

IV. *On the dispersal of non-migratory Insects by atmospheric agencies.* By ALBERT MÜLLER, F.R.G.S., &c.

[Read 20th February, 1871.]

IF any of my friends, who may do me the honour of perusing this paper, should feel tempted to say that it appears "like a wild flower, where it was least expected," I would tell them, that the subject of Insect diffusion has long had a share of my limited leisure, but that I would not yet have ventured upon publishing my reflections, had I not been reminded by the annual address (1870) of our late president Mr. H. W. Bates, that it is probable the amount of migration and dissemination by winds, currents, and other means, is much underrated by some Entomologists.

It is not within the scope of my theme to consider the great number of instances which literature records of migratory insects.* They are mostly prompted to undertake their wanderings by instinct, climatic or meteorological influences, scarcity of food, and probably other causes at present unknown to us; and we are all more or less familiar with the accounts given of the travelling *Lepidoptera*, viz.: the larvæ of several *Pieridæ*, of *Gastropacha processionea* and *pinivora*, and of *Leucanidæ* (army-worms), the imagines of *V. cardui*, *urticæ*, of several *Papilionidæ*, *Pieridæ*, *Uranidæ*, *Sphingidæ*, the 'Bugong' moths, &c.; among *Coleoptera*, several *Hydradephaga*, *Melolonthidæ*, *Lucanidæ*, *Coccinellidæ*, *Apion vernale*, &c.; amongst *Hymenoptera*, *Formicidæ*, and *Apidæ*; in the *Neuroptera* (in the Linnæan sense), *Libellulidæ*, *Termitidæ*; in *Orthoptera*, *Blattidæ*, *Locustidæ*, *Acridiidæ*, &c.; in the *Diptera*, the larvæ of several *Sciaridæ* ('Heerwurm'); the imagines of a *Bibio*, and sundry *Syrphidæ*; whilst the hosts of *Aphidæ*, and a few species belonging to *Notonecta* and *Aphrophora* may be taken as representing the erratic *Hemiptera*.

All these Insects are, so to say, travellers by choice or profession, and very little surprise need greet their appearance, isolated or *en masse*, in any part of the globe. But it is very different with the normally more or less

* A general survey of the subject has been given by C. Cornelius, in his work "Zug und Wanderthiere aller Thierklassen," Berlin, 1865.

stationary or else local insect tribes, which, by habit, food, or bodily organization, are confined to their native haunts. Their appearance in out of the way localities deserves to be fully investigated, and in following their tracks, we may join Thomas Moore, in saying:

“Poor wanderers of a stormy day,
From wave to wave we are driven,
And fancy’s flash and reason’s ray,
Serve but to light the troubled way.”

Various authors have lit up parts of the troubled way of these insect-waifs, by throwing reason’s ray on the means of their accidental transportation. Sir Charles Lyell, Messrs. Kirby, Darwin, Wallace, Wollaston, Bates, and other naturalists, have shown what human agency, for instance, trade and navigation,* the carrying by larger animals and birds, by the ocean and rivers, by floating trunks of trees, and matted floating islands, pumice stone,† icebergs, and other drifting objects, and what atmospheric conveyance can, in some cases, accomplish.

But I agree with Mr. Bates, that the amount of dissemination by atmospheric means is still much underrated, and it has therefore appeared desirable to me, to bring together into a small compass, some of the leading facts which have forced on my mind the conclusion, that aërial involuntary locomotion is a most active agency in regulating the distribution of sedentary terrestrial Entoma.

It is well known that Monads, Infusoria, winged and other seeds, the ashes of volcanic eruptions, the sands of the deserts of Africa and America, and other substances, are carried over land and sea by heavy gales. Fishes and newts have been known to be taken up by waterspouts or whirlwinds, and deposited far from their original localities, when the forces which had raised them, were spent. A. von Humboldt has recorded that small

* Consult Von Frauenfeld’s paper in *Verhandl. zool.-bot. G. in Wien*, XVII. pp. 425-464, 1867.

† I have often found such floating and porous pumice stones on the Rhine, along the line of rejectamenta left by the spring floods, and I used to find these stones resorted to by various small *Carabidæ*, such as *Bembidium*, *Anchomenus*, *Loricera*, *Chlænium*, *Omophron*, and others. I can therefore confirm Mr. Bates’ supposition (‘*Naturalist on the River Amazons*,’ 2nd ed. 1864, p. 299), that they often serve as vehicles for insects and seeds to distant shores. I have also seen such stones left high and dry by a freshet, the pores filled with river mud, and seeds germinating in it. A. M.

songsters and butterflies were met by him several times in the South Sea, during gales blowing away from the land, and that, just as involuntarily, insects are often carried to the height of 15,000 to 18,000 feet above the plains. This illustrious savant says that the warmed surface of the earth causes a vertical current of air, by which light bodies are driven upwards, in confirmation of which explanation he gives the observation of M. Boussingault, who, together with his companion, Don Mariano de Rivero, saw rise from the valley of Caracas, whitish illuminated bodies mounting up to the height of 5,400 feet to the summit of the Silla, and then sink towards the adjoining coast. This was at midday, and lasted an hour without interruption. Taken at first for a swarm of small birds, these bodies were afterwards recognized as small balls of accumulated blades of the grass *Vilfa tenacissima*.* The same author observes that Captain Fremont met with bees on the peak in the Rocky Mountains, bearing Fremont's name, and that, perhaps, like the butterflies met with by himself in much higher regions of the Andes, also within the line of perpetual snow, they were involuntarily carried up by ascending currents of air.† Mr. Wollaston says: "Unwilling victims, are ever and anon hurried to comparatively distant lands by the very winds that blow; and not only to distant lands, but over altitudes in which the severity of the cold would quickly annihilate them, were they (as, perhaps, usually happens) to be deposited there on their headlong and compulsory course."‡ Sir Charles Lyell observes that, "as almost all insects are winged, they can readily spread themselves wherever their progress is not opposed by uncongenial climates, or by seas, mountains, and other physical impediments; and these barriers they can sometimes surmount, by abandoning themselves to violent gales, which may, in a few hours, carry them to very considerable distances."§ Our president, Mr. A. R. Wallace, has lately reminded us that violent gales of wind, for example, will carry bodies of greater specific gravity than beetles for many miles

* A. von Humboldt, 'Ansichten der Natur,' 1860, vol. II. p. 30.

† Ibid. Vol. I. p. 42.

‡ 'On the variation of species,' p. 148, 1856.

§ 'Principles of Geology,' 9th edit., p. 656.

through the air; and storms and hurricanes are of such frequent occurrence, that they must have played a large part in stocking all uninhabited lands. (Address, &c., to the Ent. Soc. Lond. 23rd January, 1871.) A small longicorn beetle was observed to fly on board a vessel 500 miles off the west coast of Africa.* A moth belonging to the genus *Andea* was captured at sea, more than 200 miles from the west coast of Africa, and a butterfly and several grasshoppers were noticed on board the ship, all of which are said to have been borne over the sea by the trade wind.† A *Colymbetes* once flew on board the "Beagle," when forty-five miles distant from the nearest land: how much further it might have flown with a favouring gale no one can tell.‡ The beetles in Madeira, as observed by Mr. Wollaston, lie much concealed until the wind lulls and the sun shines;§ a fact which I have found to hold good with all orders almost everywhere. I have collected in mountains, but more particularly in the bleak range of the Swiss Jura, near the Creux du Vent, where I have noticed that a breeze has the immediate effect of sending every flying creature either to the nearest rock, or into the very short herbage for shelter. This universal habit of mountain insects seems to denote their appreciation of the dangers which may arise to them from atmospheric disturbances.

Taking all these facts (selected at random) into consideration, and bearing in mind the towering and soaring,|| often out of sight, of many butterflies and moths, the cloud-like swarms of *Formicidæ*, *Tipulidæ*, and other *Diptera*, dancing round church towers,¶ and over the tops of

* 'Zoologist,' 1864, p. 8920.

† B. T. Lowne, in Trans. Ent. Soc. Lond. ser. 3, vol. 2, proc. p. 39.

‡ Darwin, 'Origin of Species,' 3rd ed. 1861, p. 417.

§ *Ibid.* p. 153.

|| Soaring of a moth, *Anisoneura hypocyana*; read Charles Horne's note, 'Zoologist,' 1869, pp. 176-7.

¶ *Vide* Bond, in Trans. Ent. Soc. Lond. ser. 3, vol 2, proc. p. 114:—"Millions of swarming reddish ants round the tower of St. Maurice at Coburg, mistaken for curls of smoke....Firemen called out, &c.;" and Wormald, *ibid.*, stating that he "had seen something very similar at St. Albans, on the 26th of August, when a swarm of small black ants presented the appearance of smoke issuing from the Abbey."

trees,* or on cliffs exposed to all the vehemence of sudden gusts of wind; the circling flight of *Anoxia australis* over the highest ashy cone of Vesuvius, observed by Dr. C. A. Dohrn in 1856;† the occurrence of *Chlorops lineata* enclosed in a hailstone, as recorded by Mr. F. Walker,‡ coupled with Mr. Pascoe's remark, that though insect swarms were not common on or very near to the surface of the earth, there must be great abundance of insect life in the upper atmosphere, and that the destruction of insects at a considerable elevation by swifts, must of itself be enormous,§ I think I have proved that the very habits of many insects are favourable to their forced removal by aerial disturbances.

But there is some other more direct kind of evidence to be related. On the 2nd January, 1868, a storm raged over Teneriffe, which felled the celebrated Dragon tree of Orotavo, and uprooted the Cochineal plantations of the island, carrying many plants clear away. Numerous living larvæ of all sizes belonging to *Ægosoma scabricorne*, were scattered far and wide from the broken bole of an old lime tree at Basle, blown down during a violent hailstorm on the 8th March, 1868.|| In an article on Argentine *Coleoptera* by Ed. Steinheil, printed in the "Atti della Società Italiana di Scienze naturali, 1869," it is stated of *Calosoma bonariense*, Dej., that this, and other *Carabidæ*, could be collected in numbers in the

* Haliday records of *Culex detritus*, that it is seen in Ireland "in the evening, in columns about the tops of trees, appearing like smoke at the distance of a furlong." (Entom. Mag. vol. I. p. 151, 1833.)

Fairmaire says:—"qu'il a vu à Stockholm, autour de peupliers, au milieu de la ville, d'immenses quantités d'insectes, probablement des Diptères et Névroptères, qui formaient des véritables nuées ressemblant à de la fumée, à l'extrémité des branches. Au dire de MM. Boheman et Sundevall, ce fait se reproduit chaque été et avec un développement plus grand." Bulet. de la Soc. Ent. de France, 1856, p. lii.

On the 12th and 13th August, 1865, the high tops of most pear trees in the commune of Roggwyl, cant. Thurgovie, Switzerland, were observed to be crowned with gyrating small blackish clouds of winged ants, presenting the appearance of curls of smoke. A west wind arose, and suddenly swept the swarms away.

† 'Stett. Ent. Zeit.' 1870, p. 423.

‡ 'Ent. Weekly Intelligencer,' Vol. 7, p. 76, 1859.

§ Trans. Ent. Soc. Lond., 1869, proc., p. xxvi.

|| *Ibid.* 1870, proc., p. xxxviii.

middle of November 1865, and at about the same period in 1866, in the streets and houses of Buenos Ayres, and that they were wafted there by the Pampéro, the stormy west wind, which brings bright weather from the neighbouring Pampa, after the rain. It is stated, that this was a "true rain" of insects, and that the houses, cellars, terraces, rooms, &c., were swarming with the creatures. Dr. C. A. Dohrn says, in allusion to this fact, which was observed by Strobel, that, if the latter were right in his supposition that the said insect rain in November is a periodical event, Professor Burmeister would certainly be in a position either to confirm, or negatively to answer it.* In connection with this record, it seems desirable to mention that Professor Lacordaire says, in his "Introduction à l'Entomologie, p. 494, that for two consecutive years, while he was at Buenos Ayres, this town was, every spring, for eight days, visited by millions of *Harpalus cupripennis*, which arrived daily in the dawn of the morning, and had to be swept away every morning from the outside of the houses, where they were piled up several feet in height."† Professor Westwood has recorded swarms of *Harpalus* near Dover, on the 12th August, 1839.‡

Monsieur Rouzet states, that on the 21st May 1856, the exterior Boulevard of the Barrière du Père Lachaise at Paris, was covered with multitudes of *Rhizophagus parallelcollis*, Gyll., to a height of from five to six millimètres, and along the walls they lay a centimètre high, for a distance of more than a kilomètre. A storm came on in the evening and swept them all away, so that none were left the next day.—*Bulletin de la Soc. Ent. de France*, 1856, p. lii.

Captain Fitzroy tells us in his "Narrative of the Surveying Voyages of H.M. ships 'Adventure' and 'Beagle,' that, "between the La Plata and the Rio Negro, myriads of white butterflies surrounded the ships in such quantities that the seamen said, 'it snows butterflies!'" They were brought by a gale from the north-west, which increased for a time.

* Stettin. Ent. Z., 1870, p. 428.

† Quoted by Cornelius, 'Wanderthiere,' p. 230.

‡ Trans. Ent. Soc. Lond. ser. 1. vol. V., proc., p. 24.

Caldcleugh relates in his "Travels in South America," that he experienced in 22° north latitude, a violent gale accompanied by thunder, lightning, and a waterspout, and that afterwards, on the deck, and in the tackle, a number of butterflies were found.

Cornelius, in referring to the two preceding facts, points out, that here we meet with swarms of butterflies in casual connection with grand natural phenomena, such as strong gusts of wind and violent tempests, and that it seems to him very well admissible, that during great storms, but especially in the course of waterspouts and tornados, a large number of such insects are swept together, and carried over land and sea.* The same author observes, that, in preference, he would assert this for mixed swarms, consisting of several kinds of insects. An instance of such an assemblage is related by Van Bemmelen, † who met with unspeakable numbers of white butterflies, principally *Pieris brassicæ*, one or two species of *Sphæx*, and *Diptera* agreeing with *Musca vomitoria*, Linn., arriving from the sea in the Downs near Nordwyk aan Zee, at eleven o'clock, a.m., on the 13th July, 1855. On reaching the Downs, they lessened the rapidity of their flight; some settled, others kept on their course. The flying past was observed for an hour; the direction was W.N.W. to E.S.E., the wind was W.N.W., and gentle.

The above are by no means all the observations referring to the occasional transportation of non-migratory insects which have been made, but I opine that enough has been said to prove that, whenever atmospheric disturbances occur suddenly, considerable numbers of more or less stationary insects are likely to be, or are in reality, removed to distant quarters. Who has not seen the clouds fly overhead with astounding rapidity, and what insect could resist the direction of the current of air thus indicated, even for hundreds of feet away from the moving mass?. In mountainous districts particularly, the clouds as they closely encircle a peak for a time, must often bring or carry off such castaways.

A local phenomenon connected with the forced dispersal of living beings, occurs constantly on the Alps; I

* 'Wanderthiere,' p. 255.

† *Handelingen nederl. Entom. Vereen*, 1857, p. 91.

allude to the avalanche. Wherever strong inclines annually receive and discharge large masses of snow, there the dreaded spectacle may occur. Many thousands of feet overhead, the fleet step of the chamois, the rising of a bird, or a stone detached by the action of the frost, may loosen a small lump of snow, which rolls down and detaches others, their weight and rapidity of fall increase, whole fields of snow loosened by the wind called "Föhn" follow, and down the mass rushes, mile after mile, carrying everything before and with it, snow and ice, rock, forest, chalet, meadow, man and brute! The body of air quickly displaced by this moving mass, rushes in front with the rapidity of lightning: woe betide the living creature within its reach; hurled along with thousands of fellow sufferers, it finds itself in a few minutes deposited miles away from its home; eggs, larvæ, pupæ, all—the very bush on which they were surprised—the very sod which had harboured them, have joined the flight, and for miles down the valley the windows rattle, and the doors slam with the impetus they have received from the sudden shock of air.

I mention this Alpine scene, to show the power of the atmosphere in dealing with organized nature. I feel certain that a great many so-called faunistic novelties, are the mere wrecks of hosts of insects distributed by currents of air; the results of their carrying powers are often before us, but as it is the wholesome habit of man with "the bare back," to seek shelter when the storm rages, no doubt they are mostly overlooked. However, just as the floating belts of *Aphidæ*, *Syrphidæ*, and *Coccinellidæ* around our coasts, as the rows of dead locusts on the banks of southern waters, as the white "*Uferaaas*," the remains of *Ephemeridæ* lining continental rivers, indicate the destructive power of the watery element, so the atmosphere, too, has its great wreck chart spread out for those who will read it. It has this in common with the new charts of the mariner, that, excepting general outlines, it presents to the eye a white surface, which becomes gradually dotted over with little blotches, denoting the spots where living freights have suffered shipwreck. Wherever a certain altitude presents the needful conditions, or when winter clothes the land with snow, our map is spread; and I will now endeavour to point out some of the wrecks, which human observation has marked upon it.

1672. Nov. 20. S. F. Frenzel records a fall of insects, with snow, in Hungary.—*Dissertatio de Insectis*, 1673.

1672. D. M. Moller writes a "Meditatio de insectis quibusdam Hungaricis prodigiosis anno proxime præterito ex aere una cum nive in agros delapsis.—(No doubt the same fall as the one above) 1673.

1722. An account is given in this year of "snowed" worms.—*Breslau. Naturg. u. Kunstgesch. Vers.* 19, p. 166.

1749. De Geer records the occurrence in Sweden, of the larva of *Telephorus fuscus* on the snow in winter.—*Vetensk. Acad. Handl.* Vol. 10, p. 76.

1749. T. Hesselius records finding living insect larvæ on the snow, in Sweden.—*Vetensk. Acad. Handl.* Vol. 10, p. 75. (Refers perhaps to the preceding instance.)

1753. M. C. Hanow records a fall of snow-worms in Germany.—*Titius, Seltenheiten*, Vol. 1, p. 456.

1758. Another instance occurs of larvæ found on the snow, in Germany.—*Stuttgart. Phys. Econ. Anz.* Vol. 1, p. 157.

1806. Schramm publishes a note on the snowing of larvæ in Silesia.—*Verhandl. G. z. B. d. Naturkunde Schlesien's*, p. 217.

1811. J. S. Capioux makes some remarks on the appearance of many larvæ which had been seen in sundry places in Saxony on the snow.—*Leipzig Intelligenz Bl.*, No. 12, p. 97.

1828. G. Fischer von Waldheim reports on larvæ of *Telephorus fuscus* found alive on the snow.—*Bullet. du Nord.*, p. 45.

1847. January 30. Snow, together with larvæ, fell in the Eifel.—*Allgem. deut. Naturhist. Zeit.* Vol. II. p. 176.

1849. January 24. Count C. Tyzenhaus records a fall of *Telephorus fuscus* in Lithuania.—*Revue et Magas. Zool.* Vol. I. p. 72.

1856. Professor Oswald Heer records the occurrence of larvæ, to the number of 300,000, of *Telephorus fuscus*, on snow in Switzerland.—*Vierteljahrsschrift d. naturf. G. in Zürich*, Vol. I. p. 85.*

Most of these records refer to *Telephorus fuscus*, which passes its metamorphosis underground in the roots of trees, in large numbers. Such trees being uprooted by storms, the larvæ become exposed, and liable to be carried away. But it is needless to inquire, in this paper, into the real value of all these records of the fall of insects with, or on snow; some are *bonâ fide* occurrences, witnessed by careful observers; others must be taken *cum grano salis*; and a few may be referred to early and wholesale eclo-sions from the pupa-state. In the latter category must be placed the often observed occurrence of *Cynips aptera* on the snow.

I may insert here, that in 1765, a list was published of a quantity of insects found after rain,† and that probably the reason why we do not possess more evidence of the fall of insects together with fluid water, is to be

* The above chronological list is compiled from Dr. Hagen's 'Bibliotheca entomologica.'

† Frank. Samml. Vol. VII. p. 362, 1765.

sought in the circumstance of their being thus far more likely to escape notice, than if they were deposited on the unsullied surface of freshly fallen snow. But that such falls must occur, is shown by the fact of the fly found in a hail-stone, which I have already alluded to.

So far, I have only stated the evidence afforded by insects deposited in the plains.

Ascending now the mountains, we ought to expect to find similar wrecks of insect transports, if the theory that atmospheric involuntary locomotion is a powerful agency of dispersal, be worth holding.

And so we do, here are the proofs tabulated :—

PYRENEES.

MALADETTA.

Observed on the snowy dome of the glacier, at a height of about 11,000 feet, great numbers of a *Chrysopa*, both flying and crawling on the snow. July.

Glacier of the Vignemale, at a nearly equal height, obtained a fine series of *Ichneumon antennatorius*, Grav. They were picked up at intervals of a few yards, alive but feeble, each one being at the bottom of a small pit or depression in the snow. With them, in equal abundance, a moth, probably *P. gamma*. Also a few *Lygæus equestris*, noticed by Ramond in his attempt to scale the Touquerone glacier, leading up to Mont Perdu.

(Rev. T. A. Marshall, Ent. Mo. Mag., Vol. 5, p. 170; Dec. 1868.)

ALPS.

MONT BLANC.

14,800 feet (Parisian).

“Last year, one of my friends, Dr. Ordinaire, made an ascent of Mont Blanc. On arriving at the summit, the first object that attracted his attention, was a *Plusia gamma*, kicking in the snow.” (Bruand, Catal. des Lepidopt. du Dépt. du Doubs, 1845, p. 83.) Ad. & Aug. Speyer say in reference to this observation, “so much is certain, that only an accident, and ascending current of air of rare steadiness and intensity, could have brought the creature into that inhospitable region. (Die geograph. Verbreit. der Schmetterlinge Deutschlands und der Schweiz.” 2nd part, 1862, p. 29.)

MONTE MORO.

“At an elevation of about 8000 feet, in small cylindrical holes in the snow, in each either a small lump that looked like peat, or more frequently an insect, invariably either *Dipterous* or *Ichneumonideous*.” One insect found lying on the snow was still living, viz., *Cryptus tarsoleucus*. F. P. Pascoe, Proc. Ent. Soc. Lond. Vol. 3, April, 1865. Further particulars in my paper, Zoologist, 1866, p. 273; and discussion of the same in Trans. Ent. Soc. Lond., 3rd ser., vol. v., proc., p. xix.; and Dr. Imhoff's note in the ‘Zoologist’, 1866, p. 390.

ST. GOTHARD.

"I well remember, at the head of the pass during the month of May, to have been forcibly struck by the great accumulation of insect-life at the bottom of some rounded depressions in the snow, which had melted so as to expose the soil beneath it, thus, forming as it were, black oases amidst an ocean of unsullied white. They were chiefly *Coleoptera*." (T. V. Wollaston, Zoologist, 1866, p. 313. and compare this paper for arguments *pro* and *con*. the alpine origin of the insects in question.)

TIMBL.

(Passeier Grund.)

Ascending the heights towards the glacier, between 5900-8000, *Aphodius discus* is met with, "and on my second journey when I intentionally searched the snow-field, I found it strewn over with them in great numbers, if not carried there by whirlwinds, as I am inclined to suppose by the many *Noctuæ*, *Diptera*, and a *Calopus serraticornis* struggling with death, which were lying about." P. V. Gredler, 'Verhandl. etc., des siebenbürg Vereins für Naturwissensch.' 1856, No. 2.

CARINTHIAN ALPS.

"F. Löw published (Verh. zool.-bot. Ges. in Wien, xvii. pp. 751-752) a note on the species of Insects found on the snow in Carinthia (elevation 2700-3400) by R. Kaiser, in the winters of 1858, 1861, and 1862. The number of species is small, but included a new *Homalota* (*H. glacialis*, Mill.); two species of *Nabis* occurred, and *Achorutes murorum* in great quantities." ('Zool. Record,' 1867, p. 204.)

Without prejudicing the question, how many or how few of the observations mentioned in this table, refer to insects peculiar to the neighbourhood of the snow-fields and glaciers on which they were found, I think it will be allowed for each individual instance, that ascending currents of air, or whirlwinds, such as often happen in mountain regions, were the main causes of their reaching their inhospitable and, probably, last resting-places. But the winds which deposited them there, might have carried them beyond the respective mountains, and might have allowed them to settle in more comfortable quarters; and if these premises are granted, then my object of proving the forced dispersal of non-migratory *Articulata* by atmospheric agencies is reached.

Most of the facts collected in this paper refer to the dissemination of living insects in continental Europe only, but it stands to reason, that if my conclusions are correct as regards continents, the *modus operandi* of Nature will be often a similar one as regards the populating of islands. Only, of course, the chances of life for castaways are in this case much lessened; not because their chances on arrival are worse, but because they probably often find a watery grave before reaching land.

It also seems to me, that the array of facts adduced here is a justification for the opinion, that instead of being an accidental and isolated event, the involuntary dissemination of stationary insects will be eventually found to be mostly regulated by the periodical disturbances of the atmosphere, aided by their own locomotive powers in some instances, and in others by the habits of life which expose them to its constant influence.

As the ploughshare breaks up the green sward of arable land, and disturbs the closely interwoven roots of the existing assemblages of plants, so do tornados, whirlwinds, and storms furrow the surface of our globe in all directions, unsettling and scattering prosperous communities of living creatures, and rendering many of them for a time the helplessly drifting waifs of an ocean

“Whose every wave breaks on a living shore.”



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