and though I have been studying these tracks for twenty years, yet, the descriptions which I give below, contain several new and important characters not hitherto brought out.

Hind Foot.—Tridactylous, the three toes articulated to a single tarso-metatarsal bone several inches long, which the animal had the power of bringing down to the ground so as to make an impression. The toes are pachydactylous with two phalanges in the inner toe (exclusive of the ungual,) three in the middle, and four in the outer toe; claw rather broad and rounded, that process making an impression nearly behind the outer toe, as in most tridactyle living birds. . Indeed the whole foot as far as the tarsal joint, exactly resembles that of a tridactylous bird. Tail-trace narrow and continuous. Average divarication of the lateral toes, 70° . Length of the inner toe, 2.3 inches; of the middle toe, 3 inches; of the outer toe, 2 inches; of the foot, 4 inches; of the. step 5 to eight inches; of the heel, nearly 3 inches. Average width of the phalanges, 0.7 inch. Papillæ of the foot and the heel, round of the size of a mustard seed. Width of the trackway, 6 to 7 inches. Phalanges of the inner toe exclusive of the ungual phalanx, two; of the middle toe, three; of the outer toe, four.

Fore Foot.—Pachydactylous, pentedactylous, unguiculate, digitigrade; the track showing phalangeal impressions from 2 to 4; the third toe from the inside showing the largest number. Papillæ, round, small. Perhaps the fifth toe, which seems to be isolated from the rest on the track, is only the end of the heel. Foot digitigrade, marsupialoid. Length of the longest or third toe, 1.5 inches; of the foot 2.25 inches.

The usual form which the tracks of the hind and fore feet of this species present is given on Plate I., fig. 1. The heel of the hind foot is omitted, as it is in most cases upon the rocks. But the entire tracks of both feet are shown on Plate XV., fig. 1, whose description will show its peculiar and various modes of progression.

This species differs from *A. minor* in the greater divarication of the lateral toes, the stouter proportions of the whole foot; the less length of the tarso-metatarsal bone, the foot and the step. It is the most common species of the genus, and its ordinary track so greatly resembles that of birds, that it is no wonder we have all regarded its tracks as those of birds, especially the species described in the *Ichnology* as *Brontozoum isodactylum*.

A remarkably fine specimen lately obtained, has shown our error, and brought out the peculiarities of structure and progression in the most satisfactory manner. Plate XV., fig. 1, is a true copy of this slab. The specimen shows fifty tracks, probably all of them of *Anomæpus*, and I am inclined to think all except four are *A. intermedius*. These four are probably *A. gracillimus*. The impressions are unusually perfect, showing in most of them more or less of the phalangeal

impressions, and on sixteen of them the papillose imprint of the skin. The tracks form five rows. The first has in it sixteen tracks, and extends from the extreme left hand extremity to the extreme right of the slab, but not in a strait course. A second row of eight tracks commences at the right hand extremity, a little below the middle, and runs near the lower edge, terminating near the middle of the slab, or rather running off the slab. A third row of ten tracks commences near the upper right hand corner, and passes obliquely downward across the slab, leaving it at the same place with the second. After advancing three steps, the animal that made the third row seems to have brought up both his feet abreast of each other, and to have made a leap of six inches, where his tracks are abreast; after which he moved forward as usual, by alternate steps. In all these three rows, and we may say the same of the four small tracks that cross the other rows, a practised observer would see nothing leading him to suspect that the whole thirty-eight were not made by thick-toed tridactyle birds; for even the phalangeal impressions agree in number with those of living birds, and to birds they have generally been referred. But the fourth row of twelve tracks near the upper left hand side makes a different revelation. The first five show the same tridactyle imprints, but at the sixth step the animal brought down two stout heels, three inches long upon his hind feet, and two small five-toed tracks just ahead of the hind ones, after which it went forward as before, using only the toes of the hind feet, though it brings down one of its fore feet, but not its heel at the first step.

Several important conclusions flow at once from the facts. The first is, that this animal was a quadruped with unequal feet. The second is, that it here stopped to rest on all fours, sitting apparently like a frog, and bringing down its heel as far as the tarsal joint. The third is, that commonly in walking it used only the toes of its hind feet, being decidedly digitigrade. The tracks reveal, I think, the same fact in respect to several other species of those ancient animals, ex. gr. the *Otozoum*. Fourthly, the animal sometimes moved by leaps.

As confirmatory of these conclusions, it ought to be added that this animal had a tail; for just before it sat down on all fours, we find a distinct tail-trace on the stone, and a less perfect one near the right extremity of the longest row, which would not have been noticed, had not the revelations made by the first, awakened careful scrutiny.

Another fact ought to be noticed, although to me inexplicable. I never yet noticed a case where the animal brought to the ground the heel of its hind foot and the fore foot, without placing those on one side of the body in advance of the other, yet scarcely enough in advance to be the result of taking a step. What object could have been subserved by this peculiarity I cannot conceive; but it leads to the

suspicion that we have not yet discovered all the anomalous modes of locomotion possessed by this singular race of animals.

Other specimens in the Cabinet exhibit essentially the same facts as the slab just described, and are so stated in my Ichnology; but none of them bring out the facts so clearly as this specimen. It is certainly an invaluable relic, and had Mr. FIELD, who dug it out, been aware of its importance when uncovering it, he would have tried hard to preserve a broader surface to show the prolongation of the row of tracks. But he deserves much credit for preserving so large a surface.

2. ANOMÆPUS CURVATUS. (Nov. Sp.)

[In the Cabinet, Nos. $\frac{5}{8}$, $\frac{10}{6}$, $\frac{14}{5}$, $\frac{23}{12}$, $\frac{44}{2}$, $\frac{51}{3}$, $\frac{52}{5}$, $\frac{52}{10}$, $\frac{52}{13}$, $\frac{52}{14}$, $\frac{52}{16}$, $\frac{53}{5}$, $\frac{53}{7}$, $\frac{54}{13}$, $\frac{55}{35}$.]

Hind Foot. — Tridactylous, pachydactylous, tuberculate, digitigrade, ornithoid. Divarication of the lateral toes, 55° . Length of the inner, middle and outer toes, successively, 2, 3, 2.1 inches, exclusive of the heel bone in the outer toe; length of that bone, 0.7; of the foot, 3.8 inches; of the step, 6 to 7 inches. Width of the trackway, 5 to 6 inches. Toes on the track, especially the middle toe, turned inward several degrees, and somewhat curved. Average width of the phalanges, 0.5 inch. Phalanges on the inner, middle and outer toes, exclusive of the ungual and the heel bone, 2, 3, 4.

Fore Foot. — Not yet found on any specimen, but the close resemblance of the hind foot to that of the *A. intermedius*, makes it almost certain that this is an *Anomæpus*. It differs from the *A. intermedius* in being more slender throughout, and the inward curvature of the toes, and especially in the less divarication of the outer toes. Possibly, however, it may turn out to be only a variety of *A. intermedius*.

Plate I., fig. 2, is an exact outline of what I call the hind foot of this species, copied from one of the most perfect and beautiful specimens in the Cabinet, and shown in Plate XV., fig. 2. The great value of this specimen consists in the distinctness with which it exhibits the phalangeal impressions, showing especially that there are four in the outer toe, besides the heel bone. It settles that point beyond controversy, and I find that several other specimens of *Anomæpus* show the same thing; so indistinctly, however, that we have overlooked it. But more of this in another place.

3. ANOMÆPUS MINIMUS. (Nov. Sp.)

[In the Cabinet, Nos. $\frac{28}{1}$, $\frac{34}{19}$, $\frac{37}{25}$, $\frac{50}{1}$, $\frac{52}{4}$, $\frac{52}{5}$, $\frac{55}{21}$, $\frac{55}{112}$.]

Hind Foot. — Tridactylous, pachydactylous, tuberculate, digitigrade, ornithoid. Divarication of the lateral toes? 60° to 70° . Length of the toes, reckoning outward,

1.3, 1.5, and 2 inches; of the heel bone 0.4 inch; of the foot 2.3 inches; of the step, 2.6 inches. Width of the trackway, 3 inches.

Fore Foot. — Pentedactylous, unguiculate, digitigrade, marsupialoid. Middle toe longest, one inch, with four tubercular expansions and a claw. Next outer toe has three phalanges and a claw, and the outer one two and a claw. The inner toe but one has two phalanges and a claw. The innermost two, but no claw is on the specimen. Fore feet placed just forward of the hind feet and a little inside, nearly abreast, as are also the hind feet, like the other species of *Anomœpus*.

This species is shown of the natural size on Plate II., fig. 2. Fig. 1, shows the most perfect outline of the fore foot yet discovered.*

4. ANISOPUS GRACILIOR. (Nov. Sp.)

[In the Cabinet, Nos. $\frac{32}{20}$, $\frac{32}{60}$, $\frac{33}{55}$, $\frac{45}{5}$, $\frac{45}{6}$, $\frac{46}{1}$, $\frac{46}{2}$, $\frac{46}{3}$.]

The chief apparent differences between this species and the *A. gracilis* of the Ichnology, is its smaller size and shorter stride, but more especially the greater relative width of its trackway. The hind feet are tetradactylous, the fore feet pentedactylous, corresponding in this respect to the Loricoid or crocodilian reptiles. Length of the hind foot, 0.6 inch; and of the fore foot, 0.4 inch; of the step, with the alternate feet, 1.8 inches; of the feet on the same side, 2.5 inches. Width of the trackway, 2 inches. Toes strait; axis of the hind foot divergent, often 20° or 30° from the line of direction.

The short step and the wide trackway of this species show, without doubt, an animal with a broader body and shorter legs than the *A. gracilis*. The outline of the hind and fore feet is given on Plate I., fig. 3.

* ANOMŒPUS GRACILLIMUS.

[In the Cabinet, Nos. $\frac{16}{10}$, $\frac{16}{15}$, $\frac{19}{3}$, $\frac{19}{4}$, $\frac{19}{5}$, $\frac{19}{12}$, $\frac{20}{7}$, $\frac{21}{3}$, $\frac{28}{1}$, $\frac{31}{6}$, $\frac{32}{1}$, $\frac{32}{45}$, $\frac{37}{18}$, $\frac{41}{18}$, $\frac{41}{22}$, $\frac{41}{34}$, $\frac{48}{1}$, $\frac{50}{1}$, $\frac{50}{2}$, $\frac{50}{3}$, $\frac{51}{3}$.]

An examination of all the specimens referred to *Brontozoum gracillimum* in the Ichnology, has satisfied me that the animal was an *Anomœpus*, and I venture to make the change in this place. The necessity of the change was brought to my father's notice after it was too late for him to visit the Cabinet; but from his recollection of the peculiar impressions of the animal, he acquiesced in the suggestion. The characteristics of the track calling for the change are these: First, the short stride of the animal; second, the thick, *Anomœpus*

type of the foot, and third, the occasional presence of a long heel upon the hind foot, as in Nos. $\frac{50}{1}$, $\frac{50}{2}$. None of the front feet have yet been discovered.

One might at first glance, refer this ichnite to *A. minimus*. It differs from it chiefly by the much less divarication of the toes. It will be unnecessary to repeat the description of the species, as it is given mostly in the Ichnology. The chief addition would be the presence of the long heel. It is a somewhat common species in the Cabinet, as evidenced by the list of numbers. — *C. H. H.*

5. BRONTOZOOM DIVARICATUM.. (Nov. Sp.)

[In the Cabinet, Nos. $\frac{1}{3}, \frac{5}{3}, \frac{6}{1}, \frac{9}{11}, \frac{14}{4}, \frac{16}{3}, \frac{17}{1}, \frac{20}{8}, \frac{23}{11}, \frac{25}{1}, \frac{25}{2}, \frac{32}{58}, \frac{32}{59}, \frac{33}{8}, \frac{33}{51}, \frac{33}{52}, \frac{34}{2}, \frac{34}{29}, \frac{35}{37}, \frac{37}{3}, \frac{37}{27}, \frac{40}{5}, \frac{43}{4}, \frac{52}{1},$
 $\frac{52}{8}, \frac{52}{19}, \frac{58}{1}.$]

This is in part *Brontozoum isodactylum* of the Ichnology. For the most part *B. isodactylum* is referable to *Anomœpus intermedius*.

Pachydactylous, tridactylous, unguiculate, tuberculate, ornithoid. Divarication of the lateral toes, 70° to 85° ; do. of the inner and middle toes, 20° ; of the middle and outer toes, 50° . Phalanges not well marked on any specimens in the Cabinet; but they doubtless correspond to those of other species of this genus, and the *Grallator*, of which more will be said subsequently. Length of the inner toe, 7 inches; of the middle toe, 8.5 inches; of the outer toe, 7 inches. Length of the step, 2 ft. 7 inches.

An outline of this track is shown on Plate IV., fig. 1. It approaches nearest to *B. minusculum*, but has a greater divarication of the lateral toes, and they are more nearly equal in length.

On a slab from Turner's Falls, (No. $\frac{23}{11}$ in the Cabinet,) are several tracks corresponding in shape to the *B. divaricatum*: but much smaller. It is probably a distinct species, but I refer to it here as a variety, since the tracks have not the distinctness and perfection desirable to settle such questions.

6. GRALLATOR PARALLELUS. (Nov. Sp.)

[In the Cabinet, Nos. $\frac{28}{1}, \frac{49}{2}, \frac{51}{6}, \frac{52}{4}, \frac{54}{1}, \frac{54}{5}, \frac{54}{8}, \frac{55}{110}.$]

Pachydactylous, tridactylous, unguiculate, tuberculate, ornithoid, plantigrade; the track showing the heel bone. Divarication of the lateral toes, 20° to 25° . Phalanges, 2, 3, 4. Heel bones, three on the track. Length of the inner toe, 3 inches; of the middle toe, 5.8 inches. Of the outer toe, 3.5 inches; of the foot, 7 inches; of the step, 40 inches.

An outline of this track of the natural size, is shown on Plate V., fig. 1. Fig. 2 is probably *Brontozoum Sillimanium*, although defective in the extremity of the middle and outer toe; this figure is given because it shows a heel bone behind the inner as well as the outer toe.

This species differs from *G. cursorius* by its much larger size and stouter proportions, while its stride is less. Size chiefly distinguishes it from *Brontozoum Sillimanium*.

From the other species of Grallator it differs by the smallness of its divarication in the lateral toes. Not uncommon, but not abundant at Turner's Falls.*

7. LEPTONYX LATERALIS, (λεπτος narrow, and ονυς a claw.) (Nov. Gen. and Sp.)

[In the Cabinet, Nos. $\frac{47}{40}$, $\frac{47}{51}$.]

Very pachydactylous, tridactylous, unguiculate, tuberculate, ornithoid. Divarication of the lateral toes, 60° . Length of the toes 0.65, 0.95, 0.65 inch; of the heel bone, or a prolongation of the outer toe, 0.1 inch. Claws narrow and relatively long; on the outer toes apparently proceeding from the outside of the toe.

We have but two insulated specimens of the tracks of this small species, but they are so peculiar that I have ventured to give them a name. It comes from Turner's Falls, and is shown on Plate V., fig. 3. This of course is a new genus as well as species.

* GRALLATOR GRACILIS. (Nov. Sp.)

[Specimens in the Cabinet, Nos. $\frac{17}{2}$, $\frac{17}{3}$, $\frac{17}{4}$, $\frac{23}{8}$, $\frac{28}{7}$.]

In the course of my examination of the slabs in the Cabinet, I have found several examples of ichnites which could not readily be referred to any described by my father. Generally the odd examples have been referred to the nearest known species, either with or without a query. But it seems manifestly unjust to pass by one delicate species of Grallator in this way—the smallest species known of the thick-toed birds — and therefore I venture to describe it as a new one, with the specific name of gracilis. It should be mentioned too, that my father was unable to refer it satisfactorily to any known species, and intimates in his notes that it may be a new species.

Description. — Divarication of the lateral toes, 35° ; of the inner and middle toes, 22° ; of the middle and outer toes, 14° ; of the claws and axes of the toes, 10° ; of the axis of the foot with the median line, 5° to 8° . Distance of the middle of the heel from the median line, 0.6 inch. Length of the inner toe, 0.85 inch; of the middle toe, 1.3 inch; of the outer toe, 1 inch; of the foot, 1.8 inch; of the middle toe beyond the others, 0.7 inch; of the step, 11 to 12 inches. The inner toe does not extend as far forwards as the outer, by 0.2 inch. Distance between the tips of the lateral toes, 0.95 inch; between the inner and middle toes, 0.9 inch; between the middle and outer, 0.8 inch. Length of the first phalanx of the inner toe, 0.35 inch; width of do., 0.2; length of the second phalanx with the claw, 0.5 inch; length of the first phalanx of the middle toe, 0.45 inch; width of do, 0.25 inch; length of the second phalanx, 0.35 inch; length of the third phalanx and claws, 0.5 inch; average length of each of the first three phalanges of the outer toe; 0.25 inch; width of the same, 0.2 inch; length of the fourth phalanx and claw, 0.35 inch. Length of the claws, 0.1 inch. Width of the trackway, 1.6 inch.

Outline of this species shown on Plate IX. fig. 7. A second row of this species upon No. $\frac{23}{8}$, shows a slight slipping of the heel, as if the animal was walking down a slight slope, and thus producing three ridges. One part of the heel is always the most prominent, in correspondence with what has been elsewhere observed respecting the heels of the thick-toed birds. Other rows of tracks similar to this species appear on this slab, but the divarication of the lateral toes is much greater and the stride smaller. They are more like *G. tenuis*. *G. gracilis* differs from *G. tenuis* by the much smaller size, the greater length of step and the greater proportionate length of the outer toe.

Locality. — On dark red sandstone, at the Ferry above Turner's Falls, in company with *Brontozoum Sillimanium*, *Antipus bifidus*, *Plesiornis quadrupes*, *Anisopus gracilis*, *Unisulcus minutus*, and *Apatichnus circumagens*. — C. H. H.

8. COMPTICHNUS OBESUS, (χομψος, elegant, and ιχνος, track.) (Nov. Gen. and Sp.)

[In the Cabinet, Nos. $\frac{55}{5}$, $\frac{55}{41}$.]

I cannot refer the tracks of this species to any known genus, and therefore create a new one, founded on the sleek and beautiful appearance of the track.

Hind Foot. — Pachydactylous, tetradactylous, digitigrade, without tubercular expansions, and with very short if any, claws. Divarication of the three outer toes, that is, of the outside toes of the three, 40° . Length of the toes, reckoning outward, 0.25, 0.35, 0.5, 0.4 inch; of the foot, 0.6 inch; of the step, 2.6 inches. Width of the trackway, 1.5 inch. Axis of the foot, divergent outward from that of the trackway, about 10° .

Fore Foot. — Tetradactylous, toes nearly circular on the bottom; three front ones somewhat elongated, and their axes divergent, hind toe circular; the whole track resembling one made by a living quadruped, such as a dog or cat. Position of the track a little in advance of the hind foot, and on the inside. Length of the track 0.3 inch.

An outline of our best specimen of this species is shown on Plate V., fig. 4. A photographic sketch of the same is given on Plate XVIII., fig. 6. The species (from Turner's Falls) is peculiar in being very thick toed, yet showing no protuberances, and scarcely any claws.

9. TRIHAMUS ELEGANS. (*Trias* and *Hamus*, a hook.) (Nov. Gen. and Sp.)

[In the Cabinet, No. $\frac{47}{30}$.]

Bipedal, (?) leptodactylous, palmigrade, tridactylous. Divergence of the lateral toes, 70° to 80° . Toes near their extremities, bent inward toward the line of direction as much as 20° . Heel large, broad, rounded behind, making an impression as deep as the toes. Length of the toes, reckoning outward, 0.6, 0.75, 0.9 inch; of the heel, 0.3 inch; of the foot, 1.15 inch; of the step, 5.2 inches. Breadth of the heel, 0.5 inch.

An outline of the only good specimen we have of this species, is shown on Plate II., fig. 3.

I could not refer the track to any known genus, and therefore propose a new one, named from the hooked character of the toes. The foot being tridigitate, has an ornithoid aspect, but the large heel, the hooked character of the toes, and the strong inward curvature of the feet, look rather like the lizard type. It occurs at Turner's Falls.

10. ANTICHEIROPUS HAMATUS (αντιχειρ, the thumb, and πους, the foot — the thumb-foot.) (Nov. Gen. and Sp.)

[In the Cabinet. No. $\frac{51}{17}$.]

The characteristic peculiarity of the foot of this genus, is, that one of the three front toes stands out at such an angle as to make it look like a thumb, while the two other toes are much less divaricate. The thumb and outer toe make an angle of more than 100° , and with the middle toe, of about 90° . The divarication of the other two toes is from 20° to 40° . But this angle is very difficult to measure because the toes curve so much. We have only one row of three tracks in the Cabinet, and although they differ in some particulars, there is so much of general resemblance as to identify them, and to mark off this as distinct from other genera and species. It has some resemblance to the Tarsodactylus, for in a prolongation backwards of the outer toe, at the distance of two inches, is an elongated impression evidently made by a toe articulated high up the tarsus. But the other parts of the foot bear no resemblance to that of the Tarsodactylus.

The length of the hindmost track is a little short of 6 inches, and the distance between the tips of the lateral toes, 5.5 inches. The length of the second and third tracks is 7 inches; and the distance between the tips, 8 inches. The stride between the first and second tracks is 14 inches; between the second and third, 30 inches. My opinion is, though I cannot certainly prove it, that the first track was made by a fore foot, and the two other tracks by a hind foot. Plate IX., figs. 1 and 2, show an outline of the two first tracks, not placed however in a normal position.

The only specimen we have is from Turner's Falls. But its examination brought to recollection a very large single specimen, that had been in the Cabinet for twenty years from Marsh's quarry in Montague, but which I had never ventured to describe, because I supposed it might be a distorted track of some other species. But it is obviously an Anticheiropus, and as we have not only a distinct track but a fair counterpart, I give it as follows:

11. ANTICHEIROPUS PILULATUS. (Nov. Sp.)

[In the Cabinet, Nos. $\frac{10}{4}$, $\frac{10}{5}$.]

Divarication of the lateral toes, 90° ; of the two outer ones, 15° . Length of the foot as shown on the outline sketch, Plate IX., fig., 3, is 21 inches. The pellets are large and distinct, and on the depressed track, the middle one is apparently separated half an inch from the toe, as if there were a deep furrow between them. But on the underside of the track, which is that from which our drawing was taken,

they coalesce. The toes on the sketch are wider than on the upper side, on the depressed track; but they are no longer, except perhaps the pellets. The under side was sketched rather than the upper, because upon the whole, more complete; and because along its middle there is a ridge following the lines of dots, a very unusual if not unique feature. The slope from the ridge is uniform to the edges of the toes, so that the bottom of the toe is a synclinal trough and not a semi-cylinder, which is the usual form. As it is a left hand track, I have so represented it, and the eye is supposed to be placed above it on the depressed or upper side, looking down to the bottom of the depression.

The heel is double, or rather there are two heels; the thickest swelling out on the lower side of the huge thumb, yet in fact lying behind the principal or middle toe; and sloping upward as it does on its backward prolongation, it looks like the impression of a tarsal or tarso-metatarsal bone. The other and smaller heel seems to be a backward prolongation of the outer toe, and dies away so gradually that it is difficult to say where it terminates. This may have been made by a process of the tarsus.

The large pellets remind one of the huge *Otozoum*, but the entire absence of phalangeal or other rounded protuberances on the under side of the foot, although the rock is very favorable for exhibiting them on the track, and the presence of a ridge, show that the two genera are quite distinct.

About five inches outside of the thumb is an indentation about an inch across, which was probably made by the extremity of a fourth toe, as in the *Tarsodactylus*. It is shown on the drawing. I should not have connected it with the track did I not find it in the *A. hamatus*.

This strange species of track was found at Marsh's quarry at Montague, where the first tracks that turned my attention to Ichnology, were obtained twenty-eight years ago.

12. EXOCAMPE MINIMA. (Nov. Sp.)

[In the Cabinet, No. $\frac{16}{4}$, $\frac{55}{4}$.]

This species differs from the *Exocampe ornata*, described in the Ichnology, chiefly by its diminutive size and slenderer proportions. It is unnecessary to give measurements of the parts, as the whole, both hind and fore feet, are shown in the photographic sketch, Plate XVIII., fig. 3, of the natural size. I have no great confidence in this as a new species, but the probabilities are so strong that it is such, that I let it stand. It comes from Turner's Falls, but is not common. [See *Appendix*.]

13. HARPEDACTYLUS CRASSUS. (Nov. Sp.)

[In the Cabinet, No. $\frac{47}{53}$.]

Hind Foot. — Heel and toes thick and elegantly curved; tetradactylous, lacertiloid. Inner toe shortest, its chord 0.8 inch. Second toe longest, its chord 2.1 inches. Third toe less curved, its chord 2.1 inches. Fourth toe curved outward, its chord 1.6 inch. Versed sine of the toes, reckoning outward, 0.25, 0.3, 0.25, 0.25 inch. Thickness of the heel 0.65 inch (its length not shown on the only specimen we possess.)

Fore foot. — Pentadactylous; heel stout and thick; toes stout and not much curved; the inner one set somewhat back on the heel. Thickness of the heel, 0.55 inch. Both hind and fore feet palmigrade.

An outline of this species is shown on Plate III., fig. 1, taken from our only specimen. The tracks are here brought to light by grinding down and smoothing the surface, which when wet shows the tracks beautifully, though perhaps the parts are thus made rather too thick. The tracks of two other species of animals are shown on the same specimen.

14. HARPEDACTYLUS GRACILIOR. (Nov. Sp.)

[In the Cabinet, Nos. $\frac{47}{52}$, $\frac{55}{1}$.]

Hind Foot. — Leptodactylous, tetradactylous, three inner toes gracefully curved inward, the fourth slightly outward; lacertiloid. Divarication of the outer and second toes, 90° to 100° . Length of the toes, reckoned outwardly, 0.3, 0.7, 0.9, 0.7 inch; of the heel, 0.75 inch; of the foot, 1.6 inch; of the step, 3.5 inches.

Our specimens do not show a fore foot; but the hind foot shown on Plate III., fig. 2, sketched from our best specimen, is so like a Harpedactylus that I cannot doubt that the animal had a fore foot. It comes from Turner's Falls.

15. TOXICHNUS INÆQUALIS, (τοξον, a bow, and ιχνος, a track.) (Nov. Gen. and Sp.)

[In the Cabinet, Nos. $\frac{55}{3}$, $\frac{55}{33}$.]

Both Feet. — Leptodactylous, tetradactylous, digitigrade, toes all gracefully curved inward, except the innermost, which is nearly straight.

Hind Foot. — Length of the toes reckoned outward, 0.7, 1.7, 1.35, 1 inch. Versed sine of the longest, 0.2 inch. Length of the foot, 1.7 inch; of the step of the same foot, 9.7 inches.

Fore Foot. — On one specimen, tridactyle, toes nearly straight. Length, reckoning outwardly, 0.8, 1.3, 1.1 inch; of the foot, 1.6 inch; of the step of the same foot, 9.3 inches. *On another specimen the impressions quite perfect;* Tetradactylous. Length of the toes, reckoning outwardly 0.25, 0.6, 0.75, 0.6 inch.

This last specimen, which is very much smaller than the other, as to the fore feet, I think may have been impressed by a distinct species. But as the hind foot is as large, I do not separate them, especially as I feel some doubts whether I have got hold of the exact characters of the species. An outline of the second specimen, (or a part of it,) is shown on Plate V., fig. 5, also a hind foot of the first specimen, on fig. 6; but the toes must be distorted.

The want of a heel running backwards from the toes on these tracks, makes it necessary to separate them from the Harpedactylus. The Figures suggested the above name, from their resemblance to a bow. From Turner's Falls. The specific name refers to the unequal size of the feet.

TRACKS OF INSECTS.

In my Ichnology, I put into one and the same group, the tracks of Crustaceans, Myriapods and Insects, because I could not in all cases distinguish the different classes by their tracks. In that group, however, I described six species which I had little hesitation in calling insects, because they had six feet with single linear or nearly linear extremities, which were arranged in walking as those of insects would be; and it seems to me still, that the inference was a fair one. But in the same group I placed six other species, some of which did not appear to have but two, and some only four feet, that made single linear impressions. Yet on one or two specimens, I thought I discovered the traces of two other small feet, that only occasionally left an impression, and I suggested in the Ichnology, that probably all of these species had six feet, but that only two or four of them left permanent traces. This suggestion is fully confirmed by several other specimens recently purchased. The first specimen on which I noticed the feet was one of *Acanthichnus cursorius*, (No. $\frac{47}{80}$, of the Cabinet,) of which a sketch is given on Plate VI., fig. 1.

Here we have the two prominent rows of tracks, which have been supposed to characterize the *Acanthichnus*. But two other rows are seen occasionally outside of the others, and placed almost at right angles to the line of direction, and now and then, if I mistake not, we have the impression of a third foot. The same thing appears on other specimens of *Acanthichnus* as for instance, Plate VI., fig. 6; also on many specimens of *Bifurculipes*, as figs. 7, 8 and 9, in Plate VII. But the two principal rows of linear track is a common character with several genera, as for instance the *Lithographus* and *Copezia* as figs. 14 and 15, Plate VI.; also in the *Hexapodichnus* figured in the Ichnology; Plate XXIX., fig. 7, and XXX., fig. 1. The largest of the hexapod impressions is the *Grammepus erismatus*. Even the *Conopsoides* I think will turn out to have had six feet, although usually only two made an impression. But sometimes four are very distinct, as in fig. 4, Plate VI.

In my Ichnology, I have given a species of track under the name of *Acanthichnus tardigradus*, a small portion of which I copy in this paper on Plate VII., fig. 3; but which now seems to me more probably a Myriapod. I have, therefore, given it a new name. *Pterichnus centipes*, (from πτερον a feather, which the track resembles,) taking it out of the genus *Acanthichnus*.* I am in doubt, also, about the *Biferculipes scolopendroideus* (Plate XXVII., fig. 1, of Ichnology,) whether that, also, is not a Myriapod. Yet I shall let it stand among the insects on account of its general resemblance as to the form and position of the feet to what it seems to me living insects show.

The *Saltator caudatus* and *bipedatus* (Plate XXIV., figs. 8 and 9, Ichnology,) appear most probably to have been insects; but I leave them out in my present enumeration.

If the other varieties of *Acanthichnus* figured in the Ichnology, are insects, or if some other minute animals, it seems to me I might reasonably refer them to a greater number of species than I have done. To show the probability of this opinion, I have brought into juxtaposition on Plate VI., figs. 1, 5, 6, 7, 8, 18, 9, 10, 11, 12, 13, 2, most of the varieties of *Acanthichnus*, showing the width of the trackways, the position and length of the feet, and the step or leap, and sometimes the alternation of the step; and may I not safely presume that no entomologist would

hesitate to refer them to several species? In the Ichnology I have referred, figs. 5, 7, 18 and 8, to *A. cursorius*, although they differ so widely as to the length of the stride or leap; for I find that this varies very much sometimes in the same series of tracks. The distinct alternation of the parallel rows of tracks, I must regard as a good specific character, although there is some irregularity in this respect when the steps are short. Partly on this ground and partly on the greater width of trackway and the shortness of the feet, I propose for fig. 5, the name of *A. alternans*. Fig. 6, generally shows the same characters, and the outside row of tracks standing at right angles to the trackway have so much the aspect of oars or wings, that I propose for it the name of *A. alatus*. We have only one specimen of fig. 4, Plate VII., which has the unique character of exhibiting a serpentine trackway, while the tracks on the sides are so near as to exhibit almost uninterrupted lines. I propose for it the name of *A. anguineus*. Outside of the principal rows of tracks numerous minute impressions indicate other feet, yet they do not show any regular succession and may not belong to the track. Plate VI., fig. 11, shows in some places a line of tracks along the middle of the trackway, and in all the rows the tracks almost touch.

* In the Cabinet, Nos. $\frac{36}{19}$, $\frac{36}{27}$, $\frac{36}{47}$.

Though our specimens of this species are not very good, I call it *A. trilinearis*. Fig. 13 shows evidently a distinct species — probably a different genus, which has an alternation of very minute linear feet and small punctures, nearly on a line, and hence may appropriately be named *A. punctatus*. The pairs of these minute feet — often they are in triplets — are sometimes all linear, as on fig. 2, and must make another species, that might take the name of *A. rectilinearis*. If the spreading character of two rows of tracks shown on the right-hand side of fig. 10, Plate VII., does not indicate a species of Myriapod rather than insects, it should evidently take the name of *A. divaricatus*. In the Ichnology, the name *A. saltatorius* is given to figs. 9, Plate VI., (copied from a new specimen,) also 10 and 12, on account of the lateral movement which the animal appears to have made like a dancer. This track is yet a puzzle.

I incline to strike out *Bifurculipes tuberculatus*, from the probability that the tubercles which are all of the track that remains, are in fact only the more persistent part of the original track; the little elevation of the mud, produced by the animal's tread, while the linear part has been worn away; for sometimes it remains. I have added one species of *Bifurculipes*, the *B. curvatus*, distinguished by the great curvature of the toes, as in figs. 2 and 9, Plate VII.

I have become convinced that the *Copeza* and *Lithographus* of the Ichnology are so nearly alike that they may be united. I propose to drop *Lithographus* and retain *Copeza*. The *C. triremis* is remarkable for the great width of the trackway. The *Lithographus hieroglyphicus*, Plate VII., figs. 1 and 10, has one not half as wide! and I would call the species *Copeza propinquata*. The *L. cruscularis* has the narrowest trackway of any species I have found, and as its three feet on the track are often placed so as to resemble a single crooked leg, I would retain the name *C. cruscularis*. To these I must add a fourth species, new and quite distinct, shown on Plate VI., fig. 14, and perhaps, also, on figs. 13 and 15. On this (14) all the impressions except the two principal rows, are little more than mere punctures, and hence I give the name of *C. punctata*.

As to the two species of *Hexapodichnus* in the Ichnology, their insect characteristics cannot escape observation. The *Conopsoides* may be a little more doubtful especially as no specimen described in the Ichnology showed more than three rows of tracks. But a specimen recently obtained, and which is figured on Plate VI., fig. 4, has four most distinct rows, and on one side, as the figure shows, a third row occasionally manifests itself, and thus is the genus brought into the class of insects whose usual number of feet is six. Fig. 4 differs from those shown in the Ichnology, in that the feet are not more than half as long; hence I make a new species of it, under the name of *C. curtus*.

I feel obliged to add at least two new genera to those Lithichnozoa which I regard as insects. One is the *Harpepus*, shown on Plate VII., fig. 6, from a sickle. At least one of the rows of tracks shows a delicately curved foot, one end of which is blunt, or rather it has formed a raised and blunt extremity on the track, which may well represent the handle of the minute sickle, proceeding from it. Some specimens seem to indicate that two of the feet possess these characters so as to make two rows of these curved tracks, as is seen on fig. 6. The curve of the sickle is generally very fine like a hair, and hence the specific name *capillaris*.

Sagittarius, (the Archer,) is the name given to another genus, represented on Plate VI., fig. 3. As yet, I have found only two parallel rows of delicately curved tracks, with their concave sides towards each other, looking like so many small bows,

which suggested the name. Doubtless there were other feet, but our specimens are few, and the impressions not deep. The bows alternate with each other, and hence the specific name, *S. alternans*. It is photographed on Plate XVIII., fig. 5.

According to these views, the species of Lithichnozoa, which I should now regard as insects, are the following. Numbers in brackets indicate the new species, which I now propose, and are a continuation of the new species already described. I give also the references to the specimens in the Cabinet.

- | | |
|----------------------------|---|
| <i>Grammepus.</i> | |
| 1. erismatus, Nos. | $\frac{9}{13}, \frac{12}{2}, \frac{26}{21}, \frac{36}{37}, \frac{36}{39}, \frac{47}{12}, \frac{47}{14}, \frac{47}{18}, \frac{55}{36}$. |
| <i>Acanthichnus.</i> | |
| 2. cursorius, Nos. | $\frac{36}{19}, \frac{36}{21}, \frac{36}{37}, \frac{36}{39}, \frac{47}{12}, \frac{47}{14}, \frac{47}{18}, \frac{47}{65}, \frac{47}{76}, \frac{47}{77}, \frac{47}{80}, \frac{55}{15}, \frac{55}{42}, \frac{55}{51}, \frac{55}{60}, \frac{55}{81}, \frac{55}{86}, \frac{55}{87}, \frac{55}{89}, \frac{55}{104}$. |
| 3. alternans, No. | $\frac{55}{59}$. [16.] |
| 4. altatus. | [17.] |
| 5. anguineus, No. | $\frac{55}{50}$. [18.] |
| 6. trilinearis, Nos. | $\frac{36}{35}, \frac{52}{14}$. [19.] |
| 7. punctatus. | [20.] |
| 8. rectilinearis, No. | $\frac{55}{113}$. [21.] |
| 9. divaricatus. | [22.] |
| 10. saltatorius, Nos. | $\frac{36}{27}, \frac{36}{31}, \frac{36}{34}, \frac{55}{48}, \frac{55}{68}, \frac{55}{75}$. |
| <i>Bifurculipes.</i> | |
| 11. laqueatus, Nos. | $\frac{36}{28}, \frac{36}{33}, \frac{36}{48}, \frac{55}{44}, \frac{55}{52}, \frac{55}{55}, \frac{55}{58}, \frac{55}{74}, \frac{55}{86}, \frac{55}{88}, \frac{55}{96}, \frac{55}{102}$. |
| 12. scolopendroideus, Nos. | $\frac{36}{14}, \frac{36}{41}$. |
| 13. curvatus, Nos. | $\frac{55}{62}, \frac{55}{65}, \frac{55}{66}, \frac{55}{90}, \frac{55}{91}, \frac{55}{98}$. [23.] |
| 14. elachistotatus, Nos. | $\frac{36}{17}, \frac{55}{56}, \frac{55}{82}, \frac{55}{70}, \frac{55}{92}, \frac{55}{97}, \frac{55}{98}$. |
| <i>Copeza.</i> | |
| 15. triremis, No. | $\frac{36}{7}$. |
| 16. propinquata, Nos. | $\frac{36}{18}, \frac{36}{19}, \frac{36}{26}, \frac{55}{42}, \frac{55}{43}, \frac{55}{54}, \frac{55}{64}, \frac{55}{105}$. [24.] |
| 17. punctata, No. | $\frac{36}{45}$. [25.] |
| 18. cruscularis, Nos. | $\frac{36}{17}, \frac{55}{73}, \frac{55}{78}$. |
| <i>Hexapodichnus.</i> | |
| 19. magnus, Nos. | $\frac{36}{11}, \frac{55}{45}$. |
| 20. horrens, Nos. | $\frac{36}{24}, \frac{36}{33}$. |
| <i>Conopsoides.</i> | |
| 21. larvalis, Nos. | $\frac{36}{25}, \frac{55}{57}, \frac{55}{67}, \frac{55}{80}$. |
| 22. curtus, Nos. | $\frac{55}{44}, \frac{55}{53}, \frac{55}{69}, \frac{55}{70}, \frac{55}{92}$. [26.] |
| <i>Harpepus.</i> | |
| 23. capillaris, Nos. | $\frac{55}{49}, \frac{55}{99}$. [27.] |
| <i>Sagittarius.</i> | |
| 24. alternans, Nos. | $\frac{55}{72}, \frac{55}{94}$. [28.] |

Twenty-four species of insects is a large number, but I think my specimens would justify a larger number; and if insects existed during our sandstone days, and that rock be Jurassic, we might expect this class of animals to abound.

My chief doubt as to the insect character of the preceding tracks, results from the leaning of several eminent Zoölogists to the opinion that they might rather have been made by minute crustaceans.

Profs. AGASSIZ, DANA and LEIDEY, founded their opinion upon the drawings in my Ichnology, without having seen specimens, and they feel by no means confident. Prof. AGASSIZ, however, sent me several sketches of the tracks of a small living crustacean, the *Ocypode arenaria*, which he copied from the sand of the coast in Florida. Copies of these are given on Plate VIII., figs. 1, 2, 3, 4, 5, 6 and 7. One cannot but be struck with the great want of resemblance between these and the tracks which I regard as those of insects. But they do greatly resemble the *Protichnites* described by Sir WILLIAM LOGAN on the Potsdam sandstone of Canada. The general presence of a tail trace, and the ovoid form of the tracks, form very marked distinctions between these and the insect tracks of this paper.

TRACKS OF MYRIAPODS.

How many of the species of the Ichnology may be referred to this class with confidence, I feel incompetent to decide. The *Acanthichnus tardigradus*, however, which I have changed to *Pterichnus centipes*, does seem most probably to be a Myriapod. I venture to add the following, hitherto undescribed, and whose true nature I may have mistaken, since the tracks, although numerous, are somewhat obscure from the character of the shale on which they are impressed.

29. LUNULA OBSCURA. (Nov. Gen. and Sp.) Plate II., fig. 6.

[In the Cabinet, Nos. $\frac{36}{45}$, $\frac{52}{12}$, $\frac{52}{14}$.]

This genus is characterized in its track by a narrow axis, on both sides of which are lunate impressions, extending laterally so as to make the trackway from 0.5 to 0.8 of an inch wide, looking like the rachis of a plant, with small lunate leaves, extending from 0.15 to 0.25 of an inch along the stem as thickly in fact, generally, as they can be placed. The front part of the leaflet (track) makes a much deeper impression than the posterior part, which, in fact, has no distinct outline, but is shaded off into the subsequent track. In a few instances the track appears somewhat bifid.

It is possible this impression is a plant; but it looks rather like a track to me, and I have imagined that it might have been formed by a Myriapod, first stretching itself out at full length and then drawing forward its posteriors by their vertical

elevation, and afterwards throwing its anterior part ahead by a similar movement. We might suppose that this could not be done, without obliterating the impressions of the numerous feet; but we have specimens in the Ichnological Cabinet, where an annelid has left on clay, continuous rows of setæ or feet, and a central trail, all perfectly preserved, showing that somehow or other these animals have the power of so moving forward, as to leave what seems an unbroken succession of the impressions of their bodies and feet, as if the animal had been lifted up and laid down continuously. Our specimens a good deal resemble these remarkable impressions (*Nereites*) on the clay slate of Waterville in Maine, which have been described by Prof. EMMONS and others under various names. Our specimens are on fine red micaceous shale from Turner's Falls.

TRAILS OF ANNELIDS.

I think we can speak of several of these with more confidence than in regard to Insects or Myriapods, because the latter animals are for the most part destitute of feet, unless it be sometimes slight protuberances along the under side of the body. The Ichnology describes ten species of Annelids, which I am still disposed to regard as reliable. To these I now add two other species, which fall under new genera.

30. BISULCUS UNDULATUS. (Nov. Gen. and Sp.)

[In the Cabinet, Nos. $\frac{10}{6}$, $\frac{20}{9}$, $\frac{32}{60}$, $\frac{52}{11}$, $\frac{55}{76}$.]

In the Ichnology, I have described three species of Annelids under the name of Unisulcus, where a single groove only is left, resembling exceedingly those left by the earth-worm so frequently in summer on mud. In the Bisulcus, there are two grooves with a ridge between them. The specific name of the only known species, merely indicates the serpentine course of the trail, looking like sections of waves. Plate III., fig. 5, is a poor representation of the Bisulcus.

31. TRISULCUS LAQUEATUS. (Nov. Gen. and Sp.)

[In the Cabinet, Nos. $\frac{52}{12}$, $\frac{52}{14}$.]

We have in this genus three grooves with two intermediate ridges. Sometimes the ridges show slight protuberances, like those of the *Sphærapus* of the Ichnology, indicating protuberances on the under side of the ridges of the animal's body, as they are sometimes found in Annelids. In moving forward, the animal sometimes turned back and crossed its own track, so as to form graceful loops, and hence the specific name of the only species yet found. It is shown on Plate III., fig. 4, which shows imperfectly, also, the protuberances on the ridges of the track.

The two last genera, and indeed all the species remaining to be described, have been found only at Turner's Falls.

SPECIMENS OF DOUBTFUL ORIGIN AND CHARACTER.

A few specimens remain undescribed, which I have examined with great care, and upon the whole, have a pretty strong conviction that they are tracks; but some doubts always cross my mind when I look at them. For convenience I give them names, but except in one instance I refrain from attempting to refer them to any known classes of animals.

32. GRAMMICHNUS ALPHA. (Nov. Gen. and Sp.)

[In the Cabinet, No. $\frac{47}{13}$.]

Grammepus, which is one of the genera of the Ichnology, implies that the *foot* has the form of letters; but *Grammichnus* means that the *track* has that form. This is the true idea, and I could wish that some other name were substituted for *Grammepus*. But the *G. erismatus* and *uniordinatus* certainly differ generically from the *Grammichnus* we are about to describe. The *G. uniordinatus* is certainly a different genus from either.

If the Roman capital A, or the Greek Alpha was laid down in succession along a straight line and at right angles to the line, and the letters were connected by a sort of triple hyphen, it would give a tolerably good representation of the genus and species *Grammichnus Alpha*, as a reference to Plate III., fig. 3, copied from the only good specimen we possess of the track of this species, will show. It ought to be added that the left leg of the Alpha shows certainly as many as five protuberances. The same is seen less distinctly on the right leg, especially near its lower end, and also more or less on the hyphens.

These facts show the origin of our name, but they do not furnish any clue to the nature of the animal, or make it certain that it is not of vegetable origin.

33. AMPELICHNUS SULCATUS. (*Grammepus uniordinatus* of the Ichnology.) (Nov. Gen.)

[In the Cabinet, No. $\frac{36}{38}$.]

This genus is more obscure than the last. It consists on the track of grooves rarely more than a quarter of an inch, sometimes half an inch long, about the twentieth of an inch broad, arranged somewhat in a rachis form. Most usually these grooves are by pairs, as if made by a bipedate animal; but sometimes the number is greater, and the impression has the aspect of the stem and clusters of the grape; and hence the name (αμπελος, a vine.)

Plate VI., fig. 16, gives some idea of this track from the best specimen in the Cabinet. Possibly it may be a plant.

34. CLIMACODICHNUS CORRUGATUS. (Nov. Gen. and Sp.)
(χλιμαχῶδης, like a ladder. *Corrugatus*, wrinkled.)

[In the Cabinet, Nos. $\frac{33}{57}$, $\frac{47}{20}$, $\frac{47}{21}$, $\frac{47}{22}$, $\frac{55}{7}$.]

The aspect of all the specimens of the tracks of this species (of which we have several very distinct and fine ones in relief,) is an irregularly corrugated surface, crossed by several small ladder-like rows of impressions, a good deal resembling the steps of the *Acanthichnus*, but more than sufficient to form the sides of the ladder, and extending past one another. It is doubtful whether what appear to be cross-bars to the ladder, may not belong to the general corrugations of the surface, rather than the ladders. But they give to the parallel rows of what seem to be tracks, the aspect of ladders. The width of the ladders is about 0.39 inch, and the length of the individual tracks not usually much more than 0.2 inch. The ladders are not commonly straight, but curve to the right and the left, and sometimes cross one another, retaining their individuality very perfectly.

Now did these ladder-like rows of impressions cross a smooth surface of stone, I could not hesitate to regard them as tracks. But the corrugations of the whole surface, which certainly have a general resemblance to those of the impressions, lead me to hesitate and try to refer the whole to some other agency than animals, and plants are the only resort that I can think of, or possibly some freak of water, and there is on the right hand side of the photograph, Plate XIII., a straight impression, that looks like a plant, somewhat. But after all — and I have looked at these specimens perhaps hundreds of times — my mind generally comes to the conclusion that the parallel serpentine rows of impressions must be tracks, whatever may be the origin of the other corrugations.

The outline of these rows, given in Plate VII., fig. 5, conveys but an imperfect idea of their character. But the photograph in Plate XIII., is very fine; and is almost equivalent to having the specimen itself accompanying the paper. It is one-third the natural size.

35. ÆNIGMICHNUS MULTIFORMIS, (, an enigma, and , a track.
Multiformis, of many forms.) (Nov. Gen. and Sp.)

[In the Cabinet Nos. $\frac{27}{21}$, $\frac{41}{10}$, $\frac{51}{15}$.]

Of this enigmatical species of tracks, we have three large slabs, one of them three and a half feet by four and a half, and the others not much less; all of them

covered by thousands of small impressions, which are very distinct. Most of them were evidently made by the feet of animals, but of what kind we find it difficult to decide.

For a time it seemed almost impossible to give any description of these slabs that would be at all satisfactory. But so fine a photograph of the largest was obtained, that with a microscope, all the minute markings are very distinct, and the copies from it, which we give (Plate XIV.) I trust retain most of them. Besides this, we give on Plates I., figs. 4 and 5, XI., figs. 1-6, XII., figs. 1-4, numerous rows of impressions a few inches long and of the natural size of many of the varieties of form. By these means we trust scientific men will be able to form a tolerably correct idea of these anomalous markings.

On the largest slab from which the photograph was taken the following facts are manifest, as they are also on the other specimens.

1. Several perfectly straight, simple grooves or furrows, perfectly parallel and sometimes less than half an inch apart, resembling drift furrows; yet they are certainly not such, for the slab was split out of the quarry, and did not lie upon the surface. Probably they are independent of the rows of tracks; for though the two are nearly parallel, they sometimes cross at a small angle. If a carapace-like shell of some animal, however, had points in it projecting downward, they might have made the grooves as the animal dragged himself over the surface; but it is marvellous that they are made so perfectly straight and uninterrupted.

2. Numerous rows of impressions, not less certainly than thirty-five, running across the slab nearly parallel to one another and to the grooves, but as already stated, sometimes crossing at a small angle; and sometimes the rows of tracks are a little crooked.

3. The most usual form of these impressions is circular, as if made by a punch. These vary in diameter from mere points to nearly the fifth of an inch, and are approximately equidistant from one another. Sometimes they are elongated, and even become linear.

In one case, given on Plate I., fig. 4, there is a trifid arrangement of somewhat triangular toes, with two dents behind, and two or three on one side, and this arrangement is repeated about once in an inch. The axis of the foot in this case is turned aside from the line of direction as much as 30°; but I cannot decide in which direction the animal was moving, nor find a series of impressions to the right or left, corresponding to this one.

In another case there is a flask-like impression about an inch long, having on one side of the neck, three elongated impressions, and on the other side, at the

bottom of the flask, a circular dent, the whole being separated nearly as often as it can be, along the line of progression. This is shown on Plate XI., fig. 4. I have found no corresponding line of impressions to the right or the left.

In another case we have large indentations, say a third of an inch in diameter, arranged by pairs about two inches apart. See Plate XI., fig. 6. Another shows fine markings, almost as if a tuft of hair had been impressed upon the mud. See Plate XII., figs. 3 and 4.

4. Crossing this slab, and nearly parallel to the grooves and rows of tracks, may be seen three deeper and more irregular furrows, with small ridges on each side curving outward, and even crossing the specimen, so as to look like small ripple-marks, giving to the impression the aspect of the vane of a feather. The small side ridges are doubtless ripple-marks, produced by some solid body moving along against the current. I can hardly doubt that they were produced by the tails or tail-spines of some animal ploughing across the mud.

5. If this be a reasonable conjecture, it shows us which way the animals moved, and that they may have been covered with hard shells like some crustaceans, whose numerous small extremities made the rows of tracks and the processes along the margin of the shells, and the tail-spines made the parallel furrows.

In this case, I think the animals must have been as much as two feet wide. This conjecture is made more probable by a paper in a late number of the "Canadian Naturalist" by Dr. Dawson, "On the Foot-Prints of *Limulus*, as compared with the *Protichnites* of the Potsdam Sandstone." There is certainly some resemblance between some of his drawings and ours, but not enough of likeness to justify us in bringing both the cases into a nearer relation than to refer them to the same general class of animals; and I more and more think that the markings on our specimens will be found to have had a crustacean origin.

MISCELLANEOUS ITEMS.

A large proportion of the finest tracks and rows of tracks now in our Cabinet, were obtained just as my *Ichnology* was passing through the press, or subsequently. Consequently many of the species in that work could now be described with much fuller and more satisfactory illustrations. But it would require expensive drawings, and I do not feel authorized to make much further appeal in this direction to the liberality of the Commonwealth, after having given so many illustrations which seemed to me indispensable. I shall therefore add only a few, hardly expecting that even these will not be set aside. Had I the funds requisite to obtain more good drawings of other fine rows of tracks, and the means were afforded for their

publication, I could add a large number to the engraved representations that have been given to the public. This will doubtless be done at some future time.

Brontozoum giganteum.

In my Ichnology I have given three inches as the maximum width of the toes of this species, and though we had in the Cabinet, specimens with toes considerably wider, the opinion was expressed that the surface exhibited was beneath that on which the animal trod, and might therefore show a track wider than the animal's foot by the bending downwards of the layers of mud. But among more recent specimens we have some that show toes full four inches across, and yet all the phalanges (except the fourth in the outer toe, agreeably to the views presented in this paper,) are distinct, and every mark to indicate that there is no distortion or exaggeration, and therefore this enormous size was attained by some individuals of this species. An outline of our best specimen is given on Plate X., fig. 1.

By the side of this I have placed on the same Plate, fig. 2, the drawing of another specimen, the representative of another variety not uncommon, whose outlines are very distinct, though the phalanges are not usually marked, which show so much slenderer proportions in every part, that it seems most likely it must be another species. No mere difference of age in the animals could explain the striking differences in the tracks. I have not proposed the slenderer species as new, because unwilling to add more to the list. But if we take the thick-toed specimen as the type of *B. giganteum*, the others may properly be called *B. approximatum*.*

* The above suggestion having been acted upon in the labelling of the Cabinet, I propose to give the descriptions of both as *different species*, with the usual references. No. $\frac{45}{8}$ was used as the type of *B. giganteum*. — C. H. H.

BRONTOZOOM GIGANTEUM. (Synonyms same as in Ichnology.)

[In the Cabinet, Nos. $\frac{2}{1}, \frac{2}{3}, \frac{2}{4}, \frac{2}{5}, \frac{2}{7}, \frac{8}{1}, \frac{9}{1}, \frac{9}{10}, \frac{15}{11}, \frac{15}{1},$ to $\frac{15}{5}, \frac{15}{8}, \frac{15}{11}, \frac{15}{14}, \frac{15}{16}, \frac{15}{18}, \frac{16}{6}, \frac{17}{1}, \frac{20}{6}, \frac{29}{1}, \frac{31}{22}, \frac{43}{1}, \frac{43}{2}, \frac{44}{1}, \frac{44}{2},$
 $\frac{44}{3}, \frac{45}{1}, \frac{45}{3}, \frac{45}{4}, \frac{45}{8}, \frac{45}{9}, \frac{51}{11}, \frac{53}{3}, \frac{53}{6}, \frac{53}{8}, \frac{53}{11}, \frac{53}{12}.$]

Divarication of the lateral toes, 40°; of the inner and middle toes, 18° to 20°; of the outer and middle toes, 22°. Length of the middle toe, 10 inches; of the inner toe, 9 inches; of the outer toe, 8 inches; of the foot, 15 to 18 inches; of the step 4 to 5 feet. Width of the toes, 3 to 4 inches; of the posterior part of the foot, 7.5 inches. Length of the claw, 1 inch. Distance between the tips of the lateral toes, 10 inches; between the tips of the outer and middle toes, 7.5 inches; between the inner and middle toe, 6 inches. Length of middle toe beyond the others, 3.5 inches; of the first phalanx of the inner toe, 3.75 inches; of the second, 3.1 inches; of the first phalanx of the middle toe, 3.75 inches; of the second, 3 inches; of the third, 2.9 inches; of the first phalanx of the outer toe, 2.25 inches; of the second, 1.75 inches; of the third, 1.50 inches; of the fourth, 1.25 inches. Angle made by the axis of the animal's foot with the median line, or line of direction, as it walked, 0° to 10°. Distance of the centre of the heel from the median line, 0 to 5 inches. Width of the trackway, 18 inches. Toes nearly straight; middle one slightly curved inwards. Claws nearly straight, and only slightly curved downwards. Integuments of the under side of the foot, papillary and striated. Animals gregarious.

Papillary Impressions.

Specimens showing the papillary impressions are exceedingly rare; but we have now several beautiful ones in the Cabinet; and perhaps, upon the whole, the best specimens are the large ones that have been described in this paper, and figured on Plate XV., figs. 1 and 2. But we also have at least two good specimens of the *Brontozoum minusculum*, one from Wethersfield, Connecticut, which shows striæ as well as papillæ; the other a very beautiful specimen from Turner's Falls, figured on Plate XVI., fig. 1, one-fourth of the natural size.

Plectropterna gracilis.

So beautiful and perfect a row of the tracks of this species was lately obtained, that I could not resist the temptation to have it photographed, and it is given on Plate XVII., fig. 1. (In the Cabinet, No. $\frac{51}{19}$.) This may be compared with the very inferior drawing on Plate XVIII., fig. 3, of my *Ichnology*; but I have not the strength, dictating this as I do from a sick-bed, to go into a detailed comparison.

Arachnichnus dehiscens.

This track, as I described it in my *Ichnology*, connected with the singular appendage which gives it its name, was very obscure; but the type of it, as I now understand it, is very beautiful, and I have been tempted to have a fine double row

Localities, only as represented by specimens. Horse Race, Gill; Lily Pond; below the dam at Turner's Falls; north part of South Hadley; Northampton at the east foot of Mt. Tom, and at Bassett's Quarry, Easthampton; Wethersfield Cove, Connecticut; south-west part of Middletown, Connecticut.

BRONTOZOUM APPROXIMATUM. (Nov. Sp.)

Brontozoum giganteum, in part of the *Ichnology*.

[In the Cabinet, Nos. $\frac{2}{1}, \frac{12}{1}, \frac{15}{6}, \frac{15}{7}, \frac{15}{9}, \frac{15}{10}, \frac{15}{12}, \frac{20}{6}, \frac{29}{1}, \frac{33}{56}, \frac{34}{6}, \frac{38}{4}, \frac{43}{1}, \frac{43}{6}, \frac{44}{8}, \frac{44}{9}, \frac{45}{1}, \frac{52}{17}, \frac{53}{4}, \frac{53}{9}$.]

Divarication of the lateral toes, 50°; of the inner and middle toes, 30°; of the outer and middle toes 24°. Length of the middle toe, 9 inches; of the inner toe, 6 inches; of the outer toe, 6.5 inches; of the foot, 15 inches; of the step, 3 to 4 feet. Width of the toes, 1.75 to 2.12 inches; of the posterior part of the foot, 4.75 inches. Length of the claw, 1 inch. Distance between the tips of the lateral toes, 7.5 inches; between the tips of the outer and middle toes, 6.5 inches; between the inner and middle toes, 5.25 inches. Length of the middle toe beyond the lateral ones, 4 inches; of the first phalanx of the inner toe, 2.55 inches; of the second, 2.4 inches; of the first phalanx of the middle toe, 3.1 inches; of the second, 2.5 inches; of the third, 2.25 inches; of the proximal phalanx of the outer toe, 2.25 inches; of the second, 1.18 inches; of the third, 1 inch; of the fourth, 1.05 inches. Angle made by the axis of the animal's foot with the median line, and the distance of the centre of the heel from that line, about the same as *B. giganteum*. Width of the trackway, 14 inches. Measurements from No. $\frac{54}{10}$. In the slenderer proportions and the greater divarication of the toes, and at the same time the difference in size, will be found the chief differences between these two species.

Localities, as represented in the Cabinet, Horse Race, Gill; Ferry above Turner's Falls; Lily Pond; east foot of Mt. Tom, in Northampton.

of the hind and fore feet photographed and shown on Plate XVII., fig. 2, one-ninth of the natural size. (It is No. $\frac{51}{18}$, in the Cabinet.)

For the reason above suggested, I cannot formally compare this drawing with the description given in the Ichnology.

Supposed mistakes as to the number of Phalanges in some of the Lithichnozoa.

It is well known that the number of phalanges, and their order in the toes of living birds, enables the anatomist to distinguish them from other animals, with only a few exceptional cases. In four-toed birds, it is two in the inner toe, three in the second, four in the third, and five in the outer toe, and where there are only three toes, the numbers are the same as in the three outer toes of the four-toed birds. But since the penultimate and ungual phalanges would make only one impression, we should expect in the track that the numbers would be one less than above indicated. And such they seemed to be to every observer without exception in the three-toed pachydactylous Lithichnozoa, viz.: two in the inner, three in the middle, and four in the outer toe. This of course was regarded as the grand argument to prove them made by birds.

Sometime since, my suspicions were awakened that we had all been mistaken as to the true number of phalanges in these tracks, and when I went into an examination, I found it even so in respect to the outer toe. By looking at the drawings which myself and others have published of these tracks, it will be seen that what we have supposed the posterior phalanx in that toe, lies wholly behind the first phalanx of the inner and middle toes, and sometimes, also, a little out of the line of the other parts of the toe. Now by looking at the feet of the different species of birds, either in a cabinet or in drawings, we shall see that the posterior phalanges in the three toes lie nearly abreast of one another, unless it be the middle toe, where this phalanx is usually a little in advance.

This posterior impression behind the outer toe, was not, therefore, made by a phalanx, but probably by a process of the tarso-metatarsal bone. We accordingly sometimes find a similar posterior impression behind the inner toe, and indeed a third and smaller imprint of this sort shows itself sometimes, as on the sketch at page 78 of my Ichnology, and on Plate V., figs. 1 and 2 of the present paper.

These facts, I confess, very much unsettled my convictions that any of the Lithichnozoa were birds. And they were still farther shaken by the facts I have already detailed respecting that most anomalous animal, the Anomœpus. The trifold tracks of its hind feet had been mistaken by us all for those of birds. Indeed, the number of phalanges in the toes were found without much doubt to correspond with those of living birds, and also with those Lithichnozoa I had regarded as birds.

But the *Anomœpus* had been proved without question to be four-footed; and were we not forced to the conclusion that all the *Lithichnozoa* with similar trifid feet must be quadrupeds, either mammalian or reptilian?

Another development as to the Phalanges.

Probably I should ere long have come to this conclusion, had not another discovery awaited me. Among the new specimens purchased was one very beautiful row of thick-toed trifid tracks, such as we had been in the habit of supposing made by birds; but I have little doubt that they were those of an *Anomœpus*, though no marks of fore feet or tail are seen. I have named it as a new species (the *A. curvatus*,) of that genus, though differing but little from the *A. intermedius* already described. On looking at these tracks, I was surprised to find in the outer toe, *four very distinct phalangeal impressions besides the posterior imprint*, which I now regard as made by a heel and not a phalanx. Plate I., fig. 2, gives an exact outline of one of these tracks, and on examining the remarkable slab of *Anomœpus intermedius* already described, I found one proving that in some cases the outer toe had made four phalangeal impressions besides the heel bone, as may be seen in Plate I., fig. 1. So far as the *Anomœpus* is concerned, then, I feel sure that we have in its phalangeal impressions the normal number and order in the feet of living birds. I was at once led to inquire whether the same thing might not be true in respect to those thick-toed *Lithichnozoa* which I have regarded as birds. I have found proof enough to satisfy myself that it is so, and that the reason the fact has been overlooked is, that the penultimate and ultimate phalanges (omitting the ungual,) rarely made separate impressions. But I had frequently noticed that the length of the ultimate phalangeal impression on the outer toe (as a reference to the outlines of these tracks in the *Ichnology* will show,) was as long as, and sometimes longer than those which preceded it, whereas, so far as I have examined the osteology of birds' feet, the phalanges decrease in length towards the extremity. I think that generally two phalanges have been mistaken for one in this part of the toe.

If these are probable conclusions, they lead, to important results. The first is, that if we strike off the posterior impression of the outer toe in the thick-toed bird tracks referred to, we shall still have the normal number of phalanges in the feet of living birds. But, secondly, the same thing is proved still more decidedly in regard to the *Anomœpus*, which is four-footed. Hence the conclusion follows that in the fossil foot-marks, birds cannot be distinguished from quadrupeds by the number of phalanges. This law of correlation among living animals would seem not to have been true with the fossil.

How far do the Protuberances on the Feet of Animals correspond with the Phalanges ?

This subject could not but engage my attention in the progress of these investigations. But not finding it discussed by any anatomical author, and being prevented by feeble health and winter weather from access to any large collections of animals, I have been able to arrive at only unsatisfactory results. My examinations have been confined chiefly to the feet of birds, and the following facts have been obtained. The most important question under consideration is this: Is it the phalanges, or the articulations of the toes, that make the deepest impression on mud, or other plastic material trod upon? This will be determined by finding under which of these parts the protuberances are the most prominent. If under the phalanges the number in the toe will be one less than if under the articulations; that is, if we count as one of them, the articulation with the tarsal or metatarsal bone.

The protuberances on the foot of the turkey, both wild and tame, correspond neither with the phalanges, nor the articulations, but are more numerous than either. The same is true of the domestic hen. There is a general resemblance, however, in this respect between different individuals.

In the *Botaurus lentiginosus*, the protuberances seem to correspond with the articulations or joints.

In the coot, the wings along the toes expand most in the middle of the phalanges.

In the crow, the correspondence seems to be essentially with the articulations, judging from some tracks of this bird on clay, in the Cabinet.

But the *Struthionidæ* have feet more nearly resembling the tracks under consideration. And in the *Rhea Americana* or S. American ostrich, although these protuberances are tolerably distinct on the middle toe, yet the inner and outer toes do not show them. A large heel shows itself behind the middle toe.

These few examples show that there is great diversity among living birds in the matter under consideration. Sometimes the protuberances correspond to the articulations; sometimes to the phalanges, and sometimes to neither. But I have never found feet that would make such distinct and marked tracks, and with always the same number of rounded impressions as did the thick-toed *Lithichnozoa*, and I am still inclined to believe that such was the structure of their feet that their tracks would show the number of phalanges rather than of the articulations. It could not be the latter, if the views I have presented in this paper as to the posterior imprint in the outer toe be correct, for that impression is entirely behind the phalanges on all

the toes. I could wish, however, that I had time, strength, and opportunity to pursue this subject farther among existing species of animals.*

But though my researches have been unsatisfactory on the particular point above mooted, they seem to me to have settled another of much interest. I do find protuberances on the feet of birds, especially the tridactyle species, behind the phalanges, such as might well have left those impressions on the tracks which we have mistaken for the posterior phalanx. We are thus relieved from the necessity of supposing anything peculiar in the processes of the tarso-metatarsal bone in the fossil animals.

The Feathered Fossil of Solenhofen.

The recent discovery of a remarkable animal called by some *Griphosaurus*, and by others, *Archæopteryx*, in the famous lithographic quarries of Solenhofen in Bavaria, throws some light, I think, upon the thick-toed *Lithichnozoa*, while they reflect some light upon the feathered fossil — for it had feathers — yet some of the ablest Zoölogists pronounced it a reptile; others, however, as Professor Owen, of London, and Professor Dana, of New Haven, believed it to have a predominance of ornithic characters, so as to make it a bird.

Some important parts of the skeleton are wanting, as the head, neck, dorsal vertebræ, and sacrum, and the ribs are detached and scattered about.

The forearm consists of a radius and ulna, a metacarpal bone, and a few detached small fingers, also two small slender bones, with sharp claws, like those on the hind foot, and which may have been used for clinging, or as weapons of offence.

The lower right limb consists of femur, tibia, and tarso-metatarsus, to which one hind toe, and three fore toes are articulated, the phalanges being 1, 2, 3, and 4; though the last number is a little doubtful on account of the position of the outer toe. The toes are all armed with sharp claws.

The tail is six inches in length, and consists of twenty vertebræ, of narrow, elongated form, diminishing in size to the last. The feathers of the tail are attached in pairs to each vertebra, throughout its entire length.

Now between these characters and those of some of our *Lithichnozoa*, there are some remarkable analogies, or resemblances, so far as I can judge, and which I

* August 8th, 1863. — I have just met with the statement in an early edition of Buffon's *Natural History*, (Tome Huitième, p. 87,) that "the toes of frogs (*Grenouilles*,) are pointed without a lenticular pellet (*pelotte lenticulaire*,) and ordinarily provided with a small tubercle under each articulation of the phalanges." This last fact so striking in the thick-toed *Lithichnozoa*, would seem to give them a strong batrachoid character; but in the number of feet, of toes and phalanges, there is nothing batrachian, but the bird type is very striking. Let all the facts however, be kept in mind, as they will lead to the truth at last.

would now indicate; at least such as have arrested my attention, with some of the inferences I draw from them. It is perhaps unexpected that they ally the Archæopteryx rather to the Anomœpus quadrupedal, than the biped tridactyles of my Ichnology.

1. In both we have on the hind foot, three front toes, articulated to a stout tarso-metatarsal, and not as in all animals except birds to a tarsus of several bones. This resemblance applies also to the biped thick-toed tridactyle Lithichnozoa, as well as to the Anomœpus; for they must all have had tarso-metatarsals below the tibia and fibula, though no impressions among the tracks indicate any such bone. But we have the most decisive evidence that these animals had only three toes; and where in existing nature do we find that number articulated with a tarso-metatarsus, (except a few cases in the Ruminantia and Solipedia?)

2. They both had the same number of phalanges in the three front toes, though a little doubt remains as to the outer toe of the fossil. The same number of phalanges existed in the biped Lithichnozoa, so far as we can judge by their tracks.

3. The posterior extremities of both, as far as the tarsal joint, correspond exactly with those of living birds; hence the tracks of the hind feet of Anomœpus as well as those of the biped Lithichnozoa under consideration, are pronounced at once on first seeing them to have been made by birds, and it is only when occasionally we see where the Anomœpus brought its fore feet to the ground, that we suspect it could have been four-footed.

4. Precisely how much correspondence there may be in the anterior extremities of the two animals, we cannot decide. The Archæopteryx is thought to have had but one metacarpal bone, and the fingers are so scattered that their number is not given; but two are described as slender, with long claws. The most perfect tracks of the fore foot of Anomœpus has five toes, all of which, except the hindmost, have claws, and probably that has also, but it is not visible on the track. The two hindmost toes have two phalanges, the third four, the fourth three, and the fifth two. The fingers are so arranged as to be fan-shaped, all pointing more or less outward, resembling an expanded wing. But they seem to be genuine fingers, and there is no appearance of feathers on any of the tracks of hind or fore feet. Plate II., fig. 1, shows an outline of the most perfect track of the fore foot yet found.

This certainly looks more like the fore foot of a lizard, and still more like that of some mammals, than the fore arm of a bird; and it is difficult to conceive how it could have been used as an organ of flight, though possibly it might have been employed for prehension. But on the other hand, we have conclusive evidence that it was not used for walking, except, perhaps, occasionally and imperfectly. The

right and left anterior feet that made the tracks, were placed almost invariably nearly abreast of each other, as if the animals were resting, and not in alternation as in walking. But of more than forty steps of *Anomœpus intermedius* shown on the remarkable slab (Plate XV., fig. 1,) described in this paper, the fore feet, show themselves only twice, and that where the animal rested. Indeed, we may safely assume that the principal object of the fore feet was not locomotion, and the same remark is applicable to other species, even the gigantic *Otozoum*. What other purpose in the economy of these animals could have been subserved by such a structure, except, perhaps, prehension, I will not attempt to decide. Yet the fact has awakened an inquiry in my mind, whether such a structure may not have existed in an animal whose predominant characteristics were those of a bird.

5. But there was a tail, and how shall we reconcile that with an ornithic character? It might have been impossible before the discovery of the fossil at Solenhofen. But that animal had a tail six inches long with twenty vertebræ; and yet the most eminent Zoölogists regard it as a bird. The characters of the tail in the *Anomœpus* are very peculiar; yet there are some curious resemblances between its markings on stone, and the tail of the *Archæopteryx*. The traces of the tail of the *Anomœpus* have three distinct phases. The largest species left a heart-shaped indentation, from two to three inches in diameter, which was repeated once in about ten inches.

The *A. minor* left an ovoid indentation, which was repeated every few inches. Would not such impressions be just what we might expect if this animal had a short blunt tail like the *Archæopteryx*? And does it not suggest one of the uses of such a tail, viz.: to furnish the animal with a sort of third hind foot to help sustain it, while it might use its fore feet perhaps for seizing upon objects above and around it?

The tail of the *Anomœpus intermedius*, although rarely leaving an impression, did sometimes drag along and make a narrow continuous trail. This would indicate greater length, and perhaps tenuity. But how much of attenuation and elongation might be consistent with an ornithic type, we have no means of knowing. Professor Dana speaks of "a posterior elongation of the body as connected profoundly with inferiority of grade in the different types of animal life," and says that "it is the very one of all abnormal features to be looked for in the early birds."

Upon the whole, the singular markings of the tail upon stone, with the exception perhaps of *A. intermedius*, do really suggest a curious coincidence between the caudal extremity of this genus, and that of the *Archæopteryx*.

Just as I had reached this point in my conclusions, a curious development awaited me. In examining some new specimens, a singular trail showed itself upon

one, which I had never before noticed, or if I had seen it, I had not connected it with the tracks, but considered it among those inexplicable markings, due perhaps to water and wind, which so frequently puzzle the student of Ichnology. But in this case a series of some six or seven rather flat and broad grooves, each, one to two-tenths of an inch wide, and the whole forming a trail an inch wide, (see Plate XVI., fig. 2, and No. $\frac{54}{2}$ in the Cabinet,) ran across the entire specimen, passing over one very distinct trifid, narrow-toed track, which is half an inch deep, and the grooves show themselves on opposite sides of the foot-mark, certainly two-thirds of its depth, appearing as if some flipper-like appendage had dragged behind the animal, capable of easily conforming itself to the irregularities of the surface. The fact that it made its marks deep into the track, shows that it was made subsequent to the track, and suggests at once the idea of a broad and singular tail. What a pity it is that there is only one track upon the specimen! But so far as I can judge, the tail runs in the direction in which the animal was moving.

In these conclusions I should have acquiesced with considerable confidence had I not found on examining our new specimens as well as others previously in the Cabinet, that we have quite a number with similar markings, and that the trails in these do not always follow the line of tracks but are sometimes on one side of it and sometimes on the other; now and then on both sides, and then crossing the line of track so as to seem to have no connection with them. In general, however, it seems as if some appendage to the posterior part of the animal had been thrown out on one side and the other, making sweeps occasionally so as to leave curved trails. The species of track with which they are most usually associated is the *Anisopus gracilior*, described in the first part of this paper. (See Nos. $\frac{43}{5}$, $\frac{45}{6}$, in the Cabinet.) In this species both hind and fore feet are almost always shown, and it is quite obvious that the flipper-like impressions have no connection with the feet.

They seem also rather large for the tail of so small an animal, whose feet are all less than an inch across. I have, hence, been sometimes inclined to believe that the trails were made by some animal swimming along near the bottom, and occasionally striking and grooving it with its flippers or fins. But my more mature conviction is that they are connected with the tracks. It needs a series of expensive drawings to make the facts fully understood without specimens.

6. But to return to the *Anomæpus*. Which character shall we now regard as predominating in its structure and movements, those of the bird, or those of the lizard, or mammal? It is difficult to avoid the conclusion that the ornithic characters are the most numerous and striking. It may after all have been a bird, of so low a grade, however, that even with its skeleton before him, the anatomist would hesitate where to place it, as in the case of the *Archæopteryx*.

7. This conclusion to which the facts and reasoning have conducted me, not without remaining doubts, would, not long since have appeared very absurd. But if it could be admitted, see what a relief it gives to difficulties. If the *Anomæpus* were a lizard or a marsupial, we must give up that firmly established law of correlation, which enables us to distinguish different classes of animals by the number and order of phalanges, but if it were a bird, the law can still be reckoned upon among the fossil as well as living animals. If a bird, we can see, also, how it was that it generally walked upon two feet, although it had another pair to be used perhaps for several purposes, but rarely for locomotion.

8. If we can presume that the *Anomæpus* was a bird, it lends strong confirmation to another still more important conclusion, which is that all the fourteen species of thick-toed bipeds which I have described in the *Ichnology*, and in this paper, were birds. In this case, if we can retain the law as to the phalanges, all the characters of the animals as made known by their tracks, belong to birds, with little variation from the existing bird type. They were bipeds unquestionably. Since they are the most abundant of the tracks, I have now seen thousands of them, and had fore feet existed, I am sure they would occasionally have left some trace of them, as is the case with every other species of *Lithichnozoa*. They had but three toes; at least if a fourth existed in any case, it must have been articulated so high as not to reach the ground. These three toes are articulated to a tarso-metatarsus, as is the case with nearly all tridactyle animals. They had the same number of phalanges as birds. The impressions left by the cushion beneath those processes of the tarso-metatarsus, which form the heel, correspond to those which living birds would make, so far as I have examined, not to those of any other class of animals, though my examinations on this point have been few. The claws and papillæ agree essentially with those of birds. Finally, the great length of stride in some cases, and the position of the tracks nearly on a right line indicate the long legs of wading birds, and not any other kind of animals.

Most of these arguments are good for the ornithic origin of these tracks, whatever opinion we may entertain as to the *Anomæpus*. The only difference is, that if we regard it as a reptile, the argument from the number of phalanges must be given up; if as a bird, that strong evidence is retained. But even without this, I cannot hesitate to reckon the biped thick-toed *Lithichnozoa* as birds; for I see no characters in their track that ally them to any other animals. I must consider them not only as birds, but as forming a quite perfect type of birds for sandstone days. The analogies taught us by Paleontology (see Professor Dana's appended letter,)

would lead us to expect also in the same period, a lower group of birds, and those may have been the *Archæopteryx*, and perhaps the *Anomœpus*, with some other genera of *Lithichnozoa* which we might name.

How then could I avoid the conclusion that these animals were birds? Doubtless with some peculiarities of structure, bringing them into the "comprehensive types" of Dana, but still decidedly birds. When I began this paper, and ascertained that we had probably made a mistake as to the number of phalanges, I felt as if this opinion which I have always maintained was becoming doubtful. But new examinations brought new facts to light, and the history of the Solenhofen fossil added others, until it appears to me, we may now with more confidence than ever, maintain the ornithic character of these animals. It is certainly gratifying even to seem to touch soundings after having been so much tossed on the sea of difficulty, and I cannot but hope that subsequent researches will show that we have not cast anchor merely in quicksand.

Professor Dana's Views.

Having occasion, while engaged in the investigations detailed in the preceding paper, to write a letter on business to Professor J. D. Dana, I mentioned some of the results to which my mind was coming. His reply contains too much good reasoning and important suggestions to be lost, and I venture, without asking his leave, but trusting he will excuse me, to annex his remarks to this paper.

"NEW HAVEN, February 7, 1863.

"MY DEAR SIR: — Your new results from recent researches among the tracks of the Connecticut Valley, are of great interest, and I should be glad to put your conclusions, when you are ready with them, in the Journal. I am satisfied that we cannot infer the form and character of the earliest birds from those of the present day. The early type was evidently one of the mixed types (comprehensive, as I have called them,) which diverged widely from the normal type — just in fact, as the Ganoids diverge from the Ctenoids and the Cycloids — the marsupials from ordinary mammals, and Amphibians (or Batrachians) from true Reptiles. You know that in the class of Mammals the marsupials are *semi-oviparous*, or intermediate between the true viviparous Mammals and the oviparous birds and reptiles. So again the Amphibians are intermediate between true reptiles and fishes, having gills when young, like fishes, etc. Now by the recent discovery of the feathered fossil of Solenhofen, we have a corresponding inferior division of birds intermediate between birds and reptiles. Thus each class has its great typical group

and its inferior abnormal group, related to the class next below. This being so, wide divergencies of form in the abnormal group are to be looked for.

"There is another principle bearing on this subject — *the remarkable harmony among the types of any era through the past ages*. Thus the coal-plants are made up mainly (1) of the highest Cryptogams, that is, the *Acrogens*, of which the Fern is the typical group, (2) the lowest Phænogams, the Conifers, and (3) intermediate (or comprehensive) types in each class, *Lepidodendra* of the *Lycopodium* tribe, a type coniferous in habit, and *Sigillariæ* of the Phænogams, also intermediate between Conifers (in the Gymnosperms,) and the *Lepidodendra*. By such an assemblage, the flora was rendered remarkably harmonious. Had the progress of life consisted in an advance of Cryptogams to mosses, along with the introduction of Conifers, it would have been far otherwise.

"Again, (1) the Reptilian fishes (Ganoids,) (2) Amphibians; Reptilians and (3) fish-like higher Reptilians (Marsh's *Eosaurus*,) made up a harmonious assemblage of carboniferous *animal* life. Again, the semi-oviparous Mammals (Marsupials,) and oviparous Reptiles, &c., were in harmony with one another; and if true non-marsupial Insectivores appeared also, it was still in harmony; for the Marsupials were mainly Insectivores; moreover, the former were prophetic of the higher development of the Mammalian class. Now, if, along with the semi-oviparous Mammals and swimming, crawling, and flying Reptiles, there were Reptilian birds, waders and others, the harmony would only be more complete. The presence of the same number of phalanges in birds and reptiles would be not at all improbable — certainly no basis for an argument against the birds."

In another business letter of February 14, I find the following: —

"The strongest arguments for the ornithic character of the feathered fossils, are —

"1. *That the animal had feathers*; for the idea that they were not true feathers, is a mere supposition, without any facts to sustain it:

"2. *That the expanse of the wing was made by feathers on a short arm*, and not as in the Pterodactyle by an expanse of the skin supported by an elongated finger. The structure of the foot in the Pterodactyle also shows that the animal had no close relation to the Birds. The world will have finally to settle down into the belief that there were Reptilian birds in ancient times, as well as Ichthyoid Reptiles and Oöticoid Mammals. This is my strong persuasion."

POSTSCRIPT.

Still more recently, not in fact till this paper was completed, another specimen among the new tracks, arrested my attention, containing some curious markings, leading us even still farther than the text, in conjectures, as to the avian character, even of some of the ancient quadrupeds. I found a new species of that most remarkable genus, the Plesiornis, showing certain groovings and indentations, which may give us some insight into the character of the tail of the animal. This genus, as described in my Ichnology, where two, and perhaps three species are given, exhibits both a hind and fore tridactyle foot, exactly resembling that of a bird, and in fact showing the same number of phalangeal impressions, yet the fore foot is always the smallest; but it was a long time before I could be persuaded that these tracks were not made by two species of birds, walking on parallel lines. But I cannot doubt that they are true tridactyle quadrupeds, though the toes of the most characteristic species (*P. pilulatus*,) are terminated by pellets instead of claws. The new species, which I call *Plesiornis mirabilis*, has claws, and the tracks exactly resemble a large species of *Grallator*. It was the attendant groovings and markings which arrested my attention, and I have attempted to give an idea of them, of the natural size, by adding Plate XX.

The technical description which follows, will, I hope, make the facts more intelligible.

37. PLESIORNIS MIRABILIS.

[In the Cabinet No. $\frac{51}{16}$.]

Hind Foot. — Divarication of the lateral toes, 35° to 40° . Length of the foot, 6 to $6\frac{5}{10}$ inches. Width of the foot, $3\frac{1}{2}$ to 4 inches. Length of the step as measured by the hind foot, $12\frac{1}{2}$ inches. Claws distinct, but not the phalangeal impressions.

Fore Foot. — Divarication of the lateral toes, between 80° and 90° . Length of the foot, $3\frac{1}{2}$ inches. Width of the foot, 3 inches. Length of the step as measured by the fore foot, 12 to 14 inches. Claws indistinct. Hind and fore feet sometimes in contact, sometimes almost three inches apart, but nearly abreast. Several very distinct grooves making a train $3\frac{1}{2}$ inches wide, following in the line of the tracks, varying in width from a mere line up to half an inch, not exactly parallel, and some of them broken off in one or two places. A little to the left hand side of the

grooves are three distinct cases of rounded impressions; from a quarter to half an inch in diameter, as if the blunt ends of a bundle of sticks of different sizes had been impressed on the mud. Behind two sets of these impressions, grooves from $\frac{1}{2}$ inch to $1\frac{1}{4}$ inches wide, extend from three to four inches. The whole appears as if the bundle of cylinders had dragged along the surface, until at length the animal rested on their extremities, then lifting them up, had moved forward and made other impressions. This may be only conjecture, but such is the appearance.

On the left hand groove, behind the foremost track, for six inches, the sides present so strong a resemblance to the impression of a feather, that I have had it sketched. For although I cannot persuade myself that it is such, it certainly bears a stronger resemblance to it than anything I have seen elsewhere. And I know not why, if the animal had, for instance, a tail with feathers, we may not hope to find their impressions on some delicate specimens.

Now have we not in these facts rather strong presumptive evidence of the passage of an animal which had a tail of a peculiar character, viz.: with several digitations at the extremity, and capable of being used as a foot in certain cases, so as to leave successive steps, yet usually dragging along so as to form grooves? The stone has on it several other tracks not given in the drawing, and some other obscure markings which if fully understood, might lead to a different interpretation. But I have selected what seems to form a consistent whole. If correct, we are led to conclusions, analogous indeed to those in the text, but carrying us a good deal farther in the same direction, so that we are led almost to conclude that some of the decided quadrupeds among the Lithichnozoa, were birds. The argument stands as follows: —

1. The Plesiornis was undoubtedly a quadruped. The *P. quadrupes* differs from the *P. mirabilis* only in the greater divarication of the toes, the length of the foot, and the greater disparity between the hind and fore feet. The *P. pilulatus*, is a much more slender species, with rounded extremities instead of claws. The *P. æqualipes* I pass over, because a little uncertain. But the disparity of size between the hind and fore feet, in all the species, while yet a large and a small track are always in pairs, and nearly abreast, makes it almost certain that all the species were quadrupeds. (See the drawings in my Ichnology.)

2. The feet, in their general forms, their trifold digitation, their claws, with one exception, and the number of phalanges, so far as has been ascertained, correspond precisely with those of birds.

3. The supposed existence of a tail in the *P. mirabilis*, is the only fact going against the avian character of the foot-marks, and the Solenhofen fossil shows that this is not inconsistent with such a character.

I would not have it understood, however, that I adopt the opinion that any of these ancient quadrupeds which used their fore feet for locomotion, were really birds. I could believe that a bird might have four feet; but I have imagined that in such a case the anterior feet would be very peculiar, and not ordinarily used for locomotion. But the very decided ornithic type of everything about the tracks of the *Plesiornis*, may well raise the question whether an animal might not be a real quadruped moving on four feet, with a tail, and yet a real bird. However, most naturalists, probably, will take the ground that such an animal was rather an ornithoid Batrachian, or a lizard, or marsupial. And this perhaps would be the safest conclusion. Yet the facts are certainly very remarkable; and should lead us to keep our eyes open to all reasonable suggestions, and certainly to admit that the bird-type in sandstone days may have exhibited forms very different from the perfect bird-type of the present day.

AMHERST, July 1st, 1863.

SECOND POSTSCRIPT.

December 25th, 1863.

Even up to the present date, when I am able only occasionally to catch a passing glance at the Cabinet, new facts respecting Tail Traces, continue to arrest my attention. Of No. $\frac{7}{1}$ I gave some account in the *Ichnology*, but not a Plate. It shows a blunt impression of a tail two inches across; but the other species, A. minor, exhibits an elongated trace, which may however, have been made by a stout, blunt tail, dragging along, and occasionally striking the mud. I have found something similar on No. $\frac{7}{1}$, and have thought it desirable on this account to give a photograph of the slab in Plate XIX.* This is the specimen described on page 57 of the *Ichnology*. The fore feet are wanting, but the tail impression is quite distinct, and I think it is repeated near the right hand foot, after dragging several inches. I doubt not that similar markings will reward the researches of other explorers in the Cabinet, of which I must now take a final leave.

* A photograph of the same slab is given in Deane's "Ichnographs," Plate XXXI. — C. H. H.

APPENDIX. [A.]

BONES OF MEGADACTYLUS POLYZELUS.

BY EDWARD HITCHCOCK, M. D.

Since the description of the bones on the 187th page of the Report on Ichnology was made, they have been shown to Professor OWEN, of the British Museum, London, and a few new points have been made out, by more thoroughly exposing them with a graver.

Professor OWEN very kindly gave his attention to the fossils during the limited time I was in London, and made his determinations concerning them, though "subject to correction." They are regarded by him as belonging to a "Saurian Reptile with an unusually thin and compact wall of bone in the limb bones, which, however, might have been occupied by unossified cartilage, as in the young crocodile and turtle; but if they were filled with oil or light marrow, it would point to a course of development towards Pterodactyles or Birds. This phrase is purely hypothetical, and I mean to express no more than a degree of resemblance, supposing marrow and not gristle to have filled the large cavities."

The most important characteristics of these fossils so far as determining the genus is concerned, are in the bones of the right foot, which are tolerably well preserved, and a drawing of which — of the natural size, in Plate IX., fig. 6, — has been made by my sister, Miss EMILY HITCHCOCK. From this drawing it will be seen that the prominent character of the foot is in the robustness of the pollex. Hence Professor OWEN suggests the generic name MEGADACTYLUS. The only other terminal phalanx of this extremity, is found on the fourth toe. And it might possibly seem that there were no claws on any toe but the first one, were it not that among the fragments of the skeleton, another claw is preserved which is only about one-fourth the size of the one figured on the Plate.

When the specimens were shown to Professors OWEN and WYMAN, it was thought that the foot was only four-toed, as a portion of the phalanges was covered by fragments of the rock. But close and careful work with the graver have uncovered the first and third phalanges of the fourth toe, seeming to show that the single phalanx on the right must have belonged to a fifth toe. Its greater size, also, shows that it could not have belonged to the fourth finger.

In addition to the three phalanges of the fourth toe, a small bony knob was found, seeming to represent a fourth phalanx, or rudimentary claw. This, however, is so small, and the fragments of bone are so numerous throughout the rock, that it is possible it is only a bony fragment accidentally located in the position of a phalanx.

For a specific name to this individual, I propose the name POLYZELUS, "much sought for," in allusion to the fact that for so many years other remains than simply tracks of the former inhabitants of the Connecticut Valley, have been eagerly and anxiously sought for, and that now we have the much coveted bones.

APPENDIX [B.]

DESCRIPTIVE CATALOGUE

OF THE

SPECIMENS IN THE HITCHCOCK ICHNOLOGICAL CABINET

OF

AMHERST COLLEGE.

PREPARED BY

C. H. HITCHCOCK.

DESCRIPTIVE CATALOGUE.

The specimens in the Hitchcock Ichnological Cabinet, are in the form of thin slabs of stone, so distributed over various tables, cases, and walls, as to secure the best positions for display, in the lower rooms of the Appleton Cabinet building. Each table, case, or wall is numbered; and the slabs covering or resting upon the several tables, etc., are numbered separately, there being a set of numbers for every table, etc., in the room. These two sets of numbers are combined into a fraction, the number of the table or case constituting the numerator and the number of the slab the denominator of the fraction. Every slab will be found with the printed fraction upon it corresponding to its place in the Catalogue. Sometimes the number is also engraved or painted upon the slab. For convenience in making out the descriptions in the Catalogue, we will use figures for the numbers of the tables, without expressing the whole fraction; but references to specimens upon other tables will always be given in full as entire fractions.

The following will be the order of description: 1. Number of the specimen. 2. Kind of stone. 3. Size. 4. Names and peculiar features of the ichnites. 5. Notice of any other objects of interest upon the slabs. 6. History of the slab or the date of its entrance into the Cabinet. 7. Locality. 8. References to places in the "Ichnology of Massachusetts," or the "Supplement," where the specimen is especially noticed or figured. For the sake of brevity, the signs commonly used to designate degrees and minutes, will be employed to denote feet and inches; and bare figures either for the dimensions or dates in the history of the specimen will be given in their assigned order, without description.

DESCRIPTION OF THE SLABS.

WALL NO. 1.

The specimens upon the east wall of the large room belong to the first division.

1. A slab of reddish sandstone, $8^{\circ} 4' \times 5^{\circ} 4'$. It contains 36 depressed tracks of the following species: *Anomœpus major* — the most remarkable consisting of the impressions of all four feet, two heels and a caudal mark — *Brontozoum validum*, *B. Sillimanium*, *Amblonyx giganteus* and *A. Lyellianus*. Is covered by marks of rain and vegetable (?) fragments. Procured at Marsh's auction in Greenfield, in 1853. From Field's Orchard, Turner's Falls, Gill. Noticed upon pages 57, 71 and 72, and figured upon Plate XXXVIII., fig. 2, of the *Ichnology*. Nos. 1 and 7 of this wall furnish the type of the species *Anomœpus major*.

2. A slab of reddish sandstone, $6^{\circ} 3' \times 2^{\circ} 7'$, showing raised tracks of *Brontozoum validum* and *Amblonyx Lyellianus*, with rain-marks and vegetable (?) fragments. Procured at Marsh's auction. Dug up at Field's Orchard, Gill.

3. Micaceous shale, $5^{\circ} 6' \times 7^{\circ} 9'$. Shows depressed tracks of *Anisopus Deweyanus*, *Brontozoum divaricatum*, *B. Sillimanium*, *Grallator cuneatus*, *Gigantitherium minus*, *Hyphopus Fieldi*, *Apatichnus circumagens* (a long row,) and *Saltator caudatus*. Surface covered by delicate rain-marks, and what resemble *toe-marks* of *Brontozoum*, etc. *H. Fieldi* very distinct. 1856. From the Lily Pond quarry on Field's farm, Turner's Falls. Figured, Plate XLII., fig. 2, of *Ichnology*, and noticed upon pages 61, 95, 97, and 100.

4. Micaceous sandstone, $4^{\circ} 5' \times 2^{\circ} 4'$. Shows three impressions of *Tridentipes insignis* made upon ripple-marks. Fragment of the stipe of a fern. Obtained before 1842. From Marsh's quarry, south-west part of Montague. Noticed upon page 91, and figured upon Plate XLVII., fig. 2, of *Ichnology*.

5. Hard, irregular sandstone, $2^{\circ} 10' \times 3^{\circ} 6'$. Shows tracks in relief, of *Brontozoum Sillimanium*, *B. exsertum* and *Grallator cuneatus*. From west bank of Connecticut River, below Smith's Ferry in Northampton, 1855.

6. Slab same as No. 5, $2^{\circ} 5' \times 3^{\circ} 8'$, showing tracks in relief of *Brontozoum exsertum*. Same locality and history as No. 5.

7. Slab of trapezoidal shape, $9^{\circ} 2' \times 7^{\circ} 2'$. Very fine impressions of the hind feet, heels, and tail of *Anomœpus major*. 1858. From Lily Pond quarry. Noticed upon page 57 of *Ichnology*, page 37 of Supplement, and photographed in Plate XIX. of Supplement.

Total number of tracks on Wall No. 1, 125.

TABLE NO. 2.

Slabs upon elevated desk-like table by the south-east windows of the large room.

1. Flagstone, $4^{\circ} 8' \times 5^{\circ}$, showing impressions of *Brontozoum giganteum*, *B. approximatum*, *B. validum*, and a variety of fragments of the stipes of the *Clathropteris*. 1855. From below Smith's Ferry, Northampton.

2. Flagstone, $4^{\circ} 11' \times 3^{\circ} 6'$. Rows of *Brontozoum validum*. *B. exsertum*, *B. Sillimanium* (?), with fern stipes and ripple-marks. 1853 or 1854. Below Smith's Ferry.

3. Flagstone, $7^{\circ} 3' \times 4^{\circ} 11'$. Tracks in relief of *Brontozoum giganteum*, *B. validum* and *B. exsertum*. Ripple-marks and shrinkage cracks. 1853 or 1864. Near Smith's Ferry.

4. Flagstone, $6^{\circ} \times 4^{\circ} 6'$. Impressions of *Brontozoum giganteum* with shrinkage cracks. 1853 or 1854. Near Smith's Ferry.

5. Micaceous sandstone, $5^{\circ} 6' \times 3^{\circ} 3'$. One row of impressions of *Brontozoum giganteum*, and another of *B. Sillimanium*. 1854. Horse Race, Gill.

6. Flagging stone, $4^{\circ} 2' \times 2^{\circ}$. Shows tracks in relief, remarkably distinct, of *Brontozoum validum* and *B. exsertum*. Some of these ichnites, the type of the old species *B. expansum*, which are with difficulty referred to any species in the existing classification. Slab used as a flagging stone at Turner's Falls, previous to 1848. Figured in Final Report, Geology of Massachusetts, Plate XLVIII., fig. 50.

7. Tough, thick slab of hard slightly reddish sandstone, $8^{\circ} \times 4^{\circ}$. Impressions of *Brontozoum giganteum*, upon uneven surface. 1855. Below Smith's Ferry.

8. Slab, $16' \times 13'$, of ripple-marks. South Hadley(?). No. $\frac{22}{4}$ of Ichnology.

9. Slab, $19' \times 13'$, of ripple-marks. South Hadley. No. $\frac{22}{17}$, of Ichnology.

10. Gray shale, $15' \times 12'$, showing impressions of rain-drops. From Turner's Falls, below the dam. No. $\frac{23}{4}$ of Ichnology.

11. Shale with ripple-marks. South Hadley. No. $\frac{23}{7}$ of Ichnology.

Total number of tracks on Table No. 2, 91.

TABLE NO. 3.

Table next platform, adjacent to No. 1.

1. Large slab, $30^{\circ} \times 4^{\circ} 3'$, made up of three separate slabs cemented together. The stone is broken up into numerous wedge-shaped joints. The layer of red mud, one-fourth of an inch above this layer, upon which the animals trod, could not be preserved. The slab was procured on account of a row of the depressed tracks of *Otozoum Moodii*, eleven in number. Other impressions are those of *Anisopus Deweyanus*, *Brontozoum Sillimanium*, *Grallator formosus* (type of species) and *G. cursorius*. 66 tracks in all. From Moody Corner, South Hadley. 1854. The original of Plate I. of Ichnology, designed for Frontispiece, and copied upon the salver of a silver service presented to Dr. Hitchcock by the Faculty and students of Amherst College in 1859. Figured also in Plate XXXIII., fig. 4, and mentioned on page 124.

TABLE NO. 4.

1. Slab of coarse reddish sandstone, the counterpart of $\frac{3}{1}$. The western portion, $10^{\circ} 8' \times 2^{\circ} 10'$, not naturally connected with the other part, $13^{\circ} 4' \times 4^{\circ}$. The former was obtained by Pliny Moody of South Hadley, near his house in 1847, and subsequently presented by him to the Cabinet. The other part of the slab was removed from above No. $\frac{3}{1}$. Tracks the same as on $\frac{3}{1}$, except *Grallator formosus* is wanting. Those of *G. cursorius* are specially important as showing the animal producing them to have been a biped and not a quadruped. Slab covered with rain-marks. Older slab described in Amer. Journ. Sci. N. S. Vol. IV., p. 46; Trans. Amer. Acad. Arts and Sciences in 1849, and page 124 of Ichnology. Figured Plate XXXIII., fig. 5 of Ichnology. Newer slab the same references in the latter volume.

2. Micaceous sandstone, showing a single raised track of the *Otozoum Moodii*, from Turner's Falls. About 1855.

3. Micaceous sandstone with single impression of *Otozoum Moodii*, showing the marks of a web beyond the toes. Same locality as No. 2.

4. Same as No. 3. Page 126, and Plate XLVI., fig. 2 of Ichnology.

5. Same as No. 3. Single raised track, imperfect, and probably belonging to a smaller species.

6. Hard, gray shale, 1° 6' X 8'. One track of *Brontozoum exsertum* or *B. Sillimanium* from Chicopee Falls. Before 1849. No. $\frac{22}{13}$ of Ichnology.

7. Slab, 2° 3' X 9'. Two tracks in relief of *Anomæpus minor*, and a multitude of large rain-marks. No. $\frac{22}{5}$ of Ichnology.

Total number of tracks on this Table, 133.

TABLE NO. 5.

1. Slab, 1° 7' X 2° 1' of sandstone. Single raised track of *Otozoum Moodii* with recurved "thumb," also one of *Brontozoum Sillimanium*. Broken and poorly mended. Moody quarry, South Hadley. 1854. Plate LIX., fig. 1 of Ichnology.

2. Slab of hard schistose sandstone, 2° 3' X 1° 9', like No. 4. Tracks in relief of *Brontozoum exsertum* and *B. validum*, with stipe of fern. From below Smith's Ferry. 1854.

3. Slab, 2° 5' X 2°, showing depressed tracks of *Brontozoum divaricatum*, *B. Sillimanium*, *B. validum*, with delicate ripple-marks. Horse Race, Gill.

4. Hard schistose slab, 2° 6' X 2°, exhibiting impressions of *Brontozoum exsertum*. From below Smith's Ferry. 1854.

5. Hard, schistose slab, 3° X 2°, with *Brontozoum validum* and *B. exsertum* in relief. 1854. Below Smith's Ferry.

6. Same as No. 5, 2° 8' X 3° 10'.

7. Same as No. 5, 3° X 2°.

8. Slab, 3° 6' X 3° 3'. Curved rows of impressions of *Anomæpus curvatus*, with a tail-trace. Shrinkage cracks and ripple-marks. Counterpart of No. $\frac{53}{7}$. 1858. Lily Pond quarry, Turner's Falls. Page 100, Plate XLVI., fig. 4 of Ichnology.

9. Hard schistose slab, 4° X 2° 6'. Tracks in relief of *Brontozoum exsertum* and *Grallator cuneatus*. Below Smith's Ferry. 1854; Ichnology, Plate XXXIX., fig. 4.

10. Gray micaceous flagging stone somewhat worn by use, 4° X 3°. Shows rows of *Tridentipes insignis* in relief. 1840. Below Smith's Ferry. Figured in Final Report Geol. Mass., Plate XLVIII., fig. 64.

11. Same as No. 10, showing in addition, rows of *Platypterna varica* and several conjectural coprolites. 4° X 4°. Page 91, Plate XLV., fig. 3 of Ichnology.

12. Same as No. 4, 2° 6' X 2° 3'. *Brontozoum exsertum* and *B. validum* in relief.

13. Sandstone, 15' X 12', showing a single raised track of *Otozoum Moodii*. 1855. Moody quarry, South Hadley.

14. Coarse sandstone, slightly reddish. Shows in relief, both hind and fore feet of *Otozoum Moodii*, and tracks of *Brontozoum Sillimanium*. An unique and typical specimen for the *Otozoum*. 1855. Moody quarry, South Hadley. Pages 124-126, 183, Plate XLVI., fig. 5 of Ichnology.

Total number of tracks on this Table, 139.

TABLE NO. 6.

1. Large, thick slab, placed upon edge, 6° 3' X 5° 8'. On the east face are rows of *Tridentipes uncus*, *Tarsodactylus caudatus*, *Brontozoum divaricatum*, *Orthodactylus floriferus*, *Chelonoides incedens*, *Saltator caudatus*, *Exocampe ornata*, with obscure tracks of an unknown quadruped, "mud-holes" and unknown plant. On west side of slab, row of *Platypterna varica*, trail of bisulcate annelid and shrinkage cracks. 1855. From Lily Pond quarry, Turner's Falls. Figured in part, in Ichnology, Plate XLVI., fig. I, Plate XLV., fig. 2.

2. Slab, 3° 3' X 1° 6', of hard argillaceous sandstone, showing many pebbles scattered over the surface. Row of *Platypterna recta*, (type of the species,) with transverse ripple-marks. 1854. From the south side at Turner's Falls. Page 85, Plate XLVII., fig. 3 of Ichnology.

3. Fine micaceous sandstone, $1^{\circ} 11' \times 1^{\circ} 6'$. Tracks in relief of *Otozoum Moodii* (second species,) (?) *Brontozoum exsertum*, and two of *Apatichnus circumagens*. 1854. Ferry at Turner's Falls. Page 69, Plate XLVI., fig. 3 of *Ichnology*.

4. Red sandstone $2^{\circ} 1' \times 1^{\circ}$, with row of impressions of *Selenichnus breviusculus*, and many rain-marks. Lily Pond.

5. Single track of *Brontozoum exsertum*, $12' \times 8'$. From Ferry at Turner's Falls.

6. No. $\frac{22}{6}$ of *Ichnology*. Slab, $2^{\circ} 2' \times 1^{\circ} 4'$, with single impressions of *Brontozoum tuberculatum* and *Amblonyx Lyellianus*, and many rain-marks. Turner's Falls, Field's Orchard.

7. Reddish sandstone, $15' \times 12'$, with marks of large rain-drops in relief. Turner's Falls.

8. Reddish shale, $1^{\circ} 9' \times 1^{\circ} 3'$, showing thirteen pedal and caudal impressions of *Plectropterna gracilis*, and single ones of *Brontozoum Sillimanium*, *Grallator cursorius* and *G. cuneatus* (?). Turner's Falls.

Total number of tracks on this Table, 122.

TABLE NO. 7.

1. Large slab of sandstone, $10^{\circ} 3' \times 2^{\circ} 3'$. Contains three tracks of *Brontozoum giganteum* in relief — in a row — the largest in a row of this species in the Cabinet. Covered with stipes of ferns. 1842, or earlier. From below Smith's Ferry. Page 64, Plate XXXIII., fig. 2 of *Ichnology*.

TABLE NO. 8.

1. Large slab running across from the platform to the south wall, $22^{\circ} \times 2^{\circ} 5'$. Micaceous sandstone, showing a row of seven tracks of the *Brontozoum giganteum* (?). If not *B. approximatum*, a small individual of *B. giganteum*. One of the most impressive slabs in the Cabinet. In two parts, one of them somewhat broken. Before 1842, from below Smith's Ferry. Page 64, Plate XXXIII., fig. 1 of *Ichnology*.

2, 3. Slabs of fine red sandstone, covered with nests of *Batrachoides nidificans*. 1865. Near South Hadley Falls. Page 123 of *Ichnology*.

TABLE NO. 9.

1, 2, 3, 4, 5. Slabs of red sandstone, containing *Batrachoides nidificans*. Near South Hadley Falls. 1855. Page 123 of *Ichnology*.

6, 7. Slabs, $3^{\circ} 6' \times 2^{\circ} 8'$, and $2^{\circ} \times 1^{\circ} 5'$, showing *Batrachoides nidificans*. South Hadley Falls. 1855.

8. Red shale, $2^{\circ} 5' \times 2^{\circ}$, showing on front side seven tracks of *Brontozoum validum*; behind, eight tracks of the same in relief, not corresponding to those in front. Two miles north of the village of South Hadley on a hill. About 1849.

9. Large slab of reddish shale, $7^{\circ} 1' \times 2^{\circ} 3'$, standing upon its edge, lengthwise of the table, showing three remarkable tracks of *Gigantitherium caudatum* with tail-trace; also two or three rows of *Saltator caudatus*, and a single track of *Tridentipes*. Few shrinkage cracks. Lily Pond, Turner's Falls. 1855. Presented by Roswell Field, Esq. Page 94, Plate XLIV., fig. 4 of *Ichnology*, both of this and No. 10.

10. A larger slab than No. 9, $12^{\circ} 3' \times 2^{\circ} 6'$, the continuation of No. 9, with perhaps two or three feet gone between them. Shows in front, four tracks with tail-trace of *Gigantitherium caudatum*, a row of seven tracks of *Tridentipes uncus*, one of four tracks of *Platypterna varica*, one of four tracks of *Chelonoides incedens*, a second row of five tracks of *Tridentipes uncus*, one track of *Brontozoum Sillimanium*, and shrinkage cracks. On back side, five tracks of *Brontozoa*.

One of *B. giganteum* looks like a depressed track, when in fact it is in relief. The apparent depression results from the great irregularity of the surface. Described in Amer. Jour. Sci. N. S., Vol. XXI., p. 97. Ichnology, Plate XLIV., fig. 4, LVII., fig. 7.

11. Large thin slab of gray shale, resting edgewise upon Nos. 9 and 10, 7° 4' X 2° 4'. On one side in relief, there is a row of three tracks of *Brontozoum minusculum*, two tracks of *B. exsertum*, four of *Grallator cuneatus*, and portions of several other similar tracks.

On the other side (facing the door,) may be seen a row of three impressions of *Brontozoum giganteum*, a single one of the same, (two toes,) most of a track of *B. divaricatum*, two rows and several single tracks of *Grallator cuneatus*, a row of four tracks of the hind feet of *Apatichnus circumagens*, delicate impressions of rain-drops, and a multitude of those triangular *dents*, which are of obvious organic origin. The upper side shows that tracks may interfere with one another without obliterating either of them. 1855. Lily Pond.

12. Slab of micaceous gray sandstone, 3° X 1° 5', showing two rows of tracks in relief of *Argozoum pari-digitatum*. Turner's Falls.

13. Slab, 2° X 1° 10', showing two rows of *Anisopus gracilis*, a large number of tracks of *Grammepus erismatus*, and an Annelid (?) trail. About 100 tracks in all. Turner's Falls.

14. Slab of reddish flagging stone from Middlefield, Connecticut, 5° X 3° 4'. Shows in relief 48 tracks of *Brontozoum Sillimanium*, six of *B. exsertum*, three trails of *Cunicularius retrahens*, shrinkage cracks, and one curious ring of unknown nature. "The gem of the Cabinet because everything is so distinct." E. H. History given in Ichnology, page 68. See Plate LX. fig. 1. 1856.

15. Slab, 3° 8' X 1° 4', with two rows of two and six impressions of feet of *Platypterna varica* (?) with one of a smaller species. Stride more irregular than common. Turner's Falls.

Total number of tracks on this Table, not including *Batrachoides*, 388.

TABLE NO. 10.

1. Large slab, 10° X 3° 3', of gray micaceous sandstone from below Smith's Ferry, Northampton. Contains one depressed row of three tracks of *Brontozoum minusculum*, rows of *B. validum*, *B. exsertum*, *Grallator formosus*, and *G. cuneatus*; in all about fifty tracks. 1854. Sketched in outline, Plate XXXIII., fig. 3 of Ichnology, but some of the tracks omitted.

2. Slab of hard gray sandstone, 3° 6' X 2° 3' from the quarries near the Hudson River in New York, of the Hamilton Group, Devonian. Shows 26 tracks or 52 impressions of the *Harpagopus Hudsonius*. Type of the species. Taken by E. H., from the sidewalk in Greenwich Street, New York, before 1849. See Ichnology, page 147, and Plate XLIX., fig. 6.

3. Gray shale, 3° X 1° 8', containing at least fifty tracks of *Anisopus gracilis*, with ripple-marks. Horse Race, Gill. 1856.

4, 5. Slabs of reddish micaceous sandstone, a little more than two feet square, split apart so as to show both raised and depressed tracks. Track of *Anticheiropus pilulatus*, the largest of all the ichnites. Dug up early in the history of the science, but until the publication of the Supplement, regarded as a *lusus*. See the Supplement, page 10, and Plate IX., figs. 1 and 2. From Marsh's quarry, S. W. Montague. About 1842.

6. Slab of reddish shale, 10° 6' X 3° 9'. On the front or west side, one row of three tracks of *Brontozoum exsertum*, one track of *B. tuberatum*, other Brontozoa, two rows of *Grallator cursorius*, several rows of *Platypterna varica*, *Anomæopus curvatus* (?), two rows of *Sphærapus magnus*, and a long branching sea-weed (?).

On back side (or relief,) one track of *Brontozoum validum*, a row of *Platypterna varica* and two delicate trails of *Bisulcus undulatus*, the type of the species. Supplement, Plate III., fig. 5. In all, 85 tracks. Field's Orchard, Gill. 1855.

7. Fragment, 3° X 2° 4', broken off from No. 6. Shows a row of fine tracks of an *Orthodactylus*, *Unisulcus Marshi*, numerous twigs of a coniferous plant, and an abundance of rain-marks. The same may be seen in relief upon the back side of No. 6, whence this was split off. Total number of tracks on this Table, 213.

TABLE NO. 11.

1. Gray micaceous sandstone, 6° 9' X 2° 5', with a row of ten tracks of *Platypterna varica*. Taken from the sidewalk in front of house of Franklin Ripley, Esq., of Greenfield, in 1853. From Turner's Falls. *Ichnology*, Plate XLVII., fig. 4, page 85.

2. Dark gray sandstone, 2° 4' X 1° 2', showing two tracks of *Tridentipes uncus*. Ferry at Turner's Falls. Before 1848.

3. Same as No. 2, but showing the tracks in relief.

4, 5. Small thick slabs, near 2° long, showing both the depressed and raised tracks of *Platypterna varica*. Ferry at Turner's Falls. Probably the type of the species.

Total number of tracks on this Table, 22.

TABLE NO. 12.

1. Slab of gray sandstone, 3° 3' X 2° 3', with two depressed tracks of *Brontozoum approximatum*, two hind tracks of *Palamopus Clarki*, and probably a track of the fore foot between them. Also tracks of *B. validum*, *B. exsertum* and *B. tuberculatum* (?). Obtained by Prof. W. S. CLARK, at the east foot of Mt. Tom, Northampton, in 1848. *Ichnology*, page 127, Plate XLIV., fig. 2.

2. Slab of gray sandstone, 4° 2' X 2° 6', with several unfinished rows of *Anisopus gracilis*, one of *Tridentipes uncus* (?), one of an unknown animal, and a multitude (65) of impressions of *Grammepus erismatus*. From Dexter Marsh. Turner's Falls.

3, 4. Two slabs of red shale hardened by proximity to trap, each 3° 10' X 1° 9'. Slabs split apart, showing rows of *Grallator tenuis*, *Apatichnus circumagens*, fine rain-marks and shrinkage cracks. 1855. Turner's Falls, near the trap-range. *Ichnology*, Plate LIII., fig. 5, page 73.

Total number of tracks on this Table, 136.

TABLE NO. 13.

1. Slab of gray sandstone, two feet square, showing two rows and part of a third, of *Plesiornis pilulatus*, the type of the species. Also a fine row of *Anisopus gracilis*, one large track and impressions of an aroid plant. Tracks in relief. Figured in *Ichnology*, Plate XXXVI., fig. 4. See also, page 104. Turner's Falls, below the dam (?). 1855.

2. Gray sandstone slab, 5° 6' X 1° 5', broken in two at a joint. Row of six tracks of *Chimæra Barratti* on two layers; the upper one showing the heel of the hind foot and a short tail; the lower layer showing only the toes. Two fore feet are shown between the second and third large tracks, one of them quite distinct. Figured in *Ichnology*, Plate XXXVII., fig. 1. These tracks remind one of *Tridentipes uncus*. Turner's Falls, below the dam.

3. Hard reddish shale, 1° 6' X 1° 1', showing two tracks of *Argozoum dispari-digitatum*. A "mud-vein" is attached to one of the tracks, very much like a fourth toe. Cabotville. 1840.

4. Large slab, 9° 5' X 5° 2', of red shale, from the Orchard quarry at Turner's Falls. Tracks in relief. On front side the ichnites are remarkable for the distinctness of the phalanges and claws. There are the following tracks: (Two rows,) of *Amblonyx giganteus* — the type of the species — a row of four tracks of *Brontozoum Sillimanium*, a row and single tracks of *B. exsertum*, row and single tracks of *B. validum*, one track of *Amblonyx Lyellianus*, obscure vegetable fragments and

rain-marks. Figured in Ichnology, Plate XXXVIII., fig. 1. On the other face are twelve tracks in two rows of *Stratipes latus*, the type of the species, evidently formed under water, while the rain-marks show the others to have been above water. Yet the shale is only two inches thick. Hence there may have been tides or vertical movements of the land during the period of the Lithichnozoa. Also a multitude of vegetable fragments. Back side figured in Ichnology, Plate XLIX., fig. 4. The counterpart of this slab was purchased by the Boston Society of Natural History, at Marsh's auction in Greenfield, in 1853, at the same time No. 4 came to Amherst. 73 tracks on the slab.

5. Gray, hard sandstone, 3° 4' X 1° 9', from below Smith's Ferry. Tracks in relief of *Brontozoum exsertum* and *Grallator cuneatus*. 1854.

6. Same rock and locality, 3° 8' X 1° 11'. Tracks of *Brontozoum minusculum* and *B. exsertum*.

7. Same as Nos. 5 and 6. Tracks of *B. validum*, *B. exsertum* and *Grallator cuneatus*.

8. Gray micaceous sandstone, 2° X 1°, showing two tracks of *Argozoum dispari-digitatum*. Wethersfield.

9. Reddish shale, 1° 9' X 9', with two tracks of *Argozoum dispari-digitatum*. Wethersfield.

10. Slab of *Batrachoides nidificans*, from South Hadley Falls.

Total number of tracks on this Table, 138.

TABLE NO. 14.

1. Gray micaceous sandstone, 1° 8' X 1° 7', showing seven or eight tracks in relief, of *Grallator cuneatus*. Turner's Falls. Obtained from Dexter Marsh.

2. Hard, gray, thick-bedded sandstone, 2° X 1° 9', showing two depressed tracks of *Argozoum Redfieldianum*. On the under side, are two fine examples of coprolites, with toes in relief. Chicopee Falls. 1840. Ichnology, Plate LIX., fig. 6.

3. Same rock, 2° 10' X 1° 10', with two tracks of the same in succession; both defective. Coprolite on the underside. Chicopee Falls, from the middle of the stream in the dam above the bridge.

4. Large slab of reddish gray shale, 8° 6' X 5° 3', placed on edge and showing numerous ichnites and shrinkage cracks on both sides. On the upper side we have one row of three tracks of *Brontozoum minusculum*, besides a single track of the same, more slender, one track of *B. validum* and as many as six rows and several single tracks of *Grallator cuneatus*. Thirty-four tracks on this face, besides several trails, apparently of vegetable origin. The reverse side shows tracks in relief of *Brontozoum tuberatum*, *B. minusculum* (?), *B. divaricatum*, *B. validum*, *B. Sillimanium* and *Grallator cuneatus*. Turner's Falls. 1856. Ichnology, Plate XLII., fig. 3.

5. Red shale, 2° 5' X 1° 7', showing two rows of three hind impressions of *Anomæpus curvatus*, with one track of a fore foot, and tail mark of another species crossing the slab. Turner's Falls. 1856.

6. Red shale, 2° 3' X 11', showing on upper side, one track of *Brontozoum Sillimanium*, and parts of four others unknown. Below, row of four tracks of *Tridentipes uncus*. Turner's Falls. 1856.

7. Red shale, 2° 8' X 1° 10', with shrinkage cracks, and seven tracks of *Grallator cuneatus*. Turner's Falls.

8. Coarse gray sandstone, 2° 5' X 1° 3'. Upper side covered with beautiful rain-marks. On reverse side, in relief, several short rows and single tracks of *Grallator tenuis*, as well as three tracks of *Brontozoum Sillimanium*, and an *Anisopus*. From the stream near Pliny Moody's, South Hadley. Presented by Rev. Plinius Moody.

9. Slab, 1° 9' X 1° 7'. Like No. 3. Nos. 2, 3 and 9, the type specimens of *Argozoum Redfieldianum*.

Total number of tracks on this Table, 116.

TABLE NO. 15.

1. Gray micaceous sandstone, 3° X 2° 4', showing a single imperfect impression of *Brontozoum giganteum*, capacious enough to hold a gallon of water. See page 65 of *Ichnology*. From below Smith's Ferry.

2. Same rock, 1° 6' X 10', showing in relief, single track of *Brontozoum giganteum*. Below Smith's Ferry.

3. Same as No. 2, 1° 7' X 1°, and interesting as being the first specimen of this species ever found. When first picked up, was thrown away as a *lusus*, the geologists then not having been educated to believe in the existence of large birds. 1835. Original type of the species. Figured in *Amer. Journ. Sci.*, Jan. 1836; in Buckland's *Bridgewater Treatise and Ichnology*, Plate LVII., fig. 1, reduced. Smith's Ferry.

4. Cast of a large specimen of *Brontozoum giganteum*, from Smith's Ferry. Dug up by Dexter Marsh.

5. Slab, 1° 8' X 1° 7' showing *Brontozoum giganteum* in relief From below Smith's Ferry, Northampton.

6. Slab, 2° 3' X 1° 11', with single tracks of *Brontozoum approximatum* and *B. validum* in relief. Smith's Ferry.

7. Slab of reddish shale, 2° X 1° 4', showing single impressions of *Brontozoum approximatum*, *B. validum* and *B. Sillimanium*, with delicate rain-marks. Turner's Falls.

8. Hard sandstone, 2° 3' X 1° 9', used for a long time as a hearthstone at Smith's Ferry. Single impression of *Brontozoum giganteum*.

9. Slab of reddish shale, 1° 10' X 1° 6', showing two impressions of *B. approximatum*, rain marks and vegetables with seeds. Turner's Falls.

10. Gray micaceous sandstone, 1° 9' X 1° 1', showing single impression of *Brontozoum approximatum*. Smith's Ferry.

11. Single depressed track of *Brontozoum giganteum*. Slab, 2° 6' X 2° 7'. Smith's Ferry.

12. Slab, 1° 9' X 1° 3', showing single impression of *Brontozoum approximatum*.

13. Micaceous sandstone, 2° 3' X 2°, with single impression of *Tridentipes ingens*. Shows well on under side of slab. Horse Race, Gill.

14. Gray grit, 1° 10' X 12', showing poor impression of *Brontozoum giganteum*. Smith's Ferry.

15. Red micaceous sandstone, 2° 11' X 1° 10', showing three tracks of *Tridentipes elegans*. Turner's Falls.

16. Gray micaceous sandstone, 2° 10' X 2° 6', with one track in relief of *Brontozoum giganteum*, three of *B. validum*, and one of *B. exsertum*. Turner's Falls, below the dam.

17. Reddish shale, 2° 6' X 1° 4', with four tracks of *Brontozoum validum*. Turner's Falls.

18. Coarse sandstone, 1° 6' X 1° 5', with a single raised track of *Brontozoum giganteum*. Imperfect, but interesting from its locality — near Bassett's quarry, Easthampton — from the west face of Mt. Tom. 1858. Presented by Prof. E. HITCHCOCK, M. D.

Total number of tracks on this Table, 30.

TABLE NO. 16.

1. Fine red shale, 5° 1' X 1° 4', containing a row of two tracks — the typical specimen — of *Brontozoum minusculum*, three of *B. Sillimanium*, one of *B. exsertum*, one of *B. validum*, two of *Grallator cuneatus*, a row of three tracks of *Platypterna varica*, one track of *P. digitigrada*, a tail trace (?) of *Anomœpus major*, a row of tracks of *Saltator caudatus*, delicate rain-marks, and row of *Anisopus* (?). Lily Pond. 1855. *Ichnology*, Plate XL., fig. 2.

2. Slab of sandstone, 2° 9' X 1° 7', showing a row of *Anomæpus minor*, and another of *Ancyropus heteroclitus* (?). From South Hadley, near Moody Corner. This specimen was ploughed up by Pliny Moody, in 1800. It was subsequently used for a door-step, then obtained by Dr. Dwight, of South Hadley, and finally bought by E. H., of his heirs. This is the earliest specimen of fossil footmarks anywhere preserved. The tracks were called by Moody, those of Noah's Raven. See page 3 of *Ichnology*.

3. Reddish shale, 2° 6' X 12', with three impressions of *Anomæpus intermedius*, one of *A. gracillimus* with a long tail trace; also a row of eight tracks of *Ancyropus* (?), with tail trace. Turner's Falls. From D. Marsh. Before 1853.

4. Red shale, 4° 6' X 2°, placed on edge. On upper side, one example of the hind and fore feet of *Anomæpus minor*, with the long hind heel and an elliptical impression between them, made either by a tail or a projecting abdomen. After the animal had rested we can see at least one track as he moved forward on his hind feet. Several tracks of *Platypterna varica*, one of *P. digitigrada*, one of *Brontozoum validum*, one of *B. exsertum*, three or more trails of *Cunicularius retrahens* and other imperfect tracks, e. g. of *Corvipes lacertoideus*. On reverse side of slab, in relief, are two tracks of *B. validum*, one of *Grallator cuneatus*, a row of ten tracks of *Exocampe minima*, and trails of *Unisulcus minutus*. Field's Orchard, Gill. From Marsh's collection. 1853.

5. Red shale, 4° X 2°, placed on edge. Upper side covered mostly by fine ripple-marks formed after the tracks. Shows fine row of *Anomæpus minor*. At first three tracks of the toes of the hind feet are seen; then the animal sat down resting on its long heels, bringing down its small front feet. An ovoid impression between the tracks looks as if made by the body of the animal, or by a tail as it advanced. A doubtful track of the hind foot shows itself before the resting place. Type of the species. *Ichnology*, Plate IX., fig. 1.

On this side, also, may be seen an insulated track of the hind foot of *A. minor*, lower down, two of *Grallator cuneatus*, one of *Brontozoum Sillimanium*, and probably a tail trace near the bottom on a higher layer. On the reverse side we have one track of *B. Sillimanium*, one of *B. validum*, two of *Grallator cuneatus*, two hind feet, and fore foot of *Corvipes lacertoideus*, a row of two tracks of *Anomæpus minor*; other indistinct quadrupedal tracks and rain-marks. Turner's Falls. From Marsh's auction.

6. Gray micaceous sandstone, 7° 5' X 5°, placed on edge. On upper side, two tracks of *Brontozoum giganteum*, with a stride of forty-five inches, thirty-two of *B. exsertum*, among which is the type of the species, one of *B. Sillimanium*, three of *B. validum*, two of *Grallator cuneatus*, two of doubtful character, and stipes of *Clathropteris*. On lower side, several obscure tracks of *B. validum*. Smith's Ferry. 1854. *Ichnology*, Plate XL., fig. 3.

7. Hard shaly sandstone, 3° X 2°, showing three tracks of *Tridentipes elegans*, others of *T. unicus* and mud veins. Turner's Falls.

8. Reddish shale, 3° 1' X 1° 2', with tracks of *Brontozoum Sillimanium*. Turner's Falls.

9. Gray sandstone, 3° X 1° 4', with three tracks of *Tridentipes elegans*. Turner's Falls.

10. Reddish micaceous sandstone, 2° 11' X 1° 6'. Eleven tracks of *Anomæpus gracillimus*, and rain-marks above, and two rows of *A. gracillimus* beneath. Turner's Falls.

11. Gray micaceous sandstone, 2° 2' X 1° 6', with two tracks of *Brontozoum validum*, two of *Apatichnus* (?) *bellus*, one of *Grallator* (?) *tenuis*, one of *A. cuneatus* (?) and others. Turner's Falls.

12. Gray micaceous sandstone, 2° 6' X 1° 6', with one track from below where the animal trod, of *Tridentipes ingens*. Horse Race, Gill. About 1840 (?).

13. Coarse, gray, micaceous sandstone, 2° 3' X 1° 9', with one track of *Brontozoum divaricatum*. Smith's Ferry.

14. Gray micaceous sandstone, 1° 8' X 1° 6', showing three tracks of the hind feet of

Anomœpus intermedius, and two tracks of the front foot, one very perfect. On the right a distinct tail mark. Also trails of *Unisulcus minutus* and *Sphærapus larvalis*. Turner's Falls.

15. Reddish shale, 1° 11' X 9', covered with rain-marks, showing four tracks of *Anomœpus gracillimus*. On reverse side, four or five tracks of *Anomœpus*. Turner's Falls. From Dexter Marsh.

Total number of tracks on this Table, 206.

TABLE NO. 17.

1. Reddish shale, 7° 3' X 4° 9', showing two tracks (a row) of *Brontozoum giganteum*, with stride of 45 inches, two rows of *B. divaricatum*, with stride of 41 inches, seven rows of *Grallator cuneatus*, one row of *B. validum*, trails of *Unisulcus minutus*, and innumerable vegetable impressions. Turner's Falls. 1856. *Ichnology*, Plate XLI., fig. 1.

2. Red shale, 3° 9' X 3° 1', showing in relief two imperfect tracks of *Antipus bifidus*, with strong tail trace, one row of *Brontozoum Sillimanium*, two of *Grallator gracilis*, and one of *Plesiornis quadrupes* (?). Ferry above Turner's Falls. Marsh's auction. 1853.

3. Similar slab, 4° 2' X 2° 1', with imperfect tracks in relief of *Plectropterna* (?) *gracilis*, *Grallator gracilis*, etc., poor. Ferry above Turner's Falls.

4. Similar slab, 4° 1' X 2° 6', with tracks of *Grallator gracilis*, *Unisulcus minutus*, and *Anisopus gracilis*. Ferry above Turner's Falls.

5. Slab, 2° 3' X 12', showing single track on both sides of *Tridentipes ingens*, with the large brush. Horse Race, Gill.

6. Micaceous sandstone, 2° 6' X 1° 3', with one track of *Tridentipes ingens*, and two of *T. insignis*, all impressed on a surface below that on which the animal trod. Turner's Falls.

Total number of tracks on this Table, besides the trails, 69.

TABLE NO. 18.

1, 2. Slabs of red micaceous sandstone, each about three feet square, with two rows of *Tridentipes elegans*. The slabs were split apart for flagging stone, the impressions having been made through them both, making a *folio* of four pages. Marsh's quarry, Montague. 1835. These are the slabs noticed by Messrs. Draper, Marsh, Wilson, and Deane; and by the latter, brought to the attention of Prof. HITCHCOCK. Purchased of Dr. Deane at their value as flags. *Ichnology*, Plate LII., figs. 9, 10, 11. Eight ichnites visible.

TABLE NO. 19.

1, 2. Small slabs of fine, gray, micaceous sandstone, with four impressions of *Typopus abnormis*. Type of the species. Ferry at Turner's Falls. Marsh's auction. *Ichnology*, Plate XLV., fig. 7.

3. Red shale covering micaceous sandstone, 2° 3' X 12', showing in relief two rows of *Anomœpus gracillimus*, *A. minor*, and rain-marks. Ferry at Turner's Falls. Marsh's auction.

4. Same stone, 1° 9' X 1° 3', with eight tracks of *A. gracillimus* and *A. minor*, one of *Grallator tenuis*, eight of *Anisopus gracilis*, and rain-marks. Two *Anisopus* tracks beautifully impressed one upon the other. *Ichnology*, Plate XXXIX., fig. 2. Marsh's auction.

6. Same stone, 2° X 1°, with twelve tracks of *A. gracillimus*, *A. minor*, with a tail trace, one of *Anisopus gracilis*, and rain-marks. Marsh's auction.

6. Hard grit, 1° 5' X 12', with five tracks in relief (hind foot,) of *Plectropterna minitans*. Chicopee Falls.

7. Gray micaceous sandstone, 2° 8' X 2°, with tracks of *Anomœpus minor* upon both sides, also *Grallator cursorius*, and *A. intermedius*. Obtained of Dexter Marsh. Turner's Falls.

8. Reddish shale, 4° 6' X 1° 10', placed on edge. On upper side, a row of seven tracks of *Tridentipes uncus*, and five other imperfect tracks. On reverse side, two parallel trails of *Helcura surgens*, with two imperfect tracks of *Brontozoum validum*, and ripple-marks. Turner's Falls.

9. Slab like No. 8, 4° 3', X 2° 9'. On upper surface, one row of three tracks of *Platypterna varica*, one of eight tracks of *Tridentipes elegantior* making a turn, (see *Ichnology*, page 91,) a row of three tracks of *T. elegans*, a trail of *Helcura caudata*, a broken track of *Brontozoum minusculum*, and three others doubtful. On reverse side, two fine tracks of *Grallator formosus* and *Brontozoum Sillimanium*. *Ichnology*, Plate XLV., fig. 1.

10. Red micaceous sandstone, 2° 9' X 1° 10', with three imperfect tracks of *Brontozoum Sillimanium* and *Unisulcus Marshi*. On reverse side, tracks of the same, one of *Grallator formosus* with perhaps trails of *Unisulcus*. Turner's Falls. *Ichnology*, Plate XLIX., fig. 2.

11. Red micaceous sandstone, 2° 4' X 1° 9', showing two tracks of *Apatichnus* (?) with tail trace, one or two trails of *Unisulcus Marshi*, type of the species, and perhaps a dozen of *U. minutus* upon the upper surface. Below are two or three impressions with rain-marks. Turner's Falls. From D. Marsh, before 1849. *Ichnology*, Plate XXVI., fig. 1, page 160.

12. Slab same as No. 11, 1° 5' X 13', with *Anomœpus gracillimus* in relief above, and trail of *Unisulcus Marshi*, below. *Ichnology*, Plate XLIX., fig. 1.

13. Gray micaceous sandstone, 1° 6' X 13', with one track of *Tridentipes ingens*. From the "City," in Montague, a few rods east of the canal, on the old Boston road.

14. Gray micaceous sandstone, with a thin scale of red shale, 3° 10' X 2° 1'. Three distinct rows of *Anomœpus intermedius*, showing the hind feet. A fourth row may be seen in the middle, one pointing the other way. There are two cases where the animal having moved on its hind feet alone, brought down its long heel and fore feet. The latter remarkably distinct, showing the number of phalanges. Also two isolated tracks of the fore foot. Turner's Falls. Marsh's auction. *Ichnology*, Plate XLIV., fig. 1.

15. A leaf, 1° 8' X 1° 5', split from No. 8, showing a part of the fine row of *Tridentipes uncus*.

16, 17. Small slabs, showing single tracks of *Typopus abnormis*. Ferry at Turner's Falls. Marsh's auction.

18. Gray micaceous sandstone, 2° X 11', showing four tracks of *Plesiornis quadrupes*. Turner's Falls. Presented by Dr. James Deane. Figured in *Trans. Amer. Ass. Geologists*, Vol. 1, Plate XI.

19. Shale with two impressions of *Brontozoum validum*. Field's orchard, Gill. 1863.

20. Dark sandstone, with tracks in relief. Heel and hind foot of an *Anomœpus*, trail of *Unisulcus Marshi* (?), and several of *U. minutus*. Turner's Falls. 1863.

Total number of tracks on this Table, 200.

TABLE NO. 20.

1. Red shale, 2° 10' X 1° 9', showing one track of *Brontozoum exsertum*, several of *B. Sillimanium*, one of *Hyphepus* (?) Fieldi, with a strong tail trace a little in advance, and two remarkable heart-shaped shallow impressions, corresponding with the caudal marks of *Anomœpus major* on Nos. $\frac{1}{1}$ and $\frac{1}{7}$. Figured in *Ichnology*, Plate XLIV., fig. 5. Slab also covered with the curious "triangular dents." Lily Pond. 1855. *Ichnology*, Plate XLIV., fig. 5.

2. Slab, 2° 1' X 1° 3', similar to the last one from the same locality, showing one impression of *Gigantitherium minus*, one of *Brontozoum Sillimanium*, and one tail trace.

3. Two slabs of reddish shale, each $1^{\circ} 9' \times 12'$, showing two tracks of *Grallator cuneatus* pointing in opposite directions. Also shrinkage cracks. Lily Pond.

4. Slab of hard, gray grit, with a thin coating of red shale, $2^{\circ} 3' \times 1^{\circ} 8'$, with one distinct hind and one fore foot of *Chimæra Barratti*; two hind feet of the same, obscured by erosion, moving in opposite directions with a tail trace. Also a row of four tracks of *Anisopus gracilis*, and some rain-marks. This is the true type of the genus and species of *Chimæra*, rather than the one figured in *Ichnology*, Plate XXI., fig. 1. Fig. 4 is a hind foot more like the one on this slab. Fig. 1 may be another genus. From the sidewalk in Middletown, Connecticut, presented by Dr. Joseph Barratt. Tracks in relief.

5. Gray micaceous sandstone, $1^{\circ} 10' \times 1^{\circ} 6'$, with two tracks of *Brontozoum validum* and one of *Apatichnus* (?) *circumagens*. Turner's Falls.

6. Large slab of red shale, $9^{\circ} \times 7^{\circ}$, placed on edge, containing the following tracks, carefully studied by E. H. On west side of the slab in relief, are one row of three tracks of *Gigantitherium minus* with tail trace; one row of eleven tracks and tail trace of *Hyphepus Fieldi*; one row of twenty-one tracks of *Anisopus Deweyanus*; three rows of fourteen, nine and six tracks of *Anisopus gracilis*; one row of fourteen hind and two front feet of *Apatichnus circumagens*; three rows of four, three and three tracks of *Brontozoum validum*; one row of two tracks of *B. tuberculatum*; two rows of four and three tracks of *B. Sillimanium*; one row of two tracks of *B. exsertum*; twelve rows of from two to four tracks of *Grallator cuneatus*; also four single tracks of *Anisopus gracilis*, one of *G. cuneatus*, and two of *B. Sillimanium*; several sea-weeds, numerous small seeds (?), and the triangular dents. In all twenty-six rows of tracks.

On the opposite side are the following impressions: — Two rows of two tracks of *Brontozoum approximatum*; one row of two tracks of *Amblonyx Lyellianus*; single tracks of *B. minusculum*, *B. giganteum*, *B. exsertum*, *B. Sillimanium*, and *A. Lyellianus*. Numerous small ripple-marks, formerly referred to *Ptilichnus pectinatus*, and shrinkage cracks. From Lily Pond. 1855. Presented by R. Field. In *Ichnology*, Plate XLI., fig. 2. 159 ichnites on the slab.

7. Slab of red shale, $4^{\circ} 4' \times 3^{\circ} 4'$, placed on edge, containing two rows of seven tracks each of both feet of *Plesiornis quadrupes*, one row of two tracks of the hind feet of same, one row of single hind and front feet of same, a row of two tracks of *Brontozoum* (?) *exsertum*, one row of four tracks of both feet of *Exocampe arcta* (?), two single tracks of *Anomæopus gracillimus*, one of *G. cuneatus*, four or five single tracks of *P. quadrupes* and several branches of *Cunicularius retrahens*. All impressions. The reverse side is the surface from which No. $\frac{19}{9}$ was taken. This is larger and shows in relief two tracks of *Tridentipes elegantior* in a row, two of *T. elegans*, five of *Platypterna varica*, and rain-marks. Turner's Falls. Marsh's auction. *Ichnology*, Plate XLV., fig. 5.

8. Red micaceous sandstone, $1^{\circ} 6' \times 1^{\circ} 4'$, showing single track of *Brontozoum divaricatum* in relief, with rain-marks. Turner's Falls.

9. Red shale, $3^{\circ} 1' \times 1^{\circ} 10'$, showing one track of *Brontozoum minusculum*, one of *B. validum* (?), a row of three tracks and single track of *Tridentipes elegantior*, a row of *Ptilichnus anomalus* — four trails of the fin — several rows of *Sphærapus larvalis*, one row of eight tracks of *Grammepus* (?) *erismatus* and one trail of *Bisulcus undulatus*. Lily Pond. 1855.

10. Red shale, $2^{\circ} 8' \times 1^{\circ} 6'$, showing multitude of fine rain-drops, two tracks of *Platypterna varica*, and two of *Tridentipes elegantior*. On reverse side one good track of *Grallator cuneatus* (?). Lily Pond. 1856.

11. Red micaceous sandstone, $1^{\circ} 8' \times 1^{\circ} 5'$, with one track of *Brontozoum Sillimanium*, and numerous trails of *Unisulcus minutus*. Turner's Falls.

12. Slab, $1^{\circ} 10' \times 1^{\circ} 3'$, with tracks of *Brontozoum validum*, *B. Sillimanium*, and *B. exsertum*. 1861. Horse Race.

Total number of tracks on this Table, 365.

TABLE NO. 21.

The specimens upon this Table were badly broken by the accidental fall upon them of No. $\frac{26}{9}$, and have been repaired as well as possible, but probably the descriptions will be defective.

1. Slab of red shale, $4^{\circ} \times 3^{\circ} 8'$, containing the following rows: — One of ten tracks of *Anisopus Deweyanus*; one of thirteen and two single tracks of *A. gracilis*; one of two tracks of *Brontozoum exsertum*; one of two tracks of *B. validum*; two of two tracks each of *B. Sillimanium*; two of two tracks each of *Grallator cuneatus*; one of three tracks of *Apatichnus circumagens*; one of four tracks of *A. bellus*; one of five tracks of *Platypterna digitigrada*, with one track of *Grallator cursorius*, a few of doubtful name, and numerous indentations. Broken into a number of fragments of which the four largest are preserved. From Lily Pond. 1855.

2. Two slabs, $2^{\circ} 6' \times 1^{\circ} 6'$, badly broken and partly cemented, of gray sandstone, with three (part of a fourth) tracks of *Apatichnus circumagens*. It shows a tail trace, also a trail of the claw. On the under side, a front and hind foot are shown more distinctly than upon any other slab in the Cabinet, and the specimens are the type of this interesting species. Turner's Falls.

3. Gray sandstone, $2^{\circ} 5' \times 1^{\circ} 3'$, with two rows of two and three impressions of *Anomœpus gracillimus*, one of *A. minor*, and one of *Brontozoum Sillimanium*. On the under side in relief, are several tracks of *A. intermedius* (?), without the heel. Turner's Falls. From Marsh's auction.

4. Fragment broken from No. 3, $12' \times 11'$, with tracks of *A. minor* in relief, and impressed with one of *Brontozoum Sillimanium*.

5. Red shale, $2^{\circ} 3' \times 1^{\circ} 6'$, showing on the upper side, a row of two hind and one fore track of *Apatichnus circumagens*, two of *Anomœpus minor*, one of *Brontozoum tuberatum*, and impressions of rain-drops. In relief are two rows of nine and six tracks of *Plectropterna gracilis*, with trails of the claws and tail. One row of two tracks of *Platypterna varica*, and two single tracks of *Grallator cuneatus*. Turner's Falls. From Marsh's auction.

6. Gray sandstone, $3^{\circ} 9' \times 2'$, with ten impressions of *Tridentipes elegans*. Horse Race, Gill. About 1842.

7. Gray micaceous sandstone, with seven impressions (five showing themselves in relief on the lower side,) mostly of *Tridentipes elegans*. Horse Race, Gill. About 1842.

8. Gray micaceous sandstone, $2^{\circ} 5' \times 2^{\circ}$, with eight tracks in relief of *Tridentipes elegans*. Horse Race, Gill. About 1842.

Total number of tracks on this Table, 133.

TABLE NO. 22.

1. Slab, $14^{\circ} 6' \times 2^{\circ} 6'$, with seven impressions of *Brontozoum minusculum*, several in a row, six of *B. validum*, twenty-seven of *B. Sillimanium*, and one of *Grallator cuneatus*. Also a row of eight indistinct small quadrupedal impressions. Horse Race, Gill. 1863.

Total number of tracks on this Table, 49.

TABLE NO. 23.

Next to west wall of room.

1. Red shale, $3^{\circ} \times 2^{\circ} 9'$, with two tracks of *Brontozoum validum* and innumerable rain-marks. Turner's Falls.

2. Gray sandstone, $2^{\circ} 10' \times 2^{\circ} 8'$, with one row of three tracks of *Grallator cursorius*, two tracks with a tail trace of *Antipus bifidus*, the type of the species; one row of three tracks of *Anomœpus minor*, one hind and fore foot (?), with rain-marks. All impressions. Turner's Falls. From D. Marsh. Ichnology, Plate XLVIII., fig. 10, XXXVI., fig. 8.

3. Gray sandstone, $2^{\circ} 11' \times 1^{\circ} 6'$, with two tracks of *Antipus bifidus*, ten of both feet of *Anomœpus minor*, imperfect, and rain-marks. Turner's Falls. From D. Marsh.

4. Slab of reddish sandstone, $2^{\circ} 4' \times 1^{\circ} 6'$, of impressions of rain-drops, and *Unisulcus intermedius*. No. $\frac{22}{2}$ of Ichnology. Turner's Falls.

5. Reddish shale, $2^{\circ} 6' \times 1^{\circ} 3'$, with deeply impressed rain-marks, one indistinct row of two tracks of *Anomœpus minor*, both feet with tail; two isolated tracks, perhaps of *Ornithopus*, and one other doubtful track, perhaps of *Anomœpus*. Reverse side contains a row of two tracks of hind foot of *A. minor*, with two or three tracks of the same moving in opposite directions. Also four tracks of *Anisopus gracilis* — all in relief. Turner's Falls.

6. Micaceous sandstone, $3^{\circ} \times 1^{\circ}$, with one row of five tracks of *Tridentipes uncus*. Turner's Falls. Marsh's auction.

7. Coarse sandstone, $1^{\circ} 4' \times 1^{\circ} 3'$. $\frac{22}{15}$ of Ichnology. One track of *Brontozoum validum*, and impressions of rain-drops. South Hadley, opposite Smith's Ferry.

8. Red micaceous sandstone, $4^{\circ} \times 2^{\circ} 6'$, with one row of five tracks of the hind foot of *Apatichnus circumagens* — two showing the fourth toe, — two rows of ten and four tracks of *Anisopus gracilis*, two rows of four and two tracks of *Grallator gracilis*, two rows of five and two tracks of a strange *Grallator* — remarkable for the heel, which shows three ridges. Ferry at Turner's Falls. Marsh's auction.

9. Coarse micaceous sandstone, $5^{\circ} 6' \times 2^{\circ} 6'$, with two large tracks of *Brontozoum giganteum*. Smith's Ferry. 1854. Ichnology, Plate IV., fig. 2.

10. Gray coarse sandstone, $1^{\circ} 3' \times 1^{\circ} 2'$, with shrinkage cracks. Portland quarries, Connecticut. 1857.

11. Slab of shale, $11^{\circ} \times 3^{\circ} 5'$, with twenty-eight tracks, large and small, of *Brontozoum divaricatum*, and one of *B. Sillimanium*. Turner's Falls. 1863.

12. Reddish sandstone, $2^{\circ} 9' \times 2^{\circ} 4'$, with about twelve impressions of *Anomœpus*, chiefly of *A. curvatus*. Ferry at Turner's Falls.

Total number of tracks on this Table, 108.

WALL NO. 24.

1. Large slab of red shale, $7^{\circ} 9' \times 4^{\circ} 5'$, showing impressions of two rows of two and three tracks of *Brontozoum exsertum*, one row of two tracks of *B. validum*, three rows of two and three tracks and two single tracks of *Grallator cuneatus*, one track of *B. giganteum*, and one row of *Anisopus gracilis*. In all thirty-three impressions. Also a few shrinkage cracks. Lily Pond. 1856. Ichnology, Plate XLIII., fig. 1.

WALL AND TABLE NO. 25.

1. Large slab of red shale, $7^{\circ} \times 6^{\circ}$, showing on a surface abounding in shrinkage cracks, impressions, viz.: One row of two tracks and two single tracks of *Gigantitherium minus*, three rows of two and three tracks of *Grallator formosus*, four rows of two tracks, four rows of three tracks, and one row of four tracks of *Grallator cuneatus*, besides twenty-five single tracks of the same, two tracks of *Brontozoum divaricatum*, and row of eleven tracks of *Argozoum pari-digitatum*. Lily Pond. 1856. Ichnology, Plate XXXIX., fig. 1.

2. Smaller slab from same locality. Shows three rows of two tracks, and four single tracks of *G. formosus*, ten single tracks of *G. cuneatus*, one of *Brontozoum validum*, one of *B. divaricatum*, and mud veins. Ichnology, Plate XLVII., fig. 5.

3. Gray shale, $2^{\circ} 2' \times 1^{\circ} 9'$, with seventeen tracks of *Ornithopus gracilior*. Turner's Falls, below the dam. Before 1848.

4. Reddish shale, 4° X 3° 5', showing impressions, viz.: One row of fifteen tracks of *Exocampe ornata*; one row of eight tracks, two front, of *Plectropterna gracilis*; one row of eight tracks of both feet of *Corvipes lacertoideus*; single tracks of *Brontozoum minusculum* and *B. tuberculatum*; five of *Grallator cuneatus*; one row of two tracks of *Tridentipes uncus*, and another of two tracks of *Platypterna varica*. Lily Pond. 1856. No. $\frac{22}{1}$ of Ichnology, Plate XLVII., fig. I.

5. Red sandstone, 4° 10' X 5° 6', with two impressions of *B. tuberculatum*, one of *B. exsertum* and a row of three tracks of *Grallator-cuneatus*, and vegetable fragments. (Under the table.) Turner's Falls.

Total number of tracks on this Wall, 176.

TABLE NO. 26.

1. Slab, 3° X 1° 6'. Shrinkage cracks and rain-marks. Turner's Falls. Ichnology, Plate LVI., fig. 3.

2, 3. Thick red sandstone, 2° 6' X 1° 7', with shrinkage cracks. Remarkable for the rounded form of the pieces. Newark, N. J. 1855. Ichnology, Plate LVI., figs. 1, 2. Called facetiously, "Nature's Hieroglyphics."

4. Red sandstone, 2° 7' X 10', with four tracks of *Isocampe strata* and what is called a tail-trace in Ichnology. It was supposed that the tracks on the other side of the tail-trace had been broken off. Possibly the supposed tail-trace may be a *Cunicularius*. Portland, Connecticut. Ichnology, Plate XXXVI., fig. 5.

5, 6. Hard gray shale, 2° 6' X 2° 4', with rows — both impressed and elevated — of fifteen tracks of both feet of *Anisopus Deweyanus*. Large shallow depressions of uncertain origin. Stone indurated by heat. Ichnology, Plate LIII., fig. 8.

7, 8. Gray shale, 4° 3' X 2° 3', 3° 3' X 2° 2', covered with tracks of *Anisopus gracilis* and ripple-marks. Horse Race, Gill. Ichnology, Plate XLIII., figs. 4 and 5.

9. Slab, 3° 3' X 7', with row of ten tracks of hind feet of *Exocampe ornata*. Lily Pond. Ichnology, Plate XLVIII., fig. 1.

10. Large slab, 3° 9' X 3° 7', with impressions, viz.: Four rows of hind feet of *Anomæpus intermedius*; row of ten tracks of both feet of *Anisopus Deweyanus*; two trails of *Helcura caudata*, and numerous rain-marks. Field's Orchard, Turner's Falls. Dug up by D. Marsh. Ichnology, Plate XL., fig. I.

11. Coarse white sandstone, 2° X 16', with one perfect and two imperfect hind feet of *Cheirotherium Barthii*, Kaup, Hilderberghausen in Saxony. Trias.

12. Same rock and locality, 14' X 10', with two tracks of *O. Barthii*, hind and front feet nearly perfect. Also as many as four tracks of some undescribed lizard.

13. Same rock and locality, 12' X 8'. Single hind foot of a *Cheirotherium*, hardly like *C. Barthii*, lying upon a vegetable stem, and a similar relic by its side. Nos. 11 to 13 in relief.

14. Hard sandstone, 1° 9' X 11', of the coal formation, from S. W. Pennsylvania. Five tracks in relief of *Thenaropus heterodactylus*, King. Shrinkage cracks abound, some of which proceed from the ends of the toes, and convey a wrong impression to those not conversant with such phenomena. Before 1848.

15, 16, 17. Shale slightly calcareous, the last in relief. Tracks of *Polemarchus gigas*, the type specimens. Nos. 15 and 16, from middle of the river at Chicopee Falls; 17 from a quarry half a mile south of Cabotville on the Springfield road. Before 1848. Ichnology, Plate LIX., fig. 3.

18. Sandstone 1° 10' X 1° 7', showing in very distinct relief, eighteen tracks of *Brontozoum Sillimanium* and *Grallator formosus*. South Hadley, N. W. of Moody Corner, in the stream. Presented by Rev. Plinius Moody. Ichnology, Plate XLIII., fig. 6, page 68.

19, 20. Slabs, $2^{\circ} 5' \times 1^{\circ} 3'$, $1^{\circ} 9' \times 1^{\circ} 6'$, like Nos. 7 and 8, with tracks of *Anisopus gracilis*. From Horse Race, Gill. 1856.

21. Red shale, $4^{\circ} 6' \times 2^{\circ} 3'$, showing one row of four tracks of *Tridentipes elegans*, the hind toe especially; one row of fourteen hind tracks of *Apatichnus bellus*, besides two rows of seven tracks of the same, and traces of at least five fore feet; one row of six tracks of hind feet of *Apatichnus bellus*, and numerous tracks of *Grammepus erismatus*. Besides are numerous small single lines of ichnoid character. Turner's Falls. Ichnology, Plate XLV., fig. 6.

22. Removed to $\frac{28}{5}$.

23. Red sandstone, $2^{\circ} 3' \times 1^{\circ} 6'$, containing two rows of five, and one of four tracks of *Argozoum pari-digitatum*, and two tracks of *Tridentipes uncus*. Turner's Falls.

24. Red sandstone, $3^{\circ} 8' \times 12'$, with a row of six tracks of the hind foot of *Plectropterna gracilis*, and one track of an unknown species. Turner's Falls.

25. White sandstone, $1^{\circ} 7' \times 1^{\circ} 1'$, containing in relief, one hind and two front tracks of *Cheirotherium*. From the Storeton quarries, near Liverpool, England.

26. Same rock and locality, $1^{\circ} 5' \times 9'$, with single hind and fore feet in relief, of the *Cheirotherium*.

Total number of tracks on this Table, 443.

CASE NO. 27.

In first side-room.

The tracks in this case are mostly quite small, and in the form of "books," or different strata showing the same tracks, and fastened by hinges. Called the "Stony Library."

1. Soft gray shale in two leaves, with eight hind and fore feet of *Macropterna vulgaris*. This is the "Ledger." North bank, below Turner's Falls. Ichnology, Plate LII., fig. 3.

2. Reddish shale, with two tracks in succession, shown on the outside and inside of *Platypterna Deaniana*. There is a third track on the outside, which does not show through. This specimen shows how much impressions may alter in passing through even an inch of stone. Turner's Falls.

3. Red shale, showing four tracks of both feet of *Macropterna divaricans* without the heels. Turner's Falls. Ichnology, Plate LIII., fig. 4.

4. Five leaves of micaceous sandstone with two tracks of *Platypterna varica*, showing through them all. Turner's Falls. Marsh's auction. Ichnology, Plate LII., fig. 6.

5. Two leaves of shale, showing ten tracks with traces of the toes and tail of *Orthodactylus linearis*. Turner's Falls. Ichnology, Plate VI., fig. 7. Tracks mostly of the hind feet resembling those of the living *Menobranchus*.

6. Two leaves of gray shale, with tracks of *Ornithopus gracilior*. Turner's Falls, north bank, below dam.

7. Four leaves of brown shale, showing the fore foot of *Ancyropus heteroclitus*. The second leaf shows *Conopsoides larvalis*, and something similar on second leaf. On third leaf, also, tracks of an unknown animal. Wethersfield Cove. Twenty-eight tracks. Ichnology, Plate LIII., fig. 2.

8. Three leaves of gray shale, showing *Ornithopus gracilior*. North bank, below Turner's Falls.

9. Two leaves of red shale, with three tracks of *Triænopus leptodactylus*. Wethersfield Cove. Ichnology, Plate LII., fig. 1.

10. Two leaves of gray shale, showing five tracks of hind feet and one of fore foot of *Xiphopeza triplex*. North bank of Connecticut River, below Turner's Falls. Ichnology, Plate LII., fig. 4.

11. Two leaves of gray shale, with two rows of tracks (six of hind feet,) of *Xiphopeza triplex*. Same locality as No. 10. Ichnology, Plate LII., fig. 2.

12. Three leaves of gray shale, showing tracks of hind foot of *Ancyropus heteroclitus*. Wethersfield. Fore feet on No. 7. Ichnology, Plate LIII., fig. 1.
 13. Two leaves of gray shale, showing three tracks of hind feet of *Xiphopeza triplex*. Turner's Falls, below dam.
 14. Three tracks of the same. Ichnology, Plate LIII., figs. 3, 6.
 15. Two leaves of red shale, with two rows showing nine hind and five front feet impressions of *Orthodactylus linearis*. Turner's Falls. Ichnology, Plate XLVIII., fig. 4.
 16. Two leaves of red shale, with single track of *Brontozoum Sillimanium*. Turner's Falls.
 17. Two leaves of red shale, with single track of *Brontozoum tuberatum*, showing phalanges and claws very distinctly. Turner's Falls. Ichnology, Plate LII., fig. 7.
 18. Two leaves of shale, with two hind foot tracks of *Harpedactylus gracilis*. Below Turner's Falls. Ichnology, Plate LII., fig. 5.
 19. Two leaves of red shale, with two tracks, not consecutive, of *Triænopus leptodactylus*. Heel long and peculiar at its end. Wethersfield Cove.
 20. Same as 19, except tracks are consecutive.
 21. Slab, 4° 6' X 3° 6', with numerous impressions of *Ænigmichnus multiformis* in front, and casts of rain-drops and trail of *Sphærapus larvalis* behind. Ferry above Turner's Falls. Supplement, Plate XIV., page 21.
- Not including No. 21, there are 94 impressions, repeated to 163, in Case No. 27. Including No. 21, there are 3,355.

TABLE NO. 28.

The Table numbered $\frac{28}{1}$ in the Ichnology, is now No. $\frac{58}{2}$.

1. Slab of red sandstone, 6° 9' X 3° 2', with rows of impressions of hind feet of *Anomœpus minor*, *A. gracillimus*, *A. minimus*, *Brontozoum Sillimanium*, *Grallator formosus*, *G. cursorius*, *G. parallelus*, and impressions of rain-drops. In all 44 tracks. Field's Orchard, Gill. 1862.
 2. Thick slab of red sandstone, 2° 2' X 8', with impressions like tracks, but only indicating a concretionary structure. From the quarries at Portland, Connecticut. 1857.
 3. Red sandstone, 3° 6' X 2° 4', with numerous casts of rain-drop impressions, trails of *Sphærapus larvalis*, with two tracks and a tail trace of an *Orthodactylus*. Ferry above Turner's Falls. 1863.
 4. Red sandstone, 2° 8' X 2° 6', with numerous impressions of rain-drops, one track of *Tridentipes elegans*, two trails of *Sphærapus larvalis*, a row of nine tracks of hind feet of an *Anisopus*, and a row of nineteen tracks of *Exocampe ornata*, with a row of similar tracks parallel to them. Ferry above Turner's Falls. 1863.
 5. Red sandstone, 3° 6' X 2° 2', with five tracks in relief of *Brontozoum Sillimanium*, four of *B. exsertum*, one of *B. validum* and a number of shrinkage cracks. Portland quarries, Connecticut. 1857.
 6. Slab of red sandstone, 5° 6' X 3° 6', counterpart of No. 3, covered with hundreds of beautiful impressions of rain-drops, and exhibiting a trail of *Sphærapus larvalis*. Ferry above Turner's Falls. 1863.
 7. Slab of red shale, 17' X 15', showing on the upper side, two impressions of the hind feet of *Apatichnus circumagens*, and a few rain-drops. In relief, are one row of four tracks of *Argozoum pari-digitatum*, one row of four tracks of *Anisopus gracilis*, one row of ten tracks of *Grallator gracilis* (?), and four more tracks of *A. gracilis*. Turner's Falls.
- Total number of tracks on this Table, 119.

TABLE NO. 29.

1. Red shale ten feet long, placed on edge, and broken off from No. $\frac{20}{6}$. On the upper side are two single impressions of *Brontozoum giganteum*, one of *B. approximatum*, and one row of two tracks forty-eight inches apart; also a few shrinkage cracks. On the under side in relief, are the following: — One crooked row of eleven hind and five front tracks of *Apatichnus circumagens*. This is the row that first revealed the character of the animal. Two rows of four and one of two tracks and one single track of *Hyphepus Fieldi*; two rows of two and three tracks and one single track of *Grallator formosus*; six rows of from two to seven tracks and two single tracks of *G. cuneatus*; single tracks of *Brontozoum approximatum*, *B. validum*; two heels and one hind foot of *Anomæpus major*; two of both feet of *Anisopus gracilis*; one row of eight tracks of *Anisopus gracilis*; one row of eight tracks of *A. Deweyanus*; one row of two tracks of *Brontozoum tuberculatum* (*Gigantitherium minus*) (?), and one row of six tracks of *Apatichnus* (?) *bellus*. Lily Pond. 1855. *Ichnology*, Plate XLII., fig. 1.

2. Coarse red sandstone, $2^{\circ} 6' \times 1^{\circ} 5'$, and five inches thick, containing at least eight tracks of *Cunichnoides marsupialoideus*, with say twenty trails of *Cunicularius*, probably of more than one species. The type specimen of *Cunichnoides*. Presented by one of the freestone companies at Portland, Connecticut. 1857. Page 55, Plate IX., fig. 5, LX., fig. 2.

3. Same rock, $3^{\circ} \times 1^{\circ} 11'$, with one and part of another deep ovoid impression, made probably by the abdomen and posterior part of the animal as it moved forward. The impressions of the feet were wider apart than the width of this slab, as shown on another slab too heavy for: transportation. Referred to *Hoplichnus equus*. Portland, Connecticut. *Ichnology*, page 65, Plate LX., figs. 3 and 4. A tail-trace crosses this specimen. Another impression resembles the print of a human shoe. At several inches distance is another similar impression, probably connected with the principal one, and it is probably a heel; so that what appears like the heel of the shoe may be the toe of the animal. It is certainly not of human origin.

4. Slab of rain-marks, impressions, $2^{\circ} 9' \times 1^{\circ} 9'$. From Turner's Falls. Marsh's auction. No. $\frac{22}{19}$ of *Ichnology*.

5. Red shale, $1^{\circ} 6' \times 14'$, with irregular wave-marks. Turner's Falls.

6. Gray shale, $3^{\circ} \times 1^{\circ} 7'$, with twenty tracks, mostly of *Anisopus gracilis*, some of them perhaps of *Exocampe*. Turner's Falls.

7. Reddish shale, $1^{\circ} 6' \times 1^{\circ} 7'$, with tracks of both feet of *Apatichnus circumagens*; four tracks of *Anisopus gracilis*; one of *Grallator cuneatus*, and a tail-trace with the triangular indentations. Turner's Falls.

8. Gray shale, $3^{\circ} 6' \times 1^{\circ} 5'$, with thirty-seven tracks of *Anisopus gracilis*, one of *Brontozoum validum*, and one of *B. Sillimanium*. Horse Race, Gill.

Total number of tracks on this Table, 196.

WALL NO. 30.

1. Large slab, $10^{\circ} \times 4^{\circ}$, with one fine typical row of *Brontozoum validum*, and two single tracks of the same. The row a curved one. Four rows of two and three tracks, and four single tracks of *Grallator cuneatus*; imperfect traces of two large tracks, *B. giganteum* (?), and shrinkage cracks. Twenty-two in all. Lily Pond. 1855. *Ichnology*, Plate XXXIX, fig. 3.

2. Reddish shale, $10^{\circ} \times 4^{\circ}$, all impressions, shows rows of *Hyphepus Fieldi*, one row of five tracks; *Gigantitherium caudatum*, one row of three tracks, rather imperfect; *G. minus*, two tracks and two single ones; *Grallator cuneatus*, three rows of three and five of two tracks; *Platypterna*

varica, two rows of three tracks; *Anomœpus major*, one row of two tracks and one heel; tracks of small quadruped, perhaps *Macropterna vulgaris*, common on the slab. Lily Pond. 1855. Ichnology, Plate XLIV., fig. 6.

3, 4. Curious ripple-marks, 3° X 8', counterparts. Turner's Falls.

Total number of tracks on this Wall, 59.

The Cases Nos. 31 to 41 are upright, and arranged in order along the platform. The specimens are all small, and I shall not attempt to give their dimensions except in special instances.

CASE NO. 31.

1. Row of five tracks of *Exocampe arcta*, hind feet, on gray shale. Turner's Falls.
2. *Ornithopus gallinaceus*, on shale.
3. Three tracks of *Grallator cuneatus*; and on the reverse side one track, perhaps of the same. Turner's Falls.

4. Very perfect hind and front feet of *Anisopus gracilis*. Turner's Falls.
5. Shale, with one track of *Brontozoum exsertum*. Turner's Falls.
6. Black shale, with one track of *Anomœpus gracillimus* (?). Chicopee Falls.
7. Red shale, with tracks of *Plesiornis æqualipes* and *Platypterna tenuis*, — 12 in all. Wethersfield Cove.

8. Red shale, with hind and front feet of *Exocampe ornata* (?). Wethersfield Cove.
9. *Plectropterna minitans*, on shale. Chicopee Falls.
10. *Argozoum pari-digitatum*, on micaceous sandstone. Horse Race, Gill.
11. Two leaves of red shale, with two tracks of *Platypterna delicatula*. Wethersfield Cove.
12. *Argozoum pari-digitatum*, on gray sandstone. Horse Race, Gill.
13. *Harpedactylus gracilis*, on gray sandstone. North bank, below Turner's Falls.
14. Red sandstone, with hind foot (?) of *Chimæra Barratti*. Marsh's quarry, Montague.

E. H. remarks upon this specimen, that the characters of the *Chimæra* seem to be not well settled. Ichnology, Plate LIX., fig. 5.

15. *Grallator cuneatus*, on reddish shale. Wethersfield Cove.
16. *Brontozoum validum* and *B. Sillimanium*, on red sandstone. Turner's Falls.
- 17, 18, 19, 20. Single tracks of *Brontozoum validum*, and *B. exsertum*, on gray micaceous sandstone. From beneath the trap on Mt. Holyoke, a very interesting locality.

21. Unbound volume of four leaves, showing upon each leaf a single track of *Plectropterna minitans*. Wethersfield Cove.

22. A single track in relief of *Brontozoum giganteum*, showing the papillæ and striæ of the animal's foot. Very few other specimens of this kind in the Cabinet. Wethersfield Cove.

23. Two tracks of *Triænopus leptodactylus*, on red shale. Wethersfield Cove.
24. *Triænopus leptodactylus*, nine tracks upon both sides. Red shale. Wethersfield Cove.
25. Twelve tracks of *Triænopus leptodactylus*, on red shale. Wethersfield Cove.
26. Twenty-three tracks of *Triænopus leptodactylus*, on red shale. Wethersfield Cove.
27. Same number, etc., as 26. Ichnology; Plate XLV., fig. 8.
29. Fourteen tracks of *Triænopus leptodactylus*, on red shale. Wethersfield Cove.
30. One track of *Triænopus leptodactylus*, with a toe (perhaps) coming out from the heel and pointing forwards. Red shale. Wethersfield Cove. (Nos. wanting to 35.)

35. One track of *Triænopus leptodactylus*, showing a toe similar to No. 30. Red shale. Wethersfield Cove.

36. Four tracks of *Triænopus leptodactylus*, with a single track on the lower side, of *Typopus gracilis*, the typical and only specimen of the latter species. Red shale. Wethersfield Cove.
37. Two tracks, probably hind and fore feet of *Triænopus leptodactylus*. Two leaves in part. Red shale. Wethersfield Cove.
38. One track of same, from same locality.
39. One fair track of *Triænopus leptodactylus*, with a broad heel, and two other tracks. Red shale. Wethersfield Cove.
- 40, 41. Two unbound leaves of red shale, from Wethersfield Cove, with tracks of *T. leptodactylus*.
42. Ten tracks of the same on both sides of slab. One with a hind toe pointing backward from the end of a narrow heel. Same locality.
- 43, 44. Two leaves, unbound, showing at least two tracks of the *Triænopus* in nearly the same place, and even a third, perhaps.
45. At least seven tracks of *Triænopus leptodactylus*, two of them very small and of a doubtful character.
46. Counterpart of No. 36, *Typopus gracilis*.
- 47, and 50. Two leaves, containing fifteen tracks of the *T. leptodactylus*.
48. Five tracks of the same.
49. Eight tracks of the same.
- 51, 57, 58, 59. These slabs make four leaves of shale, with a track of *Triænopus leptodactylus*, showing a long heel.
52. Three tracks of *Triænopus leptodactylus*.
53. Five tracks of the same.
54. Two impressions — probably hind and fore feet — of the same. They occupy very nearly the same place.
55. Ten tracks of the same species.
56. Five tracks of the same, one of which shows a hind toe on a long heel, and a remarkable break in the heel. Nos. 43-59, on red shale. From Wethersfield Cove.
60. *Sphæropezium thærodactylum*, *King*. On coarse grit of the coal measures. Westmoreland, Pa. Like the ten following numbers, artificially cut by Indians.
61. *Sphæropezium ovoidactylum*, *King*. Westmoreland, Pa.
- 62, 63. *Ornithichnites Culbertsonii*, *King*. Westmoreland, Pa.
64. Cast of *Sphæropezium leptodactylum*, *King*.
66. Cast of *Sphæropezium thærodactylum*, *King*.
67. Cast of *Ornithichnites galinuloides*, *King*.
68. Cast of *Ornithichnites Oulbertsonii*, *King*.
69. Cast of *Sphæropezium ovoidactylum*, *King*.
70. Cast of *Sphæropezium pachydactylum*, *King*. The originals of Nos. 64 to 70, from Westmoreland, Pa.
71. One track of *Brontozoum validum*, on gray grit. Smith's Ferry, Northampton.
72. One track of *Brontozoum exsertum*, on grit. Smith's Ferry, Northampton.
73. One track of *Brontozoum validum*, showing phalangeal impressions very finely. Perhaps the type of the species. On red shale. Turner's Falls. Ichnology, Plate LVII., fig. 3..
74. Fine single track of *Ornithopus gracilior*, showing the impression of the end of the hind toe. Red shale. Wethersfield Cove.
75. Same, showing more of the hind toe.
- 76, 77. Two leaves of red shale, from Wethersfield Cove, with two tracks of *Triænopus leptodactylus*, showing a broad heel.

79. One track of *Plesiornis æqualipes*, with one of *Platypterna tenuis*, on red shale. Wethersfield Cove.
 80. *Ornithopus gallinaceus*, on red shale. Wethersfield Cove.
 81. *Triænopus leptodactylus*, on red shale. Wethersfield Cove.
 82. Two leaves showing *Plectropterna minitans*. Wethersfield Cove.
 83. Single track of *Triænopus leptodactylus*, on red shale. Wethersfield, Connecticut.
 84. Three tracks of *Plesiornis quadrupes*, on gray sandstone. Turner's Falls. Presented by Dr. James Deane, of Greenfield.
 85. Depressed tracks of *Amblonyx Lyellianus*, on red sandstone, Turner's Falls, showing the phalangeal impressions distinctly, but not deep. Presented by Dr. James Deane. Ichnology, Plate LVII., fig. 6.
 86. Two impressions of *Plesiornis quadrupes*, with rain-marks. Turner's Falls.
- Total number of tracks in this Case, 259.

CASE NO. 32.

1. Sandstone, from Turner's Falls. On the upper side, two tracks of the hind foot of *Corvipes lacertoideus*, pointing in opposite directions, and one fine fore foot impression; also a third hind foot. On the reverse side, seven tracks of *Anomæpus gracillimus*, and one trail of *Cunicularius retrahens*.
2. Slab of red sandstone, from South Hadley, north part, with two tracks of *Brontozoum Sillimanium*.
3. Slab with three tracks of *Tridentipes uncus*, from Turner's Falls.
4. Gray sandstone, with a single, quite small track of *Tridentipes elegans*, showing a brush on the heel. Horse Race, Gill.
5. Two tracks of *Macropterna divaricans*, from the Horse Race, Gill.
6. Two tracks of *Macropterna divaricans*; also an obscure track of the fore foot, a little in advance of the hind foot, brought to light by grinding down the surface. Four tracks.
7. Single track of *Plectropterna* (?) *minitans*, on sandstone, with some rain-marks. On the under side, singular convolutions, produced perhaps like ripple-marks. Wethersfield.
8. Hard black shale, with one track of *Plectropterna minitans* and two of *Plesiornis pilulatus* (?). Chicopee Falls. Two specimens with this number making a book.
9. Black shale with six impressions of *Harpagopus dubius*. Turner's Falls. E. H. says: — "This is a singular impression, and my judgment vibrates to one side and the other, whether it be a real track." Ichnology, Plate LI., fig. 5.
10. Shale, with one track of *Macropterna vulgaris* (?). North bank, below Turner's Falls.
11. Red shale, with one track of *Plesiornis tequalipes*. Wethersfield.
12. Red shale, with one track of *Ancyropus heteroclitus*, (a little doubtful.) Wethersfield.
13. Gray shale. Turner's Falls. Track too obscure for identification.
14. Part of two tracks of *Platypterna Deaniana*. Shows the curvature of the layers of shale by the weight of the animal. Wethersfield.
15. Unknown species of track, with three (possibly four) toes. Turner's Falls.
16. Gray sandstone, with two tracks of *Anisopus Deweyanus*. Turner's Falls.
17. Shale, with one track of *Exocampe arcta*. North bank, below Turner's Falls.
18. One track of *Anisopus gracilis*, on coarse sandstone. Turner's Falls.
19. Shale, showing hind foot of *Ancyropus heteroclitus*, probably. North bank, below Turner's Falls.
20. Front foot of *Anisopus gracilior*. Turner's Falls.

21. Reddish shale with two tracks of hind feet of *Plectropterna gracilis*, and one trail of *Sphaerapus magnus*. Turner's Falls.
22. One track of *Brontozoum exsertum*. Northampton.
23. Two leaves of red shale, showing a track on each of *Platypterna Deaniana*. Wethersfield.
24. Red shale with calcigrade track of *Platypterna Deaniana*. On the under side, the track is thrown forward an inch, showing that the animal was descending a slope. Wethersfield Cove.
25. Red shale. Wethersfield. Numerous tracks obscured by intermingling on upper side. On other side, four tracks of *Ornithopus gallinaceus*.
26. Red shale. On upper side three tracks of *Triænopus leptodactylus*, and one of *Platypterna Deaniana*. Wethersfield.
27. Three calcigrade tracks on the upper side, of *Ornithopus gallinaceus*. Two of them more distinct on the lower side.
28. Two leaves of reddish shale; one of them with two tracks of *Plectropterna gracilis*; the other has one of the same. Wethersfield.
29. Reddish shale, with two tracks of *Platypterna Deaniana*, showing the length of the step.
30. Two leaves of red shale, with tracks of *Argozoum pari-digitatum*. Wethersfield.
31. Red shale, with three tracks of *Triænopus leptodactylus*. A calcigrade impression — a distinct hind toe coming out at the end of the heel. Wethersfield.
32. Red shale, with two tracks of *Triænopus leptodactylus*. Wethersfield.
33. The same — one track with narrow heel.
34. The same — one track with broad heel and apparently a fourth toe. E. H. remarks on this specimen: "I do not think I understand this species; probably several species are embraced in it." In 1849 it was subdivided, but the two were united subsequently into one.
35. Four tracks of *Triænopus leptodactylus*; one with a long heel and apparently a fourth toe near the end; but it belongs to another track.
36. Three tracks of *Triænopus leptodactylus*. A long heel with knob at the end. Wethersfield.
37. Red shale, showing tracks of *Plesiornis æqualipes*. Wethersfield Cove.
- 38, 39, 40. Red shale, with four tracks of *Platypterna tenuis*. Wethersfield.
41. Shale with one track of *Ornithopus gallinaceus*. Chicopee, near Cabotville.
42. Red shale, with four tracks in relief of *Brontozoum Sillimanium*. Wethersfield.
43. Single track of *Grallator formosus*, on red shale. Wethersfield. .
44. Single distinct track of *Ornithopus gallinaceus*, on red shale. Wethersfield.
45. Red shale, with two tracks of *Anomæpus gracillimus*, five of *Anisopus gracilis*, and rain-marks, all in relief. Turner's Falls.
46. Dark shale, in two leaves, with three tracks of *Harpagopus dubius*. South Hadley Canal.
47. Five tracks in a row of *Triænopus leptodactylus*, and one at least reversed. Red shale. Wethersfield.
48. One track of *Brontozoum exsertum* with two nodules, perhaps coprolites. Turner's Falls.
49. Single track, perhaps of *Ancyropus heteroclitus*. Turner's Falls.
50. Red shale, with seven hind and one fore feet impressions of *Orthodactylus intro-vergens* in two rows. Turner's Falls. Type of species. *Ichnology*, Plate LI., fig. I.
51. Single track of *Brontozoum approximatum*, and another of *B. Sillimanium* upon it. Cannot say which was impressed first. A good example to show that one track often does not obliterate another. Turner's Falls.
- 52 to 55. Potsdam sandstone, with tracks and trails of *Protichnites*, from Beauharnois, C. E. As many as sixty-five indentations, with ripple-marks.
56. Three leaves of red sandstone, with single track of *Tridentipes elegans*, the middle toe extending through the whole. The hind toe shows only at one opening. Turner's Falls.

57. Two leaves of red shale, with hind and fore foot of *Anomœpus intermedius*. Turner's Falls. 1863.

58, 59. Two tracks of *Brontozoum divaricatum*. Turner's Falls.

60. Shale, with ten tracks of *Anisopus gracilior*, with trails of *Bisulcus undulatus*. Lily Pond, Turner's Falls. 1868.

61. Red sandstone, showing single track of *Brontozoum Sillimanium*, with distinct phalanges and claws. Turner's Falls.

62. Two slabs outside the case, of *Batrachoides nidificans*. South Hadley Falls.

63. Single track of *Brontozoum minusculum*. Turner's Falls.

Total number of tracks in this Case, 207.

CASE NO. 33.

1. Micaceous sandstone, with row of four tracks of *Argozoum pari-digitatum*. Turner's Falls.
2. Red micaceous sandstone, with single track of *Tridentipes elegans* (?), very small.
Marsh's quarry, Montague.

3. Single poor track of *Tridentipes elegans*. Turner's Falls.

4. Single track of *Argozoum pari-digitatum*, on gray shale. Below Turner's Falls.

5. Gray micaceous sandstone, with two tracks of *Ornithopus gallinaceus*. Horse Race, Gill.

6. Single track *Selenichnus* (?) *falcatus*. Turner's Falls.

7. Two tracks of *Tridentipes elegantior*, somewhat doubtful. Turner's Falls.

8. Single track, wanting in the outer toe, of *Brontozoum divaricatum*. Below Smith's Ferry Northampton.

9. Similar to No. 8.

10. Red shale, with three tracks of *Platypterna varica*, a trail of *Cunicularius retrahens*, and one of *Argozoum pari-digitatum*.

11. Red shale, with one track of *Stenodactylus curvatus*. Turner's Falls

12. One small track of *Tridentipes elegans*, showing the heel brush. Horse Race.

13. One track, on gray shale, of hind foot of *Macropterna vulgaris*. Horse Race.

14. Same, from Turner's Falls.

15. Same, showing the long heel. Below Turner's Falls.

16. Red shale, with one digitigrade track of *Macropterna vulgaris*. Wethersfield.

17. Gray sandstone, with a poor track of *Anisopus gracilis*. Northampton (?);

18. Hind foot of *Corvipes lacertoideus*. Turner's Falls.

19. Hind and fore feet (indistinct) of *Anisopus Deweyanus*. Turner's Falls.

20. Three tracks, probably of *Stenodactylus curvatus*. Turner's Falls.

21. Two tracks of *Stenodactylus curvatus*. Turner's Falls.

22. Two leaves of brown shale, with tracks of *Plectropterna minitans* or *P. gracilis*.
Wethersfield.

23. Three leaves of the same shale, showing two tracks passing through them, all so nearly together that they seem on some layers to be only one track. "This case is described in the *Ichnology*, pages 30, 109, and exhibited on Plate XIX., figs. 10, 11, and 12. By a slip, I have stated on page 109, that the fore foot of *P. minitans* had not been found, when both are shown on these figures; but which is the hind and which the fore foot, I am in doubt, though judging from other cases, the rear track shows the hind foot. They seem very much alike, and hence do not correspond with *P. gracilis* as to the front foot. I think these specimens are probably neither *P. minitans* nor *P. gracilis*, and very likely of a different genus." E. H.'s notes.

24. Single track of same species, going through three layers. Three tracks and four pieces. Wethersfield.
 25. One track of the same. Wethersfield.
 26. Red shale, with two hind tracks and one fore track of *Plectropterna gracilis*, and a row of three hind and one front track of *Corvipes lacertoideus*; also one track of *Brontozoum validum*. Turner's Falls.
 27. Shale, with three hind tracks and one front of *Corvipes lacertoideus*, with single hind and fore feet of *Exocampe ornata*. Turner's Falls.
 28. Slab, with fifteen tracks of *Anisopus gracilis*. Turner's Falls.
 29. Two leaves of gray shale with two rows of five tracks of *Lagunculipes latens*, seen best in relief; also one track of *Tridentipes elegans*. Turner's Falls. *Ichnology*, Plate XLV., fig. 4.
 30. Shale, with a row of eight tracks of *Macropterna vulgaris*. Turner's Falls.
 31. Row of six tracks of *Macropterna vulgaris*. Turner's Falls.
 32. Three tracks of the same. Wethersfield.
 33. Four tracks of the same. One shows the long heel finely, and all show upon the under side of the slab. Wethersfield.
 34. Track of doubtful character, showing the filling in. In two slabs. Turner's Falls.
 35. Slab of gray shale, with rows of four hind and two front tracks of *Tarsodactylus caudatus*, with traces of the claws. There is one straight trail near the tracks, made neither by the claws nor tail, being apparently a plant. Specimen shows fine example of *Halysichnus laqueatus* — made up of twenty parts or separate impressions. Turner's Falls.
 36. Shale, with several paths of *Cunicularius retrahens*, and one track of *Brontozoum Sillimanium*. On back side are several branches of coniferous plants, two unknown tracks and rain-marks. Lunate impressions are connected with the paths of the *Cunicularius*, reminding one of the genus *Lunula*. Turner's Falls.
 37. Shale, with ten tracks, both hind and front, of *Apatichnus bellus*, a row of four tracks of *Anisopus gracilis*, and fifteen tracks of *Grammepus erismatus*. Turner's Falls.
 38. One track of *Platypterna angusta*. Turner's Falls.
 - 39 to 43. Five tracks of the same.
 44. *Grallator cursorius*. Turner's Falls.
 - 45, 46. *Plectropterna lineans*. Turner's Falls.
 47. Four tracks of *Shepardia palmipes*. Turner's Falls.
 48. Two tracks of *Anisopus gracilis*. Turner's Falls.
 49. *Apatichnus bellus*. Turner's Falls.
 50. *Apatichnus circumagens*, hind and fore foot; also *Cunicularius retrahens*. Turner's Falls.
 51. Single track of *Brontozoum divaricatum*. Northampton, on railroad.
 52. Single track of *Brontozoum divaricatum*. Northampton, on railroad. Counterpart of No. 51.
 53. Three tracks of *Exocampe ornata* (?). Below the dam at Turner's Falls.
 54. Single track of *Brontozoum exsertum*. Turner's Falls..
 55. Row of eight tracks in relief of *Anisopus gracilior*. Turner's Falls.
 56. Single track in relief (type of species,) of *Brontozoum approximatum*. Turner's Falls.
 1863. Counterpart of No. $\frac{54}{10}$.
 57. Trails of *Climacodichnus corrugatus*. Turner's Falls. 1863.
 58. Single track of *Brontozoum validum*. Turner's Falls. 1863.
 59. Casts of reptilian impressions of the Carboniferous formation, from Horton's Bluff, N. S. Presented by Sir W. E. Logan to Prof. Hitchcock, in 1864.
- Total number of tracks in this Case, 215.

CASE NO. 34.

1. Shows the ridge of mud in front of track of *Tridentipes ingens*. "An elephant would not raise a higher mound.: Horse Race, Gill.
2. Single track of *Brontozoum divaricatum*. Turner's Falls.
3. Micaceous sandstone, with one row of three and another of two tracks of *Argozoum paridigitatum*. Compare with No. $\frac{9}{12}$. Turner's Falls.
4. One track of *Brontozoum Sillimanium*. Turner's Falls.
5. One track of *Brontozoum validum*. Turner's Falls.
6. *Brontozoum approximatum*. Turner's Falls
7. Red Wethersfield shale. Two tracks of *Brontozoum Sillimanium* on upper side, with four or five on back side.
8. *Plectropterna gracilis*, on micaceous sandstone. Three hind feet, four fore feet and a tail trace. It seems as if a fore foot had been put down twice before the hind foot was moved. Turner's Falls.
9. Two hind and two fore feet of *Plectropterna gracilis*. Turner's Falls. Ichnology. Plate XLVIII., fig. 2.
10. Single hind foot impression of *Plectropterna minitans*. On shale. Cabotville.
11. Four tracks, at least, of *Plectropterna minitans*. Chicopee Falls.
- 12, 13. Single tracks of the same. Chicopee Falls.
14. Two tracks of *Plectropterna minitans*, on micaceous sandstone. Heels long. Toes of a third track visible. On back side are two tracks of *Argozoum disparidigitatum*. Turner's Falls (?).
15. Two tracks of *Brontozoum tuberatum*, and one of *B. Sillimanium*, on upper side. On other side, four hind feet and one front, of *Plectropterna gracilis*. Turner's Falls.
16. On track of *Brontozoum tuberatum*. Turner's Falls.
- 17, 18, 26 and 27. Black shale with tracks of *Amblypus dextratus*. Turner's Falls. Ichnology, Plate XLVIII., fig. 5.
19. Single impression of *Anomæpus minimus*. Turner's Falls.
- 20, 21, 22 and 37. Seven hind tracks and four front tracks of *Corvipes lacetoideus*.
23. One track of *Exocampe ornata* (?). Turner's Falls.
24. Unknown track on gray shale. Below Turner's Falls, Gill.
25. The same, four tracks.
- 26, 27. See No. 17.
28. Three tracks of *Brontozoum validum*. Turner's Falls.
29. One track of *Brontozoum divaricatum*. Turner's Falls.
30. Four hind tracks, and perhaps one front track of *Plectropterna minitans* (?). Wethersfield.
31. The same, on shale. Cabotville.
32. Three tracks of *Ancyropus heteroclitus*, and three of *Plectropterna minitans*. Wethersfield.
33. Book of five leaves of *Ornithopus gallinaceus* — track extending through every layer. Turner's Falls.
34. Book of two leaves, showing both feet of *Apatichnus circumagens*. Turner's Falls.
35. Single track of *Plectropterna minitans*, of great size. North bank, below Turner's Falls..
36. Book of two leaves, of tracks resembling *Plectropterna gracilis*. Hind foot shows a fourth toe in addition to the spur; and the front lateral toes less divaricate. Nov. Gen. (?). North bank, below Turner's Falls.
37. See No. 20.
38. Single track of *Plectropterna minitans*, on micaceous sandstone. Heel very long. Wethersfield. Ichnology, Plate LIX., fig. 2.

39. Two tracks of *Tridentipes elegantior*. Turner's Falls.
 40. Thirteen or fourteen tracks of *Anomæpus minor* — seven of them of front foot. Heels of the hind feet more distinct than the toes. Presented to E. Hitchcock by Dr. James Deane. Turner's Falls.
 41. Shale, with single tracks of *Gigantitherium minus*, *Grallator cuneatus*, and *Anisopus gracilis*. Turner's Falls.
 42. Shale, with half a dozen tracks of *Ancyropus heteroclitus* in two rows, and two tracks of *Plectropterna minitans*. Wethersfield.
 43. Shale, with two rows — three hind and four front feet — of *Stenodactylus curvatus*. Turner's Falls. No. $\frac{34}{30}$ of *Ichnology*, Plate XXXIV., fig. 3.
 44. Shale, showing nineteen tracks — nine of front feet — of *Cheirotheroides pilulatus*. Turner's Falls. No. $\frac{34}{31}$, of *Ichnology*, Plate XXXVI., fig. 6.
- Total number of tracks in this Case, 158.

CASE NO. 35.

1. Shale, with two tracks of *Brontozoum validum*, and two of *Platypterna varica*. Turner's Falls.
2. Shale, with two tracks of *Brontozoum validum*. Turner's Falls.
3. Micaceous sandstone, with one track of *Brontozoum minusculum*.
4. Shale, with one track of *Brontozoum validum*, and three of *Platypterna varica*. Turner's Falls.
5. Gray shale, with row of five tracks — three hind — of *Exocampe arcta*. Below dam, Turner's Falls.
6. Single track of *Brontozoum tuberatum*. Turner's Falls.
7. Single track of *Brontozoum validum*. Turner's Falls.
8. One track of *Brontozoum exsertum*, showing all the phalanges, with a row of three tracks of *Exocampe arcta*. Turner's Falls.
9. Four tracks of *Brontozoum Sillimanium*. Turner's Falls.
10. Nine tracks of *Macropterna vulgaris*. Turner's Falls.
11. Two tracks of *Grallator cuneatus* on upper side, and one of *Brontozoum validum* on lower side. Turner's Falls.
12. Two impressions of *Grallator cursorius*. Turner's Falls. ,
13. Shale, with three tracks of what in the *Ichnology* is called *Platypterna gracillima*. Ill-defined. Compare with No. $\frac{39}{68}$. Turner's Falls.
14. Shale, with four tracks of *Platypterna varica*. Rain-marks on reverse side. Turner's Falls.
15. Same as No. 14.
16. Same as No. 14; also one track of *Brontozoum validum*, and two of *Anisopus gracilis*.
17. *Tridentipes uncus*. Turner's Falls.
18. Four tracks of *Platypterna varica*, and one of *Grallator cursorius*. Turner's Falls.
19. Both feet of *Anisopus gracilis*. Turner's Falls.
- 20, 21, 22. Volume of three leaves, showing rather doubtful impressions of *Isocampe strata*. Turner's Falls.
23. Shale, with row of nine tracks of *Macropterna gracilipes*. Turner's Falls.
24. Two hind feet and one front foot impression of *Exocampe arcta*. Very fine. North bank, below Turner's Falls.
25. Single tracks of both feet of unknown animal, remarkable for the pelleted appearance of all the toes. Turner's Falls.

27. Six tracks of *Macropterna vulgaris*, on shale. Turner's Falls.
 28. Ten tracks of the same.
 29. Shale, with two tracks of *Orthodactylus intro-vergens*. Turner's Falls.
 30. Two tracks of *Plectropterna lineans*. Below the dam, Turner's Falls.
 31. Two tracks of *Grallator cuneatus* (?) with supposed Gas Pustules. Chicopee Falls.
 32. Row of fourteen tracks of *Macropterna vulgaris*, toes very much curved. Second row of same, with four tracks. Ichnology Plate XLVIII., fig. 7. Turner's Falls.
 33. Shale, with nine tracks of *Macropterna vulgaris*, and two hundred of *Acanthichnus cursorius*. On under side, one of *Brontozoum giganteum*. Turner's Falls.
 - 34, 35. Poor specimens of what may have come from *Harpedactylus concameratus*. Horse Race, Gill.
 36. Supposed coprolites. Smith's Ferry.
 37. Track of *Brontozoum divaricatum*. South Hadley, north part.
 38. One broken track of *Brontozoum exsertum*. Turner's Falls.
 39. One track of *Ornithopus gallinaceus*. Horse Race, Gill.
 40. Shale, with unknown track. Durham, Connecticut.
 - 41, 42. Tracks of *Macropterna vulgaris*, and *Tridentipes uncus*. Turner's Falls.
 43. Impressions of both feet of *Anisopus gracilis*. Turner's Falls.
 44. *Platypterna gracillima*. Turner's Falls.
 45. *P. gracillima*. Lily Pond.
 46. Two tracks of *Platypterna gracillima*.
 47. Both feet of *Apatichnus bellus*.
 48. *Plesiornis pilulatus*, two tracks. Turner's Falls.
 50. Eight tracks of *Apatichnus bellus*. Turner's Falls.
 - 51, 52. Two leaves of shale, with obscure, apparently undescribed track. Outside of one leaf, three tracks of *Corvipes lacertoideus*.
- Total number of tracks in this Case, 387.

CASE NO. 36.

1. Coarse micaceous sandstone, with five tracks of *Hoplichnus poledrus*. Ferry at Turner's Falls. Ichnology, Plate XLVIII., fig. 9.
- 2, 3. Five tracks of the same, from same locality.
4. One track of *Brontozoum validum* (?), or of a web-footed animal allied to *Hyphepus*. Turner's Falls.
5. *Brontozoum tuberatum*. Turner's Falls.
6. Micaceous sandstone, with row (four hind and three front feet) of *Apatichnus bellus*, and two tracks of *Apatichnus* (?) *circumagens*. South Hadley, north part.
7. Slab of gray shale, with tracks of *Ornithopus gracilior*, *Triænopus leptodactylus*, and probably other species. Below dam at Turner's Falls.
- 8, 9. *Ptilichnus anomalus*. Turner's Falls.
11. Micaceous sandstone, with fine row of *Hexapodichnus magnus*; sometimes showing the tracks of six feet, usually of only two on each side; 175 in all. Turner's Falls. Ichnology, Plate XXIX., fig. 7.
- 12, 13. Shale, with *Ptilichnus anomalus*. Turner's Falls. Ichnology, Plate XXV., figs. 1, 2.
14. Shale, with two trackways of *Bifurculipes scolopendroideus*, 58 tracks. Below the dam at Turner's Falls.
15. Shale, with fine trackway of *Sphærapus magnus*, sixty impressions. Turner's Falls. Ichnology, Plate LI., fig. 3.

16. Two leaves of shale, with row of five tracks of *Platypterna digitigrada*, and trackway — twenty tracks — of *Hamipes didactylus*. Ichnology, Plate LI., figs. 2, 4.
17. Shale, showing trackways of *Bifurculipes elachistotatus* (four rows of forty-eight tracks,) and of *Copeza cruscularis* (forty-three tracks.) Also a good impression of a coniferous plant. Lily Pond, Turner's Falls. Ichnology, Plate XXIX., fig. 4.
18. Shale, with trackway of forty-eight tracks of *Copeza propinquata*. Lily Pond.
19. Shale, with several rows of *Acanthichnus cursorius*; two of *Copeza propinquata*; one of *Cochlichnus anguineus*; one of *Pterichnus centipes*; and four tracks in a row, of *Exocampe ornata*. Track of *Brontozoum Sillimanium* on upper side. 410 tracks on this slab. Lily Pond. Ichnology, Plate XXVIII., fig. 1.
20. Shale, with three splendid examples of *Cochlichnus anguineus*. Lily Pond.
21. Shale, with five double rows of *Acanthichnus cursorius*; nine tracks of *Macropterna*, and impressions of coniferous plant with supposed seeds. 196 tracks. Lily Pond. See Ichnology, Plate XXXI., fig. 1.
22. Gray sandstone, with numerous trails of *Unisulcus intermedius*, — as many as sixty. Horse Race, Gill.
23. Shale, with perhaps fifty trails of *Unisulcus minutus*. Horse Race, Gill.
24. Fine shale, with three indistinct double rows of *Acanthichnus*, and one of *Hexapodichnus horrens* — about 100 tracks. Lily Pond.
25. Shale, with two double rows of *Conopsoides larvalis* — forty-two tracks. Lily Pond. Ichnology, Plate XXIX., fig. 6.
26. Shale, with trackway of ninety tracks of *Copeza propinquata*. Lily Pond. Ichnology, Plate XXIX., fig. 3.
27. Shale, with five rows of two hundred tracks of *Acanthichnus cursorius*, *A. saltatorius*, and *Pterichnus centipes*. Lily Pond.
28. Shale, with curved trackway of forty-three tracks of *Bifurculipes laqueatus*. Lily Pond.
29. Shale, with two rows of eighty-two tracks of *Acanthichnus cursorius*. Lily Pond.
30. Shale, with trackway of sixty-two tracks of *Acanthichnus cursorius*. Lily Pond.
31. Shale, with trackway of forty-eight tracks of *Acanthichnus saltatorius*. Lily Pond.
32. Book of two leaves, showing a trackway of thirty tracks of *Acanthichnus cursorius*, both depressed and in relief. Lily Pond.
33. Shale, with three tracks of *Brontozoum validum*, three trackways of *Bifurculipes laqueatus*, and one of *Hexapodichnus horrens*. In all, 266 tracks. Lily Pond. Ichnology, Plate XXX., fig. 1.
34. Shale, with one trackway of sixty-two tracks of *Acanthichnus saltatorius*, and at least one hundred rather scattered tracks of the same genus, with a few impressions of a coniferous plant. Lily Pond.
35. Trackway of *Bifurculipes*, and a delicate one of *Acanthichnus trilinearis*. In all, ninety-six tracks. Lily Pond.
36. Shale, with trackway of one hundred impressions of *Sphærapus larvalis*. Lily Pond.
37. Shale, with trackway of one hundred and five tracks of *Copeza triremis*, and sixteen of *Grammepus erismatus*. Lily Pond.
38. Shale, with trackway of ninety tracks of *Ampelichnus sulcatus*, and very delicate ripple-marks. Lily Pond.
39. Shale, with trackway of fifty-seven tracks of *Grammepus erismatus*. Lily Pond.
40. Shale, with trail of *Cochlichnus anguineus*. Lily Pond.
41. Shale, with trackway of *Bifurculipes scolopendroideus*. Below the dam at Turner's Falls.
42. Red shale, with hind and fore feet of *Plectropterna lineans*. Wethersfield.

43. Shale, with four tracks of *Saltator bipedatus* and two of *Exocampe ornata*. Below the dam at Turner's Falls. Ichnology, Plate LI., fig. 7.
 44. Shale, with trail of *Unisulcus intermedius*. Turner's Falls.
 46. Trackway of fifty-nine tracks of *Copeza punctata*, of *Acanthichnus cursorius*, and *Lunula obscura* (?). Lily Pond.
 46. Interesting specimens of trail of *Cochlea Archimedeae*. Lily Pond.
 47. Trackway of forty-two tracks of *Pterichnus centipes*. Lily Pond.
 48. Trackway of thirty-seven tracks of *Bifurculipes laqueatus*. Lily Pond.
 49. Trackway of *Cochlea Archimedeae*. Lily Pond. Ichnology, Plate XLIX., fig. 7.
 50. Delicate ripple marks, formerly referred to *Ptilichnus pectinatus*. Lily Pond. Ichnology, Plate XXV., fig. 9.
 51. Shale, with trackway of sixty-four tracks of *Bifurculipes*. A short second trackway of the same, with numerous seeds (?). Lily Pond.
 52. Very perfect specimen of the hind and front feet of *Macropterna vulgaris*. Lily Pond.
- Total number of tracks in this Case, 3,023.

CASE NO. 37.

1. Track of *Tridentipes ingens*. Horse Race, Gill.
 2. Single track of *Brontozoum exsertum*. Turner's Falls.
 3. Single track of *Brontozoum divaricatum*. Horse Race, Gill.
 4. *Brontozoum Sillimanium*. Turner's Falls.
 5. *Brontozoum validum*. Turner's Falls.
 6. *Brontozoum validum*, in relief. Turner's Falls.
 - 7, 8. *Brontozoum validum*, depressed and in relief. Turner's Falls.
 - 9, 10. Two leaves of *Chimæra Barratti* and *Brontozoum Sillimanium*, with numerous fine rain-marks. Turner's Falls. Ichnology, Plate LIX., fig. 4.
 - 11, 12. Slab with about seventy tracks of *Anisopus gracilis*, and ripple-marks. Horse Race, Gill.
 - 13, 14. Single tracks of *Brontozoum validum*. Turner's Falls.
 15. Single track of *Brontozoum tuberatum*.
 - 16, 17. Single tracks of *Argozoum dispari-digitatum*. Wethersfield.
 18. Three tracks of *Anomæpus gracillimus*, made after the accompanying rain-marks. Turner's Falls.
 - 19, 20. *Argozoum dispari-digitatum* From Turner's Falls and Wethersfield.
 21. Red shale, with sixteen tracks of *Anisopus gracilis*, and ripple-marks. Horse Race, Gill.
 22. Red shale, with tracks of *Argozoum dispari-digitatum* (?) and *Platypterna Deaniana*. Wethersfield.
 23. Shale, with about sixty tracks of *Anisopus gracilis*, and ripple-marks. Horse Race, Gill.
 24. Two slabs, showing *Platypterna Deaniana* (?). Remarkable for the slide forward seen in the lower track.
 25. Shale, with two tracks of *Anomæpus minimus*, part of one of *Anisopus gracilis*, one of *Brontozoum Sillimanium*, and the trails of *Cunicularius retrahens*, probably. Lily Pond.
 26. Red shale, with two impressions of *Platypterna Deaniana*. Wethersfield Cove.
 27. *Brontozoum divaricatum*. Turner's Falls.
 - 28, 29. Shale, with rain-marks, two hind tracks of *Anomæpus minor*, part of the fore foot, and one of *Plesiornis quadrupes*. Lily Pond.
 30. Annelid tracks, from Lower Silurian of Waterville, Maine.
- Total number of tracks in this Case, 182.

CASE NO. 38.

1. Shale, with one track of *Grallator formosus*, and one of *G. cuneatus*. Chicopee Falls.
 2. One track of *Grallator formosus*. Northampton.
 3. One track of *Brontozoum validum*. Turner's Falls.
 4. One track of *Brontozoum giganteum*. Turner's Falls.
 - 5, 6. Two leaves of *Batrachoides nidificans*, below the layer where the nests were made. South Hadley Falls.
 7. *Batrachoides nidificans*, on successive layers. South Hadley Falls.
 - 8, 9. Nests of Tadpoles (*Rana palustris*, Leconte,) in mud. From "Tadpole City," in Hadley. Ichnology, page 121, Plate L., figs. 3, 4.
 - 10, 11, 12. Concretions in limerock of Niagara Group, Lockport, New York, referred in Ichnology (Plate L., fig. 2,) to *Batrachoides antiquior*.
 13. Slab of red sandstone, showing *Batrachoides nidificans*, occupying the furrows of ripple-marks, just as is done by modern tadpoles. South Hadley Falls.
 - 14, 15. Elegant leaves, $2^{\circ} 8'$ X $2^{\circ} 1'$, of sandstone, marked by nests of *Batrachoides nidificans*. South Hadley Falls. Ichnology, Plate L., fig. 1.
 16. Slab, $2^{\circ} 6'$ X 2° , with sixty tracks of *Anisopus gracilis*, and ripple-marks. Horse Race, Gill. Ichnology, Plate XLIII., fig. 3.
 - 17 to 21. Nests of *Batrachoides nidificans*, in the furrows of ripple-marks. South Hadley Falls.
 22. *Batrachoides nidificans*, on different layers. South Hadley Falls.
 23. Mud-holes, slightly resembling the *Batrachoides*. Turner's Falls. Presented by C. H. Hitchcock.
 - 24, 25. Nondescript tracks, like *Brontozoa*. 1863. Turner's Falls.
- Total number of tracks in this Case, exclusive of tadpole nests, 67.

CASE NO. 39.

1. Track of *Brontozoum exsertum*. Turner's Falls.
2. Shale, with track of *Grallator formosus* (?). Chicopee Falls.
3. Rain-drop impressions. Turner's Falls.
4. Four tracks of *Platypterna gracillima* a doubtful species. Turner's Falls.
5. The same, four tracks.
6. Six tracks of *Xiphopeza triplex* — probably the same with Nos. 4 and 5. Turner's Falls.
7. Two tracks of *Stenodactylus curvatus*. Turner's Falls.
8. Three tracks of *Xiphopeza triplex*. Turner's Falls, below the dam.
9. Four tracks of *Anisopus Deweyanus*. Turner's Falls.
- 10, 11. Two leaves, showing a *Harpedactylus* but below where the animal trod. Wethersfield, Connecticut.
12. A depression in talcose schist, somewhat resembling a footmark. Western Massachusetts.
- 13 to 18. Different forms of Coprolites, from the hard grit at Chicopee Falls. No. 18 is from Northampton and may not be a coprolite.
- 19 to 24 and $24\frac{1}{2}$. Ripple-marks from the Connecticut Valley, except the first three, which are from the Lower Silurian sandstone on the south shore of Lake Superior.
- 26 to 65. Impressions and casts of rain drops, principally from Turner's Falls. No. 44 is a brick marked by rain. Nos. 58 and 60 are small ripple-marks. Nos. 33, 34 and 35, are mud-holes, difficult to explain. Nos. 31, 34, 54, 63, in Ichnology, Plate LVI., figs. 7, 5, 8, 6.

- 66, 67. Coprolites from the Lias, near Bristol, in England. One of them has been polished.
- 68. Two tracks of *Macropterna divaricans* (?). Turner's Falls.
- 69. Three tracks of *Exocampe ornata*. Turner's Falls.
- 70. Seven tracks of *Macropterna vulgaris*, with impressions of an aroid plant. Turner's Falls.
- 71. Four tracks of *Exocampe ornata*. Turner's Falls.
- 72, 73, 74. Echinoderms (?). Turner's Falls.
- 75. *Septaria*. Chicopee Falls.
- 76. Singular and unknown impressions — probably of animal origin. From Wethersfield Cove, Connecticut.
- 77. Row of fourteen tracks of *Macropterna gracilipes*. Turner's Falls. Ichnology, Plate LI., fig. 6; XXXIV., fig. 1.
- 78. Seven tracks of the same. Turner's Falls.
- 79. Fine row of twenty-eight tracks of *Macropterna vulgaris*. Turner's Falls. Ichnology, Plate XLIX., fig. 3.
- 80 to 86. Marks of rain-drops. Turner's Falls.
- Total number of tracks in this Case, 92.

CASE NO. 40.

- 1. Shale, indurated by proximity to trap, with ten tracks of *Exocampe arcta*, and numerous fine rain-drops. Turner's Falls, below the dam.
- 2. Cast of the foot of a wild turkey.
- 3. Plant (?) or effect of water upon shale. Turner's Falls.
- 4. Single track of *Brontozoum exsertum*. Turner's Falls, Montague shore.
- 5. Track of *Brontozoum divaricatum*. Northampton.
- 6. Single track of *Tridentipes uncus*. Turner's Falls.
- 7. Cast of five tracks of Paleozoic reptiles. From Pennsylvania. Presented by Prof Jeffries Wyman.
- 8. Trails and tracks of *Helcura anguinea*, nine in all. Traces of the toes and tail. Turner's Falls, north bank, below dam.
- 9. *Macropterna vulgaris*. Turner's Falls.
- 10. Both feet of *Xiphopeza triplex*. Turner's Falls.
- 11. Three tracks of *Arachnichnus dehiscens*. Turner's Falls.
- 12. One good track of *A. dehiscens*. Turner's Falls.
- 13. Four tracks of *A. dehiscens*. Turner's Falls.
- 14. Unknown track. Turner's Falls, north bank, below dam.
- 15. Claw and tail traces, and about ten tracks of *Helcura anguinea*. Turner's Falls, north bank, below dam.
- 16. Tracks of a modern salamander. Prepared and presented by Roswell Field. Ichnology, Plate LV., fig. 3.
- 17. Cast of a crow's foot.
- 18. Impressions of raindrops on alluvial clay. Connecticut River, Hadley.
- 19. *Exocampe arcta* (?). Turner's Falls.
- 20. Two impressions of a boy's foot, on alluvial clay, showing finely the striæ upon the skin. Hadley.
- 21. One track of *Macropterna vulgaris*. Turner's Falls.
- 22. Impression of boy's foot, showing striæ of two bird's feet; and of raindrops, on clay. Hadley. Ichnology, Plate XXXII., fig. 1.

23. Nine impressions of bird's feet (crow) with rain-drops, on clay. Hadley.
24. Impressions of boy's foot, of seven bird's feet, and rain-drops, on clay. The boy's foot slipped. The papillæ of the crow's foot, as well as the phalangeal protuberances, are well exhibited. The boy's heel trod on a crow's track, yet did not obliterate it. Hadley.
25. Two tracks of a bird, probably a crow, standing still, showing long hind toe and claw, on clay. Hadley. Ichnology, Plate LIV., fig. 4.
26. Single impression of crow, and of rain-drops, on clay. Hadley.
27. Tracks of a snipe, *Totanus macularius*, on black mud spread over shale. From Horse Race, Gill. A specimen interesting as having convinced some naturalists in the early history of Ichnology of the verity of the ichnites. Described in the "London Literary Gazette."
- 28, 29. Casts of the feet of *Rhea Americana*, the South American ostrich. Presented by Prof. Jeffries Wyman. Ichnology, Plate LV., fig. 1.
30. Two double trails of unknown living animal — possibly a young tortoise — whose carapace impressed the soft clay; also gas pustules. Hadley. Ichnology, Plate LV., fig. 2.
- 31, 32, 33. Five tracks of common snipe, on clay. Hadley.
34. Eight tracks of common snipe, on clay. The bird stopped occasionally on his march, making his tracks irregularly. Hadley. Ichnology, Plate LIV., fig. 1.
35. Four tracks of the snipe, two of which are in relief, and obtained by splitting off a layer of clay; thus completely illustrating the mode of formation of the fossil foot-marks on clay. Hadley.
36. Single impression of an unknown bird, on clay. Hadley.
37. Track in relief of a thick-toed bird, on clay. Hadley.
38. Hind feet of a frog, probably, on clay. Hadley.
39. Two tracks of fore feet of a frog, and the trail of an annelid, on clay. Hadley.
40. Six tracks of a frog, and fifty of an annelid, on clay. Hadley. Ichnology, Plate LV., fig. 4.
41. Two tracks of a snipe, and annelid trail, on clay. Hadley.
42. Unknown track, on clay. Hadley.
43. Rain-marks, on clay. Hadley.
44. Row of six impressions of a snipe and of rain-drops, on clay. Hadley. Ichnology, Plate LIV., fig. 2; XXXI., fig. 2.
- 45, 46. Snipe's tracks, on clay. Hadley.
47. Rain-marks, on clay. Hadley.
48. The hind and front feet, with the marks of the abdomen of a frog as he rested on the ground; also twenty-six small trifid tracks in two rows, very wide apart, for a bird, on clay. Hadley. Ichnology, Plate LIV., fig. 3; XXXII., fig. 2.
49. Minute traces, perhaps of an annelid, on clay. Hadley.
50. Plaster cast of the foot of a hen.
51. Cast of the foot and spur of the domestic cock.
52. Cast of the foot of a domestic turkey.
- 53, 54. Casts of tracks of both feet of a large tortoise.
55. Six impressions of a snipe, and trails of annelids, on clay. Hadley.
56. Three impressions of a snipe, and rain-marks, on clay. Hadley.
57. Track of a dog, on clay. Hadley.
58. Cast of *Ptilichnus anomalus*.
59. Cast of tracks of Paleozoic reptile. From Pennsylvania. Presented by Prof. Jeffries Wyman.
60. Book of two leaves, showing one track of *Hyphepus Fieldi*; one of *Grallator cuneatus*, and two or three of *Anisopus gracilis*. Turner's Falls.

61. Track of foot and tail of *Hyphepus Fieldi*. The hind toe shows well. Turner's Falls.
 62. Both feet of *Isocampe strata*. Turner's Falls.
 63. Eight tracks of *Anisopus gracilis*(?). Turner's Falls.
 64. Single track of *Macropterna divaricans*. Horse Race.
 - 65, 66. Rain-marks. Turner's Falls.
 67. Cast of foot of domestic turkey.
 68. Two casts of foot of the coot — *Botaurus lentiginosus*.
 69. Fourteen impressions of *Arachnichnus dehiscens*, and one of *Tridentipes elegans*. Turner's Falls.
 70. Annelid impressions. New York State. J. Avery, donor.
 71. Crustacean impressions, Clinton Group. Columbia, New York.
- Total number of tracks in this Case, 322.

The specimens of clay from Hadley, were obtained chiefly by C. H. Hitchcock, in 1852 and 1853, and by him presented to the Cabinet. Described in *American Journal of Science and Arts*, N. S., Vol. XIX., p. 391. See *Ichnology*, page 170, and Plates XXXI., XXXII.

CASE NO. 41.

1. Twelve tracks of *Macropterna vulgaris*. Below the dam at Turner's Falls.
- 2, 3. Four tracks of *Macropterna vulgaris*, from the same locality.
4. Four leaves of shale, showing part of the track of *Ornithopus gallinaceus*, extending through them all. Wethersfield.
5. Four tracks on three leaves of *Plectropterna minitans*. Probably Wethersfield.
7. Single track of *Grallator cuneatus*. South Hadley, two miles N. W. from the church.
- 8, 9. Three hind and two front feet of *Plectropterna gracilis*. Turner's Falls.
10. Two tracks of *Corvipes lacertoideus*. Horse Race, Gill;
11. One track of *Brontozoum exsertum* or *B. validum*. Turner's Falls.
12. Sixteen tracks of *Macropterna vulgaris* (?). Turner's Falls.
18. Twelve tracks of *Exocampe arcta*, and one of *Arachnichnus* (?). Rain-marks on reverse side.
14. Four tracks of *Ornithopus gracilior*. Turner's Falls.
- 15, 16. Single tracks of *Brontozoum Sillimanium*; Wethersfield.
17. Single track of *Grallator cursorius*. Wethersfield.
18. Single obscure track of *Anomæpus gracillimus*. Wethersfield.
19. Single track of *Brontozoum Sillimanium*. Wethersfield.
20. Fine row of six tracks of the hind foot of *Exocampe arcta*. Turner's Falls. *Ichnology*, Plate XLIX., fig. 5.
21. *Argozoum dispari-digitatum*. Wethersfield Cove.
22. Two tracks of *Anomæpus gracillimus*. Wethersfield.
23. Single track of *Brontozoum validum* or *Grallator formosus*. The animal was changing his course. Chicopee Falls.
24. Two tracks of *B. Sillimanium* (?), and two minute unknown tracks. Wethersfield.
25. Row of eight tracks of both feet of *Macropterna divaricans*. Turner's Falls. *Ichnology*, Plate XLVIII., fig. 8.
26. Two rows of seven tracks of both feet of *Xiphopeza triplex*. Turner's Falls.
27. Twenty-five tracks of *Macropterna vulgaris*. Turner's Falls.
- 28, 29. Rows of eleven and ten tracks of *Macropterna vulgaris*. Turner's Falls.
- 30, 31, 32, 35, 36. Single tracks of *Plectropterna minitans*. Wethersfield.
33. Single track, showing well the phalanges of *Brontozoum exsertum*. Below the dam at Turner's Falls.

34. Two tracks of *Anomæpus gracillimus*, and one of *Grallator cuneatus*. Wethersfield.
 37. Single track of *Argozoum pari-digitatum*. Marsh's quarry, Montague.
 38. Three tracks of *Grallator cuneatus*. Wethersfield.
 39. Fine row of ten tracks of *Exocampe ornata*. Below the dam at Turner's Falls. Ichnology, Plate XLVIII, fig. 6.
 - 40, 41. Two leaves of ten tracks of *Exocampe ornata*. Turner's Falls.
 42. Both feet of *Macropterna divaricans*. Turner's Falls.
 43. Single track of *Brontozoum exsertum*. Northampton.
 44. Probably vegetable impressions. Wethersfield.
 45. Two tracks of *Macropterna vulgaris*. Wethersfield.
 46. One track of *Plectropterna minitans*. Wethersfield.
 47. Two tracks of *Ornithopus gracilior*. Turner's Falls (?).
 - 48, 49. One track of *Ornithopus gallinaceus*. Horse Race.
 50. Row of six tracks of *Ancyropus heteroclitus*, on two pieces. Wethersfield.
 - 50 $\frac{1}{2}$. Three tracks of the same.
 51. Six tracks of *Anisopus Deweyanus* or *A. gracilis*, with imperfect rain-marks. Turner's Falls. Presented by Dr. James Deane, of Greenfield.
 52. Nine tracks of both feet of *Antipus flexiloquus*; also on a deeper layer, two trails of *Cunicularius retrahens*; and on under side one hind foot of *Anomæpus minor*, and another trail of *Cunicularius*. Turner's Falls.
 53. Five tracks of both feet of *Xiphopeza triplex*. Below the dam at Turner's Falls.
 54. Tracks of both feet of *Harpedactylus gracilis*. Below the dam at Turner's Falls.
- The number of tracks in Case No. 41, upon the specimens thus far described, is 220.

The specimens in this Case, Nos. 55 to 108, are tracks and trails of Crustaceans and Annelids from the Clinton Group of the Upper Silurian in Columbia, N. Y. They were obtained by C. H. Hitchcock in 1863, but have never been studied, and therefore are only mentioned here in general.

109. Two specimens, showing the fore foot of *Megadactylus polyzelus*, *E. Hk. fil.* Springfield. Supplement, Plate IX., fig. 6.
110. Rib of the same.
111. Metatarsal bone.
112. Head of humerus.
113. Metatarsal bone.
114. Single claw.
115. Part of femur, showing the third trochanter.
- 116, 117. Vertebrae.
118. Metatarsus; all of *Megadactylus polyzelus*. There are other osseous fragments of the same in the Case, not numbered.

All the 6 specimens in the remaining Cases are from Turner's Falls, generally from Lily Pond, except those specially designated, and were obtained in two lots, in 1857 and 1862.

WALL NO. 42.

Nos. 42 to 48, are in the second side room as you advance from the front door along the platform. No. 42 is upon the south side of the room, west of the door.

1. Slab of fine sandstone, 3° 9' X 9', showing a depressed row of tracks of the hind feet of *Plectropterna angusta*; also a larger unknown track.
2. Slab of gray shale, 3° 5' X 9', showing a row of impressions of hind feet of *Plectropterna lineans*; a row of twelve tracks of *Exocampe ornata*, and three tracks of *Anisopus gracilis*.

3. Slab of dark shale, 4° 8' X 7' showing a long row of twelve impressions of *Anisopus gracilis*, with four tracks of the same, upon another row crossing the first. The finest specimens of this ichnite in the whole Cabinet.

4. Slab like No. 3, 3° 10' X 6', with a row of sixteen impressions of *A. gracilis*, with single tracks of *Apatichnus circumagens* and *Anomæpus minor*.

5. Slab of hard shale, 4° 9' X 1° 3', showing every kind of impression made by *Tarsodactylus caudatus*, viz.: a row on each side of the trackway, with marks of the toes and tail trailing on the ground. The finest slab of this species in the Cabinet. Also nine imperfect tracks of a *Brontozoum*, and shrinkage cracks. Ichnology, Plate XXXVI., fig. 2.

6. Slab of red sandstone, 4° 2' X 10', showing a row of fifteen depressed tracks of hind feet and one fore foot of *Selenichnus falcatus* with a very distinct tail trace; also a row of impressions of *S. breviusculus*, with obscure plants and rain-marks. Ichnology, Plate LX., fig. 8.

7. The same as No. 6, in relief, 3° 6' X 2° 2'. These two slabs are the type of the *S. falcatus*. Total number of tracks on this Wall, 138.

WALL NO. 43.

1. Slab of dark shale, 2° 8' X 1° 8', showing single impressions of *Brontozoum giganteum* and *B. approximatum*, the latter with claws almost like pellets.

2. Similar slab, 5° 7' X 1° 5', with a rough surface, showing two fine tracks of *B. giganteum*.

3. Sandstone, 15' X 18', with single impression of *Brontozoum minusculum*.

4. Large slab, 9° 8' X 2°, with a fine row of five impressions of a large *Brontozoum validum*; four rows and seven insulated tracks of *Grallator cuneatus*; single impressions of *B. minusculum* and *B. divaricatum*; with hundreds of small impressions, resembling *Saltator* or *Sphærapus*.

5. Slab, 2° 5' X 1° 2', showing four single impressions of *Brontozoum validum*, and one of *Grallator formosus*.

6. Slab, 3° 1' X 2° 5', with two impressions of *Brontozoum approximatum*, two of *B. Sillimanium*, and two of *Grallator cursorius*.

7. Slab, 2° 3' X 2°, with one impression of *Brontozoum validum*, and one of *B. minusculum*. The former has what looks like a fourth toe, and the two are associated together in a manner suggestive of the hind and fore feet of a gigantic quadruped.

Total number of tracks on this Wall, 40.

WALL NO. 44.

1. Slab; 1° 10' X 1° 6', with single impression of *Brontozoum giganteum*. Turner's Falls, north bank below the dam.

2. Slab of sandstone, 4° X 3°, with one impression of *B. giganteum*, one row of two tracks of *Gigantitherium minus* with tail trace, and impressions of *Anomæpus curvatus*; viz.: a row of five tracks, one of three, two of two, and a single one; also shrinkage cracks.

3. Slab, 1° 6' X 1° 3', with one impression of *Brontozoum giganteum*, with the claws of the inner and middle toes turned outward remarkably.

4. Single impression of *Brontozoum minusculum*.

5. Slab of red sandstone, 1° 7' X 1° 2', showing trails more or less fimbriated, of Annelidans or Crustaceans, from the Clinton Group of Upper Silurian rocks, Columbia, New York. Obtained by C. H. Hitchcock, in 1863. See Palæontology of New York, Vol. II.

7. Slab of dark sandstone, 3° 8' X 2° 2', with two rows of two and three tracks of *Brontozoum Sillimanium*; two rows of five and six, and four insulated tracks of *Plesiornis quadrupes*, and one row of four tracks and trails of *Hyphepus Fieldi*. Ferry above Turner's Falls.

8. Single impression of *Brontozoum approximatum*, with shrinkage cracks.
9. Slab, 4° X 2° 5', showing one impression of *Brontozoum approximatum*, three of *B. exsertum*, and three of *B. Sillimanium*.
10. Beautiful slab, 8° 6' X 3° 5', suspended before the window, showing upon the west side, casts of rain-marks, and the finest example in the Cabinet (type) of *Selenichnus breviusculus*; a row of twenty-three tracks, and a strong tail trace. Ichnology, Plate LX., fig. 7. Upon the opposite side are multitudinous impressions of *Ænigmichnus multiformis*, consisting of grooves and lines of punctures, more or less parallel to one another. In Ichnology referred to *Ptilichnus typographus*. Ferry at Turner's Falls.
At least 500 tracks on this Wall.

WALL NO. 45.

1. Slab, 9° 2' X 2° 6', with two rows of three impressions each, of *Brontozoum giganteum*, so nearly coincident in direction, and the tracks so near together, that they might easily be supposed to be the hind and fore feet of one animal, like the *Plesiornis*. But the two rows obviously cross each other. Shows also six impressions of *B. validum*, five of *B. Sillimanium*, one of *B. approximatum*, and one of *B. exsertum*, trod upon deeply by *B. giganteum*, but not obliterated.
2. Shale, 8° X 1° 3', with fine row of *Brontozoum minusculum*, showing the phalangeal impressions well, of the inner toes; three impressions of *B. validum*, two of *B. Sillimanium* and a few ripple-marks.
3. Similar slab, 5° 8' X 2°, with two impressions of *B. giganteum*, three of *B. validum*, and one of *Grallator cuneatus*.
4. Shale, 2° 6' X 2°, with two impressions of *B. giganteum*.
5. Fine shale, 1° 6' X 5', with one row of twelve and another of nine tracks of *Anisopus gracilior*.
6. Same rock, 1° 7' X 9', showing one row of fourteen tracks of *Anisopus gracilior*, and supposed flipper trails.
7. Red sandstone, 2° 2' X 1° 6', with numerous crustacean trails, from the Clinton Group of the Upper Silurian system. From Columbia, New York. Obtained by C. H. Hitchcock, in 1863.
8. Heavy slab in a case, 1° 7' X 1° 7', on small table, showing single impression of *Brontozoum giganteum*, the type specimen of the species as amended in the Supplement.
9. Similar slab, 1° 4' X 1° 7', with single impression of *B. giganteum*. Below dam at Turner's Falls.
10. Slab of dark sandstone, 3° 4' X 1° 9', showing very fine impressions of raindrops. Ferry above Turner's Falls.
At least 150 tracks on this Wall.

WALL NO. 46.

1. Reddish shale, 2° 8' X 12', with several rows of about thirty tracks of *Anisopus gracilior*, but obscure.
2. The same, 2° 3' X 9', with about twenty tracks.
3. The same, 4° 7' X 1° 3', with seventy-four tracks of *Anisopus gracilior*. Two rows start near the bottom and come into one line part way up. "Flipper trails" and shrinkage cracks common.
4. Shale, 1° 11' X 1° 3', with a row of six tracks of *Shepardia palmipes* and shrinkage cracks.
5. Slab of shale, 2° 7' X 12', with fine row of ten tracks of *Anisopus gracilis*, and three other tracks of same, alternating.

6. Slab, sixteen inches square, with one row of six fine large tracks of *Anisopus gracilis*; another of four tracks, and two single ones.
 7. Shale, 2° X 13', with one row of ten and another of four tracks of *Anisopus gracilis*.
 8. Shale, 15, X 9t, with a row of seven tracks of *Arachnichnus dehiscens* and shrinkage cracks.
 9. Slab, 1° 7' X 9', with eleven tracks of *Arachnichnus* (?).
 10. Slab of shale, 1° 10' X 8', with row of six tracks of *Anisopus gracilis*. Remarkable for length of step eleven inches — double that given in the Ichnology.
 11. Shale, 2° X 9', with row of ten rather indistinct tracks of *Anisopus gracilis*, and one of *Grallator cursorius* (?).
 12. Shale, 3° 7' X 1° 6', with two rows of rather indistinct tracks of *Anisopus gracilis*, twenty-one in number.
 13. Slab, 2° X 10', with seven hind and seven front feet of *Arachnichnus* (?), and shrinkage cracks.
 14. Sandstone, 3° 3' X 10', with row of sixteen tracks of some unknown animal.
- Total number of tracks on this Wall, 247.

TABLE NO. 47.

- 1, 2. Single impression of *Brontozoum Sillimanium*.
3. Single impression of *Anomæpus minor*.
- 4, 5. Single tracks of *Ornithopus gracilior*, from the north bank of Connecticut River, below Turner's Falls
6. Gray shale, with one track of *Ornithopus gracilior*, and one probably of *Plectropterna minitans*. North bank, below Turner's Falls.
7. Seven tracks of *Macropterna* (?) *vulgaris*, with fine tail trace, sweeping to the right and left.
8. Single track of *Apatichnus circumagens*.
9. Single track of *Tridentipes uncus*.
10. Two tracks of *Anisopus gracilis*.
11. Remains of *Palæphemera mediæva*, *Dana*, an insect. Horse Race.
12. Two rows of *Grammepus erismatus*.
13. Trackway of *Grammichnus Alpha*.
14. Tracks of *Grammepus erismatus*.
- 15, 16. Marks of raindrops.
17. Three impressions of *Brontozoum Sillimanium*.
18. Tracks of *Grammepus erismatus*.
19. Numerous specimens of *Palæphemera mediæva*. Horse Race.
- 20, 21, 22. Typical specimens of tracks of articulate animals named *Climacodichnus corrugatus* in Supplement. Ferry above Turner's Falls.
- 23, 24, 25. Single tracks of *Brontozoum Sillimanium*.
26. Twelve tracks of *Anisopus gracilis*.
27. Single toe of *Argozoum Redfieldianum* (?).
28. One track of *Plesiornis pilulatus*, and half a dozen of *Exocampe arcta*.
29. *Palæphemera mediæva*, *Dana*. Horse Race.
30. Two tracks in succession of *Trihamus elegans*. Type of the species. Figured in Supplement, Plate II., fig. 3.
31. One track of *Plesiornis pilulatus*, and ten of *Antipus flexiloquus*, two of them hind feet.
- 32 to 35. Seven tracks of *Anisopus gracilis*.

36. *Palæphemera mediæva*, *Dana*. Horse Race.
37. Five tracks (two fore feet,) referred to *Arachnichnus dehiscens*.
- 38, 39. Probably the same as No. 37.
40. Single track of *Leptonyx lateralis*. Typical specimen. Supplement, Plate V., fig. 3.
- 41, 42, 49, 60, 66, 69, 71. Probably *Plectropterna*, though the hind toe is wanting.
43. Echinoderm (?)
44. Single track, also a row of them, of *Plesiornis pilulatus*; an *Exocampe*, and an aroid plant.
45. Two tracks of *Arachnichnus* (?)
46. Four tracks of *Anisopus gracilis*, and seven trails of *Unisulcus intermedius*. Horse Race, Gill.
47. Two fine trails of *Unisulcus minutus*.
48. Track of *Triænopus* (?)
49. See No. 41.
50. Probably referable to *Arachnichnus*.
51. Track of *Leptonyx lateralis*.
52. Track of *Harpedactylus gracilior*. North bank, below Turner's Falls.
53. A smoothed specimen of gray shale, showing two tracks of *Macropterna vulgaris*, one of *Plectropterna minitans*, and the hind and front feet of *Harpedactylus crassus*. Typical specimen of latter species. Supplement, Plate III., fig. 1.
54. Unknown tracks.
55. Track of *Tridentipes uncus*.
56. Track of *Brontozoum Sillimanium*.
57. Trail of *Cochlichnus anguineus*.
- 58, 59. Two tracks on each, of *Plesiornis pilulatus* — counterparts.
60. See No. 41.
61. Track of *Plectropterna angusta*.
62. Hind and front feet of *Anisopus Deweyanus* (?)
63. Two tracks of *Brontozoum validum*.
64. Three trackways of *Acanthichnus cursorius*.
65. One trackway of *Acanthichnus cursorius*.
66. See No. 41. North bank, below Turner's Falls.
67. Six impressions of *Grammepus uniordinatus*, and a probable hind impression of *Selenichnus falcatus*, figured in the Supplement, Plate II., fig. 7.
68. Four tracks of *Anisopus gracilis*.
69. See No. 41.
70. One row of two tracks of *Macropterna divaricans*; one of two slender toes and not very divaricate; and one of three tracks with four toes and heel. Also, *Xiphopeza triplex*.
71. See No. 41.
72. Three tracks, probably of *Arachnichnus dehiscens*.
73. Row of six tracks of *Exocampe ornata*, and one unknown tridactyle impression.
74. Row of six tracks of *Exocampe ornata* (?)
75. Row of five tracks of an *Exocampe* (?)
76. Three double rows of *Acanthichnus cursorius*. Also numerous marks of a coniferous plant and seeds.
77. Obscure trackway of *Acanthichnus cursorius*.
78. Four tracks — one front foot — of *Xiphopeza triplex*. North bank, below Turner's Falls.
79. Row of six tracks of *Arachnichnus* (?)

80. Two trackways of *Acanthichnus cursorius*. Supplement, p. 14, Plate VI., fig. 1.
 81. One track of *Apatichnus circumagens*, and one of *Brontozoum Sillimanium*.
 82. One track of *Brontozoum Sillimanium*.
 83. Six tracks of *Arachnichnus dehiscens* (?), and shrinkage cracks.
- Number of tracks on this Table, 853.

TABLE NO. 48.

1. Very nice slab of reddish sandstone, $10^{\circ} 9' \times 2^{\circ} 4'$, showing four rows (forty-six tracks,) of *Anomæpus intermedius*, and four of *A. gracillimus*, probably the typical specimen of *A. intermedius*, showing impressions of all four feet and the tail. Figured in Supplement, Plate XV., fig. 1., and Plate I., fig. 1. See also page 3. Shows also numerous trails of *Unisulcus minutus*. From the Ferry at Turner's Falls. 46 impressions in all.

WALL NO. 49, (*in Appleton Lecture Room.*)

1. Micaceous sandstone, $10^{\circ} 8' \times 5^{\circ} 9'$, with eleven tracks of *Brontozoum validum*, *B. exsertum*, *B. Sillimanium*, and numerous trails of *Unisulcus intermedius* or *U. minutus*. 1862. Turner's Falls, south side.

2. Micaceous sandstone, $5^{\circ} 9' \times 3^{\circ} 9'$, with twenty-seven impressions of the same species of *Brontozoum* as No. 1; *Grallator parallelus*, with at least one hundred trails of *Unisulcus intermedius*, and *U. minutus*, with one of *U. Marshi*. 1862. Horse Race, Gill.

Total number of tracks on this Wall, 150.

WALL NO. 50.

On the north wall of the Ichnological Cabinet, at the east end, near the stairs.

1. Red sandstone, $10^{\circ} 7' \times 4^{\circ} 10'$, showing no less than 207 different impressions of feet, and eighteen caudal trails. They are chiefly of *Anomæpus minor*; a few of *A. intermedius* probably; some of *A. minimus*, *A. gracillimus*, *Brontozoum Sillimanium*, *B. validum*, *Grallator cuneatus*, and *Chimæra Barratti*. Both feet appear of the quadrupeds. Perhaps a few impressions of rain-drops and *Anisopus*. A remarkable slab, and one requiring careful study. From Howland's farm at Turner's Falls. 1862.

2. Red sandstone, $7^{\circ} \times 2^{\circ} 5'$, counterpart to No. 1, and showing seventy-two tracks of feet in relief, and nine tail traces. They are of *Anomæpus minor*, *A. intermedius*, *A. gracillimus*, *Brontozoum Sillimanium*, and *Chimæra Barratti*.

3. Same stone, $4^{\circ} 4' \times 3^{\circ}$, counterpart to No. 1, and showing twenty-five tracks and ten tail traces. Tracks of *Anomæpus minor*, *A. gracillimus*, *B. Sillimanium*, and others probably.

Total number of tracks and trails on this Wall, 341.

The remainder of the slabs are in the first side-room, and were obtained in 1863, mostly from Roswell Field.

WALL NO. 51.

1. Slab of tough sandstone, $3^{\circ} 2' \times 2^{\circ} 6'$, with thirty-four impressions of *Anomæpus intermedius*, *Brontozoum Sillimanium*, *Grallator cuneatus*, and *Plesiornis quadrupes*, besides numerous trails of *Unisulcus intermedius*. Ferry, above Turner's Falls.

2. Slab of sandstone, same as No. 1, with eighty-four impressions of *Anomæpus minor*, *A. intermedius*, *Brontozoum Sillimanium*, *Grallator cursorius*, *G. cuneatus*, and *Plesiornis quadrupes*, besides trails of *Unisulcus intermedius*.

3. Reddish sandstone, 2° 6' X 2° 1', with tracks of *Anomæpus minor*, *A. intermedius*, *A. curvatus*, *Plesiornis quadrupes*, and a row of five tracks of *A. gracillimus*. Ferry at Turner's Falls.
 4. Red shale, 1° 8' X 1° 7', with two impressions of *Brontozoum exsertum*, one of *B. validum*, a row of two tracks of *B. Sillimanium*, and trails of *Unisulcus minutus*. Field's Orchard, Gill.
 5. Sandstone, 2° X 1° 3', with eight impressions of *Anomæpus intermedius*, etc., and trails of *Unisulcus intermedius*. Ferry, above Turner's Falls.
 6. Red shale, 1° 5' X 1° 6', with impressions of *Brontozoum validum*, *B. exsertum*, *Grallator parallelus*, and numerous fine rain-marks. Field's Orchard, Gill.
 7. Red shale, 2° 3' X 1° 9', with impressions of *Brontozoum validum*, *B. exsertum*, *B. Sillimanium*, three of *Grallator cursorius* and numerous fine rain-marks. Field's Orchard, Gill.
 8. Red shale, 2° 7' X 2° 6', with thirteen impressions of *Brontozoum Sillimanium*, *Grallator cuneatus*, and *Tridentipes elegans*, and perhaps others. Lily Pond, Turner's Falls.
 9. Slab of tough sandstone, in three pieces, 9° 9' X 4° 5', counterparts of Nos. 1 and 2, with tracks in relief of *Anomæpus minor*, *A. intermedius*; also tail and claw marks; *Brontozoum Sillimanium*, *Grallator cuneatus*, *G. cursorius*, and trails of *Unisulcus intermedius*. Ferry, above Turner's Falls.
 10. Red sandstone, 2° 9' X 1° 9', with row of eleven impressions of the feet, and a caudal trail of *Selenichnus breviusculus*, and rain-marks. Some of the latter interesting, as they show lines where the drops run together and trickled down a slope. Ferry.
 11. Single track in relief, of *Brontozoum giganteum*. Turner's Falls.
 12. Red sandstone, 2° X 10', with fine impressions of rain-drops. Ferry, above Turner's Falls.
 13. Red sandstone, 2° 8' X 2° 2', with six tracks in relief of *Anomæpus minor*. Ferry.
 14. Red sandstone in two pieces, 3° 6' X 3°, with tracks in relief of *Anomæpus intermedius*, *Plesiornis quadrupes*, *Platypterna* (?), *Brontozoum exsertum*, and *Grallator cursorius*; thirty-five in all. Ferry, above Turner's Falls.
 15. Red sandstone, 3° 3' X 3°, covered with relief markings of *Ænigmichnus multiformis*. Ferry.
 16. Shale, 4° X 3°, with impressions of *Plesiornis mirabilis*, the type of the species. Three rows of *Anisopus gracilis*, and tracks of *Brontozoum Sillimanium*. Supplement, p. 35, Plate XX. Lily Pond, Turner's Falls.
 17. Red shale, 5° X 3° 4', with impressions of *Anticheiropus hamatus*, the type of the species; *Brontozoum Sillimanium*, *Tarsodactylus caudatus*, *Tridentipes elegantior*. Supplement, p. 10, Plate IX., figs. 1, 2. Lily Pond, Turner's Falls.
 18. Shale, 2° 9' X 10°, with a beautiful row of twenty tracks in relief, of both feet of *Arachnichnus dehiscens*. Supplement, Plate XVII., fig. 2. Lily Pond, Turner's Falls.
 19. Red sandstone, 1° 6' X 7', with a row of eight tracks in relief, and tail trace of *Plectropterna gracilis*. Supplement, Plate XVII., fig. 1.
- Total number of tracks on this Wall, 2,508.

WALL NO. 52.

1. Large slab of shale, 5° X 2°, with thirty-three impressions of *Tridentipes uncus*, *Brontozoum divaricatum*, *Anisopus Deweyanus*, *Platypterna varica* (?), *Gigantitherium minus*, and beautiful marks of rain. Turner's Falls. 1854.
2. Red shale, 1° 7' X 1° 2', with one impression of *Brontozoum tuberculatum*, two rows of *Saltator bipedatus*. Lily Pond.
3. Indurated shale, 1° 6' X 1° 5', with shrinkage cracks, and a row of six impressions of *Anisopus Deweyanus*. Turner's Falls.

4. Red sandstone, $4^{\circ} \times 2^{\circ} 6'$, with rows of impressions of *Anomæpus intermedius*, *A. minimus*, *Brontozoum Sillimanium*, *Grallator parallelus*, and *Plesiornis quadrupes*. Ferry.
 5. Same as 4, $5^{\circ} 3' \times 1^{\circ} 11'$, with rows of impressions of *Anomæpus curvatus*, *A. minimus*, and *Apatichnus circumagens* (?).
 6. Red shale, with a row of ten impressions of *Xiphopeza triplex*, and others, obscure. Lily Pond.
 7. Four impressions of the same, $11' \times 10'$.
 8. The same in relief, partly counterpart of Nos. 6, and 7. Shows also *Brontozoum divaricatum*, $2^{\circ} 3' \times 1^{\circ} 11'$.
 9. Thin sandstone, $2^{\circ} 3' \times 1^{\circ} 11'$, showing impressions of rain-drops, and of a quadruped, perhaps a *Tarsodactylus*. Ferry.
 10. Beautiful slab, $4^{\circ} 3' \times 1^{\circ} 9'$, showing a row of five impressions of hind feet of *Anomæpus curvatus*, and trails of *Unisulcus intermedius*. Type of species of the first. Supplement, Plate XV., fig. 2. Lily Pond, Turner's Falls.
 11. Red shale, $2^{\circ} 6' \times 8'$, with trails of *Bisulcus undulatus*, and *Halysichnus laqueatus*. Turner's Falls.
 12. Same, $1^{\circ} 8' \times 12'$, with trails of *Trisulcus laqueatus* (type of species,) and *Lunula obscura* (type of species.) Supplement, Plate III., fig. 4.
 13. Micaceous sandstone, $2^{\circ} 10' \times 12'$, with five impressions of hind feet of *Anomæpus curvatus*, and several of *Anisopus gracilis*. Lily Pond.
 14. Same, $2^{\circ} 6' \times 1^{\circ} 3'$, with typical impressions of *Acanthichnus trilinearis*, trails of *Trisulcus laqueatus*, *Lunula obscura*, and four impressions of hind feet of *Anomæpus curvatus*.
 15. Red sandstone, $3^{\circ} \times 1^{\circ} 6'$, with the impressions of *Brontozoum minusculum*. Ferry.
 16. Sandstone, $14' \times 11'$, with two impressions of hind feet of *Anomæpus curvatus*. Ferry.
 17. Shale, $18' \times 12'$, with one impression of *Brontozoum minusculum*, and one of *B. approximatum*. Horse Race.
 18. Red sandstone, $15' \times 12'$, with single impression of *B. minusculum*. Ferry. Nos. 15, 18, and $\frac{56}{2}$, from the same row.
 19. Shale, $13' \times 11'$, with impressions of *B. divaricatum*. Turner's Falls.
 20. Red shale, $3^{\circ} 3' \times 1^{\circ} 4'$, with impressions of *B. Sillimanium*, *Grallator cuneatus*, and others. Lily Pond.
- Total number of tracks on this Wall, 200.

WALL NO. 53, (*north side.*)

1. Red shale, $3^{\circ} \times 2^{\circ} 8'$, with rows of impressions of *Brontozoum Sillimanium*, *Apatichnus circumagens*, *Hyphepus Fieldi*, and *Anisopus gracilis*. Field's Orchard, Gill.
2. Red shale, $3^{\circ} 6' \times 2^{\circ} 6'$, with numerous impressions of *B. validum*, a few of *B. Sillimanium*, and many trails of *Unisulcus minutus*. Field's Orchard, Gill.
3. Gray shale, $19' \times 16'$, with impression of *B. giganteum*. Turner's Falls.
4. Shale, $18' \times 14'$, with impression of *B. approximatum*. Turner's Falls.
5. Slab of sandstone, $2^{\circ} 10' \times 2^{\circ} 8'$, with impressions above, of *Anomæpus intermedius* and *A. curvatus*. In relief of *Argozoum pari-digitatum*. Field's Orchard, Gill.
6. Sandstone, $19' \times 18'$, with single impression of *B. giganteum*. Turner's Falls.
7. Slab of shale, $4^{\circ} \times 3^{\circ} 5'$, with three rows of impressions of hind feet of *Anomæpus curvatus*. Counterpart of No. $\frac{3}{8}$. Lily Pond.
8. Gray shale, $24' \times 18'$, with single impression of *B. giganteum*. Turner's Falls.
9. Red sandstone, $18' \times 15'$, with one impression of *B. approximatum*. Ferry, above Turner's Falls.

10. Red sandstone, 4° 6' X 3° 6', with rows of impressions of *Anomæpus intermedius*, and *Apatichnus circumagens* (?), and single track of *B. Sillimanium*. Ferry.
 11. Gray shale, 20' X 19', with single impression of *Brontozoum giganteum*. Turner's Falls.
 12. Shale, 3° 4' X 2° 3', with single impression of *B. giganteum*, double row of *Tarsodactylus caudatus*, and others, chiefly of *Tridentipes elegans*. Lily Pond.
- Total number of tracks on this Wall, 149.

WALL NO. 54, (*east side.*)

1. Red shale, 5° X 4° 3', with numerous impressions of *B. validum*, and trails of *Unisulcus minutus*, with one of *Grallator parallelus*. Field's Orchard, Gill.
 2. Red sandstone, 3° 4' X 1° 6', with numerous impressions of *Argozoum pari-digitatum*, and a few of *Sphærapus larvalis*. Field's Orchard, Gill.
 3. Same rock, in two pieces, 4° 6' X 1° 7', with numerous tracks in relief, of *A. pari-digitatum*.
 4. Same as No. 3, 3° X 2°.
 5. Red shale, 2° 6' X 1° 6', with three impressions of *Brontozoum exsortum*, and one of *Grallator parallelus*. Turner's Falls.
 6. Cast of tracks of *Cheirotherium Barthii*. Hildberghausen, Saxony.
 7. Same, with shrinkage cracks.
 8. Red sandstone, 2° 9' X 1° 3', with fine impressions of *Brontozoum validum*, *B. Sillimanium*, *Grallator parallelus*, *G. cursorius*, and rain-drops. Field's Orchard, Gill.
 9. Shale, 16' X 15', with scattered impressions of *Anisopus gracilis*. Turner's Falls.
 10. Gray shale, 2° X 14', with impression of *Brontozoum approximatum*, type of species. Turner's Falls.
 11. Shale, 1° 9' X 12', with impressions of *Gigantitherium minus*, *Hyphepus Fieldi*, and *Grallator cursorius*. Lily Pond.
 12. Sandstone, 2° 4' X 1° 5', with scattered, deeply impressed print of feet of *Anomæpus minor*, and *Plesiornis quadrupes*. Howland's Farm, Gill.
 13. Sandstone, 2° 6' X 1° 6', with two rows of *Anomæpus curvatus*, and one of *A. intermedius*. Ferry.
- Total number of tracks on this Wall, 184.

CASE NO. 55.

The slabs in this Case are too small to require measurements.

1. Two impressions of *Harpedactylus gracilior*, typical specimen. Supplement, Plate III., fig. 2. North bank, below Turner's Falls.
2. Track of *Platypterna*, with caudal trail. Supplement, p. 31, Plate XVI., fig. 2. Turner's Falls.
3. *Toxichnus inæqualis*, typical specimen. North bank, below Turner's Falls. Supplement, Plate V., fig. 5.
4. *Exocampe minima*, typical specimen. Supplement, Plate XVIII., fig. 3. Field's Orchard, Gill.
5. *Comptichnus obesus*, row of six impressions, typical specimen. Supplement, Plate XVIII., fig. 6. Lily Pond.
6. Single impression of *Brontozoum minusculum*. Lily Pond.
7. *Climacodichnus corrugatus*, several trails, type of species. Ferry.
8. Six impressions of *Xiphopeza triplex*, and *Arachnichnus dehiscens*. Field's Orchard, Gill.
9. *Brontozoum validum*. Lily Pond.

10. *Macropterna* (?). Lily Pond.
11. *Anomœpus*. Field's Orchard, Gill.
12. Four impressions of both feet of *Anisopus gracilis*. Lily Pond.
13. *Xiphopeza triplex*. North bank, below the dam.
14. *Argozoum dispari-digitatum*. Turner's Falls.
15. Five trails of *Acanthichnus*. Lily Pond.
16. *Brontozoum Sillimanium* (?). Turner's Falls.
17. Trails of *Cochlichnus anguineus*. Lily Pond.
18. *Grallator cursorius*. Lily Pond.
19. Row of impressions of *Anisopus gracilis*, and numerous trails of *Unisulcus intermedius*. Lily Pond.
20. Trail of *Halysichnus laqueatus*. Lily Pond.
21. Three tracks in relief, of *Anomœpus minimus* — both feet — and one of *Plectropterna minitans*. Field's Orchard, Gill.
22. Twelve impressions of both feet of *Exocampe ornata*. Turner's Falls, north bank, below the dam;
23. Two tracks in relief, of *Plectropterna lineans*. Lily Pond.
24. Five tracks in relief, in a row, of *Shepardia palmipes*. Lily Pond.
25. Row of impressions of *Orthodactylus intro-vergens*, and another of *Anisopus gracilis*. Lily Pond.
26. Tracks in relief, of *Exocampe ornata*. North bank, below the dam.
27. Impressions of *Plectropterna lineans*. Lily Pond.
28. Impressions of *Plectropterna angusta*. Lily Pond.
29. Impressions of *Brontozoum exsertum*. Lily Pond.
30. Row of twelve tracks in relief of *Arachnichnus dehiscens*. Lily Pond.
31. Three tracks in relief of *Orthodactylus intro-vergens*. Lily Pond.
32. Seven impressions in a row, of *Arachnichnus dehiscens*. Lily Pond.
33. Ten impressions in a row of *Toxichnus inæqualis*. Typical specimen. Howland's Farm, Turner's Falls. Supplement, Plate V., fig. 6.
34. Impressions of rain-drops. Turner's Falls.
35. Two impressions of *Anomœpus curvatus*. Turner's Falls.
36. *Grammepus erismatus*. Lily Pond.
37. Part of impression of *Grallator cursorius*. Turner's Falls.
38. Row of eight tracks in relief, of *Macropterna gracilipes*. Lily Pond.
39. Counterparts, showing single impression of *Brontozoum validum*. Field's Orchard, Gill.
40. Single track in relief, of *Orthodactylus intro-vergens*. Turner's Falls.
41. Single impression of *Comptichnus obesus*. Lily Pond.
42. Two trackways of *Acanthichnus cursorius*, one of *Copeza propinquata*, and one uncertain. Lily Pond.
43. *Copeza propinquata*. Lily Pond.
44. *Bifurculipes laqueatus*, and *Conopsoides curtus*. Lily Pond.
45. *Hexapodichnus magnus*. Lily Pond.
46. Impressions of feet of *Apatichnus circumagens*. Lily Pond.
47. Impressions of both feet of *Tarsodactylus caudatus*. Lily Pond.
48. *Acanthichnus saltatorius*. Lily Pond.
49. *Harpepus capillaris*. Lily Pond.
50. *Acanthichnus anguineus*, type of species. Lily Pond. Supplement, Plate VII., fig. 4.
51. *Acanthichnus cursorius*. Lily Pond.
52. *Bifurculipes laqueatus*. Lily Pond.

53. *Conopsoides curtus*, typical specimen. Supplement, Plate XVIII., fig. 4.
54. *Copeza propinquata*, and a plant. Supplement, Plate XVIII., fig. 9. Lily Pond.
55. Two trackways of *Bifurculipes laqueatus*. Lily Pond.
- 56, 82, 97. *Bifurculipes elachistotatus*. Lily Pond.
- 57, 67, 80. *Conopsoides larvalis*. Lily Pond.
- 58, 74, 88, 96, 102. *Bifurculipes laqueatus*. Lily Pond.
59. *Acanthichnus alternans*, typical specimen. Lily Pond. Supplement, Plate VI., fig. 5.
- 60, 81, 89, 104. *Acanthichnus cursorius*. Lily Pond.
- 61, 77, 79, 93, 95. *Bifurculipes*. Lily Pond.
- 62, 65, 66, 90, 91. *Bifurculipes curvatus*. Lily Pond.
62. *Cochlea Archimedeae*. Lily Pond.
63. *Copeza propinquata*. Lily Pond.
- 68, 75. *Acanthichnus saltatorius*. Lily Pond.
69. *Acanthichnus*, *Copeza cruscularis*, and *Conopsoides curtus*. Lily Pond.
70. *Bifurculipes elachistotatus*, and *Conopsoides curtus*. Lily Pond.
- 71, 85. *Copeza*. Lily Pond.
72. *Sagittarius alternans*. Lily Pond.
- 73, 78. *Copeza cruscularis*. Lily Pond.
76. *Bisulcus undulatus*. Lily Pond.
83. *Acanthichnus*. Lily Pond.
84. *Acanthichnus* and *Copeza*. Lily Pond.
86. *Acanthichnus cursorius*, and *Bifurculipes laqueatus*. Lily Pond.
87. *A. cursorius* and unknown quadrupeds. Lily Pond.
92. Two trackways of *Conopsoides curtus*, and one of *Bifurculipes elachistotatus*. Lily Pond.
94. Two rows of *Sagittarius alternans*. Supplement, Plate XVIII., fig. 5. Lily Pond.
98. *Bifurculipes curvatus*, and *B. elachistotatus*. Lily Pond.
99. *Acanthichnus*, and two trackways of *Harpepus capillaris*. Lily Pond.
100. Perhaps the veins of a leaf. Lily Pond.
103. Unknown insect track. Lily Pond.
105. *Copeza propinquata*, and new species of *Cochlichnus*. Lily Pond.
106. *Brontozoum validum*. Lily Pond.
107. Row of four impressions of *Anisopus gracilis*. Lily Pond.
108. *Plectropterna*, both feet in relief. North bank, below Turner's Falls.
109. Two tracks in relief, of *Xiphopeza triplex*. Same as 108.
110. *Grallator parallelus*. Lily Pond.
111. Row of six tracks in relief, of *Arachnichnus dehiscens*. Lily Pond.
112. Five tracks in relief, of *Anomæpus minimus*, type of species, and two of *A. intermedius*.
Field's Orchard, Gill. Supplement, Plate II., figs. 1, 2.
113. Row of *Acanthichnus rectilinearis*. Typical specimen. Also *Bifurculipes elachistotatus*.
Total number of tracks in this Case, 3,700.

TABLE NO. 56.

1. Shale, 12' X 11', with two beautiful impressions of *Brontozoum minusculum*, and *B. Sillimanium*, showing the markings of the skin on the feet. Supplement, Plate XVI., fig. 1. Lily Pond.
 2. Red sandstone, 1° 5' X 12', with two fine impressions of *B. minusculum*, and *B. Sillimanium*. Ferry.
- Total number of tracks on this Table, 4.

TABLE NO. 57.

1. Shale, 1° 10' X 1° 4', in two pieces with hinges, showing foot of *Tridentipes ingens*. Horse Race, Gill.
2. Shale, from same locality, 2° X 1° 4', in two pieces with hinge, showing foot of *Brontozoum giganteum*.

TABLE NO. 58.

1. Hard shale, a little below the layer upon which the animals trod, 12° 6' X 3°, showing a row of four impressions, and one isolated track of *Brontozoum divaricatum*, five of *B. validum*, and six of *B. Sillimanium* — two in the same row — besides a few others indistinct, say 20 in all.

WALL NO. 59, (*large room, over Nos. 35 and 36.*)

- 1 to 6. Casts of *Protichnites* from Potsdam sandstone of Canada. Beauharnois.
 - 7, 8. Casts of *Climatichnites Wilsoni*, Logan. From Perth, C. W.
- Nos. 1 to 8, presented in 1864, by Sir W. E. Logan, to Dr. Hitchcock.

Total number of Tracks in the Hitchcock Ichnological Cabinet, 21,773

APPENDIX. [C.]

Exocampe minima. — On page 11 a notice of this beautiful species is given, without detailed description. I have recently obtained from Mr. Field a larger slab than those of this species in the Cabinet, containing two or three rows of the impressions made by this animal; and present the following description, based partly on this specimen and partly upon No. $\frac{55}{4}$.

Hind Foot. — Digitigrade; tetradactylous; toes curved outward gracefully; length, reckoning outward, 0.125, 0.25, 0.325, 0.175, so far as they impressed the mud in walking. Divarication of the outer toes from 100° to 130° ; the angle between the third and fourth being greater than that between any other two. Divergence of the axis of the foot from the median line outward, 16° to 50° . Distance of the heel from the median line, 0.2 to 0.45. Length of the step from track to track of the same foot, 1.1 to 2 inches. Width of the toes, less than the twentieth of an inch. Very delicate claws occasionally seen. Width of the trackway, 1.5 inches. Some of the impressions display a heel similar to that of *E. arcta*, in Plate XXV., fig. 6, of Ichnology.

Fore Foot. — Digitigrade, but less so than the hind foot; pentadactylous; one short hind toe, and the four front ones about equally distributed through an arc of 138° , and varying in length from 0.15 to 0.2 inch. Toes nearly straight, slightly curved outward. Axis of the foot but little turned outward from the median line. Fore foot generally situated a little outside of the hind one in walking, not more than a tenth of an inch apart.

This animal differs from *E. ornata* by its smaller stature, the greater width of its trackway, and the greater irregularity of the arrangement of its footsteps in walking. It must have been, though smaller, a more clumsy or unwieldy animal.

Locality. — It has been found as yet only at Field's Orchard, in Gill.

C. H. H.

DESCRIPTION OF THE PLATES.

PLATE I.

- Fig. 1. Outline of the tracks of *Anomæpus intermedius*, of the natural size. From slab No. $\frac{48}{1}$.
- Fig. 2. Outline track of the hind foot of *Anomæpus curvatus*, natural size.
- Fig. 3. Tracks of *Anisopus gracilior*, natural size. From slab No. $\frac{46}{3}$.
- Figs. 4 and 5. Impressions of the natural size, referred to *Ænigmichnus multiformis*.

PLATE II.

- Fig. 1. Fore foot of *Anomæpus minimus*, part of Fig. 2.
- Fig. 2. Outline of slab containing five tracks of *A. minimus*, natural size. From slab No. $\frac{55}{112}$.
- Fig. 3. Feet of *Trihamus elegans*, natural size.
- Fig. 4. Feet of *Arachnichnus dehiscens*, natural size.
- Fig. 5. Same as Fig. 4, with shrinkage cracks.
- Fig. 6. Outline of impressions of *Lunula obscura*, natural size.
- Fig. 7. Outline of hind foot of *Selenichnus falcatus* (?), natural size. No. $\frac{47}{67}$.

PLATE III.

- Fig. 1. Outline tracks of *Harpedactylus crassus*, natural size.
- Fig. 2. Outline tracks of *Harpedactylus gracilior*, natural size. From slab No. $\frac{55}{1}$.
- Fig. 3. Impressions of *Grammichnus alpha*, natural size.
- Fig. 4. Trail of *Trisulcus laqueatus*, natural size. From slab No. $\frac{52}{12}$.
- Fig. 5. Trail of *Bisulcus undulatus*, natural size. From slab No. $\frac{10}{6}$.

PLATE IV.

- Fig. 1. Outline of track of *Brontozoum divaricatum*, natural size.

PLATE V.

- Fig. 1. Outline of track of *Grallator parallelus*, showing all the phalanges and heel bones, natural size.
- Fig. 2. Outline of part of a track of *Brontozoum Sillimanium*, natural size.
- Fig. 3. Outline of track of *Leptonyx lateralis*, natural size. From slab No. $\frac{47}{40}$.
- Fig. 4. Row of tracks of *Comptichnus obesus*, natural size.
- Fig. 5. Outline of tracks of *Toxichnus inæqualis*, natural size. From slab No. $\frac{55}{3}$.
- Fig. 6. Outline of foot of *Toxichnus*, natural size. From slab No. $\frac{55}{33}$.

PLATE VI.

- Fig. 1. Tracks of *Acanthichnus cursorius*, natural size. From slab No. $\frac{47}{80}$.
 Fig. 2. Tracks of *Acanthichnus rectilinearis*, natural size.
 Fig. 3. Tracks of *Sagittarius alternans*, natural size.
 Fig. 4. Tracks of *Conopsoides curtus*, natural size.
 Fig. 5. Tracks of *Acanthichnus alternans*, natural size. From slab No. $\frac{55}{59}$.
 Fig. 6. Tracks of *Acanthichnus alatus*, natural size.
 Fig. 7. Tracks of *Acanthichnus cursorius*, natural size.
 Fig. 8. Tracks of *Acanthichnus cursorius*, natural size.
 Fig. 9. Tracks of *Acanthichnus saltatorius*, natural size.
 Fig. 10. Tracks of *Acanthichnus divaricatus*, natural size.
 Fig. 11. Tracks of *Acanthichnus trilinearis*, natural size. From slab No. $\frac{52}{14}$.
 Fig. 12. Tracks of *Acanthichnus saltatorius*, natural size.
 Fig. 13. Tracks of *Acanthichnus punctatus*, natural size.
 Fig. 14. Tracks of *Copeza punctata*, natural size.
 Fig. 15. Tracks of *Copeza punctata*, natural size.
 Fig. 16. Tracks of *Ampelichnus sulcatus*, natural size.
 Fig. 17. Tracks of *Copeza* (?), natural size.
 Fig. 18. Tracks of *Acanthichnus cursorius*, natural size.

PLATE VII.

- Fig. 1. Outline of slab of *Copeza propinquata*, natural size.
 Fig. 2. Outline of slab of *Bifurculipes curvatus*, natural size.
 Fig. 3. Outline of slab of *Pterichnus centipes*, natural size.
 Fig. 4. Outline of slab of *Acanthichnus anguineus*, natural size. From slab No. $\frac{55}{50}$.
 Fig. 5. Outline of slab of *Climacodichnus corrugatus*, natural size.
 Fig. 6. Outline of slab of *Harpepus capillaris*, natural size.
 Fig. 7. Outline of slab of *Bifurculipes*, natural size.
 Fig. 8. Outline of slab of *Bifurculipes*, natural size.
 Fig. 9. Outline of slab of *Bifurculipes curvatus*, natural size.
 Fig. 10. Outline of slab showing *Copeza propinquata*, *Acanthichnus cursorius*, and *Acanthichnus divaricatus*, natural size.
 Fig. 11. Not labelled by Dr. Hitchcock.

PLATE VIII.

- Figs. 1 to 7. Tracks of a living crab from Florida — the *Ocypode arenaria*.

PLATE IX.

- Fig. 1. Outline track of *Anticheiropus hamatus*, natural size. From slab No. $\frac{10}{5}$.
 Fig. 2. Outline track of *Anticheiropus hamatus*, natural size.
 Fig. 3. Outline track of *Anticheiropus pilulatus*, natural size.
 Figs. 4, 5. Supposed tracks of the *Iguanodon*, one-ninth of the natural size.
 Fig. 6. Sketch of bone, of the foot of *Megadactylus polyzelus*, natural size.
 Fig. 7. Outline track of *Grallator gracilis*, natural size.

PLATE X.

- Fig. 1. Outline track of *Brontozoum giganteum*, natural size. From slab No. $\frac{45}{8}$.
 Fig. 2. Outline track of *Brontozoum approximatum*, natural size. From slab No. $\frac{54}{10}$.

PLATE XI.

Figs. 1 to 6. Various forms of the tracks of *Ænigmichnus multiformis*, natural size.

PLATE XII.

Figs. 1 to 4. Various forms of the tracks of *Ænigmichnus multiformis*, natural size.

PLATE XIII.

Photograph of *Climacodichnus corrugatus*, one-third of the natural size.

PLATE XIV.

Photograph of *Ænigmichnus multiformis*, one-twentieth of the natural size. Copied from No. $\frac{27}{21}$.

PLATE XV.

Fig. 1. Photograph of a fine slab of *Anomœpus intermedius*, one sixty-fifth of the natural size. Copied from No. $\frac{48}{1}$.

Fig. 2. Photograph of a fine slab of *Anomœpus curvatus*, one-thirtieth of the natural size. Copied from No. $\frac{52}{10}$.

PLATE XVI.

Fig. 1. Photograph of *Brontozoum minusculum* and *B. Sillimanium*, the former showing papillary impressions; one-fourth of the natural size. Copied from No. $\frac{56}{1}$.

Fig. 2. Photograph of *Platypterna* (?), showing a supposed caudal trail of singular character; of the natural size. Copied from No. $\frac{55}{2}$.

PLATE XVII.

Fig. 1. Photograph of fine row of *Plectropterna gracilis* in relief, one-fourth of the natural size. Copied from No. $\frac{51}{19}$.

Fig. 2. Photograph of fine row of *Arachnichnus dehiscens*, one-ninth of the natural size. Copied from No. $\frac{51}{18}$.

PLATE XVIII.

Fig. 1. Photograph of *Copeza punctata*, of the natural size. Copied from No. $\frac{36}{45}$.

Fig. 2. Photograph of slab of *Copeza propinquata*, of the natural size. Copied from No. $\frac{55}{54}$.

Fig. 3. Photograph of slab of *Exocampe minima*, of the natural size. Copied from No. $\frac{55}{4}$.

Fig. 4. Photograph of slab of *Conopsoides curtus*, of the natural size. Copied from No. $\frac{55}{53}$.

Fig. 5. Photograph of slab of *Sagittarius alternans*, of the natural size. Copied from No. $\frac{55}{94}$.

Fig. 6. Photograph of slab of *Comptichnus obesus*, natural size. Copied from No. $\frac{55}{5}$.

PLATE XIX.

Photograph of slab of *Anomœpus major*, showing curious caudal impressions; one-tenth of the natural size. Copied from No. $\frac{1}{7}$.

PLATE XX.

Various impressions, pedal and caudal, of the *Plesiornis mirabilis*, natural size. From No. $\frac{51}{16}$.

INDEX.

	PAGE.		PAGE.
A.			
Acanthichnus, new species of,	14	Comprehensive types,	33
Ænigmichnus multiformis,	20	Comptichnus obesus,	9
Ampelichnus sulcatus,	19	Conopsoides curtus,	15
Andrew, John A., message of,	iii	Contents, table of,	v
Anisopus gracilior,	6	Copeza cruscularis,	15
Annelids, trails of,	18	propinquata,	15
Anomæpus curvatus,	5	punctata,	15
Anomæpus gracillimus,	6	Crustacean impressions,	17
Anomæpus intermedius,	2	D.	
Anomæpus minimus,	5	Dana, Professor, Views of,	33
Anomæpus, progression of,	4	Description of Plates,	91
footprints have avian characters,	26	Descriptive Catalogue,	ix, 41
compared with Archæopteryx,	28	E.	
Anticheiropus hamatus,	10	Exocampe minima,	11, 89
pilulatus,	10	F.	
Appendix [A.],	39	Footmarks, number of in Cabinet,	88
[B.],	41	number of species,	x
[C.],	89	G.	
Arachnichnus dehiscens	24	Grallator gracilis,	8
Archæopteryx,	28	parallelus,	7
Author, Letter of to Gov. Andrew,	vi	Grammichnus alpha,	19
B.		H.	
Bifurculipes curvatus,	15	Harpedactylus crassus,	12
Bisulcus undulatus,	18	gracilior,	12
Brontozoum approximatum,	24	Harpepus capillaris,	16
divaricatum,	7	Hitchcock Ichnological Cabinet,	x
giganteum,	23	description of,	44
gracillimum,	6	Hitchcock, C. H., Preface by,	ix
isodactylum,	2	Notes by,	6, 8, 23, 37
C.		Catalogue by,	41
Case No. 27,	59	on Exocampe minima,	89
31,	62	Hitchcock, Edward, M. D., describes fossil bones,	39
32,	64	I.	
33,	66	Ichnological Cabinet, additions to,	1
34,	68	re-arranged and labelled,	ix
35,	69	Insects, tracks of,	13
36,	70	list of,	16
37,	72	L.	
38,	73	Legislature, Resolve of concerning Supplement,	iv
39,	73	Leptonyx lateralis,	8
40,	74	Lunula obscura,	17
41,	76		
55,	85		
Caudal impressions,	31		
Climacodichnus corrugatus,	20		

	PAGE.		PAGE.
M.		Tables Nos. 7, 8, 9,	47
Megadactylus polyzelus,	39	10,	48
Moody, Pliny, first person that ever observed		11, 12, 13,	49
footmarks,	52	14,	50
Myriapods, tracks of,	17	15, 16,	51
		17, 18, 19,	53
O.		20,	54
Owen, Professor, on Archæopteryx,	28	21, 22, 23,	56
on fossil bones,	39	26,	58
		28,	60
P.		29,	61
Papillary impressions,	24	47,	80
Phalanges, number of in the ichnites,	25	48,	82
Plectropterna gracilis,	24	56,	87
Plesiornis mirabilis,	35	57, 58,	88
Postscript, First,	35	Toxichnus inæqualis,	12
Second,	37	Trihamus elegans,	9
Preface,	ix	Trisulcus laqueatus,	18
Protuberances on feet of animals,	27	Trustees of Amherst College, vote of,	x
Pterichnus centipes,	14		
		W.	
S.		Wall No. 1,	44
Sagittarius alternans,	16	30,	61
Species of Ichnology doubtful,	2, 19	42,	77
not reliable,	2	43, 44,	78
new,	2	45, 46,	79
Supplement, preparation of,	ix	49, 50, 51,	82
		52,	83
T.		53,	84
Table No. 2,	44	54,	85
3, 4,	45	59,	88
5, 6,	46		

Fig. 5.



Aenigmicknus multiformis.

Fig. 4.



Fig. 3.



Anisopus gracilior.

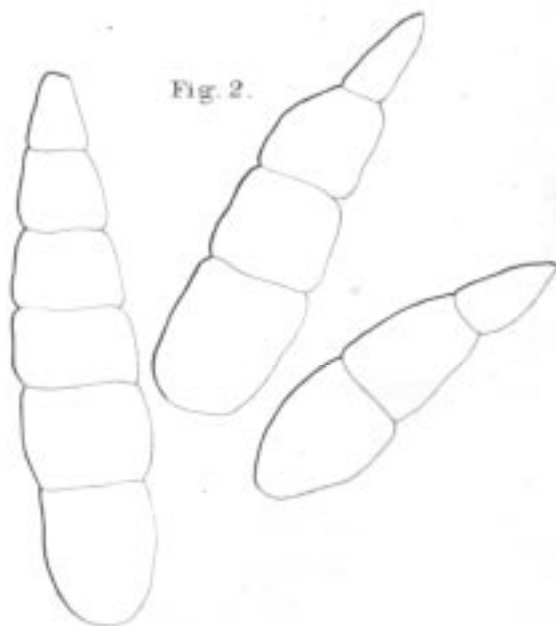


Fig. 1.



Anomoëpus intermedius.

Fig. 2.



Anomoëpus curvatus.

Fig. 7.

*Selenichnus falcatus.*

Fig. 3.

*Trihamus elegans.*

Fig. 2.

Slab containing five tracks of
Anomoepus minimus.

Fig. 4.

*Arachnichnus dehiscens.*

Fig. 5.

*Arachnichnus dehiscens.*

Fig. 6.

*Lunula obscura.*

Fig. 1.



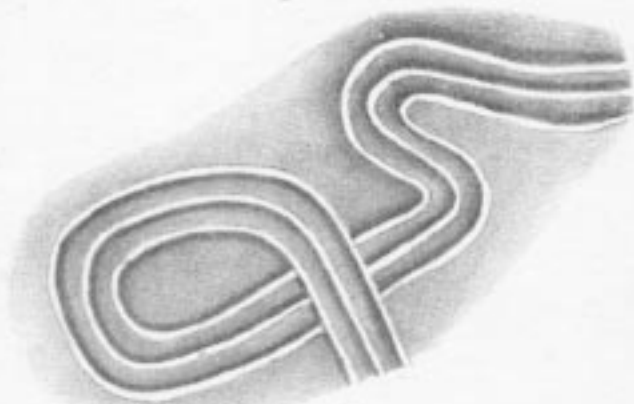
Harpedactylus crassus.

Fig. 2.



Harpedactylus gracilior.

Fig. 4.



Trisulcus laqueatus.

Fig. 5.



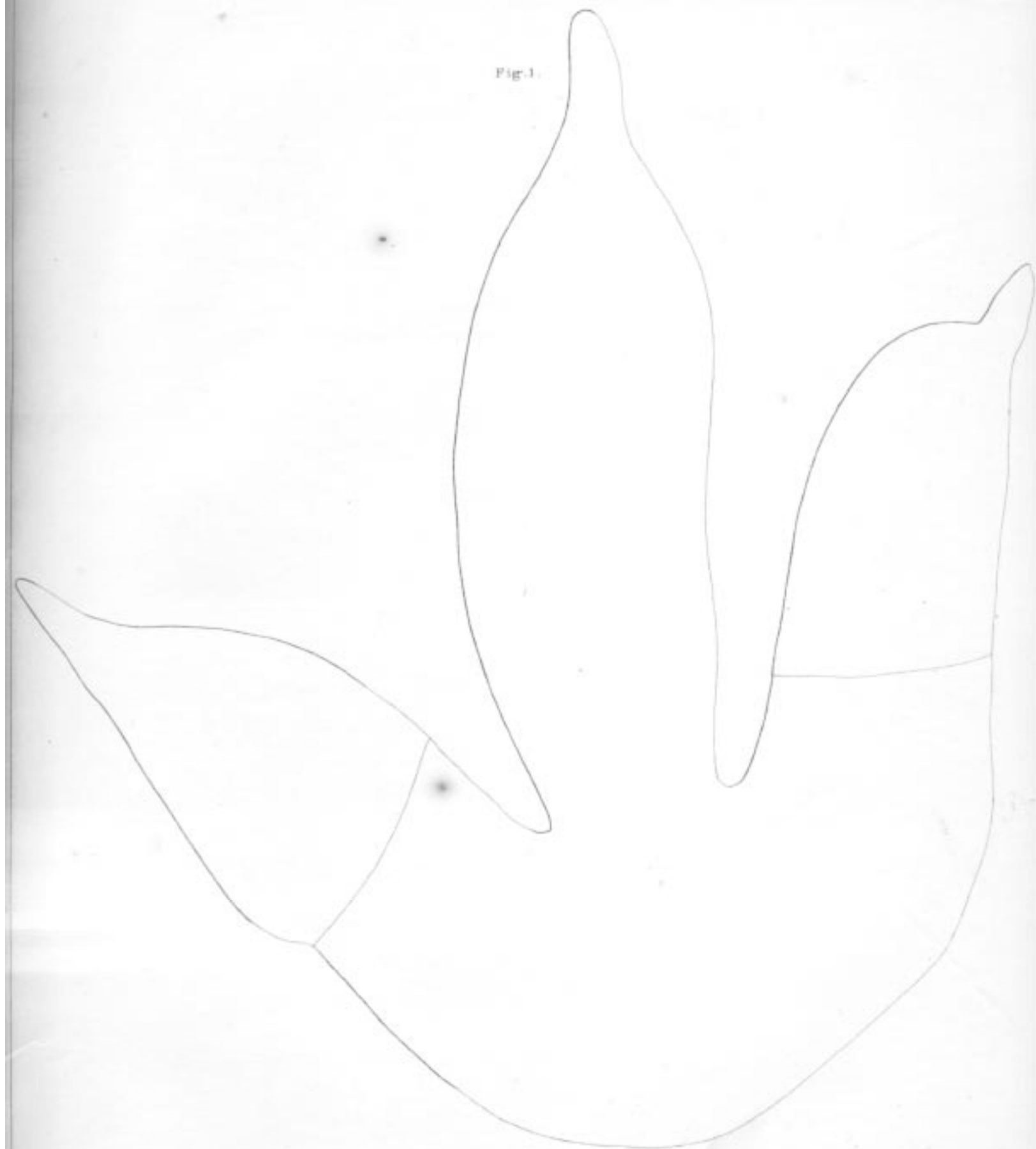
Bisulcus undulatus.

Fig. 3.



Grammichnus alpha.

Fig. 1.



Brontozoum divaricatum.

Fig. 6.



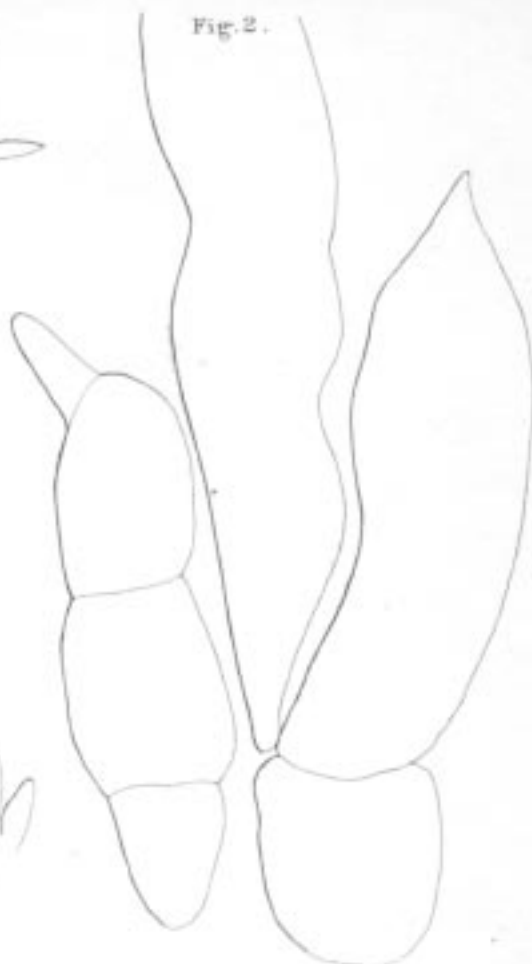
Toxichnus.

Fig. 5.



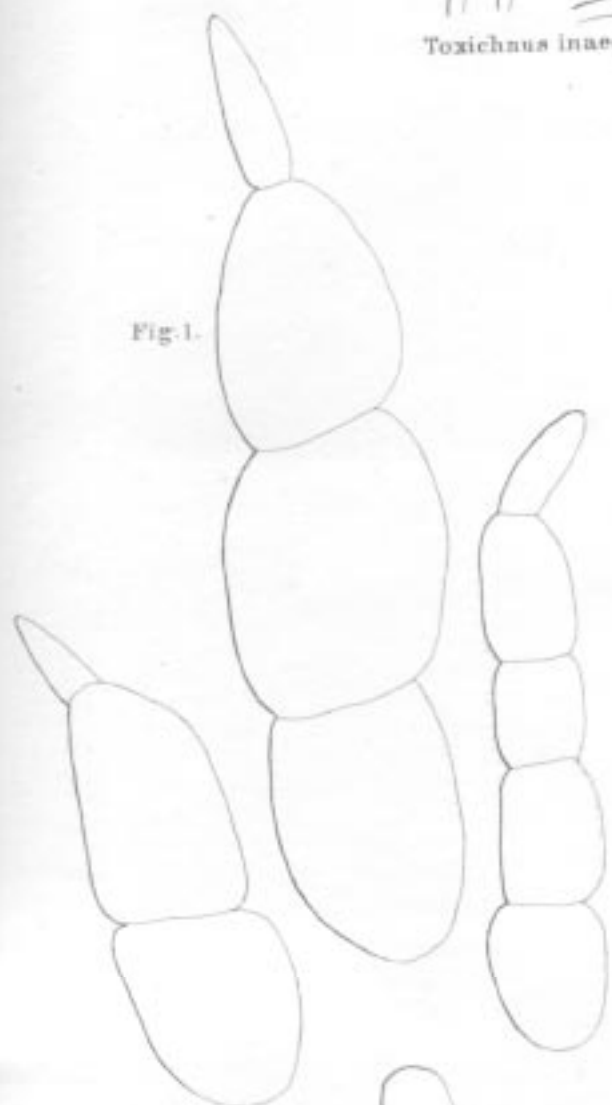
Toxichnus inaequalis.

Fig. 2.



Brontozoum Sillimanum.

Fig. 1.



Grallator parallelus.

Fig. 4.



Comptichnus obesus.

Fig. 3.



Leptangx lateralis.

Fig. 1.

*Acanthichnus cursorius.*

Fig. 2.

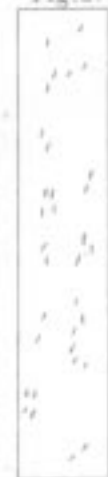
*Acanthichnus rectilineatus.*

Fig. 3.

*Sagittarius alternans.*

Fig. 4.

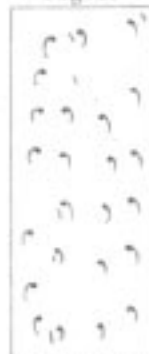
*Conopseoides curtus.*

Fig. 5.

*Acanthichnus alternans.*

Fig. 6.

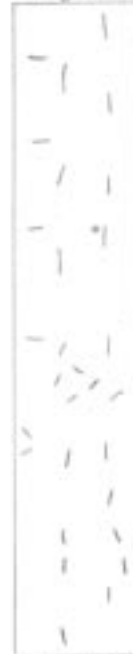
*Acanthichnus alatus.*

Fig. 7.

*Acanthichnus cursorius.*

Fig. 8.

*Acanthichnus cursorius.*

Fig. 9.

*Acanthichnus saltatorius.*

Fig. 10.

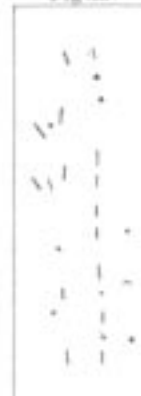
*Copeza punctata.*

Fig. 12.

*Acanthichnus saltatorius.*

Fig. 16.

*Ampelichnus sulcatus.*

Fig. 13.

*Acanthichnus punctatus.*

Fig. 17.

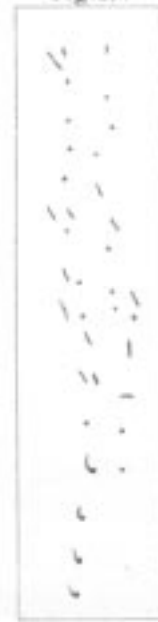


Fig. 18.

*Acanthichnus cursorius.*

Fig. 10.

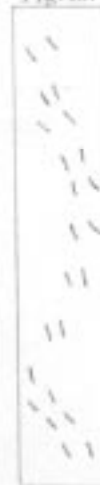
*Acanthichnus divaricatus.*

Fig. 14.

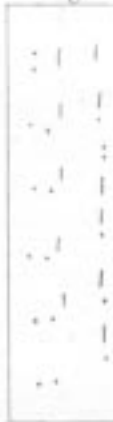
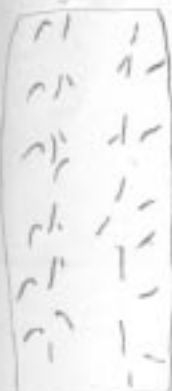
*Copeza punctata.*

Fig. 11.

*Acanthichnus trilineatus.*

Fig. 1.



Copeza propinquata.

Fig. 2.

Bifurcalipes curvatus.

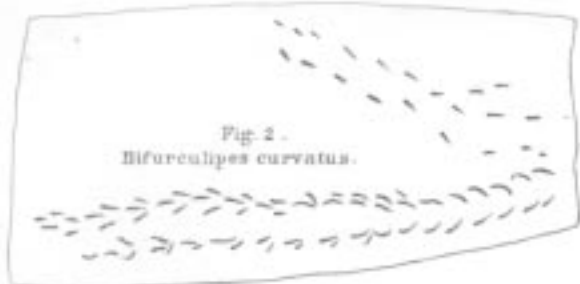


Fig. 3.

Pterichnus centipes.



Fig. 4.

A. angulatus.

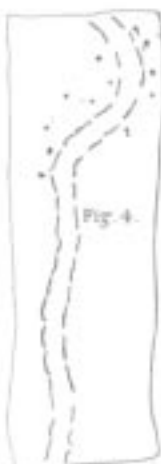


Fig. 6.

Harpepus capillaris.



Fig. 9.

Bifurcalipes curvatus.

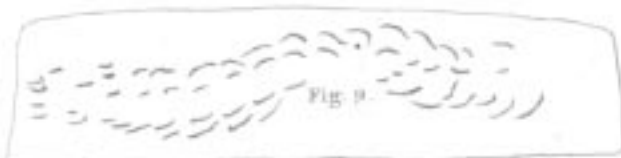


Fig. 11.



Fig. 7.

Bifurcalipes?

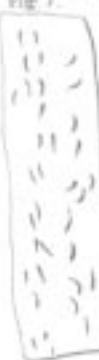


Fig. 8.

Bifurcalipes.



Acanthuchnus cursorius.



Fig. 10.

Copeza propinquata.

A. divaricatus.

Fig. 5.

Climacodichnus corrugatus.

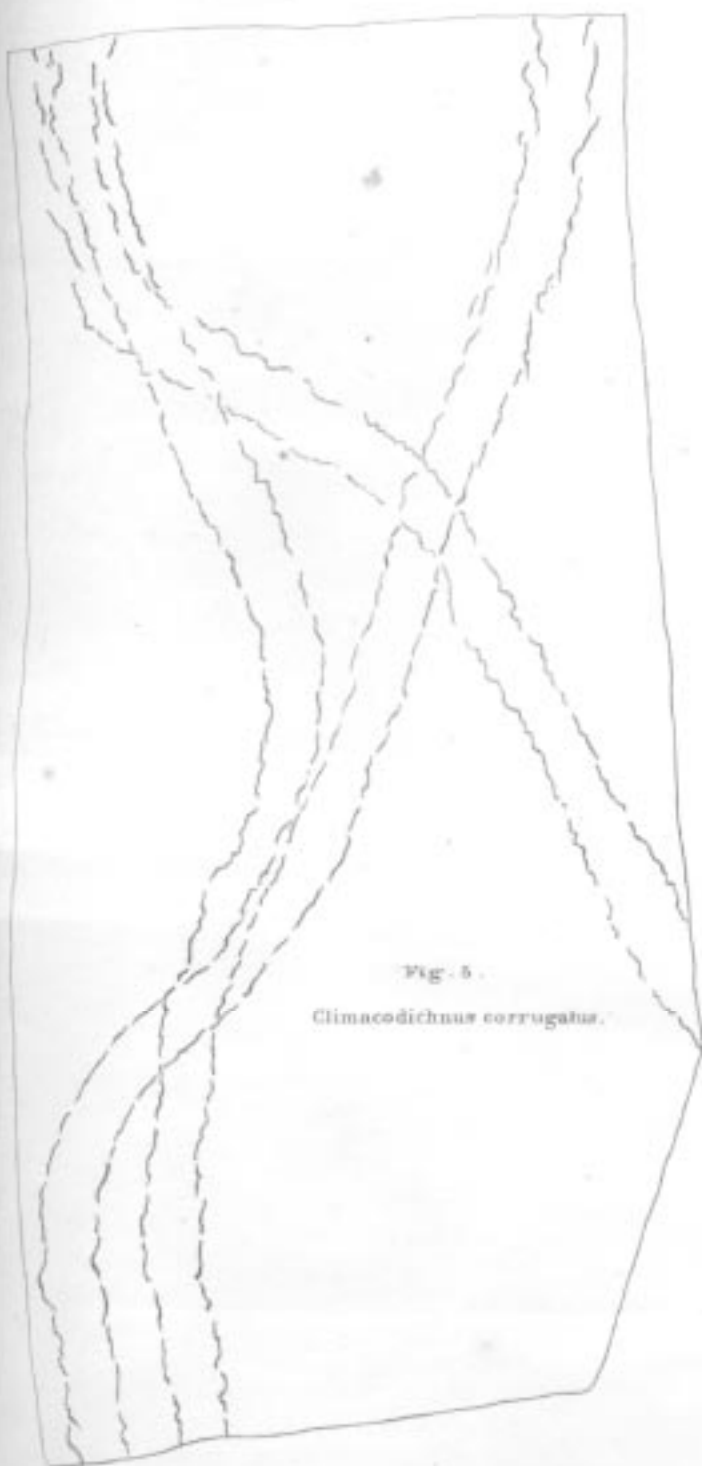


Fig. 1.



Fig. 2.



Fig. 3.

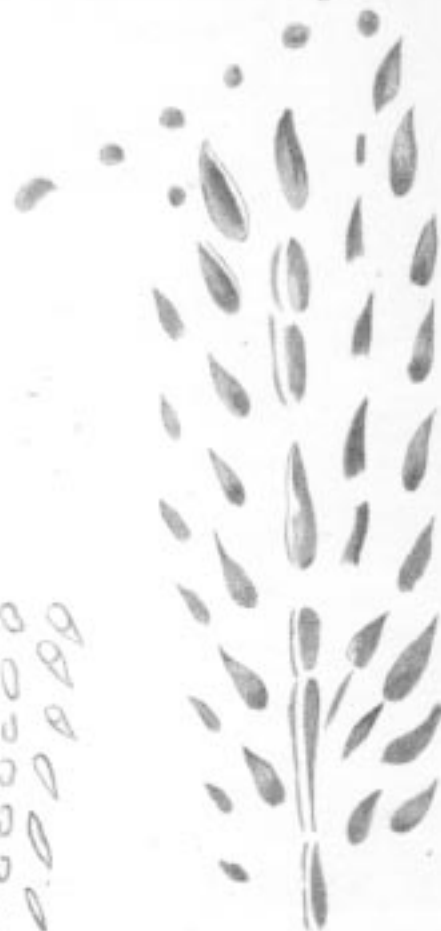


Fig. 7.



Fig. 5.



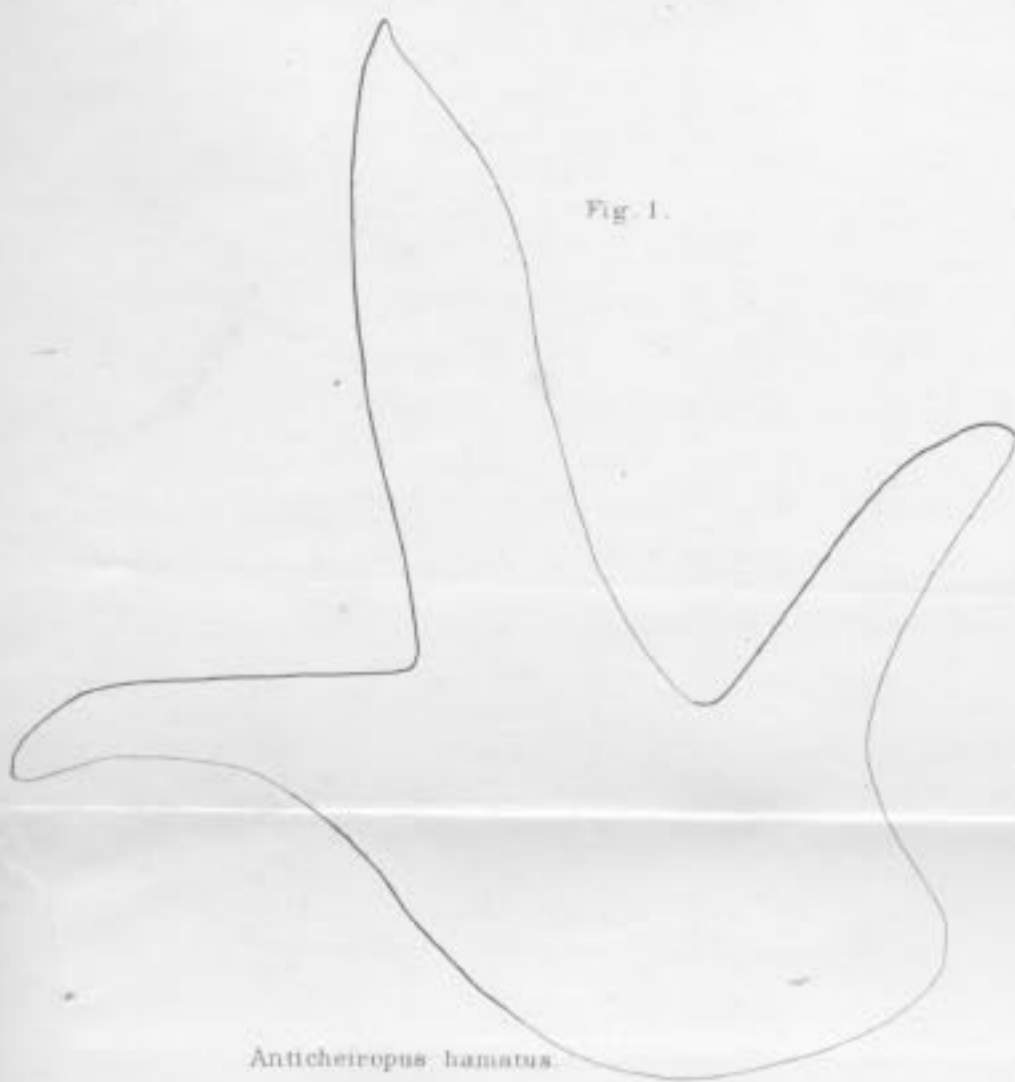
Fig. 4.



Fig. 6.



Fig. 1.



Anticheiropus hamatus.

Fig. 7.



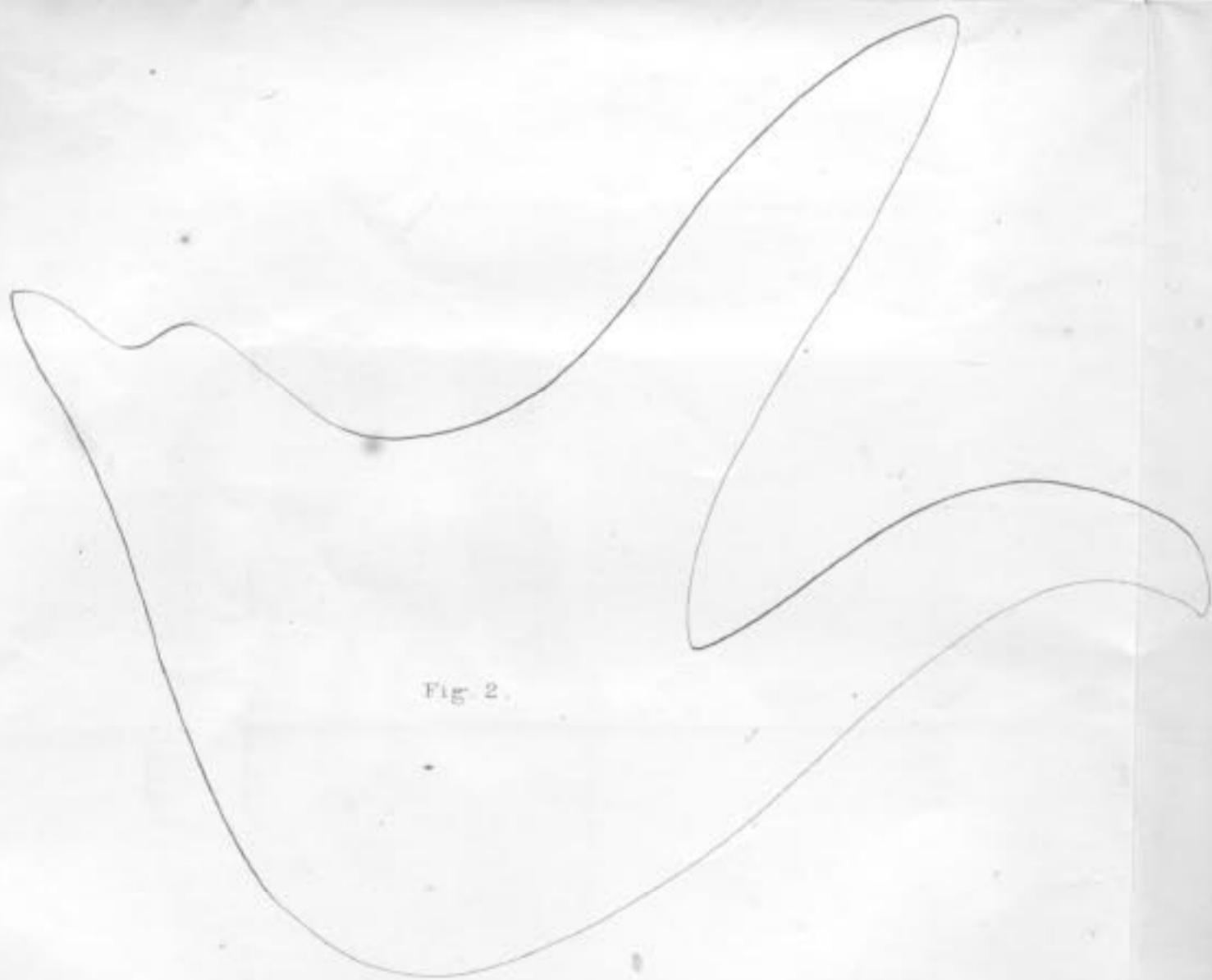
Grallator gracilis.

Fig. 6.



Bones of the right foot of *Megadactylus polyzelus*.

Fig. 2.



Anticheiropus hamatus.

Fig. 3.



Anticheiropus pilulatus.

Fig. 4.



Fig. 5.



Supposed tracks of the *Iguanodon*, $\frac{1}{4}$ natural size.

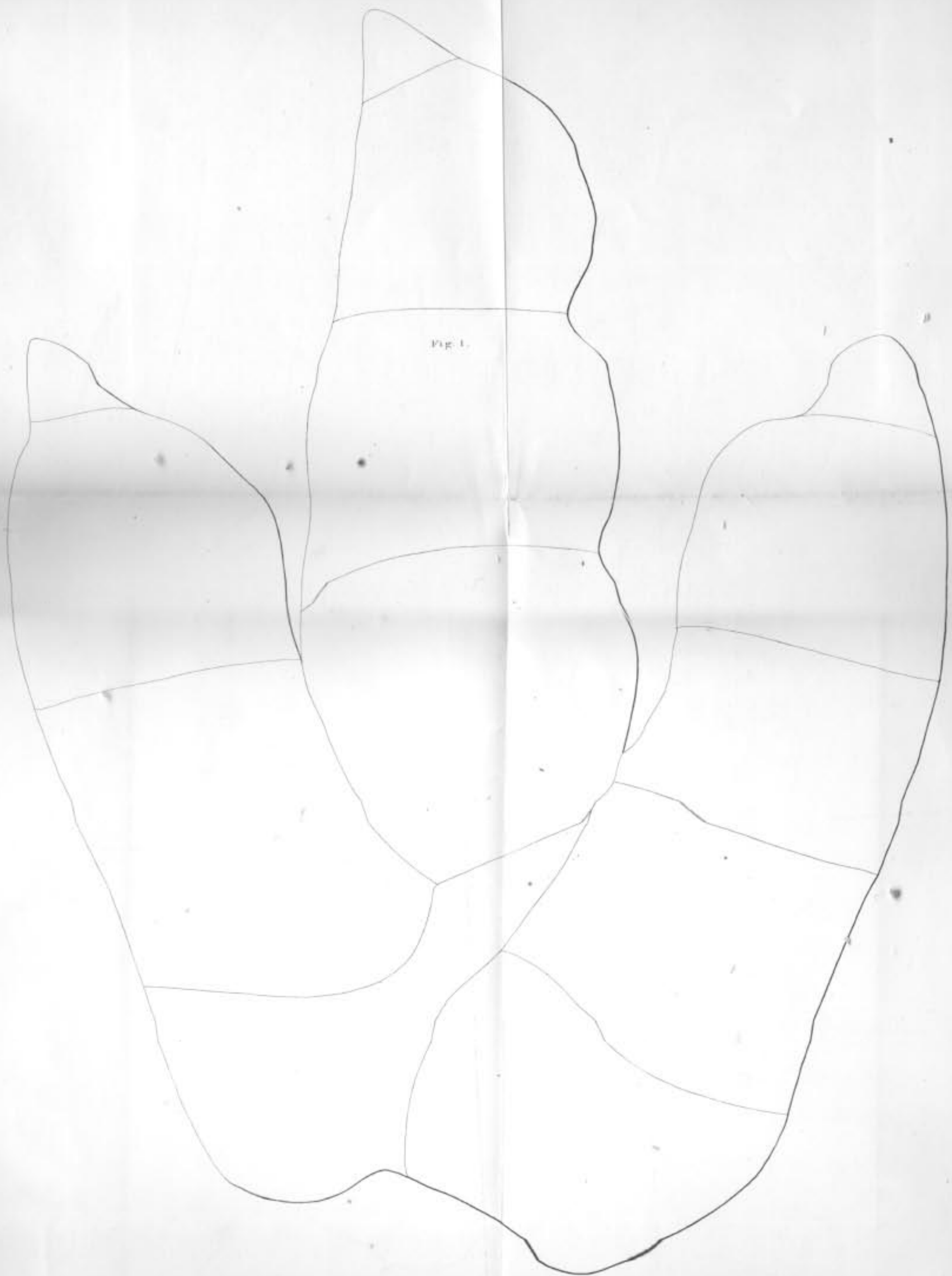


Fig. 1.

Brontozoum giganteum.



Fig. 2.

Brontozoum approximatum.

Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.



Fig. 5.

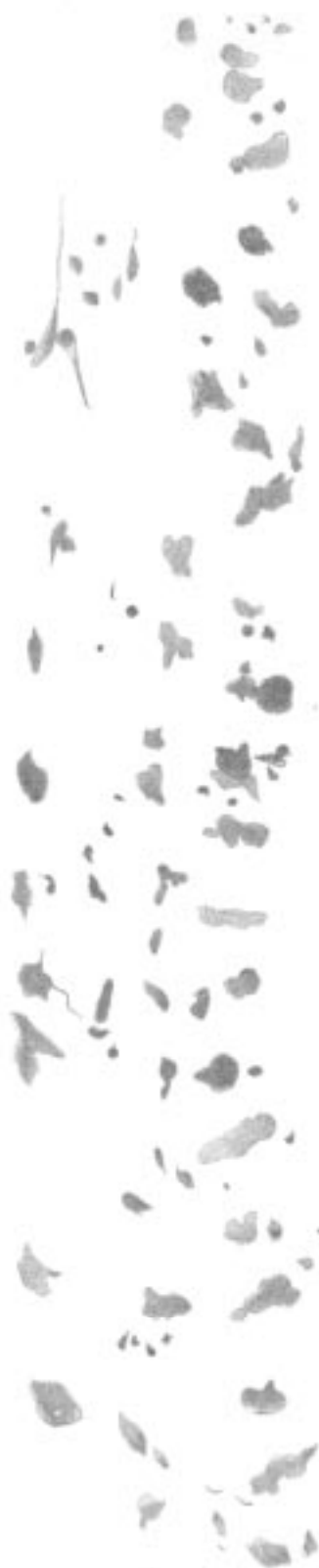


Fig. 6.



Fig. 1.

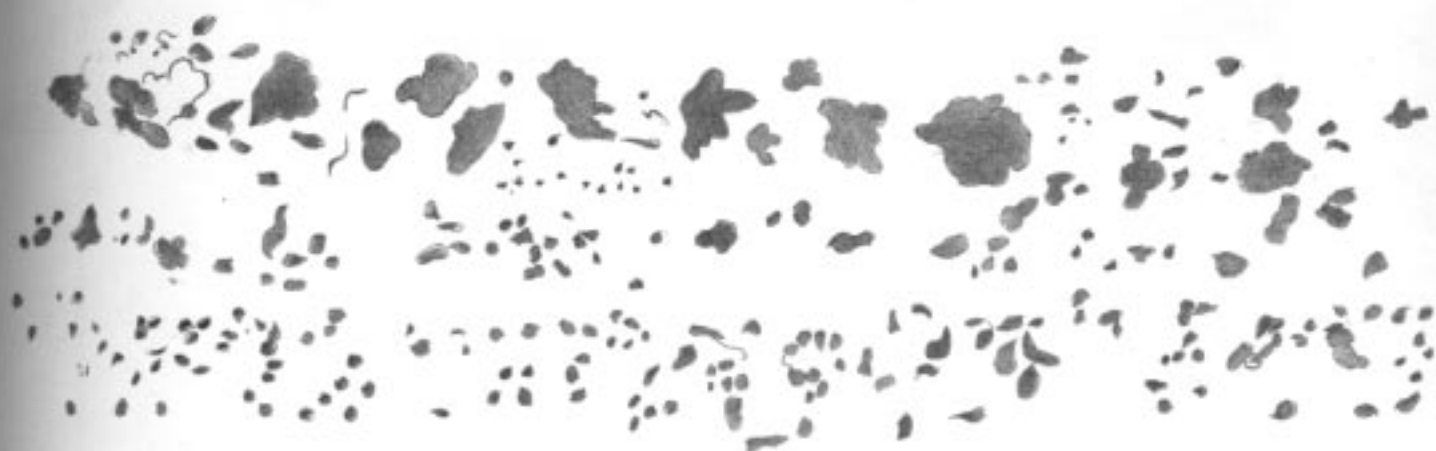


Fig. 2.

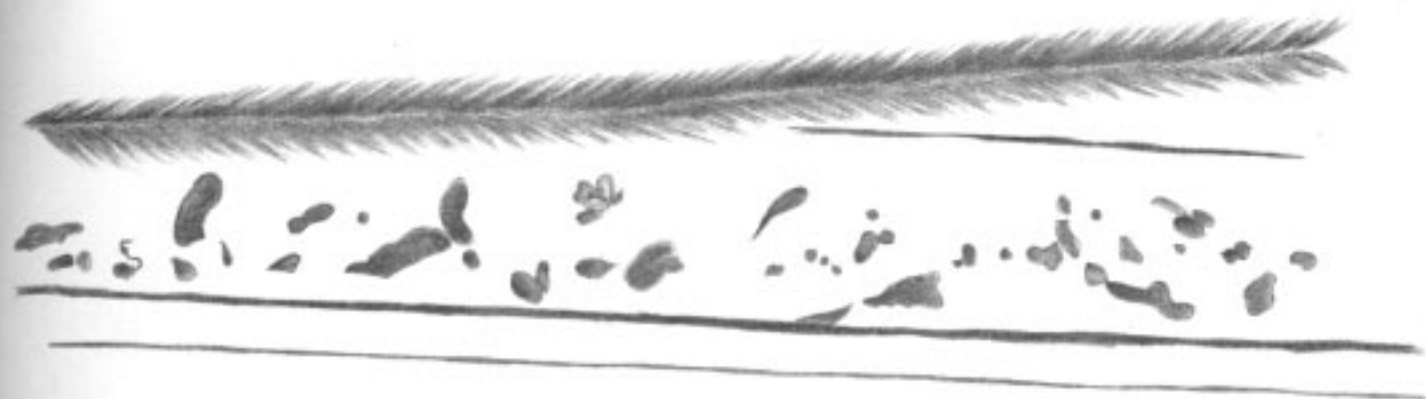
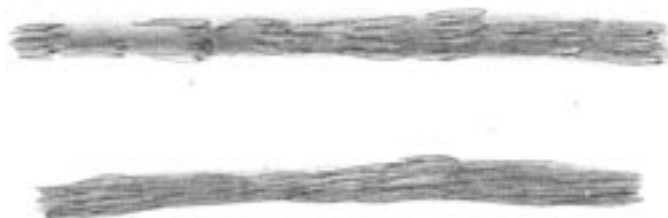


Fig. 3.

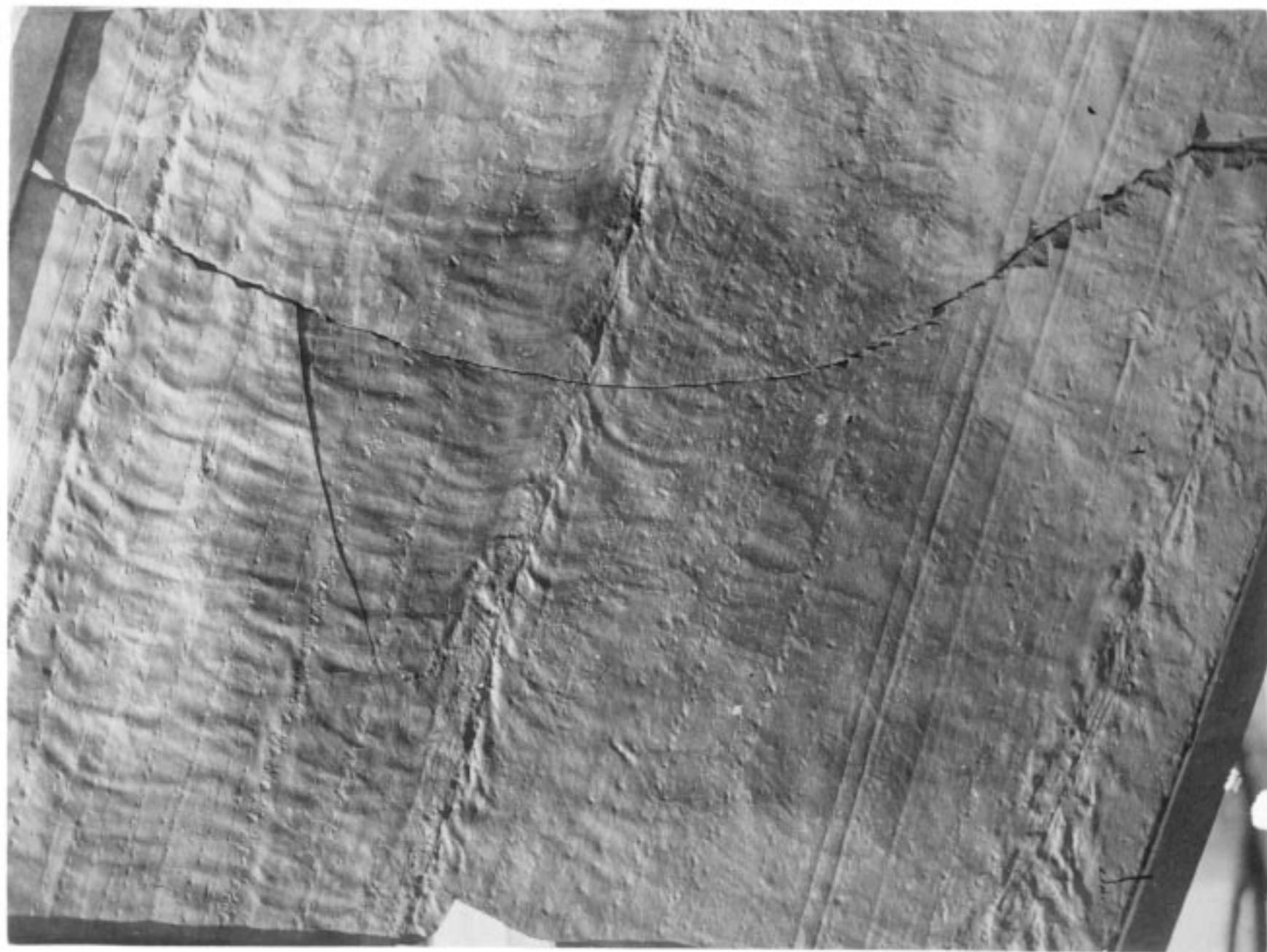


Fig. 4.





Climacodichnus corrugatus.



Aenigmichnus multiformis.

FIG. 2.



Anomæpus curvatus.

FIG. 1.



Anomæpus intermedius.

FIG. 1.



Brontozoum Sillimanium and *B. minusculum*.

FIG. 2.

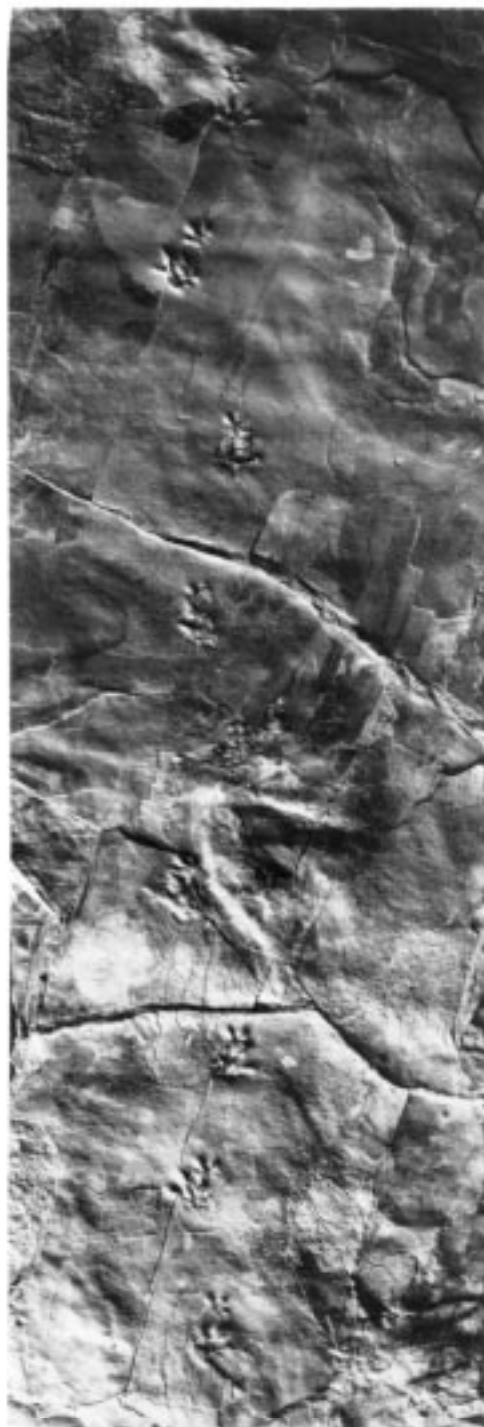


Caudal Trail?

FIG. 2.

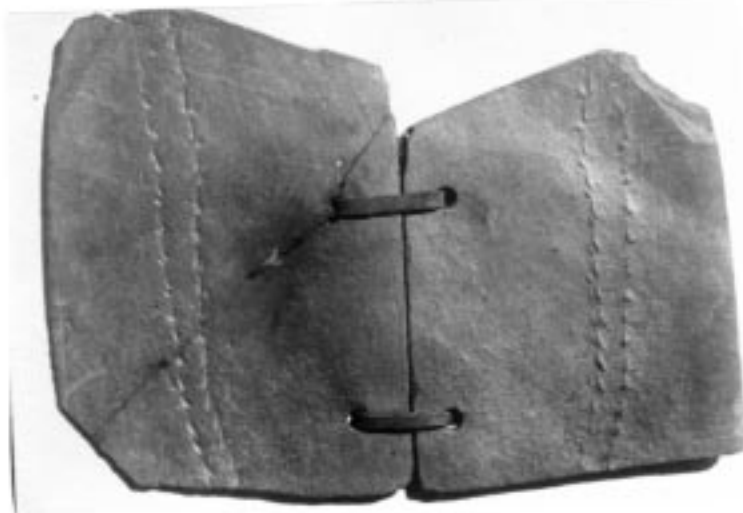


Plectropterna gracilis.



Arachnichnus dehiscens.

FIG. 1.



Copeza punctata.

FIG. 4.



Conopsoides curtus.

FIG. 3.



Erocampe minima.

FIG. 2.



Copeza propinquata.

FIG. 6.



Comptichnus obesus.

FIG. 5.



Sagittarius alternans.



Anomæpus major.

Plesiornis mirabilis

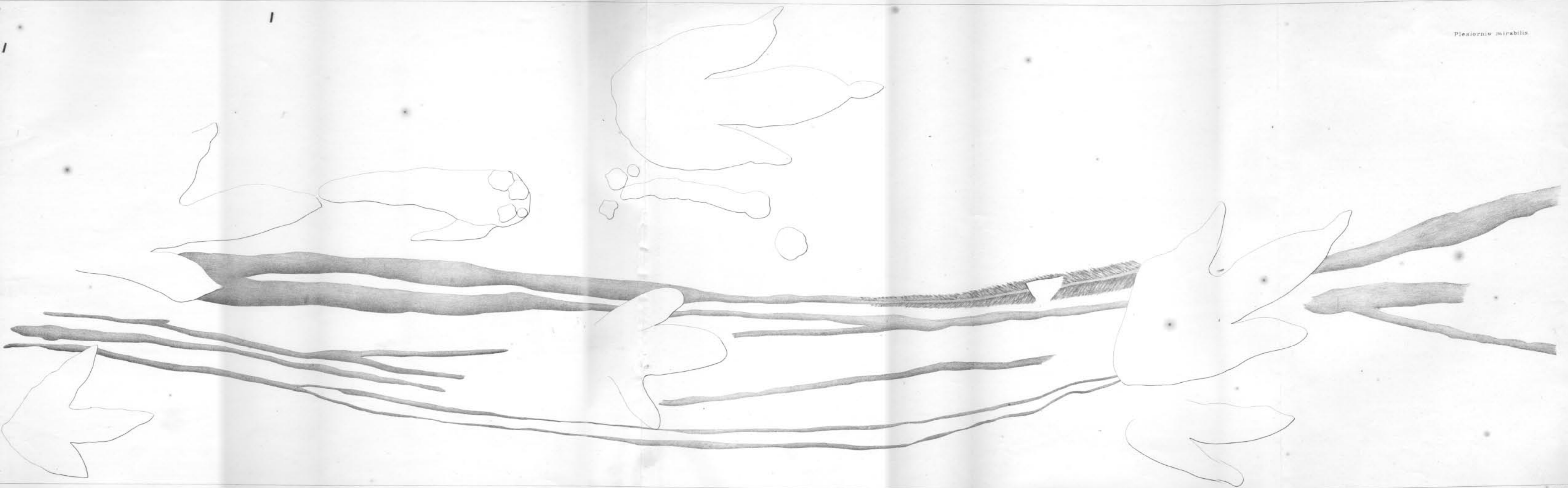


Fig. 1



Ascaris suum

Fig. 2



Ascaris suum

Fig. 3



Ascaris suum

Fig. 4



Ascaris suum

Fig. 5

Ascaris suum



Fig. 6

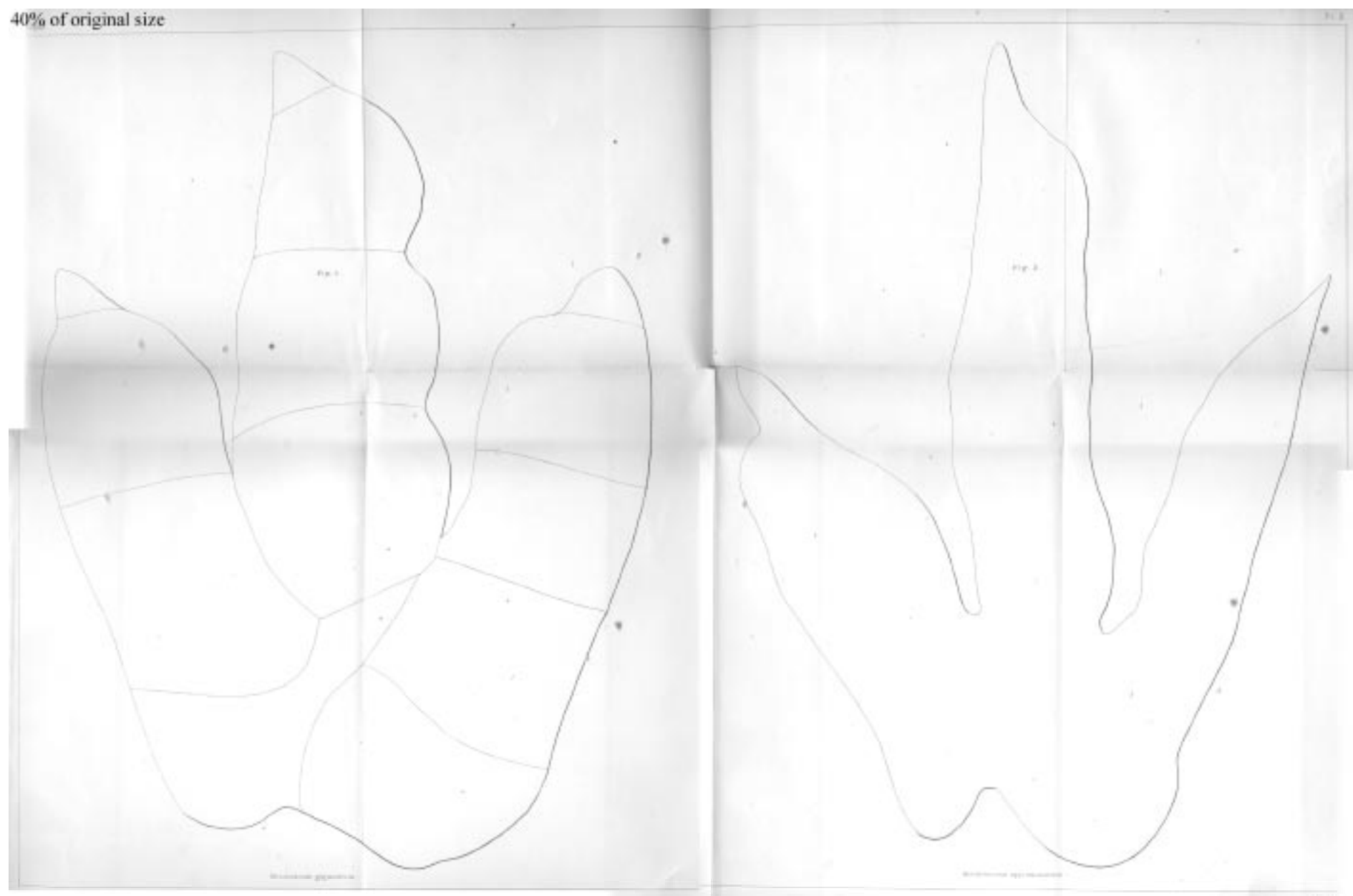


Fig. 7



Ascaris suum

40% of original size



Platanus mirabilis

