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THE

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ARTICLE VIII. *Observations on the Natural History of the Valley of the River Rouge, and the surrounding Townships in the Counties of Argenteuil and Ottawa.* By W. S. M. D'URBAN.

(*Continued from page* 276, *Vol. IV*)

INVERTEBRATA.

INSECTA.

COLEOPTERA.

Nearly all of the 114 species in the following Catalogue were obligingly determined for me by Dr. J. L. Leconte of Philadelphia. Besides those enumerated, many others were collected, but were unfortunately lost by the accidental fracture of the bottle which contained them.

I have added a list of 34 species, not observed in this district by myself, but brought by Mr. Robert Bell from the Augmentation of Grenville, and the neighbourhood of L'Orignal, on the south bank of the Ottawa.

Cicindela longilabris, Say.—Hamilton's Farm on the River Rouge, 2nd September.

" *vulgaris*, Say.—Very abundant on sand-banks, River Rouge, August.

* " *Baltimorensis*, Herbst. (*repanda*, Say.)—Common on sand-banks, River Rouge, July and August.

*The larvæ of this species were numerous in their burrows in the sand, by the side of the Rouge, five miles below Hamilton's Farm, 13th August.

Lebia viridis? Say.—Huckleberry Rapids, River Rouge, DeSalaberry, 30th July.

Patrobus longicornis, Say.—Sixteen-Island Lake, &c., Montcalm, May and June.

Platynus sinuatus, Dej.—Under dead logs, Sixteen Island Lake, &c., Township of Montcalm, May and June.

" *retractus*, Lec.—With the last species.

" *obsoletus*, Say.—With the last two species.

Pœcilus lucublandus, Say.—Under stones near the town of Grenville, 13th May.

Pterostichus fastiditus, Dej.—Under bark of decaying logs, Sixteen Island Lake, Montcalm, end of May; Lake of Three Mountains, end of September.

" *patruelis*, Dej.—River Rouge.

" *caudicalis*, Say.—Under stones near Grenville, 13th May.

" *orinomum*, Leach (*vitresis*, Esch.)—Township of Montcalm, June.

Luczotii, Dej. (var. præc?)—Sixteen Island Lake, Montcalm, May and June.

Lophoglossus mutator Lec.—Under stones near Grenville, 13th May.

Rembus major, Lec.— " " " "

Chlænius impunctifrons, Say — " " " "

Cychrus (Sphæroderus) Brevoortii, Lec.—Under dead logs, Bevin's Lake, Montcalm, 4th July.

Notiophilus punctatus, Lec.—On rocks, Huckleberry Rapids, River Rouge, DeSalaberry, 27th July.

Bembidium impressum, Fabr.—On wet sand, River Rouge, 13th August.

" *punctatostriatum*, Say.—Very abundant on wet sand, River Rouge, July and August.

" *patruelis*, Dej.—Abundant on wet sand, River Rouge, 13th August.

" *lucidum*, Lec.—Under stones near Grenville, 13th May.

Agabus striatus? Say.—In Sixteen Island Lake, Montcalm, end of May.

Coptotomus interrogatus, Fabr.—In Sugar-bush Lake, Montcalm, 23rd June.

Hydroporus proximus, Aubé.—With the last species.

Haliplus immaculaticollis, Harris.—With the last two species.

" *cribarius*, Lec.—Very abundant in Sugar-bush Lake, Montcalm, 23rd June.

Gyrinus (several species not determined)—In various Lakes.

Dineutes (not named)—Very abundant, Sugar-bush Lake, Montcalm, 23rd June.

Philhydrus cinctus, Say.—In a small stream crossing the portage between Gate and Gut Lakes, Wentworth, and in Sugar-bush Lake, Montcalm.

Necrophorus lunatus, Lec.—Huckle-berry Rapids, River Rouge, DeSalaberry, 27th July.

" *pygmæus*, Kirby.—Township of Montcalm, 20th June.

Silpha marginata, Fabr.—Abundant under putrid fish, Sixteen Island Lake, Montcalm, 1st June.

Homalota, (not determined)—Township of Montcalm, June.

Tachyporus, (not determined) " " "

Tachinus fumipennis, Say.—In bear's dung, Chain Lake, Montcalm, 17th June.

" *conformis*, Dej.—Township of Montcalm, June.

Philonthus cyanipennis, Fabr.—In a fungus on a rotten tree, River Rouge, 13th August.

" (not determined)—Under stones near Grenville, 13th May.

Stenus (not determined)—Numerous on wet sand, River Rouge, Arundel, July.

" (not determined)—Numerous on wet sand, River Rouge, near Hamilton's Farm, 13th August.

Oxytelus Pennsylvanicus, Er.—Common in our tents throughout the district.

Anthobium dimidiatum, Mels.—Township of Montcalm, June.

Platysoma parallelum, Say.— " " "

Carpophilus niger, Er.— " " "

Epurœa, (not determined) " " "

Cucujus clavipes, Oliv.—One specimen taken as it pitched on the mane of a horse, Township of Harrington, 15th May.

Pediacus planus, Lec.—Very abundant in the tents, Huckle-berry Rapids, end of July.

Dermestes lardarius, Linn.—Observed about the provisions, Sixteen Island Lake, Montcalm.

Anthrenus castaneæ, Mels.—Township of Montcalm, June.

Platycerus depressus, Lec.—Near Huckleberry Rapids, River Rouge, DeSalaberry, July.

Onthophagus Hecate, Pz.—Near Huckleberry Rapids, River Rouge, DeSalaberry, 2nd August.

Geotrupes Egerici, Germ. (*microphagus*, Say.) Woods near Hamilton's Farm, 31st August.

Aphodius fimetarius, Fabr.—Abundant in cow-dung, Hamilton's Farm, August.

Dichelonycha subvittata, Lec.—Abundant throughout the district, June to August.

Osmoderma scabra, Beauv.—River Rouge, July and August.

Nichius piger, Fabr.—On blossoms of *Viburnum opulus*, Sugar-bush Lake, and on white clover blossoms, and bleeding stumps of yellow birch, Bevin's Lake, Montcalm, end of June and beginning of July.

Ancylocheira maculiventris, Say.—Near Silver Mountain, River Rouge, 12th August.

Cryptohypnus silaceipes, Germ.—Under stones near Grenville, 13th May.

Dolopius fucosus, Lec.—Township of Montcalm, June.
" *stabilis*, Lec.— " " "
Corymbites triundulatus, Randall.—Township of Montcalm, end of May.
Pyractomena angulata, Say.—Common, Sugar-bush Lake, Montcalm, 23d to 26th June.
Ellychnia corrusca, Linn.—Under stones near Grenville, 13th May.
* " *lacustris*, Lec.—Abundant in the woods of Harrington, middle of May; Hamilton's Farm, and Lake of Three Mountains, August and September.
Digrapha terminalis, Say.—Bevin's Lake, 29th June, and 5th July, and Hamilton's Farm, 31st August.
Eros coccinatus, Say.—Sixteen-Island Lake, &c., Montcalm, end of May.
" *molis*, Lec.—Huckleberry Rapids, River Rouge, DeSalaberry, 2nd August.
Podabrus modestus, Say.—About clearings, Bevin's Lake, Montcalm, 2nd July.
Telephorus rotundicollis, Say.—Abundant " " "
" *carolinus*, Fabr.— " " " "
" *fraxini*, Say.— Township of Montcalm, June.
Anobium foveatum, Kirby.—Abundant in a rotten tree, Bevin's Lake, 4th July.
Cis. (not determined)—Township of Montcalm, June.
Pedilus collaris, Say.— " " "
Mordella nigricans, Mels.— " " "
Meloe rugipennis, Lec.—Hamilton's Farm, 31st August, and Grenville, 14th October.
†*Cistela* (not determined)—Very abundant on leaves of Bass-wood, Sugar-bush Lake, Montcalm, 26th June.
" (not determined)—River Rouge.
Nyctobates (not determined)—Under logs on grass-land, Hamilton's Farm, August.
Upis reticulatus, Say.—(*ceramboides*, Linn.)—With the last species.
‡*Bolitophagus cornutus*, Pz.—Larvæ and Pupa in a boletus, Huckleberry Rapids, DeSalaberry, 3rd August.
Apion, (not determined)—Township of Montcalm.
Sitona lepidus, Sch.—Near Hamilton's Farm.
Hylobius, (near *pineti*)—Sixteen Island Lake, 1st June.
" *pales*, Herbst.—Township of Montcalm, June.
Tomicus, (not named) " " "
Saperda tridentata, Oliv.—Base of Silver Mountain, Rouge, 10th Aug.
Monohammus confusor, Kirby,— " " " "

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* No Fire-flies were seen at night after the 19th of July. The Pupa of *Ellydinia lacustris* is as luminous as the perfect insect.

† This *Cistela* has a very rank scent.

‡ These larvæ were very active, wriggling about and jerking their abdominal segments with great force. One changed to Pupa, August 9; and a Pupa to Imago the same day. Another was evolved 13th August.

Monohammus scutellatus, Say.—Numerous, Bevin's Lake, 7th July; and abundant the whole way up the Rouge, to the end of August.

Encyclops cæruleus, Say.—One specimen taken on blossoms of *Viburnum opulus*, Sugar-bush Lake, Montcalm, 26th June.

Acmæops proteus, Kirby.—Township of Montcalm, June.

Evodinus monticola, Randall.—Sixteen-Island Lake, 30th May; and abundant on blossoms of *Viburnum opulus*, Sugar-bush Lake, end of June.

Leptura canadensis, Oliv.—Abundant on blossoms of *Spiræa salicifolia*, River Rouge, July and August.

" *vittata*, Oliv.—Near Huckle-berry Rapids, DeSalaberry, 15th July.

" *pubera*, Say.—Abundant on blossoms of *Viburnum opulus*, Sugar-bush Lake, Montcalm, 25th June.

" *proxima*, Say.—Near Huckleberry Rapids, DeSalaberry, 26th July.

" *mutabilis*, Lec.—On blossoms of *Viburnum opulus*, Sugar-bush Lake, end of June.

Donacia palmata, Oliv.—In blossoms of *Nuphar advena*, (Yellow Water-lily), Sugar-bush Lake, end of June.

" *subtilis*, Kunze.—In a small Lake near Lake of Three Mountains, 14th September.

" *pusilla*, Say.—Sugar-bush Lake, Montcalm, end of June.

" *flavipes*, Kirby.— " " "

Syneta tripla, Say.—Township of Montcalm.

Chrysomela scalaris, Lec.—Abundant on alders throughout the district, from the end of June to the end of September.

" *spirææ*, Say.—Very abundant, Sugar-bush Lake, 25th June.

" *interrupta*, Fabr.—Abundant on alders, Sixteen-Island and Sugar-bush Lakes, Montcalm, May and June. Larva abundant on alder leaves, June 25.

" *Vitellinæ*, Linn.—Abundant on oak and poplar leaves, Sixteen Island and Sugar-bush Lakes, May and June.

Systena pontalis, Fabr.—Township af Montcalm, June.

Phyllobrotica decorata, Say.—(*Oliviéri*, Kirby,)—Very abundant on *Scutellaria galericulata* and *lateripolia*, River Rouge, July and August.

Adoxus vitis, Fabr.—Amongst dead leaves, Gate Lake, Wentworth, 16th May.

Chrysochus auratus, Fabr.—Abundant on *Apocynum androsæmifolium* and *cannabinum*, Bevin's Lake, Huckleberry Rapids, &c., July.

Galleruca sagittariæ, Kirby.—Township of Montcalm, June.

Coccinella picta, Randall.— " " "

LIST OF SPECIES FROM L'ORIGNAL AND THE AUGMENTATION OF GRENVILLE.

Cymindis reflexa, Lec.
Calathus gregarius, Say.
Platynus capripennis, Say.
Pterostichus erythropus, Dej.
" *adjunctus*, Lec.
Amara angustata, Say.
" *impunctico*llis, Say.
Anisodactylus Baltimorensis, Say.
" *Harrisii*, Lec.
" *rusticus*, Say.
Harpalus Pennsylvanicus, Geer.
" *herbivagus*, Say.
Chlænius sericeus, Forst.
" *tricolor*, Dej.
Acilius fraternus, Harris.
Silpha Surinamensis, Latr.
Pœderus littorarius, Grav.
Hister perplexus? Lec.
Ips quadrisignatus, Say.
Cytilus varius, Fabr.
Lachnosterna fusca, Frolich.
Osmoderma eremicola, Knoch.
Photuris Pennsylvanica, Geer.
Trichodes, Nuttalii, Kirby.
Thanasimus dubius, Fabr.
Tenebris molitor, Linn.
Ipthinus Pennsylvanicus, Geer.
Orthosoma unicolor, Drury.
Saperda vestita, Say.
Chelymorpha cribaria, Fabr.
Haltica collaris, Fabr.
Chrysomela trimaculata, Fabr.
Helodes trivittata, Say.
Hippodamia 13-*punctata*, Linn.

LEPIDOPTERA.

With the exception of the *Rhopalocera* (Butterflies), the greater portion of the Lepidoptera collected are still undetermined. Some of the *Heterocera* (Moths) enumerated below, were named for me, at the British Museum, by Mr. Francis Walker, to whom I am much indebted. I obtained a great number of beautiful larvæ in October, but from the difficulty of transporting them from place to place, when travelling, I failed to rear any of them. From the end of May till August, *Noctuidæ* and *Geometridæ* swarmed at dusk in the woods, the light of our camp-fire often attracting them in great numbers into our tents, and the numerous delicate *Microlepidoptera* would have delighted Mr. Stainton.

Rhopalocera.

1. *Papilio turnus*, Linn., (Tiger Swallow-tail). Figured and described in the " Canadian Nat. and Geol.," Vol. 2, pl. 3, p. 223. Abundant throughout the whole of the district traversed. First observed 30th May, at Sixteen Island Lake, Montcalm, and became very numerous by the middle of June, continuing so until the beginning of July, at which time most of them were much worn, and they disappeared altogether by the end of the month. The beautiful apple-green larvæ were very abundant at the end of August and during the first week of September, at Hamilton's Farm on the River

Rouge. At that time we were camped on the grass of the clearing, under some scattered elm and ash trees, and the larvæ, which were numerous in the tents, appeared to have been blown out of these trees by the high winds, and were rapidly crawling about in search of a suitable place to spin their suspending girths, and undergo their transformations. Just before assuming the pupa state, they became dark brown in colour, with some lilac stripes and spots. On the 31st August, I met with a larva on an alder bush, across a leaf of which it had spun a bed of silk, and was reposing upon it in its usual manner, with the anterior segments drawn in and swollen out, so as to render the ocellated spots on the third segment very conspicuous. When in this position, these larvæ, if disturbed, rock themselves slowly from side to side, throwing out the forked orange tentacle, which is usually concealed from view in the segment behind the head, emitting at the same time a very acrid odour. The pupa is whitish-brown on the back and abdomen, with a darker line down the sides, and the wing-cases are dark brown, or black. This splendid butterfly frequently assembles in great numbers about wounds on the roots of trees from which sap exudes, and also about decaying fish and animal matter. On the shores of Sugar-bush Lake in the Township of Montcalm, on the 25th June, I counted fifty-six individuals crowded together in a space, not exceeding six square inches, where a dead cat-fish had lain for some time, and others were constantly ariving, flying straight to the spot against the wind, as though they had scented it from afar. On several occasions more than a dozen specimens were captured at a single grasp of the hand, having become so gorged and drowsy with their disgusting repast, as to be unable to fly.

2. *P. asterias*, Fab. (Black Swallow-tail.)—Figured and described in the "Canadian Nat. and Geol." vol. 2, pl. 3, p. 220. A large black butterfly seen by myself, as it sailed rapidly through the woods, on the borders of Chain Lake, Montcalm, 17th June, I supposed to be this species. It was not, however, again met with, which is not surprising, considering the scarcity of Umbelliferous plants in this district.

3. *Colias philodice*, Godt. (Clouded Sulphur.)—Figured and described in the "Canadian Nat. and Geol." vol. 2, pl. 4, p. 313. Numerous at Grenville on the 5th June, but I did not observe it again till the 30th of that month, after which it was not uncommon along the banks of the Rouge. At Hamilton's farm, 50 miles up

the river, it was quite numerous, especially in August and September. The last date at which I observed it there, was the 13th September, when it was still abundant, and I then captured a specimen apparently just evolved. I saw several individuals at Grenville, October 14th and 18th, and on my return to Montreal on the 19th of that month it was still rather numerous there. As the larva of this butterfly feeds on various species of *Trifolium* it is not to be looked for in uncleared districts, and in fact it is only to be seen around clearings and open places,where the clovers have been introduced either by accident or design.

4. *Pieris oleracea*, Harris (Grey-veined White). Described in the "Canadian Nat. and Geol." vol. 2, p. 347. Abundant throughout the whole district. First observed near Grenville, 14th May, and was then numerous in the woods of that township. It continued abundant up to the end of June, but was not seen afterwards till the end of August, when I observed a few worn individuals at Hamilton's Farm. This species also, had the habit of pitching upon the dead fish and offal lying round our camps, but never assembled in any great numbers.

5. *Danais Archippus*, Fab. (Storm Fritillary.)—Figured and described in the Canadian Nat. and Geol. vol. 2, pl. 6, p. 350.—A single specimen, which appeared to have been recently evolved, was seen by myself, flying across the Rouge, a little above Silver Mountain, on the 12th August. The different species of *Ardepias*, which constitute the food-plants of the larva, are sparingly distributed in this district, and accordingly this butterfly is seldom met with.

6. *Satyrus* Portlandia*, Boisd. (Pearly Eye.) First seen about the camp on the south side of Bevin's Lake, Montcalm, on the 2nd July, after which it was met with abundantly in the woods along the Rouge as far as Silver Mountain, near which on the 6th August, those seen were much wasted, and they soon afte entirely disappeared. The specimens collected agree tolerably accurately with Boisduval's figures and descriptions of *Satyrus Portlandia*. It is figured under the name of *Hipparchia Andromacha*. Hübner, in Say's "American Entomology," vol. 2, pl. 36, and in Gosse's "Canadian Naturalist" p. 246. In the latter work it is spoken of as very rare in the Eastern Townships, and Prof. T. P. Kirtland, says it is among the most rare of the butterflies of Ohio. Being generally supposed to be a southern species, it is not little remarkable that it should be so abundant

* (*Debis.*)

to the north of the Ottawa. I have also met with it near Montreal.

7. *Hipparchia nephele*? Kirby. Abundant amongst grass on Hamilton's Farm, from the 22nd August to the beginning of September, but all seen were much worn. It is a common species in hay-fields at Montreal and Sorel, and is described in "Fauna Boreali-Americana," p. 297.

8. *Limenitis Arthemis*, Drury. (Banded Purple). Figured in Gosse's "Canadian Naturalist" p. 220. First seen at Sugar-bush Lake, Montcalm, on the 26th June, after which it became the most abundant species and continued so until the end of July, when all observed were much worn, but lingered on till the middle of August. It frequently assembles in astonishing numbers round old lumbering camps, &c., congregating about the tea-leaves and other refuse lying about such places. On the 15th July, on the site of a lumbering camp and timber roll-way, on the banks of the Rouge, about three miles above the Indian Village in the Township of Arundel, I saw the most extraordinary assemblage of butterflies I ever beheld, several hundreds of this species being congregated together in groups consisting of from twenty to fifty individuals in each, whilst many others flew around and rendered it difficult to arrive at an accurate estimate of their numbers; nevertheless I am convinced that I am within the mark, when I state that there were more than three hundred assembled within a space of a few square yards. This species is very restless and active when on the ground, constantly opening and shutting its wings, unrolling its tongue, and running to and fro very rapidly, and even when feeding is not easily surprised It flies freely in cloudy weather and quite late in the afternoon. According to Prof. Kirtland it is a rare species in Ohio.

9. *Cynthia cardui*, Linn. (Painted Lady). Described in the "Canadian Nat. and Geol." vol. 3, p. 346. But one specimen was met with, which was on the 21st August, at Hamilton's Farm, where the common thistle (*Cirsium lanceolatum*), the food-plant of its larva, is plentiful about the fields.

10. *Vanessa Atalanta*, Linn. (Red Admiral). I observed a butterfly which appeared to be of this species, on the 24th June, at Sugar-bush Lake, Montcalm.

11. *V. Antiopa*, Linn. (Camberwell Beauty). Figured and described in the "Canadian Nat. and Geol.," vol. 2, p. 93. Rather common at Grenville on the 13th May; a few specimens were seen

in the Township of Montcalm in June, and near Silver Mountain on the Rouge, on the 12th of August.

12. *V. Milberti*, Godt. *furcillata*, Say. (Forked). Common at Grenville, 14th May, not seen again until July 10th, on the Rouge, after which it was observed occasionally at Hamilton s Farm, up to the 31st August.

13. *V. J. album*, Boisd. (Compton Tortoise). A common species throughout the district, from the 19th May to the end of September. I observed one near Grenville on the 18th October.

14. *Grapta Progne*, Fab. (Green Comma). Abundant everywhere from the 14th May to the middle of September. On one occasion an individual of this species pitched on my hand and I caught it between my fingers.

15. *G. C. album*, Godt. (Orange Comma). The species of the genus *Grapta* (popularly termed Commas, from the silver spots in the centre of the hind-wings on the under side, which resemble an inverted comma) are so subject to variation, that it is extremely difficult to determine them, unless they are reared from the larvæ. I, however, took several specimens of a species which I believe to be *G. C. album* along the Rouge in July and August.

16. *Argynnis Daphnis*? Cramer (Small Silver-spot Fritillary). First seen at Bevin's Lake, Montcalm, 2nd July, andfrom that date it was abundant all the way up the Rouge as far as Hamilton's Farm, at which place, on the 25th of August, I saw a specimen perfectly fresh, whilst many others were flying about in a worn condition. It was very numerous on the flowers of *Asclepias incarnata*, near the Indian Village on the 18th July. The last date at which it was observed by me was 12th September. I am of opinion that Boisduval was in error in considering *A. Aphrodite*, Fab., and *A. Cybele*, Fab. as one and the same species. There are at least three closely allied species of *Argynnis* inhabiting Canada, but nothing short of breeding each from the larvæ will satisfactorily separate them. Two of my specimens agree best with Cramer's figure of *A. Daphnis*, but a third differs considerably and may be another species. They are all too small for *A. Cybele*, Fab.

17. *A. Myrina*, Cramer. (Pearl-border Fritillary). First seen at Grenville 5th June. Common at Bevin's Lake, Montcalm, at the beginning of July, and at Hamilton's Farm up to the 31st August.

18. *A. Bellona*, Fab. One specimen taken near Mr. Thompson's clearing on the Rouge, in the Township of Arundel, on the 30th June. , It was not again met with.

19. *Melitæa Tharos*, Cramer, *Cocyta*, Hübner, (Pearl-crescent Fritillary). First observed at Sugar-bush Lake, Montcalm, 29th June. *In copula* and rather worn 2nd July about Bevin's Lake. A few seen a few miles up the Devil's River, 14th July.

20. *Thecla* (?) A large *Thecla* was seen by me at the Huckleberry Rapids on the Rouge, 2nd Range of De Salaberry, on the 30th July, but I failed in my attempts to secure it, and could not recognise the species, nor did I meet with any other of this genus.

21. *Lycæna Americana*, Harris (American Copper). Numerous from the 21st to the 31st August, on grass-land at Hamilton's Farm, where its food-plant, the sorrel (*Rumex acetosella*), abounds.

22. *Polyommatus pseudargiolus*, Boisd. (Spring Azure). Numerous on the 14th May, in the woods of the Township of Grenville. The males were extremely abundant, congregating round putrid fish on the shores of Sixteen-Island Lake, at the end of May; I saw worn specimens as late as the 2nd July, about Bevin's Lake. When in a canoe on Sixteen-Island Lake, one of these beautiful little butterflies pitched on my hand and remained there for some time.

23. *Pamphila* (?) Two specimens of a dingy grey species of Shipper were captured, one at Sugar-bush Lake, June 26th, and the other at Bevin's Lake, 2nd July.

24. *Pamphila* (?) One specimen of a *Pamphila*, resembling *P. paniscus* (Chequered Shipper) of Europe, was taken near Bevin's Lake, Montcalm, 2nd July.

Two or three other species of *Pamphila* were taken in the Townships of Montcalm and Arundel, and at Hamilton's Farm, in June, July and August, which I have been unable to determine, and which are probably undescribed species.

Heterocera.

SPHINGINA.

Sphinx. I captured two species of *Sphinx* on the Rouge, in the Townships of Arundel and DeSalaberry, in July, allied to *S. kalmiæ*, Abbot and Smith, and *S. gordius*, Cramer, but not agreeing satisfactorily with the descriptions of those species as given by Dr. Harris in his Catalogue of American Sphinges, (Amer. Jour.

Sci. vol. xxxvi). According to Mr. Walker, neither of them is in the collection of the British Museum. Dead fish appear to be very attractive bait for Sphinges as well as other Lepidoptera, one of the species above mentioned having been taken whilst hovering over a dead carp lying by the water side, and many others were seen under similar circumstances. On the 11th August, when camped on a low flat at the base of Silver Mountain on the Rouge, I obtained a *Sphinx* larva, which from my notes, appears to have resembled that of *S. Kalmiæ*, as described by Harris (vide Amer. Journ, Sci. vol. xxxvi, p. 295). It was light green, with seven oblique yellow stripes edged above with dark purple, on each side; head yellow, with a vertical band of dark brown on either side; caudal horn, blue, covered with small black tubercles, and tipped with black. It appeared to have been washed by the heavy rain which had just fallen during a violent thunder storm, from the soft maples (*Acer rubrum*), which almost exclusively surrounded the tents, and on one of which it was crawling. Another splendid larva was found on the 19th September, feeding on a bush of *Myrica gale*, growing on the shores of Green Lake, adjoining the Lake of Three Mountains, in the county of Ottawa, about five miles from Hamilton's Farm. The following is the description of it which I made at the time: "Deep olive-green, covered with minute spots of white, edged with black; seven oblique pink stripes, edged above with black and below with pale yellow, on either side; caudal horn, black; spiracles, orange; pro-legs, yellow; a stripe of light green on each side of the head." The minute white spots surrounded by black, thickly covering the whole upper surface, gave it a striking and most interesting resemblance to the scurfy resinous dotted leaves of its food-plant, the Bog Myrtle or Sweet Gale. This beautiful larva changed to a pupa which unfortunately perished during the following winter.

Smerinthus. I obtained two larvæ, belonging to this genus, under elm trees at Hamilton's Farm, on the 3rd and 4th September, of which the following are descriptions: No. 1, pale green, whitish on the back, with oblique stripes of white and dark green on the sides. No. 2, green, with oblique tuberculated stripes on the sides, and two tubercles on each of the second and third segments.

Trochilium. On the 25th June, at Sugar-bush Lake, I captured a beautiful and apparently undescribed species of *Trochilium*, sitting on the blossoms of *Viburnum opulus* which were

much frequented by insects of all orders. The anal tuft is deep orange; antennæ, black; expansion of thewings 11 lines; length of the body 5 lines.

BOMBYCINA.

1. *Ctenucha Latreillana*, Kirby. (Cœrulean). Described in "Fauna Boreali-Americana," p. 305. One specimen taken on the 16th July, near the Indian Village on the Rouge, Township of Arundel.

2. *Crocota brevicornis*, Walker. Described in "British Museum Catalogue Lepid. Het." part II, p. 535. Observed in open places at Huckleberry Rapids, DeSalaberry, and numerous amongst grass at Hamilton's Farm, end of July and August.

3. *Medaria Mendica*, Walker. (Buff Muslin). Described in "British Museum Cat. Lepid. Het." Part II, p. 576. Not abundant in this district, but occurred near Bevin's Lake, Montcalm, in July.

4. *Arctia Parthenos*, Harris (Great Northern Tiger). On the 19th July, five miles up the Devil's River, a tributary of the Rouge, I took a fine *Arctia* agreeing in every respect with the figure and description of *A. Parthenos*, given by Dr. Harris in Agassiz's "Lake Superior," p. 390, pl. 7, fig. 4, with the exception that it has *five*, instead of *three* cream-coloured spots on the costal edge of the anterior wings.

5. *Hypercompa Lecontei*, Boisd. (White Tiger). Occurred at various places in the Townships of Montcalm, Arundel and DeSalaberry, during the month of July. *H. confinis* and *contigua*, Walker, ("Brit. Mus. Cat. Lepid. Het." part III, p. 651), appear to be merely varieties of this very variable species.

6. *Halesidota annulifascia*, Walker. Described in Brit. Mus. Cat. Lepid. Het. part III, p. 733. I found cocoo of a Muff Moth under stones, 22nd May, near Sixteen Island Lake, Wentworth, most probably belonging to this species, which abounds near Montreal. Mr. Walker's *H. annulifascia* appears to me to be identical with *Sophocanipa Caryæ* (Hickory Jussock Moth) of Harris, (vide Fitch's "Noxious Insects of New York," p. 163).

7. *Orgyia leucostigma*, Abbot and Smith (American Vapourer). Vide Fitch's "Noxious Insects of New York," p. 213. The males were numerous flying in the sunshine at Hamilton's Farm, at the end of August and beginning of September.

8. *Telea Polyphemus*, Hübner, (Eyed Emperor). Abundant at the end of June and beginning of July, about Bevin's Lake, Township of Montcalm. I also found numerous empty cocoons, near Sixteen Island Lake, Wentworth, and at Huckleberry Rapids, DeSalaberry, and the beautiful larva, (vide the excellent figure in Gosse's "Canadian Naturalist," p. 309,) was common on elm trees at Hamilton's Farm, being full grown and spinning up at the end of August. This fine species is therefore distributed over the whole district traversed. These gigantic Emperor Moths have a very strange appearance when seen against the clear sky of a fine summer evening, as they fly over the lakes.

NOCTUINA.

1. *Thyatira scripta*, Gosse. (Pink Arches). Figured in Gosse's "Canadian Naturalist," p. 249. This most beautiful species was abundant in the Townships of Montcalm and Arundel, at the end of June and the beginning of July.

2. *T. cymatophoroides*, Guén. Common at Sugar-bush and Bevin's Lakes, Montcalm, and mouth of Devil's River, Arundel, at the end of June and July; also at Trembling Mountain Lake, Grandison, 7th September.

3. *Graphiphora C. nigrum*, Linn. One specimen taken at Huckleberry Rapids, DeSalaberry, 24th July; and another worn one at Hamilton's Farm, 28th August.

4. *G. Dahlii*, Hübner. One specimen taken near Gate Lake, Wentworth, 17th May.

5. *Euplexia lucipara*, Linn. (Small Angleshades)—Common in the Township of Montcalm in June.

6. *Plusia mortuorum*. Abundant flying by day at Hamilton's Farm in the end of August.

GEOMETRINA.

1. *Angerona crocataria*, Fab. (Lemon beauty). Common in the Townships of Montcalm and Arundel, frequently flying by day in July. The female of this species is much larger, and paler in colour than the male.

2. *Sicya solfataria*, Guén. This lovely little moth was not uncommon at the end of July, in the Township of DeSalaberry. It bears a great resemblance in colour, markings, and form to *Ennomos macularia*, Harris. (Vide Agassiz's "Lake Superior," p. 392, pl, 7, fig. 3.)

3. *Ellopia æqualiaria.* Township of Montcalm, June.

4. *Nematocampa filamentaria,* Guén. Huckleberry Rapids, 2nd Range, DeSalaberry, 27th July.

5. *Endropia tigrinaria,* Guén. Very abundant in the Township of Montcalm at the end of June.

6. *Melanippe gothicata,* Guén. Extremely numerous, especially in rocky woods, in the Township of Montcalm, during the month of June. It flies in such a manner that the white bands across the wings appear to form a complete circle in the air. It is closely allied to *M. hastata* of Europe.

7. *Scotosia undulata,* Linn. (Scallop Shell). Common in the end of June and the beginning of July in the Township of Montcalm. Those collected are exactly similar to English specimens.

PYRALIDINA.

1. *Pyralis,* n. sp? Huckleberry Rapids, DeSalaberry, 27th July. Mr. Walker supposes this to be a new species, and the following is a description of it:—Anterior wings, dull pink, crossed by two black transverse lines, the first of which, situated near the base, is straight, and has a yellow spot on the inner side, occupying the angle which it forms with the costa; the second, situated beyond the middle, is bent, forming an obtuse angle before it reaches the costal margin, where it has a yellow crescent-shaped spot on the outer side. Posterior wings, dusky-white at the base, with a broad, pale black, sub-marginal band and crossed by two black transverse lines. Expansion of the wings 12½ lines; length of body 4 lines.

2. *Bleptina surrectalis,* Guén. Huckleberry Rapids, DeSalaberry, 4th August.

3. *Anania octomaculata,* Linn. (White spot). One specimen taken on the 2nd July, near Bevin's Lake, Montcalm. It occurs also on the northern shores of Lake Superior and in Europe.

4. *Hydrocampa.* A species of *Hydrocampa* was abundant, flying over aquatic plants in a small lake near Hamilton's Farm, 15th August.

5. *Botys verticalis,* Linn. (Mother of Pearl). Not uncommon at Huckleberry Rapids, DeSalaberry, about the 1st of August. Those collected have been compared with British specimens and appear to be identical.

6. *Eubulea.* A small species apparently closely allied to the European *E. sambercalis,* Schiff., was very numerous on the blos-

soms of the Raspberry, (*Rubus strigosus*) near Bevin's Lake, Montcalm, at the beginning of July.

TORTRICINA.

Tortrix. On the 19th July, five miles up the Devil's River, I found a mass of web, spun by larvæ, over the leaves and branches of the Indian Hemp (*Apocynum cannabinum*), which was full of pupæ of a *Tortrix*, and at the end of the month, those I collected, produced the perfect insect, but I have been unable to determine either this or any other of my *Miero-Lepidoptera.*

MOLLUSCA.

Some of the Terrestrial Gasteropoda, enumerated below, were determined by W. G. Binney, Esq., of Burlington, New Jersey, and a portion of the Fresh Water species, and the *Naiades*, by Dr. Isaac Lea, of Philadelphia. It is not a little remarkable that *Unio radiatus*, which, as I am informed by Messrs. Billings and Bell, is very abundant in the Ottawa at L'Original, and at the mouth of the Rouge, is not found higher up the latter river. Shells of the genera *Limnæa*, *Physa* and *Planorbis*, were remarkably scarce in every lake except Sugar-bush Lake, Montcalm, and a small lake one mile west of the Indian Village on the Rouge in the Township of Arundel, and in fact it was only in places where the water was shallow and the bottom soft that they occurred at all. The valves of the *Unio* and *Anodontæ* were very much eroded in most of the lakes.

GASTEROPODA. (*Terrestrial.*)

1. *Tebennophorus caroliniensis*, Bosc. (Great grey Slug)—Common under bark of decaying logs, &c., throughout the district.
2. *Succinea obliqua*, Say.—Abundant under decaying logs on grass-land at Hamilton's Farm, in August. It occurred very sparingly on the leaves of bushes, in other parts of the district.
3. *Helix albolabris*, Say (White-lipped Snail).—Not very common; Township of Wentworth, Montcalm and Harrington.
4. " *exoleta*, Binney.—Not uncommon under dead logs in the Townships of Wentworth, Harrington and DeSalaberry.
5. " *monodon*, Rackett. (One-toothed Snail.)—Sparingly met with; portage from the Indian Village to Bark Lake, Arundel; Hamilton's Farm and near the Lake of Three Mountains.
6. " *concava*, Say.—Abundant under dead logs; Townships of Wentworth, Montcalm and Arundel. On one occasion I found an individual of this species devouring the animal of *Achatina lubrica*, having made a hole through the spire of its shell

7. *Helix pulchella*, Müll.—Occurred under stones at Carillon, but was not elsewhere met with.
8. " *Sayii*, Binney.—Several specimens were found by myself under dead logs in the woods near Doran's Lake, in the 10th Range of Grenville.
9. " *labyrinthica*, Say.—Common under dead logs, bark of stumps, in moss on the trunks of trees, &c.; Townships of Wentworth, Montcalm and Arundel.
10. " *alternata*, Say.—Abundant throughout the district, under dead logs and ascending the trunks of trees after rain.
11. " *striatella*, Anthony.—Very abundant under stones and dead logs everywhere throughout the district.
12. " *arborea*, Say.—Plentiful under bark of decaying trees, &c., throughout the district.
13. " *chersina*, Say.—Common under dead logs, &c., over the whole district.
14. " *lineata*, Say.—Abundant throughout the district.
15. *Bulimus marginatus*, Say.—Near Gate Lake, Wentworth, and Sugar-bush Lake, Montcalm.
16. *Achatina lubrica*, Müll.—Common under dead logs near Gate Lake, Wentworth, and Bevin's Lake, Montcalm.
17. *Vertigo Gouldii*, Binney.—In moss (*Neckera pennata*) on tree trunks; Sixteen Island Lake, Montcalm.
18. *Pupa* (undetermined)—With the last species.
19. *Carychium exiguum*, Say.—One specimen found near Sixteen Island Lake.

(*Fresh Water.*)

20. *Physa heterostropha*, Say.—Pools on grass near Grenville, and Sugar-bush Lake, Montcalm.
21. " *aurea*, Lea.—Sparingly in a small lake near Hamilton's farm.
22. " *elliptica*, Lea.—In a small lake one mile west of the Indian Village, Arundel; collected by Mr. J. Lowe.
23. " *elongata*, Say.—In great numbers copulating in pools on grass, near Grenville, May 13th.
24. *Limnæa reflexa*, Say.—Abundant in pools of water on grass land near the Village of Grenvile, May 13th.
25. " *umbilicata*, Say.—With the last species.
26. " *galbauns*, Say.—Abundant in shell marl from the bottom of Eagle Nest Lake, Wentworth.
27. " *plicata*, Lea.—This small species was numerous on dead leaves in Sugar-bush Lake, Montcalm, June 26th.
28. " *exigua*, Lea. (young)—In a small lake near Hamilton's farm.

29. *Planorbis trivolvis*, Say.—Collected by Mr. J. Lowe, in a small lake one mile west of the Indian Village on the Rouge, Township of Arundel.
30. " *bicarinatus*, Say.—In shell marl, and living in Eagle Nest Lake, Wentworth, and in a small lake near Hamilton's farm.
31. " *companulatus*, Say.—Pools near Grenville; Eagle Nest Lake, Wentworth; a small lake west of Chain Lake (a few dead specimens full of minute holes); Sugar-bush and Bevin's Lakes, Montcalm; the lake one mile west of the Indian Village, Arundel; and in a small lake near Hamilton's farm.
32. " *parvus*, Say.—Abundant in shell marl, Eagle Nest Lake, Wentworth; living in the lake one mile west of the Indian Village, and in one near Hamilton's farm.
33. " *deflectus*, Say.—Abundant amongst decaying leaves in shallow and muddy parts of Sixteen Island and Sugar-bush Lakes, Montcalm.
34. *Paludina decisa*, Say.—Very abundant the whole way up the Rouge and its tributary the Devil's River. Those collected are of a reddish brown colour, very unlike the light green of specimens from L'Orignal opposite the mouth of the Rouge, or those from the St. Lawrence near Montreal. They were encrusted with a rusty-red sponge-like substance.
35. *Valvata tricarinata*, Say.—A few specimens found in shell marl from the bottom of Eagle Nest Lake, Wentworth.

Conchifera (*Fresh Water.*)

1. *Unio complanatus*, Lea.—This was the only species of *Unio* met with. It inhabits nearly every lake in the district and was abundant the whole way up the Rouge as far as we ascended. In shallow and muddy parts of Sixteen Island Lake it attains a considerable size and weight, but in the other lakes and in the Rouge the specimens were generally rather small. It was most numerous in the stream through which the waters of Bevin's and Bark Lakes are discharged into the Rouge, where, in shallow places, thousands might be seen buried in the mud with only the tips of their valves sticking out, and as thick as they could lie together. The specimens collected vary much in shape, and in the colour of the interior of the valves, which, except those from Bevin's Lake, have hardly any of the beautiful purple colour generally possessed

by this species as it occurs in the St. Lawrence and Ottawa. The muskrats devour vast numbers both of this species and of the *Anodontæ*, depositing their empty valves in large heaps on the shores of the lakes and streams.

2. *Alasmodon rugosus*, Barnes.—One specimen obtained in the fourth small lake* west of Balsam or Chain Lake, Lot 11, Range 3, Montcalm.
3. *Anodonta cygnea?* Linn.—This species was found in almost every lake we visited. The largest specimen met with was obtained from a small lake occupying part of an ancient channel of the Rouge, near Hamilton's farm, and measured 4¾ inches in length and 2⅛ inches in height.
4. " *edentula*, Say.—One specimen obtained by Mr. J. Murray, at the same time with the specimen of *Alasmodon rugosus* in the lake situated in the 11th Lot, 3rd Range, Montcalm.
5. " *fragilis*, Linn.—Eagle Nest Lake, Wentworth; Sixteen Island and Bevin's Lakes, Montcalm.
6. " *Footiana*, Lea.—With the last species.
7. *Cyclas similis*, Say.—Living in Sixteen Island and Sugar-bush Lakes, Montcalm; in a small lake one mile west of the Indian Village, Arundel; and in shell marl in Eagle Nest Lake, Wentworth.
8. " *partumeia?* Say.—Young specimens amongst dead leaves in ponds near Eagle Nest Lake, Wentworth; in Sugar-bush Lake, Montcalm; and the small lake near Hamilton's farm.
9. " *dubia?* Say.—In shell marl, Eagle Nest Lake, and living in the small lake near Hamilton's farm.

EXETER, DEVONSHIRE, January 30, 1860.

* This lake communicates by a rapid stream with Sugar-bush Lake, which is connected with Bevin's Lake, and the latter is in direct communication with the Rouge by a large creek about two miles in length. The difference in level between these lakes and the Rouge is only a few feet, but there is a very considerable rise between them and Chain and Sixteen Island Lakes, which also empty their waters into Bevin's Lake, but by a very circuitous route. Bevin's Lake rises about 12 feet in spring when the snow disappears.

ARTICLE IX.—*Review of "Darwin on the Origin of Species by means of Natural Selection."**

Nothing is more humbling to the scientific enquirer than to find that he has arrived in the progress of his investigations at a point beyond which inductive science fails to carry him. The physicist finds himself in this position when required to explain the nature of matter, or the cause of gravitation or cohesion, or the essence of the mysterious influences of light, heat, and electricity. The chemist is equally baffled in the presence of those mysterious atoms which are in all his processes, yet are not perceptible to his senses The physiologist stands awe-stricken in the presence of a microscopic cell whose structure he knows, but whose origin and wonderful vital endowments he fails to comprehend. The geologist and the systematic zoologist are haunted in their dreams by those multifarious species that appear and disappear, like phantoms on the stage of geological time, yet seem so fixed and unchangeable in existing nature. True science is always humble, for it knows itself to be surrounded by mysteries—mysteries which only widen as the sphere of its knowledge extends. Yet it is the ambition of science to solve mysteries, to add one domain after another to its conquests, though certain to find new and greater difficulties beyond. Hence we find every difficult problem assailed by a constant succession of adventurers, some of them content cautiously to explore the ground and prudently to retreat where to advance is no longer safe; others gathering all their strength for a rush and a leap into an unknown and fathomless abyss. Both classes do good to science. The first show us the real nature of the difficulties to be overcome or to be abandoned as hopeless. The second we follow to the last crumbling margin of sound fact and deduction on which their feet have rested before their final plunge, and thus gain an experience that otherwise we should not have had the courage to seek.

The question of the origin of species yields in difficulty to none of the problems to which we have referred above, and Mr. Darwin's book is a noted instance of the second of the methods of

* *On the Origin of Species by means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life;* by CHARLES DARWIN, M.A. 1 vol. post 8vo. pp. 502. London: John Murray. New York: Appletons. Montreal: Dawson. 1860.

treatment which we have indicated. We do not however value him the less on account of his boldness and rash self-sacrifice in the cause of science. We follow him with pleasure over many agreeable and instructive paths not previously explored, and we shrink back only when he leads us to the brink of a precipice, and we fail to perceive the good land which he says lies beyond, or to place confidence in the bridge, thinner than gossamer, which he has woven to bear our feet over the gulf that separates the proved ground of specific variability from the mystery of specific difference. We regard this as the most accurate and concise statement that can be made respecting the character of this book. It elaborately investigates the question of variation of species, and illustrates its laws in a very full and satisfactory manner, though giving to some of these laws an undue prominence as compared with others. It then attempts to apply the laws of variation to an entirely different series of phenomena, those of specific diversity, and finding some analogies between the characters that distinguish species and varieties, seeks on this ground to break down all specific distinction in respect to origin, and to reduce all species to mere varieties of ancient and perhaps perished prototypes.

The work thus divides itself naturally into two distinct and quite dissimilar portions: 1st. The careful induction of facts bearing on the nature and laws of variation, in which the author appears in all his strength as a patient and reliable zoologist; and, 2nd. The wild and fanciful application of the results thus attained to another class of phenomena with which they have no connection except that of mere analogy. We shall endeavor to distinguish these two portions of the work, but cannot avoid treating of them together.

Variation occurs under two very different conditions. It takes place in domesticated animals and plants, and in animals and plants in a wild state. Very properly our author first examines its conditions under domestication, in which state variation is much more extensive and also more easily observed. The great variations that occur in a state of domestication are no doubt due to changed and unnatural conditions of life; but farther than this we know nothing of their precise causes. On this subject our author indulges in some preliminary speculations, and tries to rid the subject of what he terms misconceptions, some of which are, however, only facts too stubborn to be bent to his theory. For example, in speaking of the prevalent idea, that domesticated

animals have been chosen by man on account, among other things, of their capacity for variation, he says:—"I do not dispute that these capacities have added largely to the value of some of our domesticated productions; but how could a savage possibly know when he first tamed an animal whether it would vary in succeeding generations, and whether it would endure other climates? Has the little variability of the ass or the guinea-fowl, or the small power of endurance of warmth of the reindeer or of cold by the common camel, prevented their domestication? I cannot doubt that if other animals and plants equal in number to our domesticated productions, and belonging to equally diverse classes and countries, were taken from a state of nature, and could be made to breed for an equal number of generations under domestication, they would vary on the average as largely as the parent species of our existing domesticated productions have varied." On reading these sentences it must occur to any reflective reader, 1st. That savages very rarely tame animals. 2d. That if savages or others attempted to tame animals indiscriminately, they would fail in many cases, and these in the very cases in which species could endure little change. 3d. Animals little variable, like the reindeer and the camel, have little geographical range, and this just because of the fixity or tenderness of their constitution. 4th. Even the capacity of breeding at all under the changed conditions of domestication, is wanting in some species. In short, there is no reason whatever to believe that species are equally variable; but, on the contrary, that they differ very much in this respect,—as naturalists have always maintained. In the same loose way he treats the doctrine of the tendency of varieties to revert to the original types of the species. This, our author admits, if established, would overthrow his whole hypothesis, and he gets rid of it by denying the evidence of reversion afforded by so many of our domestic animals and cultivated plants, and by farther affirming that such reversion, if it does occur, amounts to nothing, because produced by external causes. Certain species, by the external causes applied in domestication, are caused to vary. These causes being removed, as every one knows, they gradually lose their acquired and unnatural characteristics; but, according to Mr. Darwin, this gives no evidence of an original type, but only of the operation of other causes of change, tending in some other direction. The argument would be good if we could have species destitute of all distinctive characters to begin with; in

other words, if we could create species. But as the case stands, it is a mere *petitio principii.*

In this way our author, in the opening paragraphs of his first chapter, quietly ignores a number of facts essential to the validity of the received views of species, and so leads the unwary reader to enter on the consideration of variation with an impression already formed that varieties and species are not distinguishable. We take the liberty of entering on the enquiry in another spirit, and of beginning with the fact that we have species which have remained distinct in the whole period of human experience, and also as far back in geological time as we can trace any of them. This being premised, we may enquire what variations man has been able to effect in those species which he has domesticated, and by what processes and under what laws these changes have occurred.

These changes have been very great. Mr. Darwin has studied the domestic pigeon as a convenient instance, and his investigations on this animal are worthy of all praise, and establish most clearly the great amount of variation of which some species are susceptible. We quote this in full, as the most valuable portion of the book:—

"Believing that it is always best to study some special group, I have, after deliberation, taken up domestic pigeons. I have kept every breed which I could purchase or obtain, and have been most kindly favoured with skins from several quarters of the world, more especially by the Hon. W. Elliot from India, and by the Hon. C. Murray from Persia. Many treatises in different languages have been published on pigeons, and some of them are very important, as being of considerable antiquity. I have associated with several eminent fanciers, and have been permitted to join two of the London Pigeon Clubs. The diversity of the breeds is something astonishing. Compare the English carrier and the short-faced tumbler, and see the wonderful difference in their beaks, entailing corresponding differences in their skulls. The carrier, more especially the male bird, is also remarkable from the wonderful development of the carunculated skin above the head, and this is accompanied by greatly elongated eyelids, very large external orifices to the nostrils, and a wide gape of mouth. The short-faced tumbler has a beak in outline almost like that of a finch; and the common tumbler has the singular and strictly inherited habit of flying at a great height in a compact flock, and

tumbling in the air head over heels. The runt is a bird of great size, with long massive beak, and large feet; some of the sub-breeds of runts have very long necks, others very long wings and tails, others singularly short tails. The barb is allied to the carrier, but, instead of a very long beak, has a very short and very broad one. The pouter has a much elongated body, wings, and legs; and its enormously developed crop, which it glories in inflating, may well excite astonishment and even laughter. The turbit has a very short and conical beak, with a line of reversed feather down the breast; and it has the habit of continually expanding slightly the upper part of the œsophagus. The Jacobin has the feathers so much reversed along the back of the neck that they form a hood, and it has, proportionally to its size, much elongated wing and tailfeathers. The trumpeter and laugher, as their names express, utter a very different coo from the other breeds. The fantail has thirty or even forty tailfeathers, instead of twelve or fourteen, the normal number in all members of the great pigeon family; and these feathers are kept expanded, and are carried so erect that in good birds the head and tail touch; the oil-gland is quite aborted. Several other less distinct breeds might have been specified."

"In the skeletons of the several breeds, the development of the bones of the face in length and breadth and curvature differs enormously. The shape, as well as the breadth and length of the ramus of the lower jaw, varies in a highly remarkable manner. The number of the caudal and sacral vertebræ vary; as does the number of the ribs, together with their relative breadth and the presence of processes. The size and shape of the apertures in the sternum are highly variable; so is the degree of divergence and relative size of the two arms of the furcula. The proportional width of the gape of mouth, the proportional length of the eyelids, of the orifice of the nostrils, of the tongue (not always in strict correlation with the length of beak), the size of the crop and of the upper part of the œsophagus: the development and abortion of the oil-gland; the number of the primary wing and caudal feathers; the relative length of wing and tail to each other and to the body; the relative length of leg and of the feet; the number of scutellæ on the toes, the development of skin between the toes, are all points of structure which are variable. The period at which the perfect plumage is acquired varies, as does the state of the down with which the nestling birds are

clothed when hatched. The shape and size of the eggs vary. The manner of flight differs remarkably; as does in some breeds the voice and disposition. Lastly, in certain breeds, the males and females have come to differ to a slight degree from each other."

"Altogether at least a score of pigeons might be chosen, which if shown to an ornithologist, and he were told that they were wild birds, would certainly, I think, be ranked by him as well-defined species. Moreover, I do not believe that any ornithologist would place the English carrier, the short-faced tumbler, the runt, the barb, pouter, and fantail in the same genus; more especially as in each of these breeds several truly-inherited sub-breeds, or species as he might have called them, could be shown him."

"Great as the differences are between the breeds of pigeons, I am fully convinced that the common opinion of naturalists is correct, namely, that all have descended from the rock-pigeon (*Columba livia*), including under this term several geographical races or sub-species, which differ from each other in the most trifling respects. As several of the reasons which have led me to this belief are in some degree applicable in other cases, I will here briefly give them. If the several breeds are not varieties, and have not proceeded from the rock-pigeon, they must have descended from at least seven or eight aboriginal stocks; for it is impossible to make the present domestic breeds by the crossing of any lesser number: how, for instance, could a pouter be produced by crossing two breeds unless one of the parent-stock possessed the characteristic enormous crop? The supposed aboriginal stocks must all have been rock-pigeons, that is, not breeding or willingly perching on trees. But besides *C. livia*, with its geographical sub-species, only two or three other species of rock-pigeons are known; and these have not any of the characters of the domestic breeds. Hence the supposed aboriginal stocks must either still exist in the countries where they were originally domesticated, and yet be unknown to ornithologists; and this, considering their size, habits, and remarkable characters, seems very improbable; or they must have become extinct in the wild state. But birds breeding on precipices, and good fliers, are unlikely to be exterminated; and the common rock-pigeon, which has the same habits with the domestic breeds, has not been exterminated even on several of the smaller British islets, or on the shores of the Mediterranean. Hence the supposed extermination of so many species having similar habits with the rock-pigeon seems to

me a very rash assumption. Moreover, the several above-named domesticated breeds have been transported to all parts of the world, and, therefore, some of them must have been carried back again into their native country; but not one has ever become wild or feral, though the dovecot-pigeon, which is the rock-pigeon in a very slightly altered state, has become feral in several places. Again, all recent experience shows that it is most difficult to get any wild animal to breed freely under domestication; yet on the hypothesis of the multiple origin of our pigeons, it must be assumed that at least seven or eight species were so thoroughly domesticated in ancient times by half-civilized man, as to be quite prolific under confinement."

"An argument, as it seems to me, of great weight, and applicable in several other cases, is, that the above-specified breeds, though agreeing generally in constitution, habits, voice, colouring, and in most parts of their structure, with the wild rock-pigeon, yet are certainly highly abnormal in other parts of their structure: we may look in vain throughout the whole great family of Columbidæ for a beak like that of the English carrier, or that of the short-faced tumbler, or barb; for reversed feathers like those of the jacobin; for a crop like that of the pouter; for tail-feathers like those of the fan-tail. Hence it must be assumed not only that half-civilized man succeeded in thoroughly domesticating several species, but that he intentionally or by chance picked out extraordinarily abnormal species; and further, that these very species have since all become extinct or unknown. So many strange contingencies seem to me improbable in the highest degree."

"Some facts in regard to the colouring of pigeons well deserve consideration. The rock-pigeon is of a slaty-blue, and has a white rump (the Indian sub-species, *C. intermedia* of Strickland, having it bluish); the tail has a terminal dark bar, with the bases of the outer feathers externally edged with white; the wings have two black bars; some semi-domestic breeds and some apparently truly wild breeds have, besides the two black bars, the wings chequered with black. These several marks do not occur together in any other species of the whole family."

"Now, in every one of the domestic breeds, taking thoroughly well-bred birds, all the above marks, even to the white edging of the outer tail-feathers, sometimes concur perfectly developed. Moreover, when two birds belonging to two distinct breeds are

crossed, neither of which is blue or has any of the above-specified marks, the mongrel offspring are very apt suddenly to acquire these characters; for instance, I crossed some uniformly white fantails with some uniformly black barbs, and they produced mottled brown and black birds; these I again crossed together, and one grandchild of the pure white fantail and pure black barb was of as beautiful a blue colour, with the white rump, double black wing-bar, and barred with white-edged tail-feathers, as any wild rock-pigeon. We can understand these facts, on the well-known principle of reversion to ancestral characters, if all the domestic breeds have descended from the rock-pigeon. But if we deny this, we must make one of the two following highly improbable suppositions. Either, firstly, that all the several imagined aboriginal stocks were coloured, and marked like the rock-pigeon, although no other existing species is thus coloured and marked, so that in each separate breed there might be a tendency to revert to the very same colours and markings. Or, secondly, that each breed, even the purest, has within a dozen or, at most, within a score of generations, been crossed by the rock pigeon: I say within a dozen or twenty generations, for we know of no fact countenancing the belief that the child ever reverts to some one ancestor, removed by a greater number of generations. In a breed which has been crossed only once with some distinct breed, the tendency to reversion to any character derived from such cross will naturally become less and less, as in each succeeding generation there will be less of the foreign blood; but when there has been no cross within a distinct breed, and there is a tendency in both parents to revert to a character, which has been lost during some former generation, this tendency, for all that we can see to the contrary, may be transmitted undiminished for an indefinite number of generations. These two distinct cases are often confounded in treatises on inheritance."

"Lastly, the hybrids or mongrels from between all the domestic breeds of pigeons are perfectly fertile. I can state this from my own observations, purposely made on the most distinct breeds. Now, it is difficult, perhaps impossible, to bring forward one case of the hybrid offspring of two animals *clearly distinct* being themselves perfectly fertile. Some authors believe that long-continued domestication eliminates this strong tendency to sterility: from the history of the dog I think there is some probability in this hypothesis if applied to species closely related together,

though it is unsupported by a single experiment. But to extend the hypothesis so far as to suppose that species, aboriginally as distinct as carriers, tumblers, pouters, and fantails now are, should yield offspring perfectly fertile, *inter se*, seems to me rash in the extreme."

"From these several reasons, namely, the improbability of man having formerly got seven or eight supposed species of pigeons to breed freely under domestication; these supposed species being quite unknown in a wild state, and their becoming nowhere feral; these species having very abnormal characters in certain respects as compared with all other Columbidæ, though so like in most other respects to the rock-pigeon; the blue colour and various marks occasionally appearing in all the breeds, both when kept pure and when crossed; the mongrel offspring being perfectly fertile;—from these several reasons, taken together, I can feel no doubt that all our domestic breeds have descended from the *Columba livia* with its geographical sub-species."

"In favour of this view, I may add, firstly, that *C. livia*, or the rock-pigeon, has been found capable of domestication in Europe and in India; and that it agrees in habits and in a great number of points of structure with all the domestic breeds. Secondly, although an English carrier or short-faced tumbler differs immensely in certain characters from the rock-pigeon, yet by comparing the several sub-breeds of these breeds, more especially those brought from distant countries, we can make an almost perfect series between the extremes of structure. Thirdly, those characters which are mainly distinctive of each breed, for instance the wattle and length of beak of the carrier, the shortness of that of the tumbler, and the number of tail-feathers in the fantail, are in each breed eminently variable; and the explanation of this fact will be obvious when we come to treat of selection. Fourthly, pigeons have been watched, and tended with the utmost care, and loved by many people. They have been domesticated for thousands of years in several quarters of the world; the earliest known record of pigeons is in the fifth Egyptian dynasty about 3000 B. C., as was pointed out to me by Professor Lepsius; but Mr. Birch informs me that pigeons are given in a bill of fare in the previous dynasty. In the time of the Romans, as we hear from Pliny, immense prices were given for pigeons; "nay, they are come to this pass, that they can reckon up their pedigree and race." Pigeons were much valued by Akber Khan in India

about the year 1600; never less than 20,000 pigeons were taken with the court. "The monarchs of Iran and Turan sent him some very rare birds;" and, continues the courtly historian, "His Majesty, by crossing the breeds, which method was never practised before, has improved them astonishingly." About this same period the Dutch were as eager about pigeons as were the old Romans. The paramount importance of these considerations in explaining the immense amount of variation which pigeons have undergone, will be obvious when we treat of Selection. We shall then, also, see how it is that the breeds so often have a somewhat monstrous character. It is also a most favourable circumstance for the production of distinct breeds, that male and female pigeons can be easily mated for life; and thus different breeds can be kept together in the same aviary."

The common rock-pigeon is thus proved to be highly variable in a state of domestication, so much so that naturalists not aware of all the facts, might well be excused for concluding, as some of them have done in the similar instances of the ox, the domestic fowl, and man himself, that the varieties represent several distinct species. To what then do these differences amount? (1) They are mainly in non-essential points, as colour, development of feather, etc., and they do not consequently interfere, to any important extent, with the food and habits of the animal; or if we were to represent the matter from the opposite point of view to that taken by Mr. Darwin, the constitution and instincts of the species being fixed by the law of its creation, it cannot vary beyond these. The author is clearly wrong in stating that any of them could amount to generic distinctions; that is, if genera are to be based on *structural* differences, for of these there is comparatively little, except in the one point of proportion of parts, difference in which is of specific value only, and often occurs in near varieties. (2) Many of the differences are abnormal; that is, they are of the character of monstrosities, and this separates them widely from true specific differences. (3) The varieties are perfectly fertile, which is not the case with hybrids between clearly distinct species. (4) The cross breeds revert to the characters of the rock-pigeon, showing that the specific type still remains uneradicated, or that each variety is, so to speak, a hemitropic form, which, when united with an opposite one, tends to reproduce the original form. It follows from these results, that, however

likely to be mistaken for species, the varieties of the pigeon are really something essentially different from true species, and the same conclusion would hold with any animal that could be selected.

We now come to the causes of variation in a state of domestication; and here, already, in the twenty-ninth page of his volume, we find our author leaving the basis of fact and losing himself in the mazes in which he henceforth continues to wander. He attributes the varieties of domestic animals to "Man's power of accumulative selection; nature gives successive variations; man adds them up in certain directions useful to him." We object to this, as altogether a partial and imperfect statement. It is not nature that gives the variations, but external circumstances; while nature only gives a certain capacity to vary, the extent of which is the point in question. Man places animals in abnormal conditions into which their instincts and natural powers would not permit them of themselves to enter. They vary in consequence of these, sometimes suddenly, sometimes gradually, sometimes from premeditated treatment, sometimes unaccountably, sometimes in directions useful to man, sometimes the reverse. Out of all the diversities thus produced, man no doubt selects what suits him, and keeps it, as far as he can, in the conditions favorable to its permanence and improvement; but such selection is a comparatively small part of the actual cause of the phenomena observed, which result really from unnatural conditions of life compelled by man. Who selected, for example, the niata cattle of South America, the hairless dogs of Chili, the tail-less cats of the Isle of Man, and many other forms?

Selection is no doubt an important cause of the continuation and improvement of varieties, and has also, as our author maintains, been practised from a very remote antiquity in the case of the more valuable domesticated animals. He might have referred to a more ancient case than any of those he has noticed. Laban selected all the speckled cattle from Jacob's flock, understanding very well the principle of selection; but Jacob was better informed than Laban or Mr. Darwin, and not trusting to selection, but knowing the effect of external influences and their special importance in the embryonic state, he set up peeled twigs before the pregnant cattle, and so acting on the embryo through the senses of the mother, produced the variety he desired. The undue prominence given to selection by our author is the main basis on which he subsequently proceeds.

His next step is to establish analogies between variation and specific difference, as observed in nature. Many species are doubtful; that is, naturalists are not quite decided that they may not be varieties. This is true; but such species are the exceptions, and the differences of view have arisen as much from defective observation or reasoning as from any real difficulty. Again, in large genera the species approach each other very nearly. This is inevitable from the nature of the case, and though it may cause difficulties in distinguishing them, it proves nothing as to their not being true species. Species which range widely also are prone to vary, and this also follows from the nature of the case, great range and much variability being really cause and effect, and reacting on each other. Farther, it is stated that species belonging to large genera are more prone to vary than species belonging to small genera. This has not been established as a general principle, nor, if it should be, would it necessarily bear the interpretation put upon it. To reach the facts we must be certain that we are comparing natural genera consisting of species having true affinities of structure, and that all our generic distinctions are based on the same grades of difference. Further, we must make separate lists of the genera small now but large if we take all geological time, as for instance the genus *Lingula*, of genera small in any particular country, but large if the whole world be taken; and lastly, of genera large in some particular region or country. This last is the only case which can fairly test Mr. Darwin's principle, and we must say that in our limited experience there appear to be quite as many exceptions as agreements with the rule. Take, for instance, the genera *Solidago* and *Aster* among American plants, which, though growing together in numerous species, are not remarkably variable. Further, when a generic type has proved suitable to occupy many places in a particular country, it may well be that many of its species will be capable of a wide range, and so variable. For such reasons we hold that the attempt made on the ground of analogies between the species and the variety to break down the distinction between them signally fails.

But if the reader is willing to take this for granted, Mr. Darwin will carry him a step further. He next proceeds to maintain that in nature there is a power of selection similar to that which the breeder exercises—a power of "Natural Selection" not heretofore recognised, and by virtue of which varieties are produced and developed

into species. There is here a huge hiatus in the reasoning of our author. We have already shown that an excessive importance is attributed to artificial or human selection; but with all the exaggeration of its powers, it has proved insufficient to change one species into another. The pigeon, with all its varieties, is still a pigeon, and, according to our author's own conclusive argumentation, a rock-pigeon. It is not a wood-pigeon, or turtle dove, still less a partridge or a rook. But now we are asked to believe that those same natural courses which break down all the breeder's elaborate distinctions so soon as his breeds are allowed to intermix and live in a natural way, are themselves able to take up the work and do still greater marvels in the way of selection. Such a doctrine is self-contradictory, and, we believe wholly incapable of proof; but let us see how this is attempted:

As might have been anticipated, natural selection being either creation or nothing, a new power is evoked as a *primum mobile*. This is the "struggle for existence," a fancied warfare in nature, in which the race is always to the swift and the battle to the strong, and in which the struggle makes the strong stronger. In a previous chapter we have been told very truly that the reason why the wealthy and skilful breeder succeeds in producing marked races is that his animals are cared for and pampered, while the savage and the poor man fail because their animals must struggle for subsistence. Nature it appears takes the opposite way, and improves her breeds by putting them through a course of toil and starvation, a struggle not for happiness or subsistence, but for bare existence. We can understand how this should deteriorate and degrade species, as we know it has done in every case of the kind that we have observed; but how it should elevate or improve is past comprehension. But does nature deserve to be charged with such niggardliness, and with so concealing it that all the world seems to be full of happiness and plenty, except where poor man toils on in his poverty? In looking for the proof of this strange doctrine, we find stated in support of it only a number of isolated and exceptional facts, many of them cases in which man interferes with the equilibrium of nature; and we have to fall back on the general statement that the struggle for existence inevitably follows from the high rate at which organic beings tend to increase but this Malthusian doctrine, though good for a single species viewed by itself, is false for the whole in the aggregate. Vegetable life and the lower forms of animal life support the higher,

and these supporting forms increase far more rapidly than those that subsist on them. So much so, that vast quantities of organic food go to waste, or would do so but for the hordes of scavengers of low organization that seem specially created to gather up the fragments of nature's bounteous feast. Plant life thrives on the exhaustless stores of inorganic food provided for it by the soil and the atmosphere. Plant life supports animal life; but who ever saw the floor of the ocean denuded of its algæ, or the landscape bared of its verdure by the struggle of feeders for existence, except in a rare and exceptional case, as in a flight of locusts? There is always enough and to spare. Again, do the insects fail or become scarce under the ceaseless attacks of the insectivorous birds? Do not *Clios* and *Salpas* and coral polyps abound almost as much as if not preyed on by countless fishes and other animals? The beautiful harmony of nature provides that the feeders shall multiply more slowly than the food, and that the food shall be kept under by the feeders. When any form does locally multiply too far, the checks appear, usually in the form of a diminished reproduction or in the more rapid removal of the infirm, the sickly and the aged. When through the slow operation of physical causes or the introduction of new species, certain forms of life can no longer find the means of subsistence, all the facts we know indicate their disappearance, not their change into new forms. Nay, species verging to extinction or struggling for existence, like the red deer of Scotland, degenerate rather than improve, and must necessarily do so, so long as the laws of organic being remain what they are. In short, the struggle for existence is a myth, and its employment as a means of improvement still more mythical.

Were we bound to argue for such a thesis as that proposed by Mr. Darwin, we should much rather take up our ground on the improvement of the physical conditions of the earth, and maintain that each species finding its means of subsistence and happiness constantly extending, exerted itself for their occupancy, and so developed new powers. This would have the advantage of giving a more agreeable view of nature, and of accounting for elevation; as if nature, like a skilful breeder, were giving constantly better food or pasture, instead of imitating the luckless experimenter who strove to reduce the daily food of the horse to a single straw.

The remarks that we have made on natural selection, and the struggle for existence, afford a key to the whole of Mr. Darwin's argument, which amounts to little else than a wholesale appropria

tion of all the effects of external conditions of existence to these supposed causes of change. We could fill pages with evidence of the entire confusion of ideas which pervades his mind on this point, but one extract must suffice, both as an indication of this confusion, and as a fair example of the argument:

"How much direct effect difference of climate, food, &c., produces on any being is extremely doubtful. My impression is that the effect is extremely small in the case of animals, but perhaps rather more in that of plants. We may, at least, safely conclude that such influences cannot have produced the many striking and complex co-adaptations of structure between one organic being and another, which we see everywhere throughout nature. Some little influence may be attributed to climate, food, &c.: thus, E. Forbes speaks confidently that shells at their southern limit, and when living in shallow water, are more brightly coloured than those of the same species further north or from greater depths. Gould believes that birds of the same species are more brightly coloured under a clear atmosphere, than when living on islands or near the coast. So with insects, Wollaston is convinced that residence near the sea affects their colours. Moquin-Tandon gives a list of plants which when growing near the sea-shore have their leaves in some degree fleshy, though not elsewhere fleshy. Several other such cases could be given."

"The fact of varieties of one species, when they range into the zone of habitation of other species, often acquiring in a very slight degree some of the characters of such species, accords with our view that species of all kinds are only well-marked and permanent varieties. Thus the species of shells which are confined to tropical and shallow seas are generally brighter coloured than those confined to cold and deeper seas. The birds which are confined to continents are according to Mr. Gould, brighter coloured than those of islands. The insect species confined to sea-coasts, as every collector knows, are often brassy or lurid. Plants which live exclusively on the sea-side are very apt to have fleshy leaves. He who believes in the creation of each species, will have to say that this shell, for instance, was created with bright colours for a warm sea; but that this other shell became bright coloured by variation when it ranged into warmer or shallower waters."

"When a variation is of the slightest use to a being, we cannot tell how much of it to attribute to the accumulative action of natural selection, and how much to the conditions of life. Thus,

it is well known to furriers that animals of the same species have thicker and better fur the more severe the climate is under which they have lived; but who can tell how much of this difference may be due to the warmest-clad individuals having been favoured and preserved during many generations, and how much to the direct action of the severe climate? for it would appear that climate has some direct action on the hair of our domestic quadrupeds."

"Instances could be given of the same variety being produced under conditions of life as different as can well be conceived; and, on the other hand, of different varieties being produced from the same species under the same conditions. Such facts show how indirectly the conditions of life must act. Again, innumerable instances are known to every naturalist of species keeping true, or not varying at all, although living under the most opposite climates. Such considerations as these incline me to lay very little weight on the direct action of the conditions of life. Indirectly, as already remarked, they seem to play an important part in affecting the reproductive system, and in thus inducing variability; and natural selection will then accumulate all profitable variations, however slight, until they become plainly developed and appreciable by us."

It would be possible to fill up the remainder of our space with the objections we have to the statements in these few paragraphs. The scepticism as to the effects of food, climate, &c., in producing variation, and the effects attributable to a supposed selecting power which can merely act on such changes when previously induced; the failure to perceive that the adaptation of certain species to certain conditions of life necessarily implies that if other species not so adapted migrate within the influence of the conditions, they must, so far as their natures permit, be influenced by them; that in short such variation vindicates the wisdom of the Creator while showing that the plasticity of species may simulate in a humble way specific distinctness; the feeble attempt to attribute the warm fur of northern varieties to selection, while manifestly unable to deny that climatic influence is the main cause; these are specimens of a style of thought which pervades the whole book, and which leaves the task of a reviewer hopeless, for it would require a book as large as the original to expose the fallacies which appear in every paragraph.

In one respect Mr. Darwin vindicates fully his well-earned

reputation as a scientific naturalist. He fairly and ably states the many objections to his view that must occur to the minds of zoologists, botanists and geologists, and manfully, though unsuccessfully, attempts to cope with them.

Such objections are, the geographical distribution of the creatures supposed in Mr. Darwin's view to be nearly related by descent, the want of the innumerable transitional forms that should exist, the difficulty of accounting for the peculiar instincts of many animals, the sterility of first crosses and hybrids compared with the fertility of crosses of varieties, the want of any trace of unlimited variation in the geological succession of animals.

We shall only refer to the last of these, the geological objection. Geology he admits shews no trace of the "finely graduated organic chain" which in his theory should connect man with the extinct kangaroo-rat-like marsupials of the oolite and trias, and all our existing animals and plants with the perished creatures supposed to be their progenitors. He has but one explanation of this, the "extreme imperfection of the geological records." To illustrate this imperfection, he refers to the immense lapse of time involved in the geological record, to the small number of species known compared with this great lapse of time, to the breaks caused by the absence of fossiliferous deposits at certain periods. All these are fair abatements from the completeness of the geological series, and many of the remarks made on them are very valuable; but they do not mitigate the condemnation of the selection theory pronounced by geology. Breaks in the geological record are usually only local, and if general, might indicate actual destruction and renewal of species. Though it is true that estuary and land deposits have in most cases been preserved only in times of subsidence; this is not true of marine deposits, some of the most perfect of which mark times of elevation. Moreover, in those parts of the geological scale which are the most perfect and unbroken, there is no graduated transition of forms. Take for instance the great Silurian limestones of America, or the plant-bearing beds of the coal formation. In both we find some species perseveringly unchanged through many great deposits, and others suddenly appearing and disappearing, and this in cases where the profusion of specimens and continuity of formations preclude any supposition of much imperfection in the evidence. Nothing is more conclusive on this subject than the last of the fossiliferous deposits, next to the modern period; as, for instance, the Post-Pliocene clays and

sands of Canada. These belong to a period of elevation proceeding gradually from the time of the boulder formation up to the modern era. In these deposits we have more than stxty species of invertebrate animals, all except one or two known to be now living in the Gulf of St. Lawrence. Yet in all this lapse of time not one of the species has, by natural selection or any other cause, varied more than its living relatives now do. Still further, one or two species, as the *Leda truncata* and *Trichotropis arctica*, now found only in the Arctic seas, are quite like their modern representatives in those distant waters. They had plenty of time to vary, in order to suit the new circumstances, but they could not. Further, at the same time when these shells lived in the plains of Canada, Arctic plants, conveyed probably by ice, became settled on the White Mountains, the descendants of which still remain isolated but unchanged. Such facts as these are conclusive, notwithstanding the imperfection of the geological record on other points.

In one point our author endeavors to find support to his views from geological evidence, in the resemblance of successive faunas of the same locality to each other. The extinct tertiary animals of South America, New Zealand and Australia, for example, are like in type to those now inhabiting the same regions. But then we have no connecting links, and hence it seems more probable that successive creations were conformed to the same generic types, because the physical conditions remained unchanged, than that the modern sloths, for example, are degenerate descendants of the *Megatheria*. Farther, it does not seem to have occurred to Mr. Darwin that these resemblances are confined to the southern hemisphere. They do not obtain at all in North America, in Northern Asia, in Europe. In these countries new types have replaced the old, and certain old species, like the musk ox, the megaceros, the beaver, the aurochs, have become locally or wholly extinct, instead of undergoing change. All this has happened no doubt because the modern conditions are too dissimilar from the ancient to permit the continuance of old forms under any variety of them, and thus new forms have been introduced.

In his closing chapters the author endeavours to shew that his theory accounts in a satisfactory manner for the typical likeness of species to each other, for the curious embryological relations of animals, and for the existence of rudimentary organs; but all these things are equally intelligible on the opposite view. If spe-

cies are parts of a plan devised by an intelligent Creator, that plan must appear in their structures. If the plan embraces more general and more specialised contrivances, the latter must, in their earlier stages of growth, simulate the former. All organs, if there is a plan at all, must appear in its different parts in different degrees of relative perfection and complexity, and what we call rudimentary organs are merely the lowest of these degrees; not useless, for in many cases we know their uses, but of less relative importance than in other cases.

We have in the foregoing remarks dwelt chiefly on the points in which we believe the author to be mistaken; but we do not wish to undervalue the work. In many respects it is eminently useful. It shews, in opposition to many views maintained with much vigour on this side of the Atlantic, the great variability of species. It imposes a salutary caution on those naturalists who too readily admit geographical distribution as an evidence of specific distinctness. It illustrates by a vast fund of curious fact the obscure laws of variation and hybridity. All these pearls are not the less valuable to the judicious reader, that the author has seen fit to string them upon a thread of loose and faulty argument, and to employ them to deck the faded form of the transmutation theory of Lamarck.

In conclusion, it is but fair to state in his own words the ultimate deductions of the author, and then the opposite view, as maintained by the greater number of naturalists:—

"It may be asked how far I extend the doctrine of the modification of species. The question is difficult to answer, because the more distinct the forms are which we may consider, by so much the arguments fall away in force. But some arguments of the greatest weight extend very far. All the members of whole classes can be connected together by chains of affinities, and all can be classified on the same principle, in groups subordinate to groups. Fossil remains sometimes tend to fill up very wide intervals between existing orders. Organs in a rudimentary condition plainly show that an early progenitor had the organ in a fully developed state; and this in some instances necessarily implies an enormous amount of modification in the descendants. Throughout whole classes various structures are formed on the same pattern, and at an embryonic age the species closely resemble each other. Therefore I cannot doubt that the theory of descent with modification embraces all the members of the same class.

I believe that animals have descended from at most only four or five progenitors, and plants from an equal or lesser number.

"Analogy would lead me one step further, namely, to the belief that all animals and plants have descended from some one prototype. But analogy may be a deceitful guide. Nevertheless all living things have much in common, in their chemical composition, their germinal vesicles, their cellular structure, and their laws of growth and reproduction. We see this even in so trifling a circumstance as that the same poison often similarly affects plants and animals; or that the poison secreted by the gall-fly produces monstrous growths on the wild rose or oak-tree. Therefore I should infer from analogy that probably all the organic beings which have ever lived on this earth have descended from some one primordial form, into which life was first breathed."

We may well ask what is gained by such a result, even if established. The origin of species, as we now have them, it is true is mysterious, but what is gained by reducing them all to one primitive form? That would be an equal mystery, more especially if it included within itself the germs of all the varied developments of animal and plant life. By such a doctrine also we involve ourselves in a host of geological and other difficulties, and so break down the distinction between species and varieties as to deprive our classifications of any real value. On the contrary, if we are content to take species as direct products of a creative power, without troubling ourselves with supposed secondary causes, we may examine, free of any trammelling hypothesis, the law of their succession in time, the guards placed upon their intermixture, the limits set to their variation in each case, the remarkable arrangements for diminishing variations by the natural crossing of varieties, the laws of geographical distribution from centres of origin, and the physical causes of variation, of degeneracy, of extinction.

All these are questions to be investigated apart from any hypothesis of the common origin of different species on the one hand, or of the diverse origin of individuals apparently identical on the other; and we cannot doubt that the results will approach to the following conclusions. (1) That the origin of specific distinctness lies beyond the domain of any natural law known to us. (2) That the variations of the species are the effects of the combined influences of its natural endowments and of external circumstances. (3) That

in nature specific force and causes of variation constitute antagonist powers, acting and reacting on each other, and thus producing an equilibrium which is disturbed only by the artificial contrivance of man. We are quite certain that the belief of naturalists in these great doctrines will eventually be confirmed by Mr. Darwin's book, and that his failure, with all the immense mass of facts at his disposal, to maintain the theory of transmutation, will give an eternal quietus to the Lamarckian hypothesis; though we shall be quite prepared to find that for a time it may gain a wide acceptance with young naturalists, and with those who are willing to adopt any amount of error rather than appear not to be on a level with the latest scientific novelties. For this signal service to science we sincerely thank him, though we are sorry that it has been rendered by a man whose sincerity and honesty of purpose all who know him respect and love, and to whom natural science is under so many eminent obligations.

Since writing the above, we have seen able reviews of Mr. Darwin's work by Prof. Gray and Prof. Huxley. Both naturalists dissent from his ultimate conclusions as not satisfactorily proved, though neither, in our view, insists sufficiently on the fundamental unsoundness of the argument.

J. W. D.

ARTICLE X.—*Abridged Sketch of the life of Mr. David Douglas, Botanist, with a few details of his travels and discoveries.*

The inducement for collecting the few scattered fragments that are to be found in the following pages, is the desire to prolong somewhat, the public remembrance of one who was warmly attached to Natural History, and who also in his own short day, largely contributed by his enterprise and unwearied spirit of research, to swell the list of novelties in some of its principal departments. Cut down in the prime of life, and in the midst of his usefulness, his memory is still fondly cherished by his friends, and his successful exertions in his sphere of labour have procured him among botanists, an undying fame. Had he lived, he would have attained to the highest celebrity as a traveller, for his diligence in investigating, and accuracy in observing, would have tended to elucidate much that is of great interest in the physical geography of the earth.

David Douglas, of humble but respectable parentage, was born at Scoone in Perthshire in the last year of the last century. He received his early education at the parish school of Kinnoul, in the neighbourhood. He was somewhat wayward, and therefore frequently the mark for the master's ire. Trout-fishing and bird-nesting held out temptations too strong for the lively boy, and such occupations often lengthened his road, if they did not entirely prevent his march to school. His love of nature soon displayed itself in the rearing of birds, collecting of plants, and other such amusements. Following up these early intuitions, employment was found for him, first in the nursery ground and then in the gardens of the Earl of Mansfield, at Stowe.

Here his zeal and industry were so conspicuous, that they gained him the esteem and affection of the superintendent. After a seven years apprenticeship in these gardens, where he acquired a thorough knowledge of the practical part of gardening, the friendship of the superintendent Mr. Beatty, procured him a situation under Mr. Alexander Stewart, who had charge of the gardens at Valleyfield, the seat of Sir Robert Preston near Culross. There being at this place a very choice collection of plants, the attractions of the kitchen-garden and of out-door work, soon lost their weight with young Douglas, who now began to study botany, and to attach himself to the care of the exotics, of which Valleyfield could boast a magnificent display. Being very careful of the plants committed to his care, Mr. Stewart showed him much kindness, and allowed him the privilege and advantage of Sir Robert's botanical library. Such an opportunity was not lost by the youthful naturalist. The second year he became foreman to Mr. Stewart, when upon application, he gained admission to the Botanical gardens at Glasgow. This nursery of botanists was still in its infancy, but advancing rapidly to high reputation under the knowledge, skill, and fostering influence of Professor Hooker, since whose time, a succession of able and indefatigable Botanists have well preserved its celebrity. The energetic working qualities of Douglas, and his vivacity of disposition, speedily procured him the esteem and regard of all connected with the gardens; and the valuable friendship of the professor, which he at this time acquired, may be looked upon as the reward of his sterling merits. For the Professor, now Sir W. Jackson Hooker, I have heard him express such sentiments as a son might hold for a revered and beloved parent. First a diligent attendant at the botanical lectures,

next a favourite companion of the professor during his periodical excursions through the Highlands of Scotland, his capacity was quickly recognised by the keen judgment of Hooker. and the noble qualities of his mind pointed him out as one from whom much might be expected.

Douglas was afterwards recommended as botanical collector to the London Horticultural Society, for which he was indebted to Sir William, as well as to Mr. Stewart, Nursery Curator of the Glasgow Botanic Gardens, who always took a lively interest in his welfare. The recommendation was attended to, and the first appointment made out for the young botanist was to the United States. In the summer of 1823, he there procured many fine plants for the Society and added greatly to its collection of fruit trees. Pleased with his exertions, the Horticultural Society, thought of a wider field for their new collector, and the interior of North West America being a region yet unexplored by any naturalist, they wisely determined upon availing themselves of Douglas's youthful vigour and talents in that quarter. Joseph Sabine Esquire, then Honorary Secretary to the Society, took the most friendly notice of Douglas, and was also highly interested in the success of his mission, and the then Governor or Deputy-Governor of the Hudson's Bay Company, afforded every kind assistance, and such valuable information towards the prosecution of his labors, as to insure happy results.

The 25th of July 1824, found our scientific adventurer on board the Hudson Bay Company's ship William and Anne, fortunate in having the companionship of Dr. Scouler of Glasgow, a younger man than himself, but ardently devoted to everything pertaining to natural history. An extract from the sketch of his life taken from a London botanical periodical, will give some idea of the style in which Douglas recorded his observations on living nature. After crossing the tropics, he writes thus of the Albatross.

"While within the paralells of 50° and 60°, I caught sixty-nine "specimens of *Diomeda*, consisting of *D. exulans, fulginosa*, and "*chlororynchos*. The last, though a smaller bird than the first, "reigns lord paramount over the rest, and compels them all to flee "at his approach. It is stated by most authors that these birds "are taken with the greatest ease during warm weather; it was "only during the driving gusts of a storm that I could secure them, "and on such occasions they fight voraciously about the bait, the "hook often being received into the stomach. The appearance of

" these birds is grand and majestic; the largest which I ever saw,
" measured twelve feet four inches from tip to tip of the extended
" wings, and four feet from the point of the beak to the end of the
" tail. As respects their flight, the same remarks apply to all the
" species. When sitting on the water their wings are raised ex-
" actly like a swan's; when feeding they are somewhat higher, with
" a constant tremulous motion like those of the hawk tribe; and
" when elevating themselves in the water to soar in the air, they
" first walk the water, skimming the surface with the points of
" their pinions for the distance of several hundred yards, before
" they seem able to raise themselves, which they generally do with
" the utmost grace, and with scarcely any apparent movement of
" their wings. They are of a bold and savage disposition, which
" is especially displayed when they are captured."

At the island of Juan Fernandez he fell in with a poor sailor, named William Clarke, who had employment from the Spaniards who visit this place for the purpose of killing seals and wild cattle, which were plentiful. Near the remains of an old church once built there, Douglas writes " there is a circular oven, built of London
" fire-brick, seven feet in diameter within, bearing the date 1741,
" and therefore probably built by Anson during his residence."

" Some pigeons of a small blue species, now occupy it as their
" cote. There were eggs in it but no young ones. I pointed it out
" to Clarke, and advised him to make use of this colony."

In the old gardens were found peaches of three or four sorts, quinces, apples, and pears; figs and vines were also in a thriving state. Before leaving, Douglas left with Clarke, the seeds of some culinary vegetables, radishes being the only article of that kind that appeared to be on the island. Douglas's eye was alive to all that is picturesque, and his glowing description of that enchanting spot, is thus given with the spirit of a botanist.

" No pen, indeed, can correctly describe the charming and rural
" appearance of this island; the numerous rills descending through
" valleys overshadowed by luxuriant verdure, and terminating in
" dark recesses and rocky dells, where wave the fronds of *Lomatia*,
" *Aspidia* and *Polypodia*, several species of which are new and of
" princely form and growth. On the hills grow several kinds of
" *Escallonia*, *Berberis*, *Lobelia*, *Hordeum*, and *Avena*. During
" my short stay, I gathered seventy distinct and highly interesting
" plants. The species of birds were few and not beautiful."

Arrived at the Gallipagos, Mr. Douglas was on shore on one of

that group, named James island, from which he drew a fair collection of both birds and plants, nearly all of which were lost to him in consequence of the dampness of the vessel below, and the incessant rains upon deck. Of one hundred and seventy-five species of plants gathered, he saved but fifty, and of birds, one only remained to him of the forty-five he had killed. This was but an earnest of the still heavier losses he afterwards sustained in his collections. He says of the Gallipagos :—"Their verdure is scanty as compared with most tropical countries, owing apparently to the parched nature of the soil, and the absence of springs of fresh water. The only spring I saw, was flowing from a crevice of one of the craters. Some of the trees attain a considerable size in the valleys, but they are not numerous, and with little variety of species. The birds, however, are abundant, and some of them exceedingly handsome, but so ignorant were they of man's devices, that they suffered themselves to be killed with a stick, so that a gun was only needed when they sat high on the top of a tree or rock. Many of the small birds perched on my hat, and even unconsciously settled upon the gun (the instrument of their destruction,) which I carried on my shoulder."

One may form an idea of the difficulty of entering the Columbia river in the winter season, from the fact that the William and Anne was obliged to lay to in a tremendously heavy sea, from the 12th of February until the 7th of April ere she dared to attempt crossing the bar. On the latter date, Douglas had the happiness of passing Cape Disappointment and of viewing from the vessel's deck the luxuriant growth of vegetation on the banks of the Columbia, which he regarded with anxiety as the scene of his future labors, but also with the highest satisfaction, for there was laid before him all that mortal could desire of beauty of landscape, and all that science might covet from any single portion of the habitable globe.

Mr. Douglas's first excursions were made in the neighbourhood of Fort Vancouver, and he was there at once introduced to the modes of travelling that have to be adopted in a wild Indian country. Of a robust constitution and merry heart, he would with the greatest complacency wrap his blanket round him and stretch himself out on the beach or under a bush as if he were lying down in a comfortable bed. In a few months he had collected a number of plants, many of them rare and new, and had besides dried the seeds he had gathered for sending to England.

In the month of October, he had the pleasure of making his first shipment of plants and seeds for England by the same vessel in which he had sailed from London, and the Horticultural Society made the most of this collection.

By the skill and care applied to the raising of the seeds, the gardens of England both public and private were quickly supplied with a share of the newly introduced plants, and the finest flowers of North-west America soon became generally distributed.

Of the mode of life which had frequently to be adopted by our indefatigable collector, extracts from his own narrative will give the best explanation.

"Early in the morning of the 19th July, I descended the river "in an Indian canoe for the purpose of prosecuting my researches "on the coast, a design which was in a great measure frustrated "by the tribe among whom I lived going to war with the nations "residing to the northward, in that very direction which I in- "tended to follow. During my stay several persons were killed, and "some wounded in a quarrel. The principal chief in the village, "Cockqua, treated me with the utmost fidelity, and even built me "a small cabin in his own lodge, but the immense number of fleas "occasioned me to remove to within a few yards of the river: still "my friend was so much interested in my safety that he watched "himself a whole night, at the time that he expected the war party, "In the morning about three hundred men, in their war garments. "danced the war dance, and sang several death-songs, which "caused in me certainly, a most uncomfortable sensation, and the "following morning brought us seventeen canoes carrying nearly "four hundred men, when after several harangues, it was mutually "agreed to suspend hostilities for the present."

"A sturgeon was caught by one of my companions, which "measured twelve feet nine inches, from the snout to the tip of "the tail, and seven feet round the thickest part, and its weight "exceeded five hundred pounds. Among the plants which I found "on this occasion, were, *Lupinus littoralis, Carex Menziesii,* "*Juncus Menziesii* and *globosus, Vaccinium ovatum, parvifolium* "and *ovalifolium.* I also obtained seeds of the beautiful *Spiræa* "*ariafolia,* of *Gualtheria, Shallon, Ribes sanguineus, Berberis,* "and other valuable and interesting plants."

"Before taking leave of my Indian friends, I purchased several "articles of wearing apparel, and things used in their domestic eco- "nomy for which I paid in trinkets and tobacco. I arrived at Fort

" Vancouver again on the 5th of August,and employed myself until " the 18th in drying the specimens I had collected, and making " short journeys in quest of seeds and other plants, my labours being " materially retarded by the rainy weather. As there were no " houses yet built on this new station, I first occupied a tent " which was kindly offered me, and then removed to a lodge " of deerskin, which soon, however, became too small for me, in " consequence of the augmentation of my collections, and where " also I found some difficulty in drying my plants and seeds. A " hut constructed of the bark of the *Thuja occidentalis* was my " next habitation, and there I shall probably take up my winter " quarters. I have only been in a house three nights since my " arrival in North-west America, and these were the first after my " debarkation. On my journeys I occupy a tent, wherever it is " practicable to carry one ; which, however, is not often, so that " a canoe turned upside down, is my occasional shelter; but more " frequently I lie under the boughs of a pine tree, without any- " thing further."

About the end of August, while on an excursion up the Multuomak or Willamette river, he became aware of the existence of an enormous kind of pine, by finding very large pine seeds in the tobacco pouches of the Calapooeah Indians. When informed by these people that the tree was very large, and that its seeds were eaten as an article of food, he at once set about verifying this information, and gave the species the name of *Lambertiana*, so that this mighty tenant of the forest, second in size only to the gigantic *Sequoia*, (the *Wellingtonia* of Lindley,) now received its baptism or specific name, although, it was sometime afterwards, before Douglas saw it in all its magnificent proportions. In the month of September he visited the Cascades, heavy rapids of the Columbia, the first from the sea, and where the river breaks through the rocky barrier of the great volcanic range of Mounts Rainier and St. Helen's to the north, and their partners Hood and Jefferson to the south. After an unsuccessful attempt to scale the wooded summits on the north side, he returned, being short of food, and had two days repose; when he occupied his time with shooting seals as they descended the surging rapids, in quest of salmon. Starting then for an exploration of the other side, his wishes were gratified, and he gained the upper wooded regions, where he was rewarded with many new plants, and discovered the *Pinus nobilis* and *P. amabilis*, the former a

spruce of much grandeur and straightness in growth, the latter the most elegant, perhaps, of all the Silver Firs. His exertions being thus crowned with success, the fatigued botanist turned his steps downwards towards Fort Vancouver, in order to look after his packages for England, of which we have already spoken.

In the end of October, although much impeded in his movements, by a hurt which he had received in his knee, he was again afloat in a small canoe proceeding towards the mouth of the Columbia. Leaving Cape Disappointment, he took the coast to the northward, sometimes making portages, and at others keeping with his Indian guide, in the tiny craft on rivulets skirting the shore. At Cape Foulweather, the canoe was abandoned and a march of sixteen miles made to gain Whitby Harbour, where the Chiheelis empties itself into the Pacific. Here we shall take up his own words.

"On arriving there, when we found the village deserted, I can "hardly describe the state I was in. While my guide and the "Indians were collecting some drift-wood, I made a small booth of "pine branches, straw, and old mats My blanket having been "drenched all day, and the heavy rain affording no opportunity of "drying it, I deemed it imprudent to lie down to sleep, and ac- "cordingly spent the night sitting over the fire. The following day "found me so broken down with fatigue and starvation, and my "knee so much worse, that I could not stir out. We fared most "scantily on the roots of *Sagittaria sagittifolia* and *Lupinus* "*littoralis*, called in the Chenook language, Somuchtau, till crawl- "ing out a few steps with my gun, I providentially saw some "wild birds, and killed five ducks at one shot. These were "soon cooked, though one of the Indians ate his share raw. To "save time in plucking the fowl, I singed off the feathers, and "with a basin of tea made a good supper on one of them. I had "certainly been very hungry, yet strange to say, as soon as I saw "the birds fall, my appetite fled, and I could hardly persuade "myself that I had been in such want."

Having procured assistance at a village on the opposite side of the bay, he turned up the Chiheelis river, but after being three days on this stream, he found the weather still continuing so rainy, that he discharged his guide, and hired another Indian with a horse to carry his luggage across to the Cowlidsk river. This distance, though only forty miles, occupied two days, all the low grounds being flooded with water; and the roads in the woods

marshy with incessant rain. At the Cowlidsk, he lighted upon a small boat, belonging to the Hudsons' Bay Company, which had been lent to an Indian chief. In this, by using his cloak and blanket for sail, he got back to Fort Vancouver at midnight on the 15th of November, completely worn out, and in nearly a famished state. The weather had done its worst, and his knee was in a still more painful condition from the fatigue and cold to which he had been exposed. He was now, therefore, compelled to lay himself up in winter quarters to recruit. The months of December, January and February, were passed by him with his Vancouver friends, his time usefully occupied in collecting subjects of zoological interest, and working out in full the short notes he had taken on his various journeys.

In March of 1826 the enterprising subject of our sketch being bent on a still more extensive tour than he had hitherto made, left his wintering station with the boats that were proceeding for the upper Columbia. At the Chûtes, or first great falls of the river, six miles above the Dalles, the party, as was frequently the case there, had difficulties with the Indians in passing the portage. Douglas in his own lively manner describes the scene.

"After taking a hurried and anxious breakfast on the rocks, "we proceeded several miles up the river, and in the afternoon "made the portage over the Great Falls, where Mr. McLeod was "apprized that the Indians were lying in wait with the intention "of attacking us, and pillaging the boats. This warning proved "too correct, no sooner had they received the customary present of "of tobacco, than they became desirous of compelling us to en- "camp for the night, that they might the better effect their pur- "pose. The first symptom of hostile intentions which we ob- "served, was their cunning trick of sprinkling water on the gun- "barrels of our party, and when the boats were ordered to be put "into the water, they would not allow it to be done. As Mr "McLeod was laying his hand on the shoulders of one native to "push him back, another fellow immediately drew from his "quiver a bow and a handful of arrows, and presented it at Mr. "McLeod. My position at the time, at the outside of the crowd "enabling me to perceive this manœuvre, and no time being to be "lost, I instantly slipped the cover of my gun, which was "fortunately loaded with buck-shot, and presenting it at him, I "invited him to discharge his arrow, when I would return it "with my own weapon. Just at this moment a chief of the Ky-

" ouse tribe, and three of his young men, who are the terror of " all the other tribes west of the mountains, and the staunch " friends of the whites, (as they call us), stepped in among the " party, and settled the affair without any further trouble. This " very friendly Indian, who is one of the finest figures of a man " I have ever seen, six feet six inches high, then accompanied " us several miles up the river to the spot where we intended " to encamp for the night, and was liberally renumerated by " Mr. McLeod for his courageous and timely interference, and " friendship. I being King George's chief, or the " Grassman," " bored a hole through the only shilling which I possessed, and " which had been in my pocket ever since I left London, and " observing that the septum of his nose was perforated, I suspended " the coin to it by a bit of brass wire, a ceremony which after- " wards proved a seal of lasting friendship between us."

When he had reached Fort Colville, a short distance from the Kettle Falls, he was busily occupied for three weeks, when the lock of his gun having been broken, he determined on wending his way to the old, and then abandoned establishment at Spokan. Here resided old Jacquo Finlay, a remnant of the first Rocky Mountain Trappers, and once interpreter for the North-West Company among the Flat-head Indians. Jacquo was also the only craftsman who could work in good steel, within a distance of 800 miles. Starting with two youths to guide him, the traveller comes to the Barrier river, which has to be forded in passing from Colville to Spokan, and here we again take up his own description of the journey.

" No natives being near to help us across in their canoes, my " two young companions and I had the alternative of making a " raft or swimming, and being all well accustomed to the water, " we chose the latter. Unsaddling the horses, we drove them in, " and they all crossed with safety and ease, except one poor animal " which getting entangled by its hind legs among some brushwood " at the bottom, struggled a long time till the impediment giving " way he finally relieved our anxiety by gaining the other side. " I myself made two trips across, carrying my paper and gun the " first time and my blanket and clothes the second ;—the latter " articles I was obliged to hold above water in both my hands, " a difficult and tedious process, during which, as if to render my " labour fruitless, it rained heavily. When I landed, my whole " frame was so completely benumbed, that we were under the neces-

" sity of stopping to kindle a fire, and to indulge my guides with " a smoke, after which we proceeded. At night a severe pain be- " tween my shoulders, and general chillness kept me from sleep- " ing. I rose, boiled my kettle, and made some tea; then dried my " blanket, and substituted for my damp shirt a spare one in " which I had rolled my plants; but feeling no better, and being " unfortunately without medicine, I started on foot at a little be- " fore four, and driving the horses before me, got into a profuse " perspiration which considerably relieved my sufferings.

" Near this spot was an Indian burying ground, certainly the " most curious I had yet seen. All the property of the deceased " was here deposited near their graves; their implements, garments, " and gambling articles. Even the favorite horse of the deceased " is not spared; it is customary to shoot the animal with a bow " and arrow, and suspend the skin, with the hoofs and skull, just " above the remains of his master. On the trees which are round " the burying place, small bundles may be seen, tied up in the " same manner as the provisions which they carry when travelling. " I could not learn whether this was intended as food for the dead " or propitiatory offerings to the divinities. Within the grave the " body is placed in a sitting posture, with the knees touching " the chin, and the arms folded across the chest. It is difficult to " obtain any information on these subjects, as nothing seems to " hurt the feelings of these people so much as alluding to their " departed friends."

The gun having received thorough repair, and many new plants having been collected in this interesting locality, Mr. Douglas returned to Fort Colville, having passed in the same mode as before the Barrier river; for this, however, he suffered: he was two days confined to bed by fever and bodily pains, caused no doubt by having walked so much in wet clothes. During the rest of the month of May he made many excursions round Colville, and met with considerable success in collecting. He had since his arrival discovered a new *Pinus ponderosa*, on which he found the *Arcenthobium oxycedric*, a parasitical plant existing also in southern Europe. The beautiful genus *Pentstemon* was also enriched by three new species, *P. scouler*, *P. vetustus*, and *P. speciosus*.

On the 5th of June he left Colville and descended with the boats to Wallander, an establishment just below Lewis and Clarke's Fork, then considered the key to the navigation of the upper Co-

lumbia. On the 16th when nearly ready for his journey to the Blue mountains we have a very amusing account of a nocturnal visit of rats (probably the *Neotoma occidentalis*,) to his tent.

" During the night I was annoyed by the visit of a herd of rats " which devoured every particle of seed I had collected, ate clean " through a bundle of dried plants, and carried off my soap-brush, " and razor! As one was taking away my inkstand, which I had " been using shortly before, and which lay close to my pillow, " I raised my gun, which with my faithful dog, is always placed " under my blanket by my side, with the muzzle to my feet, and " hastily gave him the contents. When I saw how large and " strong a creature this rat was, I ceased to wonder at the " exploits of the herd in depriving me of my property. The " body and tail together measured a foot and a half; the back is " brown, the belly white; while the enormous ears are each three " quarters of an inch long, with whiskers three inches in length, " and jet black.

His journey to the Blue Mountains, occupying nine or ten days, did not turn out so productive as he had expected. He encountered tremendous thunder-storms, his guide refused to descend the southern slopes, declaring that their horses would be stolen, and that they themselves would fall victims to the hatred of the Shoshonies, or the Snake tribe, who are always on bad terms with the Columbia Indians. Before retracing his steps, however, he had the pleasure of plucking specimens of that magnificent plant, the *Lupinaster macrocephalus* of Pursh, and of adding many new-species to the genera *Lupinus*, *Pedicularis*, *Pentstemon* and *Eriogonum*. *The Trifolium altissimum and T. plumosum* were also gathered, and last, though not least, the *Pæonia Brownii* now adorned his Herbarium.

On the 10th of July Mr. Douglas left Wallawalla, proceeding down stream in a small canoe with Indians. Being unable to procure any salmon from the natives, and his stock of provisions entirely failing, he was for the first time reduced to the necessity of trying Tartar fare, and had supped and breakfasted on horse-steaks and Columbia water, when to his inexpressible joy he met, below the Chutes, the loaded boats that were so far on their way for the interior posts. The meeting is thus noticed.

" Having halted at night below the Great Falls of the Columbia, " I saw smoke rising behind some rocks, and thinking it might be ' Indians fishing, walked thither in quest of salmon. Instead of

" their savage countenances, I found, however, to my great delight,
" that it was the camp of the brigade from the sea. I cannot des-
" cribe the feeling which seized me, when after travelling some
" weeks together with Indians, I meet a person whom I have known
" before, or if even they are strangers, yet the countenance of a
" Christian is at such times most delightful. In the present in-
" stance I had the additional happiness of finding myself in the
" society of those who had ever treated me with cordiality, and
" who now seemed to vie with one another in acts of kindness to-
" wards me. Observing my dejected and travel-worn plight, one
" fetched me some water to wash with, another handed me a clean
" shirt, and a third busied himself in making ready something
" more palatable than carrion for my supper; while my old friends,
" Messrs. McDonald and Work, handed me those best of cordials,
" my letters from England!

(*To be continued.*)

ARTICLE XI.—*On the Silurian and Devonian Rocks of Nova Scotia.* By J. W. DAWSON, LL.D., F.G.S.

[Communicated to the Natural History Society of Montreal.]

In the peninsula of Nova Scotia, the formations older than the carboniferous system, which is there so largely developed, are represented by disturbed and partially metamorphosed beds, occupying a broad belt of country on the south-eastern or Atlantic coast, and certain irregular hilly tracts in the interior. These beds were described by me in a paper communicated to the Geological Society of London in 1849, and subsequently in my "Acadian Geology;" in which work will be found references to the labours of previous observers. These notices were confessedly very imperfect, owing to the difficulties of the formations themselves, the deficiency or bad state of preservation of the fossils, and the absence of sufficient suits of these for comparison. With the view of remedying these deficiencies, I have embraced such opportunities as have occurred to me since the publication of "Acadian Geology," to study these rocks in those parts of the country which appeared to promise the most satisfactory results. My collections of fossils have also been increased by contributions received from Dr. Webster of Kentville, who has long directed his attention to the New Canaan and Nictaux districts, which I have had the advantage of exploring under his guidance; from the Rev.

D. Honeyman,* who has carefully collected the fossils of the Arisaig section, and from Mr. C. F. Hart of Wolfville. Prof. Hall of Albany, has also kindly consented to apply his unrivalled knowledge of the palæozoic fauna of America to the determination of the fossils, and has enabled me to publish with this paper, his descriptions of the more important new species.

With these aids, though aware that the complete solution of all the difficulties of these deposits must await a systematic and detailed survey, I hope to fix with certainty the geological position of several important series of beds, and thus to afford some data for comparison with the formations of similar age in other countries.

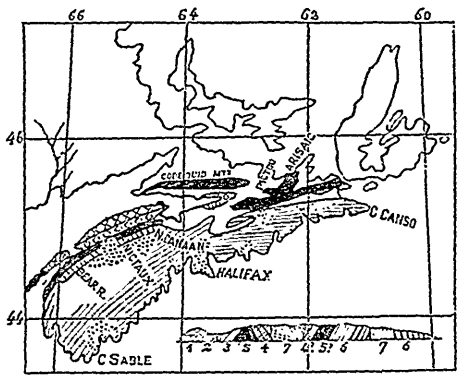


Fig. 1.—*Explanation of the Map and Section.*

(1) Secondary Trap.
(2) New Red Sandstone (Permian or Triassic.)
(3) Carboniferous.
(4) Devonian.
(5) Middle and Upper Silurian.
(6) Metamorphosed Lower Silurian.
(7) Granite.

The numbers refer to the section and to the accompanying shades of the map.

In my paper of 1849, I attempted to arrange the whole of these infra-carboniferous rocks of Nova Scotia, in two great divisions: (1.) The slate and quartzite formation of the Atlantic coast. (2.) The slaty, calcareous, and ferruginous formation of the inland hills. The second of these groups will be found in the sequel to include beds ranging from the Middle Silurian to the lower Devonian. The first is certainly older, and probably of Lower Silurian age.

* See also a paper by Mr. Honeyman, in the Transactions of the N. S. Lit. & Sci. Society.

I.—Lower Silurian.

The Atlantic coast series, which I regard as probably of this age, has afforded little that is new since my former publication on the subject. It extends continously, with prevailing east and west strike and northerly dip, from Cape Canso to the middle of the peninsula at Halifax Harbour. Thence it continues with prevailing north-east and south-west strike to the western extremity of the province. Its most abundant rocks are coarse clay slate and quartzite in thick beds. In some districts the slates are represented by mica-schist and gneiss, and interrupted by considerable masses and transverse bands of intrusive granite. It has afforded no fossils; but it appears to be the continuation of the older slate series of Mr. Jukes* in Newfoundland, which has afforded trilobites of the genus *Paradoxides*.† These fossils would indicate a position in the lower part of the Lower Silurian series, possibly on the horizon of the Potsdam sandstone or Lingula Flags. If so, the Lower Silurian limestones are either absent or buried by the unconformable superposition of the next series, or of the carboniferous beds which in some places immediately adjoin these older rocks.

It is however proper to state that on a comparison of these rocks with the series of altered deposits from Eastern Canada, collected by the Canadian Survey, and elaborately examined by Mr. Sterry Hunt, they appear more nearly to resemble those of the Hudson River group than any other of the series. It seems also, that chiastolite and staurotide, which occur abundantly in some parts of the Nova Scotia coast series, as for example, at Cape Canseau and in Shelburne, are characteristic in Canada and New England of altered Upper Silurian and Devonian rocks. It is possible that this last fact may be accounted for by the local occurence of some beds newer than the others; and the characters of the Silurian and Devonian series, as seen elsewhere in Nova Scotia, seem at least to exclude the mass of these coast rocks from any formation newer than the Middle Silurian.

II.—Middle and Upper Silurian.

The inland group of metamorphic rocks is more variable in its character, presenting many varieties of shales and slates some-

*Survey of Newfoundland.

† Salter, Proceedings Geological Society of London, 1859.

times talcose and chloritic, often coarse and arenaceous, and associated with beds of sandstone and quartzite, and with calcareous layers. In some districts there are also extensive beds which have the appearance of interstratified igneous products both of hornblendic and felspathic composition. The associated igneous rocks are granite (which appears to be continuous with that of the coast series and intrusive), syenite, diorite, porphyry and compact felspars. The more highly altered portions are penetrated by numerous veins of peroxide and carbonate of iron, with copper and iron pyrites.

These beds, as well as the overlying Devonian series, have been thrown into folds, varying in direction from east and west to north-east and south-west, and have been at the same time much altered and disturbed by plutonic rocks. They afterwards suffered extensive denudation, forming both anticlinal and synclinal valleys, in which were deposited beds of the carboniferous system, and of the New Red Sandstone of Nova Scotia, a deposit still of uncertain age.* This denudation has apparently been so complete as to remove from view nearly all the softer and least altered beds, the remains of which appear principally at the margins of the valleys now filled by the carboniferous series. Even in these exceptional spots they have in some instances been farther obscured by trappean eruptions of carboniferous or later date. The following are the principal localities in which I have been able to obtain determinable fossils. The geographical position of these points is noticed in the accompanying map. (Fig. 1, p. 132.)

Arisaig.

Near this place, at the extreme northern limit of the Silurian system on the eastern coast of Nova Scotia, is one of the most instructive sections of these rocks in the province. At the eastern end of the section, where they are unconformably overlaid by lower carboniferous conglomerate and interstratified trap,† the Silurian rocks consist of gray and reddish sandy shales and coarse limestone bands dipping south at an angle of 44°. The direction of the coast is nearly east and west, and in proceeding to the eastward, the dip of the beds turns to south 30° west, dipping 45°,

* See Journal Geol. Society, Vol. 4, and Acadian Geology.

† See papers by the author in Proceedings Geological Society, 1843-4.

so that the series, though with some faults and flexures, is on the whole descending, and exhibits in succession to the rocks just mentioned, gray and dark shales, with bands and lenticular patches of coarse limestone, some of which appear to consist principally of brachiopodous shells *in situ*, while others present a confused mass of drifted fossils. Below these the beds become more argillaceous, and in places have assumed a slaty structure, and occasionally a red colour. The thickness of the whole series to this point was estimated at 500 feet. The dip then returns to the south, and the beds run nearly in the strike of the shore for some distance, when they become discoloured and ochraceous, and then red and hardened; and finally, at Arisaig pier, are changed into a coarse reddish banded jasper, where they come into contact with a great dyke of augitic trap of carboniferous date. Beyond this place they are much disturbed, and so far as I could ascertain, destitute of fossils. The alteration of the beds extends to a distance of 300 yards from the trap, and beyond this in some places slaty cleavage and reddish colours have been produced; the latter change appearing to be connected with vertical fissures traversing the beds.

In the lower or shaly portion of the Arisaig series, the characterstic fossils are *Graptolithus* not distinguishable from *G. clintonensis*, *Leptocœlia* (*Atrypa*) *intermedia*, (Hall,) a new species closely allied to *L. hemispherica* of the Clinton group of New York, *Atrypa emacerata*, *Orthis testudinaria*, *Strophomena profunda*, *S. rugosa*, *Rhynconella equiradiata*, *Avicula emacerata*, *Tentaculites*, allied to or identical with *T. distans*, *Helopora* allied to *H. fragilis*. There are also abundant joints and stems of crinoids, and a *Palæaster*, the only one as yet found in Nova Scotia, which was presented to me by Mr. Honeyman, and has been described by Mr. Billings in the Canadian Naturalist under the name of *P. parviusculus*. These and other fossils associated with them, in the opinion of Prof. Hall, fix the Geological position of these rocks as that of the Clinton group, the upper Llandovery of Murchison, at the base of the upper Silurian or top of the middle Silurian.

In the upper and more calcareous part of the series, fossils are very abundant, and include species of *Calymene*, *Dalmanites*, *Homalonotus*, *Orthoceras*, *Murchisonia*, *Clidophorus*, *Tellinomya*, and several brachiopods, among which are *Discina tenuilamellata*, *Lingula oblonga*, *Rhynconella quadricosta*, *R. Saffordi*, (Hall,)

allied to *R. Wilsoni*, *R. neglecta*, *Atrypa reticularis*,* all found in the upper part of the Middle Silurian or in the Upper Silurian elsewhere in America. Most of the other forms are new species, descriptions of which will be found in Prof. Hall's paper appended to these notes. The general assemblage is on the whole like that of the Clinton, but is of such a character as to warrant the belief that we may have in these beds a series somewhat higher in position, and probably of Upper Silurian age. The new species *Chonetes Nova-Scotica* is very characteristic of the upper member.

On the whole we must regard the Arisaig series as representing the upper part of the Middle Silurian, probably with a part of the Upper Silurian, a position much lower than that assigned to it in my Acadian Geology, which was, however, at the time, based on the opinions of the best palæontologists who had examined specimens from these rocks. Unfortunately the Arisaig series stands alone, wedged between carboniferous and plutonic rocks, so that no opportunity occurs on the coast of verifying these conclusions derived from fossils, by the evidence of stratigraphical connection with newer or older Silurian deposits, and I have been unable to devote sufficient time to this object to attempt to trace the beds in their succession or continuation inland.

East River of Pictou.

The next example of fossiliferous Silurian rocks known to me is on the east branch of the East River of Pictou, and its vicinity, where these deposits rise from beneath the lower carboniferous series, forming the high ground on the eastern side of the river. The beds are here much altered and penetrated by igneous dykes, and are vertical, with very high southerly dips and N. E. and S. W. strike. They consist of coarse slates and calcareous bands resembling those of the upper Arisaig series in mineral character, and holding many of the same species, especially *Chonetes Nova-Scotica*; but we have here in addition a great bed of fossiliferous peroxide of iron, in some parts forty feet in thickness, and with oolitic structure; but passing into a ferruginous sandstone, and associated with slate and quartz rock. The age of these rocks relatively to the Arisaig series, it is not easy to determine. The stratigraphical evidence, though obscure, would place them in a higher position. The fossils are in a bad state of preservation; but in so far as

* Also *Strophomena corrugata*.

they give any information, it coincides with the apparent relation of the beds. Similar ferruginous beds occur in the Clinton series, (the Surgent of Rogers) in New York and Canada; and as we shall find in the sequel, in a much higher position in the western part of Nova Scotia. On the whole I regard the beds seen at the East River of Pictou as belonging to the same line of outcrop with the Arisaig series, but as containing in addition to the upper member of that series, beds higher in the Silurian system, or perhaps Lower Devonian.

Cobequid Mountains.

At the eastern end of this chain, in Earlton and New Annan, though the rocks are generally in a highly metamorphosed condition, fossils are found in a few places; and in so far as I have been able to determine from very small suites of specimens, are those of the upper Arisaig series. From the apparent continuity of strike along this long salient line of outcrop, it seems probable that these fossils indicate the true age of the greater part of the sedimentary rocks of the Cobequid hills; a conclusion confirmed by their similarity in mineral character to the altered equivalents of the Arisaig and East River series as seen elsewhere. The arrangement of the beds and their mineral contents in the central part of the chain, will be found noticed in my paper of 1849, already referred to. They are not known to contain beds of iron ore; but have enormous vein-like deposits of spathic and specular iron associated with the carbonates of lime and magnesia, and running with the strike of the beds.

New Canaan.

Between the East River of Pictou, and New Canaan in King's county, 100 miles distant, I know no Silurian beds with fossils; and in the central part of the province these rocks disappear under the carboniferous deposits. In the hills of Horton and New Canaan they reappear, and constitute the northern margin of a broad belt of metamorphic and plutonic country, occupying here nearly the whole breadth of the peninsula. The oldest fossiliferous beds seen are the fine fawn-coloured and gray clay slates of Beech Hill, in which Dr. Webster, many years since, found a beautiful *Dictyonema*, the only fossil they have hitherto afforded. It is a new species, closely allied to *D. retiformis* and *D. gracilis* of Hall, and will be described by that palæontologist under the name of *D. Websteri*, in honour of its discoverer. In

the mean time I may merely state that it is most readily characterised by the form of the cellules, which are very distinctly marked in the manner of *Graptolithus*. A portion of a frond is represented in Fig. 2.

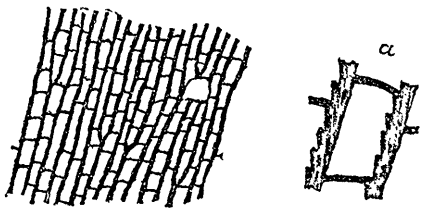


Fig. 2.—Part of frond of *Dictyonema Websteri*, Hall. *a*, portion magnified.

The Dictyonema slates of Beech Hill are of great thickness, but have in their upper part some hard and coarse beds. They are succeeded to the south by a great series of dark coloured coarse slates, often micaceous, and in some places constituting a slate conglomerate, containing small fragments of older slates, and occasionally pebbles of a gray vesicular rock, apparently a trachyte. In some parts of this series there are bands of a coarse laminated magnesian and ferruginous limestone, containing fossils which, though much distorted, are in parts still distinguishable. They consist of joints of crinoids, casts of brachiopodous shells, trilobites and corals. Among the latter are two species of *Astrocerium*, not distinguishable for *A. pyriforme* and *venustum* of the Niagara group, and a *Heliolites* allied to *H. elegans*, if not a variety of this species. On the evidence of these fossils and the more obscure remains associated with them, Prof. Hall regards these beds as equivalents of the Niagara formation of the New York geologists, the Wenlock of Murchison. Their general strike is N. E. and S. W.; and to the southward, or in the probable direction of the dip, they are succeeded, about six miles from Beech Hill, by granite. They have in general a slaty structure coinciding with the strike but not with the dip of the beds, and this condition is very prevalent throughout this inland metamorphic district, where also the principal mineral veins usually run with the strike. The beds just described run with S. W. strike for a considerable distance, and are succeeded in ascending order by those next to be described.

III.—Devonian.

It is probable that Devonian rocks, in a metamorphosed state,

are extensively distributed throughout the districts now under consideration; but the only localities in which they have been clearly recognised, are along a line of outcrop on the northern margin of the hilly region westward of New Canaan. The first and most important of these exposures is at

Nictaux.

At this place, 20 miles westward of New Canaan, the first old rocks that are seen to emerge from beneath the New Red Sand stone of the low country, are fine-grained slates, which I believe to be a continuation of the Dictyonema slates of Beech Hill. Their strike is N. 30 to 60 E., and their dip to the S. E. at an angle of 72°. Interstratified with these are hard and coarse beds, some of them having a trappean aspect. In following these rocks to the S. E, or in ascending order, they assume the aspect of the New Canaan beds; but I could find no fossils except in loose pieces of coarse limestone, and these have the aspect rather of the Arisaig series than of that of New Canaan. In these, and in some specimens recently obtained by Mr. Hart, I observe *Orthoceras elegantulum, Bucania trilobita, Cornulites flexuosus, Spirifer rugœcosta?* and apparently *Chonetes Nova-Scotica*, with a large *Orthoceras*, and several other shells not as yet seen elsewhere. These fossils appear to indicate that there is in this region a continuance of some of the upper Arisaig species nearly to the base of the Devonian rocks next to be noticed.

After a space of nearly a mile, which may represent a great thickness of unseen beds, we reach a band of highly fossiliferous peroxide of iron, with dark coloured coarse slates, dipping S. 30° E. at a very high angle. The iron ore is from 3 to 4½ feet in thickness and resembles that of the East River of Pictou, except in containing less silicious matter. The fossils of this ironstone and the accompanying beds, as far as they can be identified, are *Spirifer arenosus*,* *Strophodonta magnifica, Atrypa unguiformis,*

* There is in the iron ore and associated beds another and smaller *Spirifer* as yet not identified with any described species, but eminently characteristic of the Nictaux deposits. It is usually seen only in the state of casts, and often strangely distorted by the slaty structure of the beds. The specimens least distorted may be described as follows: General form, semi-circular tending to semi-oval, convexity moderate; hinge line about equal to width of shell; a rounded mesial sinus and elevation with about ten sub-angular plications on each side; a few sharp growth ridges at the margin of the larger valves. Average diameter about one inch; mesial sinus equal in width to about three plications. I shall call this species, in the meantime, *S. Nictavensis.*

Strophomena depressa, and species of *Avicula, Bellerophon, Favosites, Zaphrentis*, &c. These Prof. Hall compares with the fauna of the Oriskany sandstone; and they seem to give indubitable testimony that the Nictaux iron ore is of Lower Devonian age.

To the southward of the ore the country exhibits a succession of ridges of slate holding similar fossils, and probably representing a thick series of Devonian beds, though it is quite possible that some of them may be repeated by faults or folds. Farther to the south these slates are associated with bands of crystalline greenstone and quartz rock, and are then interrupted by a great mass of white granite, which extends far into the interior and separates these beds from the similar, but non-fossiliferous rocks on the inner side of the metamorphic band of the Atlantic coast. The Devonian beds appear to dip into the granite, which is intrusive and alters the slates near the junction into gneissoid rock holding garnets. The granite sends veins into the slates, and near the junction contains numerous angular fragments of altered slate.

Westward of the Nictaux River, the granite abruptly crosses the line of strike of the slates, and extends quite to their northern border, cutting them off in the manner of a huge dyke, from their continuation about ten miles further westward. The beds of slate in running against this great dyke of granite, change in strike from south-west to west, near the junction, and become slightly contorted and altered into gneiss, and filled with granite veins; but in some places they retain traces of their fossils to within 200 yards of the granite. The intrusion of this great mass of granite without material disturbance of the strike of the slates, conveys the impression that it has melted quietly through the stratified deposits, or that these have been locally crystallised into granite *in situ*.

Moose River.

At this place the iron ore and its associated beds recur on the western side of the granite before mentioned, but in a state of greater metamorphism than at Nictaux. The iron is here in the state of magnetic ore, but still holds fossil shells of the same species with those of Nictaux.

Bear River.

On this stream, near the bridge by which the main road crosses it, beds equivalent to those of Nictaux occur with a profusion

of fossils. The iron ore is not seen, but there are highly fossiliferous slates and coarse arenaceous limestone, and a bed of gray sandstone with numerous indistinct impressions apparently of plants. In addition to several of the fossils found at Nictaux, these beds afford *Tentaculites*, an *Atrypa*, apparently identical with an undescribed species very characteristic of the Devonian sandstones of Gaspé, and a coral which Mr. Billings identifies with the *Pleurodictyum problematicum*, Goldfuss, a form which occurs in the Lower Devonian in England, and on the continent of Europe.

Westward of Bear River, rocks resembling in mineral character those previously described, extend with similar strike, but in an altered condition, and in so far as I have been able to ascertain, destitute of fossils, quite to the western extremity of the peninsula, where they turn more to the southward, and are as I suppose, repeated by a sharp synclinal fold, after which they are succeeded by the Atlantic coast series, consisting of quartzite and clay slate, with chlorite and hornblende slates at Yarmouth and its vicinity, and further to the S. E. of mica slate and gneiss.

General Remarks.

The above facts show that we can recognise among the partially metamorphosed sub-carboniferous rocks of Nova Scotia, formations ranging from the Middle Silurian to the Lower Devonian inclusive; but of a more argillaceous and less calcareous character than the series occupying this position in the mainland of America. The principal masses of plutonic rock associated with these beds, and especially the granite, are of newer Devonian date; but there is evidence of igneous eruptions as far back as the beginning of the Upper Silurian, and of the continuance or recurrence of such action as late as the carboniferous period. In and near the non-calcareous Lower Silurian series, granite prevails, almost to the entire exclusion of other plutonic rocks. At a greater distance from these, the plutonic rocks penetrating the Upper Silurian and Devonian series, though apparently of nearly the same age with the granite, are principally syenite and greenstone.

With respect to the general arrangement of the formations, though I cannot venture to speak with confidence on this point, with reference to a district so much disturbed, and which I have been able only very imperfectly to explore, I may suggest, as at

present the most probable arrangement, that represented in the little section attached to the map. The coast series would thus belong to an anticlinal, bringing up Lower Silurian rocks. On these, in proceeding to the north-west, rest middle and upper Silurian and perhaps Devonian beds in a metamorphosed condition, which along the northern margin of the metamorphic district rise again with an opposite dip, at Arisaig, East River, New Canaan, &c., forming a trough, the middle of which, in the east, is divided by a secondary anticlinal and filled with carboniferous rocks, but in the west is occupied with a great mass of granite into which the beds appear to have sunk in the direction of their dip. Beyond the northwestern edge of this trough, the Silurian beds probably again dip to the northward, but are hidden by carboniferous deposits, and reappear in another anticlinal with east and west strike in the Cobequid Mountains.

Rocks similar in character and relations to those above described are extensively distributed in the Island of Cape Breton and also in New Brunswick, but I have no detailed knowledge of their distribution. The formations described in this paper, represent in age, and resemble in their state of alteration, many portions of the metamorphosed Silurian and Devonian rocks of New England and Eastern Canada. In the latter, the relations of the intrusive granite and the middle and upper Silurian rocks as described by Sir William Logan, and as I have observed them in a few localities, strikingly resemble the phenomena observed in Nova Scotia.

I have no doubt that a detailed survey of these rocks in Nova Scotia and Cape Breton, would develop many curious and intricate disturbances, and might also ascertain the presence of members of the Silurian series, now supposed to be absent, but which may be only obscured by denudation. In the mean time local observers can do much to increase our knowledge of these rocks by carefully collecting the few fossils that remain unobliterated in the semi-metamorphic beds, and the above remarks may serve to guide such explorations, and to enable geologists to speak with more confidence than heretofore of the older palæozoic rocks of an important region of eastern America.

ARTICLE XII.—*Descriptions of New Species of Fossils from the Silurian Rocks of Nova Scotia.* By JAMES HALL.

1. CRANIA ACADIENSIS. N. sp. Fig. 1.

Circular or broadly subovaI, moderately convex, the greatest convexity near the apex; apex obtuse.

Several casts show a central elevated area, with strong muscular impressions; the more elevated portion being surrounded by a flattened border, which is radiatingly striate.

These specimens are casts which appear to be of the ventral valve; and the form of the muscular impressions is so characteristic of the genus that I can have little hesitation in thus referring them.

2. DISCINA TENUILAMELLATA. Var. *subplana.*

Shell broadly elliptical, or suborbicular, externally depressed, apex subcentral; surface marked by thin sharply elevated lamellæ.

This closely resembles the Niagara species of New York, but may be distinct. Should further examination prove it a distinct species, the name *D. subplana* may be adopted.

Fig. 2. Fig. 3. Fig. 1.

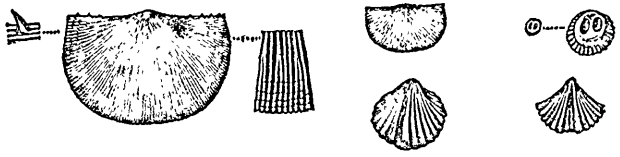


Fig. 5. Fig. 4.

3. CHONETES NOVA-SCOTICA. N. sp. Fig. 2.

Shell semielliptical, width varying from once and a half to nearly twice the length. The ventral valve variably convex, and often showing a flattened or slightly concave space down the middle of the shell; cardinal margin ornamented by four or five minute spines on each side of the beak; cardino-lateral margins often a little wrinkled; surface finely striated, striæ flexuous, dichotomising and increasing by interstitial addition, so that there are more than one hundred on the margin of the shell; striæ increasing in size below the umbo; concentric striæ fine, close, rounded and slightly undulating.

Dorsal valve moderately concave; striæ much stronger below the middle of the shell and sometimes bifurcating toward the margin.

This species resembles in form the *Chonetes cornuta* of the Clinton group of New York, but is a much larger and more ventricose shell; the striæ are proportionally less numerous and more closely arranged, the interstices being less than the striæ, while in the *C. cornuta* the interstices are wider than the striæ, and the latter increase only by interstitial additions below the middle of the shell. A stronger and more elevated stria often marks the median line from beak to base of the ventral valve.

4. CHONETES TENUISTRIATA. N. sp. Fig. 3.

Shell semi-oval, twice as wide as long; ventral valve moderately convex, hinge line equalling the width of the shell; surface marked by fine, even, closely arranged striæ, which apparently increase only by interstitial additions, and are not flexuous. The number of striæ on the margin of the shell is nearly one hundred.

This species is more finely striated than the preceding, the striæ not flexuous, more even, and in shells of equal size much more numerous. This species is somewhat larger and more closely striated than the *C. cornuta* of the Clinton group of New York.

5. SPIRIFER RUGÆCOSTA. N. sp.

Shell somewhat semi-elliptical; dorsal valve very convex, with the mesial fold depressed along the centre; ventral valve with a wide deep mesial sinus; plications six or seven on each side of the mesial fold and sinus, strong, and much elevated, subangular, crossed by numerous strongly elevated, lamellose, imbricating concentric striæ.

The specimens examined are almost all imperfect casts, some of which preserve the impression of the strong concentric striæ, and in one or two specimens an impression of the shell reveals the strength of the surface markings.

In many respects this species resembles the *S. perlamellosa* of the lower Helderberg group in New York, but the mesial elevation of this species is flattened or depressed, a character never observed in New York specimens.

6. SPIRIFER SUBSULCATUS. N. sp.

Shell semi-elliptical, hinge line equalling or greater than the length of the shell below; plications five or six on each side of the

mesial fold; mesial fold somewhat flattened or very slightly rounded on the summit; plications rounded; surface concentrically lamellose.

The specimens are all casts, or impressions of the shells.

They bear some resemblance to *S. sulcatus* of the Niagara group, and are intermediate between that species and the *S. cycloptera* of the Lower Helderberg group.

7. Tremastospira Acadiæ. N. sp. Fig. 4.

Shell wider than long; beak of the ventral valve produced and incurved; mesial depression marked by a small fold on each side, which originates about one-third of the length below the beak and continues to the margin; sinus bounded on each side by a more strongly elevated plication, beyond which are six other plications on each side.

Surface marked by fine concentric striæ.

This shell is referred to the genus *Trematospira* from external characters alone, which are unlike *Rhynchonella* proper, and the shell is not a *Spirifer*.

8. Rhynchospira sinuata. N. sp.

Shell ovoid, ventricose beak of the ventral valve incurved; a mesial sinus beginning a little below the beak; surface marked by about eight or nine simple scarcely subangular plications on each side the mesial sinus.

Surface marked by concentric lines of growth.

This species differs from the *R. formosa* of the Lower Helderberg rocks of New York in the plications being more slender, in the more defined sinus of the ventral valve, and the continuation of the two small folds in the sinus nearly to the beak.

9. Rhynchonella Saffordi.

Shell varying in form from ovoid to globose. Full grown specimens usually wider than long, and sometimes becoming extremely ventricose, so that the diameter across the two valves much exceeds the length. Ventral valve depressed convex, with the beak minute, closely incurved; dorsal valve very ventricose, most prominent toward the front. Cardinal slope a little depressed, sides rounded, and the front in direct line flattened but not depressed. Surface finely plicated, plications little elevated,

rounded or scarcely subangular, about five or six depressed in the flattened sinus of the ventral valve and a corresponding number raised on the flattened mesial elevation, which rises abruptly though usually but slightly above the lateral portions of the shell. From ten to fourteen plications mark the surface on each side of the mesial fold and sinus. Plications in front marked by a sharp groove along the centre, and those of each valve deeply interlocking.

This species resembles the *R. nucleolata* of the Lower Helderberg rocks of New York, and in some specimens it approaches to *R. ventricosa*, but is always much more finely plicated than either. It closely resembles the *R. Wilsoni* of Europe in its general form, but the plications are more rounded and somewhat coarser, and while in that species the sinus causes no depression in the ventral valve below the general surface of the shell, in ours there is an abrupt depression as well as a slightly abrupt elevation on the dorsal valve, while there is no similar feature in the *R. Wilsoni*.*

The Nova Scotia specimens are in all respects identical with those from Tennessee.

The geological position of the specimen from Tennessee is in rocks of the age of the Lower Helderberg group, associated with *Pentamerus galeatus*, *P. Verneuili*, *Spirifer macropleura*, *Spirifer perlamellosa*, *Spirifer cycloptera*, and others.

10. Leptocelia intermedia. Fig. 5. N. sp.

Shell concavo-convex; outline semi-elliptical, cardinal extremities rounded, and the hinge-line a little shorter than the greatest width of the shell; ventral valve moderately convex, carinate in the middle by a strong plication, with six or seven smaller ones on each side, the lateral ones slightly curved towards the outer extremity. Dorsal valve concave, with a broad shallow mesial sinus, the margins on either side being bent a little upward, giving a sinuous outline to the margin of the shell; surface marked by fine concentric striæ.

This species resembles the *L. hemispherica* of the Clinton group in New York, in general form, but the hinge line is shorter and the extremities rounded; the mesial elevation consists of a single strong plication, while in *L. hemispherica* the surface is regularly plicated, with the central one sometimes a little stronger than the others.

*Sowerby, M. C., vol. ii., page 38, says: The "sinus at the front, although deep, does not alter the evenness of the surface."

11. Modiolopsis? rhomboidea. N. sp. Fig. 6.

Shell sub-rhomboid, rounded in front, wider and obliquely truncate behind, hinge-line slightly ascending from the anterior end; beaks subterminal, posterior umbonial slope obtusely subangular below, anterior to which the shell is flattened; basal margin nearly straight, the shell gradually widening behind and the posterior basal extremity abruptly rounded. Surface evenly striated concentrically.

Anterior muscular impression very strong, posterior muscular impression less strongly defined, but still very conspicuous and sub-duplicate; palleal line simple, nearly parallel to the basal margin, strongly and almost equally defined in all parts of its length between the two muscular imprints.

This shell bears some resemblance to *M. primigenius*, but is less ventricose in the middle, and the sub-angular umbonial slope is not so well defined in that species.

12. Modiolopsis sub-nasutus. N. sp.

Shell elongate sub-spatulate, the length being more than twice the greatest width hinge-line; slightly ascending posteriorly; beaks sub-anterior, the anterior end very narrow, gibbous on the umbones, with a sub-angular ridge on the umbonial slope which extends to the postero-basal angle; basal margin nearly straight, the posterior end somewhat flattened and obliquely sub-truncate at the extremity; surface marked by concentric lines of growth.

This shell bears a close general resemblance to *M. nasutus* of the Trenton limestone, but a careful comparison shows it to be wider and more abrupt at its posterior termination, while the direction of the striæ of growth is very distinctive, these marks being regularly curving toward the posterior end in *M. nasutus*, while in this species they are abruptly bent at the postero-basal angle, and again on the cardinal side, corresponding with the truncate posterior extremity of the shell.

13. Clidophorus cuneatus. N. sp.

Shell ovoid, gibbous in the middle and on the umbones, gradually declining behind; beaks anterior, sub-terminal; anterior end broadly rounded, the posterior end narrower and sub-acute, posterior umbonial slope marked by an obtuse rounded ridge, which extends to the posterior extremity, and below this an unde-

fined sinus which, expanding, extends to the postero-basal extremity, while a less defined ridge bounds this sinuosity on its anterior side; surface marked by fine irregular concentric striæ.

In the casts of this shell there is a strong linear straight clavicle, extending from a point just anterior to the beak two-thirds across the valve.

Fig. 6.

Fig. 7.

Fig. 8.

14. Clidophorus concentricus. N. sp. Fig. 7.

Shell sub-equilateral, very broadly oval-ovate, the anterior end the broader; height nearly four-fifths the greatest length; anterior side a little shorter and more broadly rounded at the extremity; a slight depressed sinus on the posterior umbonial slope, which is more anterior than in the preceding species. Surface marked by even band-like concentric striæ; shell thin; a linear curving clavicle extends from the cardinal line just anterior to the beak more than half way to the base.

The prominent points of distinction between this and the preceding shell are the nearly central beaks, the band-like striæ, and the curving clavicle with the broad and nearly equal extremities of the valve.

15. Clidophorus erectus. N. sp. Fig. 8.

Shell somewhat rhomboid-ovate, the height and length about equal; umbones prominent, beaks nearer the anterior end, somewhat curved and elevated; posterior cardinal line curving, with a scarcely defined ridge along the umbonial slope; basal margin strongly rounded, sinuate on the postero-basal margin and regularly rounded, with a scarcely defined ridge extending down the slope just anterior to the clavicle. Surface finely striated concentrically, a slightly curving clavicle extending from the cardinal line nearly two-thirds the distance to the anterior basal margin.

This species differs from the preceding in the equal length and breadth and consequent greater proportional height, in the sinuosity of the postero-basal margin, and more abruptly-rounded basal outline, and the curving forward of the beaks.

16. CLIDOPHORUS ELONGATUS. N. sp. Fig. 9.

Shell sub-elliptical, length about twice the height, beaks much nearer to the anterior end, which is narrowly rounded; umbones rounded, prominent; a defined gradually widening depression extends from the umbo to the posterior basal margin, causing a straightening or slight sinuosity in the edge of the shell; a defined ridge along the posterior slope between the sinus and the cardinal margin. Surface very finely striated. A slender clavicle extends from the anterior cardinal margin a little more than half-way to the base, and curving slightly forward.

This species differs externally from all the others in the greater proportional length and in the rounded umbones.

The *C. cuneatus* of the same size is a stronger and proportionally higher shell, having a less defined sinus on the posterior slope, and a much stronger clavicle.

Fig. 9.

17. CLIDOPHORUS SEMIRADIATUS. N. sp.

Shell somewhat oval-ovate, length about one third greater than the height.

Surface marked by fine concentric band-like striæ, and the posterior slope by flattened dichotomized radiating striæ, the two sets of striæ gradually dying out at their junction. A faint line anterior to the beak marks the place of the clavicle.

18. CLIDOPHORUS NUCULIFORMIS. N. sp.

Shell nearly equilateral, subventricose, height and length as seven to nine. Anterior end rounded, basal margin regularly curved; posterior end sub-acute, a slight flattening or depression along the posterior umbonial slope, and between this and the cardinal line a narrow ridge. On the anterior slope there is a depressed line almost parallel to the cardinal line, marking apparently the course of the clavicle. Surface marked by fine concentric striæ.

This species resembles in form the *C. concentricus* in its equilateral form, but the fine unequal concentric striæ and the difference in direction of the clavicle are sufficient to distinguish it.

19. Clidophorus subovatus. N. sp.

Shell, broadly oval or ovate, moderately and evenly convex; beaks near the anterior end; umbones moderately elevated; a scarcely defined depression extending from the umbo towards the postero-basal extremity; anterior extremity rounded, posterior extremity unknown (? regularly rounded); clavicle extending half way from the anterior cardinal margin to the base of the shell. Surface marked by fine unequal sub-lamellose striæ.

This shell is larger and more regularly convex than any of the others here described, and more inequilateral than any except the *C. cuneatus.*

20. Nuculites [Orthonota] carinata. N. sp. Fig. 10.

Shell extremely elongate, nearly three times as long as wide; sides sub-parallel; hinge line straight, beaks appressed, sub-anterior, the anterior extremity rounded; posterior extremity obliquely truncate, longer on the hinge line than on the basal margin. Surface marked by a sharp carina which extends from the umbo obliquely to the postero-basal angle, the space anterior to this carina marked by distinct elevated lamellose striæ, and intermediate finer ones. The space between this and the cardinal line smooth and slightly depressed. Cardinal line anterior to the beak showing six or seven crenulations. A strong clavicle extends from the anterior cardinal line with a gentle curve nearly to the base of the shell.

Fig. 10.

Fig. 11.

Fig. 12.

This shell presents characters not before observed combined in one species. It has the general form of *Orthonta*, while the crenulated cardinal line and the anterior clavicle are characters of *Nuculites.* The shell is readily distinguished from species of either genus heretofore described. The Orthonotæ, yet known, have the surface marking much less sharply defined.

21. Tellinomya attenuata. N. sp. Fig. 11.

Shell elongate, narrow, more than twice as long as high, anterior end short and rounded, beak elevated, situated a little in

advance of the anterior third, posterior end narrow and abruptly rounded; basal margin slightly curved, and impressed posterior to the centre; posterior cardinal line straight but gradually declining; contour evenly convex. Surface concentrically striated, shell thick.

This shell resembles the *T. machæriformis*, but the anterior end is proportionally longer and more regularly round, the posterior narrower and more attenuated, and the convexity of the shell much greater. It is much smaller and proportionally more elongated than the *T. nasuta* of the Trenton Limestone.

22. Tellinomya angustata. N. sp.

Shell elongate, narrow elliptical, more than twice as long as wide, beaks fully one third from the anterior end. The anterior and posterior ends similar and equally rounded; basal margin regularly curved without indentation or sinuosity. Surface evenly convex and very finely concentrically striated.

23. Leptodomus, (Sanguinolites,) aratus. N. sp.

Shell rhomboid-ovate, ventricose, beaks at the anterior third of the valve, incurved and pointed forward, umbones gibbous, a slight depression from the umbo directly to the base of the shell leaving a slight impression in the central margin; posterior slope sub-angular, the angle not defined; anterior slope with a defined angular ridge which borders a large cordiform lunette; anterior sharply rounded; basal margin nearly parallel with the hinge line, curving upwards at the posterior extremity, and somewhat obliquely truncated from the cardinal line. Cardinal line straight posteriorly, with a wide and deep ligamental area. Surface marked by strong unequal ridges and furrows parallel to the basal margin, which become obsolescent on the posterior cardinal slope.

It is scarcely possible to refer any fossil with satisfaction to the genera *Sanguinolites* or *Leptodomus* of McCoy, since the grouping of species under these names appears to us to comprise a heterogeneous assemblage in either case. Our shell corresponds in its external features with *Leptodomus costellatus* of McCoy, so far as the general form, surface markings, ligamental area, etc. and is doubtless generically identical with that shell.

24. MEGAMBONIA (?) CANCELLATA. N. sp. Fig. 12.

Shell sub-ovate, widening posteriorly; beak anterior incurved, umbo gibbous, with a gibbous umbonial slope on the posterior side, which is scarcely diverging from the cardinal line; posterior extremity rounded, the basal margin arcuate, with a slight impression anterior to the middle, the anterior end a little gibbous. Surface cancellated by concentric and radiating elevated striæ.

It is not possible from the specimen before me to refer this species satisfactorily to any known genus.

25. MEGAMBONIA STRIATA. N. sp.

Shell somewhat oval, the basal and cardinal lines nearly parallel; beak sub-anterior, small; umbones convex, scarcely gibbous; umbonial slope regularly convex, below which is a slight depression reaching to the postero-basal margin; posterior end rounded, the longer part of the curve on the basal side. Anterior end short and narrow, somewhat abruptly rounded. Surface marked by regularly radiating rounded striæ with faint concentric lines of growth.

This differs from the preceding species in being less gibbous, in the more nearly parallel cardinal and basal lines, in the direction of the umbonial ridge, and in the stronger radiating striæ.

24. AVICULA HONEYMANI. N. sp. Fig. 13.

Left valve: body of the shell obliquely ovate, convex and somewhat gibbous towards the umbo, anterior wing small rounded, posterior wing large triangular, obtuse at the extremity, extending two-thirds the length of the shell. The line between the wing and body of the shell well defined by a slight abrupt depresssion along the junction. Surface marked by rounded radiating striæ which are interrupted by fainter concentric undulations or lines of growth; the wing is marked only by concentric striæ.

This species bears some resemblance to *A. emacerata* of the Niagara and Clinton groups of New York; but its form is slightly more oblique, and the wing is marked only by concentric striæ, while in the New York species the radiating lines on this part are stronger than the concentric ones.

25. MURCHISONIA ARISAIGENSIS. N. sp.

Shell teretely conical, volutions about five, gradually increasing from the apex, rounded with a slight angulation or carina in the middle. The surface is unknown and the angular band on the volution is the only means of determining its generic relations.

This differs from any of the described species of Murchisonia from American localities.

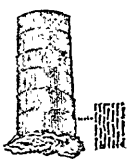
26. MURCHISONIA ACICULATA. N. sp.

Shell slender, very gradually tapering, volutions about six or seven, the last ones moderately ventricose, aperture elongate-oval or ovate, rounded at the anterior margin, columella plain; volutions marked by a distinct band along the centre, and a sub-sutural carina marking the upper side of the volutions; surface striated.

Fig. 13.

Fig. 14.

Fig. 15.



27. HOLOPEA REVERSA. N. sp. Fig. 14.

Shell small, sinistral; spire depressed, volutions about three; the two first small and gradually expanding, the last one rapidly expanding and ventricose; aperture wide expanded; suture impressed. Surface unknown.

This shell has the general form of Holopea, but I have seen only a single specimen, which is a cast. It is remarkable and readily recognised from the sinistral spire.

28. ORTHOCERAS PUNCTOSTRIATUM. N. sp. Fig. 15.

Shell slender, very gradually tapering, almost cylindrical; Septa distant about one third the diameter. Siphuncle central; section circular. Surface very finely striated with unequal undulating striæ, the interstices between which, are punctæ which are oblong indentations often becoming confluent.

This species is remarkable for its extremely gently tapering form; the fragment of more than an inch long, showing scarcely a perceptible diminution in diameter. There are twelve and a half chambers in the space of one inch. The surface markings are peculiar, and among the species of the genus known to us constitute a distinctive character.*

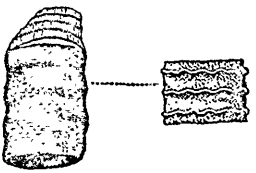


Fig. 16.

29. CORNULITES FLEXUOSUS. var. GRACILIS.

This fossil resembles the one in the Clinton group of New York, but is somewhat more slender, and the annulations a little more closely arranged. The specimens from the rocks of New York present some variation in form, and the comparative distance of the annulations. None of them, however, are so slender as the Nova Scotia specimens.

30. HOMALONOTUS DAWSONI. N. sp. Fig. 17.

Caudal shield somewhat parabolic, obtuse at the extremity, very convex, width at the anterior side greater than the length of the

* The Arisaig beds afford at least three other species of *Orthoceras*. One, the largest of the three, has a marginal inflated siphuncle, and the septa about one-eighth of an inch apart, for a specimen two inches in diameter. It tapers very gently, and in all the specimens found is elliptical in its cross section. It occurs in the upper series. A second, found in the lower series, is marked with strong annulations placed closely together. A third, occurring in the upper series, and discovered since the specimens were submitted to Professor Hall, is a very beautiful species, apparently new, but closely resembling *O. perelegans*, Salter, of the Lower Ludlow formation. It is cylindrical, but slightly flattened; septa very convex and one-twentieth of an inch apart in a specimen half an inch in diameter; siphuncle central. Surface with slight rounded annulations from one-eighth to one-fourth of an inch apart, and covered with delicate transverse striæ, scarcely visible to the naked eye, and about sixteen in a line. Under the microscope the striæ appear as thin sharp parallel curved ridges, the spaces between being finely granulated and wider than the ridges. I would name this species *O. elegantulum*.—J. W. D.

axis. Axis wider than the lateral lobes, distinguishable (in casts) from the lobes by a bending of the ribs and a scarcely perceptible depression along that line; annulations abruptly prominent; seven on the lateral lobes and nine on the axis, the anterior ones bending slightly backward at the line of division between the axis and the lateral lobe; each successive one bending more and more abruptly till the last one approaches a rectangular turn; the whole curving gently forward at their extremities, and all terminating abruptly before reaching the margin. Behind the seventh annulation the axis is marked by two more annulations, leaving nearly one-fourth of its length smooth.

This species is described from the casts and impressions of the caudal shield, so that the crustaceous covering is unknown. It is readily distinguished by the broad not prominent axis, the rectangular direction of the annulations on the axis, and their abrupt bending at the lateral furrow. An impression of a few imperfect annulations of the body shows that they are strongly elevated, much more so than in any known American species.

31. CALYMENE BLUMENBACHII. var.

Caudal shield somewhat semicircular, axis very prominent, marked by about seven annulations, lateral lobes marked by five ribs the four anterior ones bifurcating. Surface granulose. The specimens are not sufficient to make any satisfactory determinations regarding specific differences.

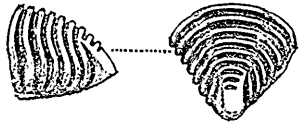


Fig. 17.

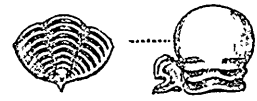


Fig. 18.

32. DALMANIA LOGANI. N. sp. Fig. 18.

The specimens are two or three imperfect cephalic shields, one preserving the palpebral lobes, and others consisting principally of the glabella, with two or three parts of caudal shields. There is a fragment of a cheek which may be of this species. Cephalic shield somewhat semicircular. Glabella ovate, wider in front and truncate behind, depressed convex; occipital ring narrow, prominent; occipital furrow bending a little forward in the middle and curving gently backward in the middle of each side, and

again turning forward; posterior furrows narrow and sharply impressed, each one extending about one third across the glabella and curving forward at their outer extremities; central furrow linear, obscure, having a direction transverse to the axis; anterior furrow obscure oblique to the axis, linear, extending to the margin of the glabella a little forward of the eye; frontal lobe regularly rounded anteriorly. A fragment of a cheek in the same association is broad, produced posteriorly in a short strong spine, and marked by a broad sub-marginal groove. Caudal shield somewhat semi-elliptical, convex, acute behind, axis very prominent, rounded and marked by about eight annulations, which are gently curved backward at the extremities; lateral lobes with six simple flattened ribs which terminate in a thickened border, and separated from the axis by a strongly defined furrow; extremity abruptly pointed.

The glabella of this species more nearly resembles *Phacops* in the general form and faintly impressed furrows, of which the posterior one is conspicuous. The form of the palpebral lobe, and the absence of tubercles at the base of the glabella, together with the form of the caudal shield, ally it with *Dalmania*, and it may be compared with *D. Phillipsi* of Barrande, but has a more pointed caudal shield, and the cheek, if correctly referred, is prolonged in a posterior spine.*

33. Beyrichia pustulosa. N. sp. Fig. 19.

Valves unequally semi-oval, a little more than once and a half as long as wide; surface marked by three prominent ridges; central, anterior, and posterior. The central one is a single oblong oval tubercle which is directly transverse to the dorsal margin and a little nearer the anterior side. The anterior ridge consists of a single highly elevated, rounded or papillose tubercle near the dorsal margin, and an elongated elliptical tubercle placed obliquely near the antero-ventral margin, and in older specimens sometimes swelling and spreading over the margin. The posterior ridge rises near the dorsal margin, and making a slightly broader curve than the posterior end of the valve approaches the ventral margin at the centre: the ridge is high and angular with a small prominent

* Attached to a fragment of one of these trilobites is a small *Spirorbis*. It is dextral, with two to three turns, and rounded concentric wrinkles on the last whorl.—J. W. D.

tubercle at the dorsal extremity, and from four to six smaller spine-like tubercles along its curve. The central ridge or tubercle is separated from the lateral ridge by a distinct furrow, and its continuation from the base of the tubercle passes between the lower ends of the two lateral ridges. Ventral and lateral margins with a narrow thickened rim.

This species resembles very nearly the *B. tuberculata* of Kloden, as described and figured by Mr. T. Rupert Jones. In our specimens the dorsal angles are more rounded; the posterior ridge at its base is never extended beyond the middle of the valve, and is marked on its crest by several small spine-like tubercles. The anterior ridge is usually more extended along the ventral margin in our specimens, and the furrow is better defined, while the tubercles are never flattened above or overhanging the base as shown in the European specimens. Smaller specimens, which appear to be the young of this species, present some slight variations of surface markings, but show less difference than the young of *B. tuberculata.*

Fig. 19.

Fig. 20.

34. BEYRICHIA EQILATERA. N. sp. Fig. 20.

Nearly equilateral, very convex, marked by three smooth or nearly smooth ridges. The central ridge is an oblong tubercle reaching from near the dorsal margin a little more than half way to the ventral margin. The posterior ridge is a little larger, but scarcely differing in form from the anterior one, its ventral extremity terminating beneath or a little in advance of the middle of the central tubercle. The furrow is narrow but well defined on the two sides of the central tubercle, and becoming shallow in its passage to the marginal furrow; ventral and lateral margins thickened.

35. LEPERDITA SINUATA. N. sp.

Minute sub-ovate, anterior end narrow, dorsal line one-third shorter than the length of the valve; an extremely minute tubercle near the anterior end. Centre extremely convex or ventricose; ventral margin near the posterior end a little sinuous, or indented from the inner-side. Surface smooth under an ordinary lens.

Two specimens only of this species have been observed, both of them having the same dimensions.

36. TENTACULITES DISTANS. var.

The specimens under examination do not present any important points of difference from those of the Clinton group in New York. In the Nova Scotia specimens there are numerous annulations near the apex, which are not observable in the New York specimens.

37. HELOPORA FRAGILIS, var. ACADIENSIS.

The specimens under examination offer no very important difference from those in New York, and as the Nova Scotia examples have been more or less compressed and worn, they are scarcely in a satisfactory condition for nice discrimination.

All the above fossils belong to the Arisaig series of Mr. Dawson's paper. Nos. 4, 10, 30, 36 and 37 appear characteristic of the dark and olive shales of the lower member, in which are also *Strophomena profunda, S. rugosa, Orthis testudinaria, Atrypa emaccrata, Rhynconella equiradiata, Graptolithus Clintonensis,* and crinoidal columns; also a *Modiolipsis* allied to *M. subcarinatus.* The remaining species are in the coarse limestone and reddish shale of the upper member, in which are also *Strophomena corrugata, Atrypa reticularis, Rhynconella neglecta, Lingula oblonga, Bucania trilobita,* and a *Chætetes* or *Stenopora* similar to that of the Clinton formation. *Cornulites flexuosus* is almost the only species which occurs equally in both groups of beds. Some of the *Clidophori* are also found in both groups.

REVIEW.

NOTES of a Clerical Furlough, chiefly spent in the Holy Land, with a sketch of the voyage out in the Yacht "St. Ursula." By Robert Buchanan, D.D. Third thousand. Glasgow, Blackie & Sons: Montreal, B. Dawson & Son. pp. 437, with illustrative maps.

This book is written by one of the most esteemed and accomplished ministers of Glasgow, Scotland. It is the fruits of a voyage in the private yacht of Mr. Tennant, a wealthy manufac-

turer of that city. The incidents of the voyage are most agreeably related. The party landed at Alexandria in Egypt, and visited Cairo and the Pyramids, of which places the author gives most graphic descriptions. Returning to Alexandria, they went on to Jaffa—the ancient Joppa, the port of Palestine. From that place they journeyed to Jerusalem. At every prominent place, vivid and most interesting descriptive accounts are given of the physical appearances of the country, together with interesting notices of the historical events associated with the localites. Instead of entering Jerusalem by the Jaffa Gate, the travellers took a detour to the Mount of Olives, which after much fatigue, they reached at night-fall, and spent a cold and comfortless night in an upper room in the Mohammedan Mosque. This, however, was the finest point for viewing the city and its environs. In the morning they descended the Mount, and wended their way along the road which the Saviour frequently traversed on His journeys to and from Jerusalem. The remarkable spots on this route, and the language of Scripture which they illustrate, are carefully noted. We have read nothing more artistic and eloquent than the descriptive parts of this entrance into Jerusalem, Having spent some time in the sacred city, and having visited the Dead Sea and the River Jordan, our travellers extended their journey northward through the classic ground of Samaria, on to the sacred Sea of Galilee. Here, with loving reverence and deep emotion, they linger among the scenes in which so many of the Lord's wonderful miracles were wrought. They went on to Lake Merom and the sources of the Jordan; and visiting Damascus, they then crossed the range of Lebanon, and examining the ruins of Baalbec, passed on to Tripoli, where they embarked again for home. While this book aims only at a familiar narrative of what was seen and experienced in Palestine, it yet exhibits an extensive and accurate erudition. If not so elaborate, it is as accurate and critical as Stanley's. In his powers of impresssing the prominent features of a scene, with its most interesting accessories, vividly upon the mind of the reader, Dr. Buchanan excels any of the late writers on the Holy Land. We know of no more fascinating or delightful book of travels than this is, and would specially recommend it as most suitable for the family library.

A. F. K.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL) FOR THE MONTH OF FEBRUARY, 1860.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE.	RAIN.	SNOW.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.		Mean amount of, in inches.	Amount of, in inches.	Amount of, in inches.	6 a. m	2 p. m.	10 p. m.
1	30.143	30.205	30.173	—25.0	—5.2	—11.1	.010	.026	.015	.64	.70	.55	N. E. by E.	S. S. W.	S.	7.23	0.5	.....	.....	Clear.	Clear.	Clear.
2	190	280	260	—11.6	12.1	2.1	.116	.039	.038	.56	.57	.73	N. E. by E.	S. E. by E.	N. E. by E.	0.52	0.5	.....	.....	Hazy.	Cirri 4.	Cu. Str. 10.
3	470	300	201	1.0	16.8	3.2	.032	.053	.042	.70	.58	.86	N. E. by E.	N. E. by E.	N. E. by E.	4.90	1.5	.....	Inapp.	Cu. Str. 10.	Cu. Str. 4.	Cirr. Cum. 4. Lunar Halo.
4	141	197	053	1.0	17.9	10.9	.041	.068	.057	.85	.67	.79	N. E. by E.	N. E. by E.	S. E. by E.	42.60	2.5	.....	.....	" 10.	Clear.	Clear.
5	014	002	29.840	—5.6	28.7	30.8	.028	.129	.161	.81	.80	.90	S. E. by E.	E. by S.	E. by S.	100.10	2.6	.....	.....	Hoar frost.	Cu. Str. 10.	Cu. Str. 10.
6	29.380	29.320	375	33.0	40.9	37.0	.168	.212	.199	.88	.83	.90	S. by E.	S. by E.	S. W.	136.20	5.3	Inapp.	Inapp.	Cu. Str. 10.	" 10.	" 10.
7	500	529	860	30.1	33.2	23.4	.148	.170	.100	.88	.87	.80	W.	W. by S.	S. W.	264.00	4.0	.....	.....	" 10.	" 10.	Clear.
8	869	874	899	20.5	26.8	18.6	.091	.105	.093	.84	.75	.90	S. W.	W. S. W.	W. S. W.	67.70	3.0	.....	.....	" 2.	Clear.	Clear.
9	567	109	068	18.2	38.9	37.7	.088	.195	.209	.90	.80	.90	S. W.	S. W. by S.	S. W.	47 90	2.0	Inapp.	.....	Clear.	Cu. Str. 10.	Slight Rain.
10	504	897	30.131	4.6	1.0	—5.0	.038	.034	.022	.73	.71	.63	W. by N.	W. N. W.	N. N. W.	655.10	2.0	.....	0.50	Snow.	Clear.	Clear.
11	30.102	914	29.862	—13.3	—4.1	—1.0	.012	.025	.036	.49	.66	.84	W. S. W.	W. S. W.	N. E. by E.	117.70	2.0	.....	.....	Clear.	"	Snow.
12	005	729	974	—1.1	18.0	11.6	.028	.082	.051	.68	.83	.70	N. E. by E.	S. W.	S. W.	146.90	2.3	Inapp.	Inapp.	Cu. Str. 10.	Cu. Str. 4.	Cu. Str. 10.
13	29.842	580	701	15.1	31.9	23.1	.070	.148	.106	.81	.80	.85	S. S. E.	S. by W.	W. N. W.	6.90	4.0	.....	Inapp.	" 10.	Slight snow.	" 10.
14	30.047	864	142	—1.1	19.9	1.0	.028	.065	.032	.66	.62	.70	W. S. W.	W. S. W.	W.	106.70	3.3	.....	.....	Clear.	Clear.	Clear. Zodiacal Light.
15	252	941	846	—8.1	7.0	6.5	.018	.036	.037	.58	.56	.63	N. N. E.	N. E. by E.	N. N. E.	151.40	2.3	.....	.....	"	C. C. Str. 4.	Clear. Imperfect Lunar Halo.
16	29.424	422	689	20.0	25.8	10.3	.091	.123	.054	.84	.88	.77	E. by S.	S. by E.	W.	223.00	5.0	.....	7.90	Snow.	Snow.	Clear.
17	894	799	876	—13.0	12.6	—7.2	.019	.039	.019	.74	.51	.60	W.	W.	W.	67.00	0.5	.....	.....	Clear.	Clear.	Clear. Aurora Borealis.
18	803	614	374	—19.2	4.0	3.1	.008	.038	.036	.40	.72	.78	S. W.	N. E. by E.	N. E. by E.	115.60	3.0	.....	1.00	"	Cu. Str. 10.	Snow.
19	256	340	774	8.9	12.9	6.4	.051	.054	.037	.78	.71	.69	N. E. by E.	W.	W. by N.	539.60	3.3	.....	5.10	Snow.	" 10.	Clear. Aurora Borealis.
20	894	650	664	1.0	25.3	28.3	.030	.111	.135	.69	.81	.88	S. by E.	S. by E.	S. W. by S.	123.20	1.6	.....	1.10	Cu. Str. 2.	" 10.	Cu. Str. 10.
21	801	754	950	26.0	49.5	31.0	.111	.272	.142	.81	.78	.84	S. W. by S.	S. by W.	S. S. W.	103.10	1.3	.....	.....	Cir. Cum. 4.	Clear.	Clear. Splendid Aurora Borealis.
22	874	462	297	17.2	42.4	39.9	.076	.261	.234	.80	.96	.93	N. E. by E.	S. by E.	S. E.	59.80	7.6	0.295	.....	Cu. Str. 10.	Rain.	Cu. Str. 2. Aurora Borealis.
23	075	028	320	35.4	38.4	34.2	.183	.223	.194	.91	.95	.97	S. S. W.	S. S. W.	W. S. W.	111.60	6.6	0.147	.....	Clear.	"	Cu. St. 10.
24	676	682	779	16.0	21.1	15.1	.059	.064	.061	.65	.56	.73	W. S. W.	W. S. W.	W. S. W.	397.40	4.0	.....	.....	Cu. Str. 10.	Cirri 2.	Clear.
25	961	827	971	10.4	25.0	13.2	.052	.094	.059	.71	.68	.74	S. W. by S.	S. W.	W.	91.80	3.3	.....	.....	" 10.	Clear.	"
26	30.244	30.164	30.090	3.7	22.7	19.0	.030	.079	.087	.59	.65	.84	W. by N.	S. W.	S. S. E.	87.00	4.6	.....	.....	Clear.	Cu. Cu. 4.	Cu. Str. 10.
27	29.979	29.960	29.901	15.0	46.1	39.0	.072	.262	.201	.82	.84	.86	N. E. by E.	S. E.	S. by W.	26.10	8.0	Inapp,	.....	Cu. Str. 10.	Cu. Str. 10.	" 4.
28	30.321	30.300	30.260	20.1	28.4	24.1	.091	.129	.111	.85	.82	.85	N. E.	N. N. E.	N. E. by E.	204.00	6.0	.....	.....	" 4.	" 4.	" 10.
29	157	030	29.954	21.7	32 0	34.6	.106	.168	.180	.86	.88	.89	N. E. by E.	N. E. by E.	N. E. by E.	127.30	10.0	0.174	.....	" 10.	Rain.	" 10.
...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

REPORT FOR THE MONTH OF MARCH, 1860.

Day of Month	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE.	RAIN.	SNOW.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.		Mean amount of.	Amount of, in inches.	Amount of, in inches.	6 a. m.	2. p. m.	10 p. m.
1	29.745	29.583	29.533	32.1	35.0	34.8	.168	.204	.196	.89	1.00	.97	N. E. by E.	N. E. by E.	S. E. by E.	64.00	10.0	0.361	.....	Cu. Str. 10.	Slight rain.	Rain.
2	425	516	30.043	32.3	41.3	32.2	.175	.228	.155	.95	.87	.89	W. S. W.	W. by S.	W. N. W.	254.30	7.0	.....	.....	" 10.	Cu. Str. 6.	Clear.
3	30.102	431	29.087	21.3	32.4	39.2	.090	.156	.201	.80	.82	.84	N. E. by E.	S. E. by E.	S. E.	148.80	1.3	.....	.....	Clear.	" 9.	Cu. Str. 10.
4	29.300	434	759	31.0	34.0	21.1	.155	.170	.080	.89	.80	.71	S. by W.	S. by W.	W. N. W.	147.50	1.3	.....	Inapp.	"	Snow.	Clear.
5	708	500	612	14.1	26.8	10.9	.067	.123	.048	.81	.87	.69	S. W. by S.	W. by S.	N. E. by E.	165.00	3.0	.....	0.14	Cu. Str. 10.	"	Cu. Str. 10.
6	856	722	904	8.3	27.0	20.9	.057	.099	.085	.80	.69	.78	S. E.	S. E. by E.	N. E.	121.70	3.0	.....	Inapp.	Clear.	Clear.	Clear.
7	824	600	420	19.1	38.2	34.4	.077	.201	.190	.76	.86	.95	N. N. E.	N. E. by E.	E. S. E.	157.70	3.0	Inapp.	1.00	C. Str. 10.	Snow.	Rain.
8	353	256	520	29.4	42.8	36.7	.136	.230	.184	.83	.85	.85	S. E. by E.	S. by W.	W. S. W.	146.60	4.0	.....	.....	Clear.	Cu. Str. 9.	Cu. Cir. 4.
9	452	462	479	28.0	32.1	21.6	.123	.143	.090	.82	.79	.78	N. W.	N. W.	N. W.	137.10	1.0	.....	.....	"	" 10.	Cu. Str. 10.
10	348	301	454	16.0	28.4	21.1	.070	.129	.080	.80	.82	.71	E.	W.	W.	654.40	1.0	.....	Inapp.	Snow.	" 10.	Cu. Str. 10.
11	547	440	601	20.0	32.0	28.2	.090	.143	.128	.78	.79	.83	W.	W.	W.	451.80	1.0	.....	.....	Clear.	Clear.	Clear.
12	669	625	670	18.9	26.9	27.0	.087	.112	.129	.85	.76	.88	N. E. by E.	N. E. by E.	N. E. by E.	211.80	0.5	.....	Inapp.	Cu. Str. 10.	Cu. Str. 10.	Clear. Faint Aurora Borealis.
13	976	850	914	11.4	35.9	22.7	.056	.170	.079	.72	.80	.65	S. W. by S.	S. W. by S.	S. W. by W.	172.20	0.5	.....	.....	Clear.	Clear.	Clear. Aurora Borealis.
14	971	797	790	13.4	41.0	31.0	.052	.190	.142	.72	.74	.84	S. W. by W.	S. W.	S. W. by S.	9.70	1.0	.....	.....	"	"	Clear. Aurora Borealis.
15	30.017	962	944	24.4	49.6	36.1	.105	.290	.177	.80	.82	.85	S. W. by S.	S. W. by S.	S. by E.	2.20	1.5	.....	.....	"	"	Clear.
16	130	747	942	29.0	57.9	46.0	.129	.343	.241	.82	.72	.84	S. by W.	S. by W.	S.	0.80	1.5	.....	.....	"	"	Clear. Aurora Borealis.
17	050	994	949	31.1	54.1	39.4	.155	.362	.190	.80	.87	.80	S. by E.	S. by E.	S. E.	1.00	1.3	.....	.....	"	"	Clear. Aurora Bor. Solar Halo.
18	159	939	932	30.1	52.0	37.6	.148	.334	.178	.89	.86	.83	E.	E. by N.	E. by S.	0.00	3.3	.....	.....	"	"	Clear. Aurora Borealis.
19	29.920	492	479	30.0	60.0	49.0	.148	.317	.223	.89	.62	.64	E. by N.	S. E. by E.	S. S. E.	0.00	3.6	.....	.....	"	"	Clear. Aurora Borealis.
20	354	042	369	39.0	39.0	37.0	.201	.223	.199	.86	.95	.90	S. S. E.	W. S. W.	S. S. W.	1.00	4.3	0.017	.....	Cu. Str. 10.	Rain.	Cu. Str. 9.
21	479	527	624	20.0	24.0	17.0	.106	.094	.068	.86	.73	.75	W. by S.	W.	W. by N.	133.90	2.0	.....	0.51	" 10.	Snow.	Cu. Str. 10.
22	327	318	560	10.1	20.9	17.2	.048	.096	.078	.78	.85	.83	W. by N.	W.	S. S. W.	306.30	2.3	.....	1.38	Snow.	Cu. Str. 10.	Clear.
23	541	324	329	6.4	34.0	23.6	.049	.144	.100	.89	.75	.79	S. W.	S. W.	S. S. W.	65.90	1.0	.....	.....	Clear.	Clear.	Clear. Aurora Borealis.
24	125	080	210	21.1	52.9	26.1	.080	.131	.117	.71	.70	.76	S. S. W.	W. by S.	W. S. W.	220.80	2.3	.....	Inapp.	Cu. Str. 4.	C. C. Str. 8	Cu. Str. 10.
25	214	234	500	19.6	34.0	31.6	.081	.155	.149	.77	.79	.84	W. S. W.	S. W. by S.	W. by N.	164.90	3.3	.....	1.10	Snow.	Snow.	Cu. Str. 10.
26	679	532	829	23.6	36.2	26.3	.100	.149	.117	.79	.71	.81	W.	W. S. W.	W. S. W.	176.10	3.3	.....	.....	Cu. Str. 10.	Cu. Str. 4.	Cu. Str. 10.
27	797	547	610	12.1	40.0	33.0	.060	.182	.156	.80	.73	.85	S. W. by S.	S. W. by S.	S. W. by S.	90.80	1.0	.....	.....	Clear.	Clear.	Clear.
28	361	350	471	34.6	36.1	26.9	.149	.170	.115	.74	.80	.83	S.	W.	S. W.	194.00	1.0	.....	.....	"	Cu. Str. 4.	C. C. Str. 9.
29	501	400	514	17.0	33.7	27.6	.078	.162	.123	.85	.84	.82	S. S. W.	S. W.	S.	21.60	1.3	.....	.....	Cu. Str. 10.	" 10.	Clear.
30	574	183	164	24.2	52.6	40.0	.100	.282	.221	.79	.73	.90	S. by W.	S. E.	S. S. W.	2.10	4.0	.....	.....	Clear.	Clear.	Clear.
31	162	28.714	008	33.6	61.1	45.0	.182	.383	.251	.91	.71	.84	S. E.	S. W.	W. S. W.	152.00	2.0	.....	.....	C. C. Str. 4.	"	Clear.

REMARKS FOR FEBRUARY, 1859.

Barometer..... Highest, the 3rd day, 30·470 inches. Lowest, the 23rd day, 29.028 " Monthly Mean, 29.813 " Range, 1.442 "

Thermometer... Highest, the 21st day, 49°5. Lowest, the 1st day, —25°0. Monthly Mean, 15°70. Monthly Range, 74°5.

Greatest intensity of the Sun's rays, 68°1.
Lowest point of Terrestrial radiation, —27°4.
Mean of Humidity, .751.
Rain fell on 7 days, amounting to 0.616 inches; it was raining 29 hours and 55 minutes.

Snow fell on 8 days, amounting to 15.60 inches; it was snowing 48 hours and 25 minutes.
Most prevalent wind, the N. E. by E.
Least prevalent wind, the S.
Most windy day, the 10th day; mean miles per hour, 28.30.
Least windy day, the 2nd day; mean miles per hour, 0.18.
Aurora Borealis visible on 4 nights.
Lunar Haloes visible on 2 nights.
The Electrical state of the Atmosphere has indicated moderate intensity.
Zodiacal Light visible. Venus prevents an early or well defined view.

REMARKS FOR MARCH, 1860.

Barometer. ..... Highest, the 18th day, 30.159 inches. Lowest, the 31st day, 28.714 " Monthly Mean, 29.562 " Monthly Range, 1.445 "

Thermometer. Highest, the 31st day, 61°1. Lowest, the 6th day, 8°3. Monthly Mean, 30°52. Monthly Range, 52°8.

Greatest intensity of the Sun's rays, 83°0.
Lowest point of terrestrial radiation, 8°0.
Mean of humidity, .813.
Rain fell on 3 days, amounting to 0.378 inches; it was raining 23 hours 10 minutes.

Snow fell on 10 days, amounting to 4.10 inches; it was snowing 43 hours 1 minute.
Most prevalent wind, the W.
Least prevalent wind, the E.
Most windy day, the 10th day; mean miles per hour, 27.26.
Least windy day, the 10th day; calm.
Crows first seen on the 1st day.
Song Sparrow (*Frangilla melodia*) first heard on 10th day.
Distant Lightning on the 5th day.
Wild Geese (*Anser Canadensis*) first seen on 27th day.
Aurora Borealis visible on 8 nights.
Solar Halo visible on 1 day.
The Electrical state of the atmosphere has indicated rather feeble intensity.