whose death in 1724 it descended to his son. The latter, having died childless, gave the business to a relative named Ebersberger, and a friend named Franz, provided they always retained the name of Homann in the title of the firm. Franz endeavoured to introduce originality into their maps, thus coming in contact with many geographers, and ultimately founding the "Cosmographic Society," which was divided into mathematical, geographical, and historical sections. In a work published in 1750—the "Kosmographische Nachricht und Sammlung auf das Jahr 1748"—the Society complained loudly of the defective condition of mapping and surveys in the German States, and criticised unfavourably existing maps of Germany, as well as suggested the best modes of improving them. The paper then describes the principal members of the Society, their projects for the increase of geographical knowledge—among others a lottery to procure funds. Gradually, however, the leading spirits were called away to various German universities, or to Russia; the Seven Years' War prevented any steady work of the kind advocated; Franz and Tobias Meyer died, and the "Cosmographic Society" ceased. Its labours appear to have been confined to remedying defects which lay at hand, to supplying good popular maps of Germany, and to obtaining more accurate information as to German geography.

In August last the ship *Fenorina*, Capt. Nilson, arrived at Philadelphia from Ivigtut, in Greenland, reporting that an Eskimo had found on an ice-floe in the Julianehaab Bay, the lower part of a tent, the sides of a wooden chest, and some other things marked *Jeannette*, a bill of lading, and some cheques signed "De Long," a pair of oilskin trousers marked "Louis Noros," and a bearskin which covered something of the shape and size of a human body, but which the Eskimo did not examine on account of his superstitious prejudices. On another floe he found a quantity of sailors' apparel. The Eskimo brought some of the articles to Julianehaab, and gave them to the governor, Herr Lytzen, who at once set out to recover all the rest, but the Eskimo was unable to find the spot again. Herr Lytzen now states that among the articles are two sides of a wooden chest, on which is written in pencil, "General orders, telegrams, sailing orders, discipline, ship's papers, various papers, various agreements, charter party, . . ." The last words are not very clear. On the other board is written, "Before sailing." There is also a torn book of cheques, on which is printed, "For deposit with the Bank of California," and a pair of oilskin trousers marked "Louis Noros." The most remarkable circumstance of this discovery is naturally the spot in which it was made, as these articles must in the course of three years have drifted on an ice-floe from long. 155° E. to 46° W.! They can hardly hail from the place where the *Jeannette* was crushed, as she sank, and the surrounding ice-floes were ground to dust by the catastrophe. But we know from the reports of Messrs. Dannenhower and Melville that the crew, after leaving the vessel, camped for a few days on some ice-floes, in order to divide the provisions. This took place near the New Siberian Islands, and probably the tent had been erected where the remains were now found. As nobody had then died, there cannot have been any corpse under the bearskin. Which way the ice-floe has drifted can only be conjectured; but by a rough calculation the distance is about 2500 nautical miles, and, as it has been covered in about 1000 days, the average rate of drifting is $2\frac{1}{2}$ nautical miles per day, without allowing for deviations.

"Emperor William," "Prince Bismarck," and "Count Moltke" are the names given to three cataracts by Herr Gustav Mederstein on his exploring tour up the Parana River in the province of Misiones (Argentine Republic). They belong to a middle group of some hundred cataracts of the Iguassi River, which at that spot forms the boundary between the Argentine Republic and Brazil. The river's breadth above the falls is about 5 kilometres; the "Emperor William" is the middle one of the three cataracts, and the total height of the falls is about 50 metres. At a distance of some 16 kilometres below the falls the Iguassi joins the Parana.

M. Thouar, who has already travelled in South America in search of the Crevaux Expedition, is about to commence a new journey of exploration, which is to last two or three years. He intends investigating the delta of the Pilcomayo, and endeavouring to open a great trade route between Bolivia and Paraguay. In this work he will, it is said, receive the active support of several South American Governments. During the journey he will collect the materials for a great work on South America.

The Expedition which had left Loango, led by Lieut. Delizie, in order to carry provisions to De Brazza's Mission at Stanley Pool, was abandoned by about two hundred carriers on the shore of Lake Loudima. It arrived at the Manyanga Station on the Congo (a station of the International Society) on July 18, and prepared to make a new start.

AN ACCOUNT OF SOME PRELIMINARY EXPERIMENTS WITH BIRAM'S ANEMOMETERS ATTACHED TO KITE STRINGS OR WIRES[1]

These experiments were regularly commenced in September 1883, and continued at intervals up to June 14, 1884. A preliminary note descriptive of the apparatus and method employed appeared in the *Quarterly Journal* of the Royal Meteorological Society in 1883. As, however, some improvements have since then been made in the mode of flying and estimating the heights, it may be as well to give a brief account of the scheme *de novo*.

First of all two kites are now flown tandem, the upper one being a small kite about 4 feet high, which is easily got up, and which, when it has reached an altitude of about 100 feet, where the wind is always considerably stronger than at the earth's surface, is used to lift up the larger main kite (7 feet high) which bears the string (latterly wire) to which the instruments are fastened. It also helps to keep the latter steady when up, and prevent any sudden and dangerous descent of kites and instruments. The larger kite is now made of tussore silk of the diamond pattern and capable of folding up like Archer's patent portable kites. The tail, which is in reality a most important adjunct, and usually the first part of the apparatus to give way, is made of six large wire-rimmed canvas cones fastened to a swivel which allows them to revolve without twisting their cord.

In the first experiments the main kite was flown with a strong flax cord, but latterly, at a suggestion by Sir William Thomson, piano-cord steel wire has been used similar to that employed in Sir William's deep-sea sounder. This I have found a great improvement on the string. It is double the strength, one-fourth the weight, one-tenth the section, and one-half the cost, the only drawback being that, unless great care be exercised, it is very liable to kink and rust. To obviate the latter I have got my supply for the coming year electroplated.

It is also necessary to have wire all through, otherwise a disagreeable discharge of electricity is apt to take place at the junction of the wire and string in ordinary weather, a fact to which some of my friends would be able to testify. When the wire is continuous, and in contact with the iron of the winder which is riveted to the ground, I have found no perceptible shock in ordinary weather. The winder was made for me by Messrs. Elliott Bros., and though by no means perfect, is capable of being riveted to the earth so as to hold the kite in a powerful wind, and being furnished with a ratchet and spring catch, can be locked so as to allow me to attend to the anemometers, take observations with the theodolite, &c.

The anemometers are of the ordinary Biram pattern, 6 inches in diameter, and suspended to a gun-metal rod so as to swing in the vertical plane of the wire, the rod being fastened to the wire by clamps at its ends. When the large kite is about 100 feet or so from the winder, and steady, an anemometer is fastened to the nearest 100-foot mark and its indication and the time noted. The wire is then payed out a certain distance, and another anemometer attached, and so on, the interval between the lowest instrument and the winder being regulated by whether the differences of velocity are required for a comparatively high or low altitude respectively. The altitudes are measured by taking the vertical angles of the instruments every ten minutes with a theodolite placed at the winder, and combining their average value for the whole period with the lengths up to each instrument. The method employed is necessarily approximate, as I cannot leave the winder very well and take simultaneous observations at the ends of a base line. It is, however, one which I have reason to believe to be very fairly accurate. A certain allowance for curvature is made up to the lowest instrument. The arc between the two instruments is then taken to be approximately equal to its chord, and from this and the vertical angles the chord to the highest instrument is calculated, and thence its vertical height. This method

[1] Paper read at the Montreal meeting of the British Association by Prof. E. Douglas Archibald.

has occasionally been checked by observations taken at the ends of a base of 891 feet, and with such satisfactory results, that in the present case, where the observations being relative, great accuracy in measuring the absolute heights is not required, I have decided to adopt it in preference to the latter infinitely more cumbrous method.

Numerous observations have been made without success, accidents of all kinds happening both to kites and instruments, sufficient to deter any one who was not imbued with a little faith that all would eventually come right. I have therefore only been able so far to collect the results of a select few, viz. 23 in all, in which the conditions were favourable.

Hitherto I have only used kites as a *point d'appui* for observations on the differential velocity of the air at different heights, a purpose for which they are obviously exceptionally fitted. I am hoping, however, during the coming year, with new and improved apparatus and assistance, for which I have received a Government grant, to employ the same means of elevation for observations of temperature, pressure, height of cloud-strata, &c.

Anemometer Observations on Kite-Wire

Date and time of day	Instrument	Height in feet H	Velocity in feet per minute V	Time in minutes T	True direction of wind D
1883					
Sept. 8	B	278	1561	98	N. 22° W.
4.53 p.m.	A	77	989	82	
Sept. 10	A	257	1542	106	S. 8° E.
12.25 p.m.	B	160	1352	85	
Oct. 6	B	425	1177	121	N. 7° E.
3.59 p.m.	A	178	833	109	
Oct. 20	B	380	1163	75	N. 85° W.
3.29 p.m.	A	146	882	59	
Oct. 20	A	217	1209	34	N. 85° W.
5.12 p.m.	B	98	864	25	
Oct. 24	B	230	1907	25	S. 82° W.
4.12 p.m.	A	110	1248	19	
Nov. 10	A	383	1771	130	N. 48° W.
12.31 p.m.	B	138	1499	109	
Nov. 10	B	405	1791	114	N. 75° W.
3.1 p.m.	A	148	1539	102	
1884					
Feb. 16	A	232	2079	26	S. 38° E.
4.42 p.m.	B	107	1638	20	
Feb. 23	B	430	2534	90	S. 37° W.
4.31 p.m.	A	294	2441	85	
Feb. 27	A	130	1147	56	S. 53° E.
5.26 p.m.	B	40	746	45	
March 8	B	270	1392	73	S. 49° W.
5.13 p.m.	A	88	1012	37	
March 15	B	268	1632	103	S. 48° E.
4.50 p.m.	A	79	1119	89	
March 19	A	433	1518	62	S. 52° W.
4.44 p.m.	B	215	1234	53	
March 20	B	344	2384	79	S. 87° W.
3 14 p.m.	A	167	2016	66	
April 2	A	446	1639	78	S. 23° E.
5.49 p.m.	B	212	1165	68	
April 4	B	430	2202	101	S. 44° E.
3.34 p.m.	A	228	1916	79	
May 14	D	422	2038	112	S. 38° W.
3.13 p.m.	C	292	1936	99	
	B	185	1904	90	
May 26	B	495	1994	69	N. 77° E.
2.58 p.m.	D	207	1879	59	
May 29	D	646	1769	98	S. 64° E.
3.44 p.m.	B	310	1648	90	
May 30	B	631	2102	97	N. 37° E.
3.38 p.m.	D	329	2025	88	
May 30	D	643	2039	87	N. 35° E.
5 p.m.	B	334	1987	78	
June 14	A	618	2040	52	N. 1° E.
11.5 a.m.	C	324	1950	38	

The height of the place of observation is 500 feet above sea-level.

Of course it is not intended at this early stage to attempt to draw any but the most temporary conclusions from such sparse data. There is no doubt that if observations could be taken every hour a distinct diurnal variation in the difference between the velocity at two given heights would be observed, the velocity at the greater altitude probably tending towards a minimum about the same time that the velocity at the earth's surface reached its maximum. This would, however, only be found to be the case when the heights were about 1000 feet or more. Apart from actual determination by help of the instruments, however, the existence of such a diurnal variation has been several times forcibly brought to my notice by the fact that while during the middle of the day the kite frequently flies with great difficulty owing to the presence of vertical ascending and descending currents; towards evening, when the wind at the surface has often died away altogether, the kite flies at a higher altitude and pulls harder and steadier than it did during the day. This has so often occurred that I have ceased noting it as anything extraordinary. I may observe that such a condition is precisely what one would expect if the theory of the diurnal variation in the velocity of the surface wind given by Dr. Köppen in the *Zeitschrift der Oesterreichschen Gesellschaft für Meteorologie* for 1879, be accepted. According to this theory the expansion of the lower strata by solar action during the day, causes an intermixture of the air (*luft austausch*) to take place between the upper and lower layers, by which the velocity of the lower layers is increased by the greater velocity which the descending air brings with it from above, while the upper layers have their velocity decreased by the smaller velocity with which the ascending lower air retarded by the asperities of the earth's surface, is endowed. Thus while the mean velocity of the atmosphere might remain about the same, the differences between the velocities above and below should undergo a diurnal period, the minimum difference occurring somewhat after midday. I was glad to see the other day that some observations on the velocity of the wind at some lofty observatory (I think Pike's Peak) showed that the diurnal period in the wind velocity at 8000 or 9000 feet, in exact opposition to what occurs at the earth's surface, exhibited a *minimum* about midday.[1]

Another feature that has been brought out by observing the flight of my kites, which frequently fly at heights of from 1300 to 1500 feet above the sea and thus enter the clouds, is the existence of a *courant ascendant* under cumulus and cumulo-stratus clouds. When such a cloud comes over, the kite rises up until the string is at an angle of 60° or more; but in proportion as it rises, so its pull becomes weak; the kite in fact lies on its face, and thus losing nearly all the horizontal component, the curvature of the string increases very much, and if an instrument is attached to it, it is sure to come down. After such a cloud has passed I have frequently noticed the apparent existence of a downward current which causes the kite to descend and at the same time increase its pull by the pressure being exerted more against a vertical surface.

Regarding the observations themselves, I am not aware that any similar ones have previously been made, except by Mr. Stevenson of Scotland. His plan was to fix anemometers to a pole 50 feet high or place them at different heights up a mountain. In the latter case it is not certain that the velocities represent what would occur in the free atmosphere at the same level. In the former, one is limited to poles of moderate height, and I do not at present see that anything else can compete with a kite-wire for greater heights; balloons, captive or otherwise, being of course out of the question where wind is concerned. Mr. Stevenson seems finally to have adopted a very simple formula for the increase of the velocity with the height, viz. that it is exactly proportional, or $\frac{V}{v} = \frac{H}{h}$. That though this might be true up to 50 feet it is certainly not true for greater heights I showed pretty conclusively in NATURE for March 29, 1883 (p. 506), where a discussion of Dr. Vettin's cloud observations favoured the formula $\frac{V}{v} = \left(\frac{H}{h}\right)^{\frac{1}{4}}$ through a range of more than 20,000 feet.

Though I do not wish to try and determine any formula at this preliminary stage, it may be interesting to note the exponent

[1] This seems also to be the case on Ben Nevis, regarding which Mr. Buchan says, "In each of the months the maximum velocity is during the *night*, and the minimum during the *day*, being thus the reverse of what occurs at low levels and on plains" (*vide Journal* of the Scottish Meteorological Society, 3rd series, No. 1, p. 17).

yielded by the observations I have made, when grouped together roughly according to altitude. The results are :—

No. of obs.	Mean upper height	Mean lower height	Mean upper velocity	Mean lower velocity	Approximate value of exponent in formula
6	249	93	1630	1145	$\frac{1}{3}$
8	412	173	1751	1474	$\frac{1}{8}$
4	634	324	1987	1902	$\frac{1}{16}$

Thus, while the velocity invariably increases as we ascend, the rate rapidly diminishes after the first 200 or 300 feet. It must, however, be remembered that the place of observation is itself 500 feet above sea-level, and though this would probably not affect the results near the surface, the air above 200 feet must be moving with very nearly the same velocity as it would have at its real elevation above a sea-level surface. Adding therefore the 500 feet to both heights in the case of the two last groups, we get, for the value of x, $\frac{1}{2}$ and $\frac{1}{7}$ instead of $\frac{1}{8}$ and $\frac{1}{16}$. These two values are probably nearer the truth than those in the table, and hover round the mean value $\frac{1}{4}$, which I have already stated was found to hold for Vettin's cloud velocities up to 25,000 feet. In any case it is plain that Mr. Stevenson's formula cannot be taken to hold beyond his 50-foot pole.

Further observations will, I trust, give a trustworthy basis for determining the variations in the velocity-increment corresponding to the direction and absolute velocity of the wind as well as those corresponding to season, humidity, temperature, and pressure. To thoroughly investigate the velocity-increment under all such conditions, and thus to afford data to the physicist who desires to construct the hitherto unwritten science of aërodynamics, will be one of the objects of my experiments during the coming year.

P.S. *October* 22.—Since the foregoing observations were made I have succeeded in getting readings with the anemometers at heights of over 1100 feet above the ground, or 1600 feet above sea-level.

THE CLASSIFICATION AND AFFINITIES OF DINOSAURIAN REPTILES[1]

In this paper the author presented briefly the results of a study of Dinosaurian reptiles on which he had been engaged for several years. The complete results will be published in a series of monographs now in preparation. The material on which the investigation is mainly based consists of the remains of several hundred individuals of this group collected in the Rocky Mountains by the author, and now preserved in the museum of Yale College. Other important American specimens have been examined by the author, who has also studied with care the more important specimens of this group in the museums of Europe. The investigation is not yet completed, but the results already attained seem to be of sufficient interest to present to the Association at this time.

In previous publications on this subject the author had expressed the opinion that the *Dinosauria* should be regarded, not as an order, but as a sub-class, and his later researches confirm this view. The great number of subordinate divisions in the group, and the remarkable diversity among those already discovered, indicate that many new forms will yet be found. Among those already known there is a much greater difference in size and structure than in any other sub-class of vertebrates, with the exception of the placental mammals. Compared with the Marsupials, living and extinct, the *Dinosauria* show an equal diversity of structure and size.

According to present evidence, the Dinosaurs were confined entirely to the Mesozoic Age. They were abundant in the Jurassic, and continued in diminishing numbers to the end of the Cretaceous period, when they became extinct. The great variety of forms that flourished in the Triassic renders it more than probable that some members of the group existed in the Permian period, and their remains may be brought to light at any time. The Triassic Dinosaurs, although very numerous, are known to-day mainly from footprints and fragmentary osseous remains; hence, many of the forms described cannot at present be referred to their appropriate divisions in the group. From the Jurassic, however, during which period Dinosaurian reptiles reached their zenith in size and numbers, representatives of no less than four well-marked orders are now so well known that different families and genera can be very accurately determined, and almost the entire osseous structure of typical examples, at least, can be made out with certainty. Comparatively little is yet known of Cretaceous Dinosaurs, although many have been described from incomplete specimens. All these appear to have been of large size, but much inferior in this respect to the gigantic forms of the previous period. The remains best preserved show that, before extinction, some members of the group became quite highly specialised.

[1] Paper read at the Montreal Meeting of the British Association, by Prof. O. C. Marsh.

Regarding the Dinosaurs as a sub-class of the REPTILIA, the forms best known at present may be classified as follows :—

SUB-CLASS DINOSAURIA.—Premaxillary bones separate; upper and lower temporal arches; rami of lower jaw united in front by cartilage only; no teeth on palate. Neural arches of vertebræ united to centra by suture; sacral vertebræ co-ossified. Cervical and thoracic ribs double-headed. Ilium prolonged in front of acetabulum; acetabulum formed in part by pubis; ischia meet distally on median line. Fore and hind limbs present, the latter ambulatory and larger than those in front; head of femur at right angles to condyles; tibia with procnemial crest; fibula complete. First row of tarsals composed of astragalus and calcaneum only, which together form the upper portion of ankle joint.

(I.) Order SAUROPODA (LIZARD-FOOT).—Herbivorous. Premaxillary bones with teeth. Large antorbital opening. Anterior nares at apex of skull. Post-occipital bones. Anterior vertebræ opisthocœlian; cervical ribs co-ossified with vertebræ; pre-sacral vertebræ hollow; each sacral vertebra supports its own transverse process. Fore and hind limbs nearly equal; limb bones solid. Feet plantigrade, ungulate; five digits in manus and pes; second row of carpal and tarsal bones unossified. Sternal bones parial. Pubes projecting in front, and united distally by cartilage; no post-pubis.

(1) Family *Atlantosauridæ*.—A pituitary canal. Ischia directed downward, with expanded extremities meeting on median line. Sacrum hollow. Anterior caudals with lateral cavities. Genera: Atlantosaurus, Apatosaurus, Brontosaurus.

(2) Family *Diplodocidæ*.—Dentition weak. Brain inclined backward. Large pituitary fossa. Two antorbital openings. Ischia with straight shaft, not expanded distally, directed downward and backward, with ends meeting on median line. Caudals deeply excavated below. Chevrons with both anterior and posterior branches. Genus: Diplodocus.

(3) Family *Morosauridæ*.—Small pituitary fossa. Ischia slender, with twisted shaft, directed backward, and sides meeting on median line. Anterior caudals solid. Sacral vertebræ solid. Genus: Morosaurus. European forms of this order: Bothriospondylus, Ceteosaurus, Eucamerotus, Ornithopsis, Pelorosaurus.

(II.) Order STEGOSAURIA (PLATED LIZARD).—Herbivorous. Feet plantigrade, ungulate; five digits in manus and pes; second row of carpals unossified. Pubes projecting free in front; post-pubis present. Fore limbs small; locomotion mainly on hind limbs. Cervical ribs free. Vertebræ and limb bones solid. Osseous dermal armour.

(1) Family *Stegosauridæ*.—Vertebræ bi-concave. Neural canal in sacrum expanded into large chamber; ischia directed backward, with sides meeting on median line. Astragalus co-ossified with tibia; metapodials very short. Genera: Stegosaurus (Hypsirhophus), Diracodon; and in Europe, Omosaurus (Owen).

2. Family *Scelidosauridæ*.—Astragalus not co-ossified with tibia; metatarsals elongated; four functional digits in pes. Known forms all European. Genera: Scelidosaurus, Acanthopholis, Cratæomus, Hylæosaurus, Polacanthus.

(III.) Order ORNITHOPODA (BIRD-FOOT).—Herbivorous. Feet digitigrade, five functional digits in manus and three in pes. Pubes projecting free in front; post-pubis present. Vertebræ solid. Cervical ribs free. Fore limbs small; limb bones hollow. Premaxillaries edentulous in front. A premandibular bone.

(1) Family *Camptonotidæ*.—Clavicles wanting; post-pubis complete. Genera: Camptonotus, Laosaurus, Nanosaurus; and in Europe, Hypsilophodon.

(2) Family *Iguanodontidæ*.—Post-pubis incomplete. Premaxillaries edentulous. Known forms all European. Genera: Iguanodon, Vectisaurus.