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THURSDAY, APRIL 8, 1875

SMITH'S "ASSYRIAN DISCOVERIES"

Assyrian Discoveries: an Account of Explorations and Discoveries on the site of Nineveh, during 1873 *and* 1874. By George Smith, of the Department of Oriental Antiquities, British Museum. With Illustrations. (London: Sampson Low and Co., 1875.)

JUDGING from the marvellous discoveries made within so short a time in the valley of the Euphrates and Tigris, Assyriology promises to be one of the most extensive as well as the most important auxiliaries to the reconstruction of ancient mythology, history, and philology. It is within the memory of the present generation that M. Botta, the French Consul at Mosul, first began the excavations of the buried cities of Assyria, and we can still remember the enthusiasm and also the incredulity with which Europe received the tidings that this *savant* had actually discovered at Khorsabad, in 1842, the long-lost palaces built by Sargon, about B.C. 722-705, exhibiting one of the most perfect Assyrian buildings and a most excellent specimen of royal architecture. Mr. Layard, who began his excavations as soon as M. Botta carried off his trophies to France (1845), astonished Europe with the still greater discoveries, both at Nineveh and in Babylonia. The researches thus started were continued, especially in Babylonia, by Rawlinson, Rassam, Loftus, and Taylor, and the British Museum now exhibits the remarkable treasures of Assyrian art, science, and literature, which crowned the labours of our explorers.

With the study of these records Mr. George Smith has been engaged for the last ten years; and since 1866 he has periodically published some of the discoveries he made among the fragments of the terra cotta inscriptions deposited in the British Museum. His most startling discovery, however, he communicated in a paper read before the Society of Biblical Archæology, December 3, 1872, which gives the Chaldean account of the Deluge, and which he deciphered on the tablets of the Assyrian library discovered by Layard. In consequence of the great interest excited by these finds, the proprietors of the *Daily Telegraph* placed a thousand guineas at Mr. Smith's disposal, to undertake fresh researches at Nineveh. It was no easy task for him to go over the same ground and reopen trenches in the same localities so successfully worked by his predecessors. Still, the field of research is so extensive, and the hidden palaces are so numerous, that even now far greater treasures may be exhumed than those which have already been reclaimed by the French and English explorers. This will readily be seen from a perusal of Mr. Smith's work which gives the results of his expedition, and from the success he achieved, though his time was limited, and his difficulties were great. In less than four months, excavations on the sites of Kouyunjik and Nimroud, he found over 3,000 inscriptions and fragments of inscriptions, besides many other objects of antiquity. The great object for which Mr. Smith undertook this expedition, namely, to recover, if possible, some of the missing portions of the inscribed terra cotta tablets he had deciphered in the British Museum, was thoroughly achieved. Among the discoveries he made at Kouyunjik is a veritable fragment containing the greater portion of seventeen lines of inscription which belong to the first column of the Chaldean account of the Deluge, completing the only place where there was a serious lacuna in the story.

The limits of this notice will only permit us to give a very brief summary of the Izdubar legends. Izdubar, the hero of these legends, is a giant who has a court, a seer or astrologer, and officers. Having lost his seer, and being unable to replace him, he determines to seek counsel of Hasisadra, the sage who escaped the deluge. After protracted wanderings through fabulous regions, he at last alights upon Hasisadra and his wife, and inquires of the sage how he became immortal. The sage thereupon tells Izdubar the story of the flood and of the vessel which he built according to the directions of Hea to save himself and his belongings from the universal deluge which the gods brought upon the earth to destroy the human family because of the wickedness of the children of men. This deluge lasted six days, and on the seventh day the storm ceased, when the vessel was stranded for seven days on the mountains of Nizir. At the end of the second hexahemeron, Hasisadra sent forth some birds to ascertain the state of the ground, the description of which we must give in the language of the legend:—

"On the seventh day in the course of it
I sent forth a dove and it left. The dove went and turned, and
A resting-place it did not find, and it returned.
I sent forth a swallow and it left. The swallow went and turned, and
A resting-place it did not find, and it returned.
I sent forth a raven and it left.
The raven went, and the corpses on the water it saw, and
It did eat, it swam, and wandered away, and did not return.
I sent the animals forth to the four winds, I poured out a libation,
I built an altar on the peak of the mountain,
By sevens herbs I cut,
At the bottom of them I placed reeds, pines, and simgar.
The gods collected at its burning, the gods collected at its good burning:
The gods like flies over the sacrifice gathered."

A careful examination of this legend, which, according to Mr. Smith, is at the latest more than two thousand years before the Christian era, will show the impartial student that he has here the polytheistic prototype of the legend of which the biblical story is a monotheistic redaction. Indeed, Mr. Smith has already announced that he has also discovered the legends of the Creation, the building of the Tower of Babel, &c. A striking illustration of how the Assyrian discoveries will materially contribute to a scientific understanding of ancient mythology may be seen in the legend of "The Descent of Ishtar into Hades."

The goddess Ishtar, *i.e.* Venus, daughter of the Moon, determines to visit "the land from which there is no return." On her arrival at the gate she demands admittance, threatening that if refused she would assault the door and raise the dead to devour the living. After consulting the goddess of the nether regions, the porter admits Ishtar, who, on entering, is, by the command of the Queen of Hades, punished in the same manner as those wives are who have been unfaithful to their husbands. At each of the seven gates of Hades she is stripped of some of her

ornaments and apparel, till at last she is divested of everything. Her detention, however, in the lower regions caused the greatest disorders upon the earth, so much so that her parents, the Sun and Moon, weepingly exclaim, "Since the time that Mother Ishtar descended into Hades the bull has not sought the cow, nor the male of any animal the female." To avoid the threatened extinction of life, Ishtar has her jewels returned and is restored to heaven.

The design of this legend, as read on the broken Assyrian tablets, is not to be made out. In the Talmud, however, where the same legend is recorded in the recast form of the monotheistic crucible, the import of it becomes perfectly clear. After the restoration of the second Temple, we are told that the men of the Great Synagogue, headed by Ezra and Nehemiah, made every effort to wean the people from polytheism and from the orgies practised in connection with the worship of idols. To this end the saints prayed that God might deliver into their hands the demon of sexual lust. In vain did a prophetic voice warn them that if their prayer were granted all nature would at once become stationary, and then life would become extinct. The zeal of the pious would not listen to the utterance, and the demon had to be delivered into their hands. For three days they kept him in prison and in chains, but after the three days no fresh-laid egg could be got in the land, and they had therefore to liberate the demon, depriving him, however, of the power to excite lust in the human breast for the first degrees of consanguinity (*Yoma* 69*b*: *Sanhedrin* 60*a*: Yalkut on Nehemiah, § 1071). The moral of the Ishtar legend thus becomes apparent, and we see how important the materials are which these Assyrian discoveries yield for the study of comparative mythology.

As to the importance of these cuneiform records to philology, we can only illustrate it by one example. The Hebrew expression עשתי which, when joined with a number denoting ten, makes the combined phrase denote eleven, has caused the greatest difficulty to Semitic scholars from the time when the first Hebrew lexicon was compiled to the present day. Such great authorities as Ibn Ezra (A.D. 1088—1176), and Kimchi (A.D. 1160—1235), take it to denote *thought*, and say that the phrase in question literally denotes "ten which are counted upon the fingers and one in thought," or, as Simonis, who espouses this notion, explains it, "*Cogitationes ultra decem*, i.e., numerus *cogitatione* sive *mente* concipiendus cum praecedentes numeri *ad digitos* numerarentur." To which Gesenius in his Lexicon adds, "This is unsatisfactory enough, though a better solution is still wanting." Now, from the cuneiform we learn that עשתן *istin* is the ordinary expression for *one*, thus yielding the long-wished-for solution of this difficult word.

Amongst the other discoveries which Mr. Smith made and which he classifies under "Foreign Inscriptions," are several Phœnician. The first of these, according to our explorer, is a contract of sale, and probably belongs to the seventh century B.C. "The Phœnician legend is beautifully incised along the edge of the tablet, and is very sharp and clear. Transcribed into Hebrew letters it reads—

דנת . אלמלך . זי ארק טמע

The sale by Almalek of the cultivated field.

The words are divided by dots, and the meaning of the inscription is clear." We, however, question whether "the meaning is clear." It is greatly to be regretted that Mr. Smith did not figure this inscription as he has done in the case of far less interesting subjects. It is important to palæography, inasmuch as it confirms the testimony of the famous Moabite inscription that at the earliest period of Semitic writing the words were not only written separately but were divided by dots, and in this respect essentially differ from the earliest Greek inscriptions. Our reasons for doubting the correctness of Mr. Smith's transliteration are, that (1) we do not remember that דנת signifies *sale;* and (2) the demonstrative pronoun has not in Phœnician the scriptio plena Yod, but is simply ז, especially in ancient Phœnician. Nor do we think Mr. Smith's rendering of טמע by *cultivated* happy. The word in question is better translated *undulating*.

We have said enough to show the extreme importance of Mr. Smith's discoveries. Much, however, still remains to be done, and Mr. Smith calculates that no less than 20,000 fragments of this valuable collection of terra cotta inscriptions, portions of which are in the British Museum and at the Louvre, still lie buried at Kouyunjik. It would require 5,000*l.* and three years' work to recover these treasures. Mr. Smith is perfectly willing to undertake the labour of systematic excavations, and we earnestly trust that the nation, either independently of, or through the Government and the Trustees of the British Museum, will be as ready to furnish this comparatively small sum.

BANCROFT'S "NATIVE RACES OF THE PACIFIC STATES"

The Native Races of the Pacific States of North America. By H. H. Bancroft. Vol. I. Wild Tribes. (London: Longmans and Co.)

IT is curious that the comparatively little known Pacific side of North America should have had its ethnology collected and digested, while this task has not been performed for the more familiar Atlantic side. Schoolcraft's great work, principally devoted to the Indians east of the Rocky Mountains, is quite of different character, containing a great amount of original information, but no systematic survey of all that is known. Bancroft's plan, to judge from the present volume, is to compile only, but to compile the substance of the whole existing literature. His success has been remarkable, and his work will be of the greatest service to ethnologists, under one condition. Travellers' accounts of savages are meagre enough already, but abstracts of them shrink almost to the bones. Therefore Mr. Bancroft's book should be used as a skeleton chart to guide inquirers to the original authorities, but should not be treated as making such reference unnecessary.

The physical descriptions of the races of Pacific America, from the Arctic Circle almost to the Equator, are carefully drawn up, though the want of engravings makes it less easy to give precise ideas of them. There are certainly two varieties of man in the district. One is the Eskimo, with their fair complexion, thick-set robust make, and low stature (not, however, so stunted on the Pacific side as in Greenland). The other is the North American Indian, with skin of more or less deep brown, slighter build, and

taller stature. It is possible, however, that on close examination three or four distinct types may be made out, for while some of the Californians are deep brown almost to blackness, the Thlinkeets are described as being fair as many Europeans, and sometimes with blue eyes. Such differences may partly result from original intermixture of races in the country, but partly also may be due to climate, food, and habits. The following passage, relating to the Indian tribes of New Mexico (p. 477), contains facts of interest in this respect :—"The disparity in physical appearance between some of these nations, which may be attributed for the most part to diet, is curious. While those who subsist on mixed vegetable and animal food present a tall, healthy, and muscular development, hardly excelled by the Caucasian race, those that live on animal food, excepting perhaps the Comanches, are small in stature, wrinkled, shrivelled, and hideously ugly. All the natives of this family, with the exception of the Apaches proper, are tall, well-built, with muscles strongly developed, pleasing features, although at times rather broad faces, high foreheads, large, clear, dark-coloured eyes, possessing generally extraordinary powers of vision, black coarse hair, and, for a wonder, beards. Taken as a whole, they are the most perfect specimens of physical manhood that we have yet encountered. While some, and particularly females, are of a light copper colour; others again approach near to the dark Californian. Women are generally plumper, inclining more to obesity than the men. Some comely girls are spoken of among them, but they grow old early. In contradistinction to all this, the Apaches proper, or Apache nation, as we may call them, are slim, ill-developed, but very agile. Their height is about five feet four to five inches ; features described as ugly, repulsive, emotionless, flat, and approaching the Mongol cast, while the head is covered with an unkempt mass of coarse, shocky, rusty black hair, not unlike bristles. The women are not at all behind the men in ugliness, and a pleasing face is a rarity. A feature common to the family is remarkably small feet; in connection with which may be mentioned the peculiarity which obtains on the Lower Colorado, of having the large toe widely separated from the others, which arises probably from wading in marshy bottoms. All the tribes whose principal subsistence is meat, and more particularly those that eat horse and mule flesh, are said to exhale a peculiar scent, something like the animals themselves when heated." Among American tribes of the tropics it would be interesting to ascertain whether there is a real foundation for the accounts of a fair tribe, with light hair and blue eyes, in Costa Rica, the so-called Guatusos, said to be descendants of English mutineers from Sir Francis Drake (p. 748).

It is not less difficult to form an opinion from how many centres the civilisation of these races has originated. Two points suggest themselves to the reader. One is, that the Columbian tribes of the Pacific coast have much in common with the American Indians east of the Rocky Mountains, as the following examples show :—"The Pend d'Oreille, on approaching manhood, was sent by his father to a high mountain and obliged to remain until he dreamed of some animal, bird, or fish, thereafter to be his medicine, whose claw, tooth, or feather was worn as a charm" (p. 283). This is a custom often described among the Algonquin tribes on the other side of the continent. The same may be said of the games played by the Columbian Indians with bits of wood, which count like dice according to the side turned up, or are passed rapidly from hand to hand, the gamester having to guess which hand (p. 198). These and other matters may have travelled across from the Atlantic tribes. The other point is, that wild tribes, though at a considerable distance from Mexico, have adopted thence some of their customs. The Mexican rubbing-stones for grinding corn (*metlatl* and *metlalpilli*) are used alike among the tribes of the Isthmus (p. 765) and the Apaches (p. 489). The Mosquito Indians even practise the well-known Mexican custom of drawing blood from their tongues, ears, and other parts of the body, by way of sacrifice (p. 740).

Mr. Bancroft's information is collected from so many and often little-known books, that almost every ethnologist will find in it some new or overlooked facts in his particular department. Col. Lane Fox's "Catalogue of Weapons" contains no mention of a boomerang, or at least a crooked stick thrown boomerang-fashion, among the Pueblo Indians of New Mexico (see p. 541), which is referred to here on the authority of Colyer (Report of Indian Affairs, 1869, p. 91). Possibly, however, it may turn out on further inquiry to be only a common throwing-cudgel, and not properly a boomerang. Again (p. 761), there is a description of a "throwing-stick" used by the Coiba and other Indians of the Isthmus of Panama. "Their javelins are thrown with much force and dexterity by means of a stick slightly grooved to hold the projectile. It is called *estorica*, and is held between the thumb and two fingers, there being a small loop on the side near the centre, in which the forefinger is placed ; the dart is cast straight from the shoulder, while the projector is retained in the hand." The occurrence of this weapon here is also not mentioned in Col. Fox's Catalogue, but it affords an interesting geographical link between the nearest districts in North and South America where it has hitherto been noticed, viz., Mexico in the north, and on tributaries of the River Amazons in the south. While on this subject of weapons, another passage may be added as to the tribes of the Isthmus : "They had also javelins with holes pierced in them near the end, so that when cast into the air a loud whistling noise was produced" (p. 774). Unless our memory deceives us, some similar device is known in Central Asia.

Among curious points of savage manners and customs from Mr. Bancroft's summary, the following may be noted. The Chinook Indians in their marriages acted on a principle not unknown among peasants in Russia, who will marry a boy to a woman old enough to be his mother. "It has been noticed that there was often great disparity in the ages of bride and groom, for, say the Chinook, a very young or very aged couple lack either the experience or the activity necessary for fighting the battles of life" (p. 241). Among the Comanche Indians, when a man's wife deserts him, the mode of reparation for his wounded honour is to wipe out the disgrace by killing somebody—anybody whom he may chance to meet (p. 513). We often hear of savages baking pigs in pits dug in the ground to serve as ovens, but the inhabitants of Queretaro may be the only people who thus bake themselves. They

"spend much of their time basking in the sun, and if the sun does not yield sufficient warmth, they scoop out a hole in the ground, burn in it branches and leaves of the maguey, and, when properly heated, lay themselves down in the place, and cover themselves with a mat or the loose earth" (p. 637).

Among the Zapotecs a very interesting art of divination prevailed, and to some extent is still practised. "When a woman was about to be confined, the relatives assembled in the hut, and commenced to draw on the floor figures of different animals, rubbing each one out as soon as it was completed. This operation continued till the moment of birth, and the figure that then remained sketched upon the ground was called the child's tona, or second self. When the child grew old enough, he procured the animal that represented him, and took care of it, as it was believed that health and existence were bound up with that of the animals; in fact, that the death of both would occur simultaneously" (p. 661). To conclude the list, among the tribes of North California, the development of the idea of current value, depending partly upon the utility and partly on the scarcity of the objects circulating, is most quaintly illustrated. Their wealth consists in shell-money, called *allicochick*, white deer-skins, canoes, and, indirectly, in women. The shell which is the regular circulating medium is white, hollow, about a quarter of an inch through, and from one to two inches in length. On its length depends its value. A gentleman, who writes from personal observation, says: "All of the older Indians have tattooed on their arms their standard of value. A piece of shell corresponding in length to one of the marks being worth five dollars 'Boston money,' the scale gradually increases until the highest mark is reached. For five perfect shells corresponding in length to this mark they will readily give one hundred dollars in gold or silver." White deer-skins are rare, and considered very valuable, the possession of one being even said to give a claim to chiefship. A scalp of the red-headed woodpecker is equivalent to about five dollars, and is extensively used as currency on the Klamath. Canoes are valued according to their size and finish. Wives, as they must be bought, are a sign of wealth, and the owner of many is respected accordingly (p. 347).

Our notice of Mr. Bancroft's first volume, consisting as it does merely of condensed accounts of the appearance and habits of wild tribes, is almost necessarily fragmentary. We look forward to the promised speedy publication of the remaining four volumes, of which the next will describe the more civilised nations of Mexico and Central America, the other three containing the comparison and discussion of the native languages, mythology, &c. When the whole work is completed, it may probably lead to the ethnology of American taking a new departure, and passing from its present chaotic condition into a more orderly and scientific state.

OUR BOOK SHELF

Quelques Nombres Caractéristiques relatifs à la Température de Bruxelles. Note de M. Ern. Quetelet, 6 pp.

THIS small tract briefly summarises the chief points of popular interest in the climate of Brussels relating to the temperature. The following are the data tabulated which have been calculated from observations made during the forty years 1833-1872:—The mean temperature of the year, seasons, and months; the absolutely highest temperature of each summer, and lowest of each winter; the absolute maxima and minima of each day of the year during any of the forty years; and the mean temperature of every day of the year; together with some other points of interest, such as the degree to which the temperature has risen every summer and fallen every winter. Such tables, if worked out for other places at which the necessary observations have been made, could not fail to prove of great general utility to horticulturists and others, particularly those which show not only the mean temperature of any particular day of the year, but also the degree to which for that day the temperature has been known in the past to rise on the one hand and fall on the other.

Some interesting points appear in connection with the periods of unusually cold and warm weather which are known to occur in North-western Europe at different times of the year. Thus the cold weather of May is not only shown in the forty years' mean temperature of the days, but also in the absolute maximum temperatures which have been noted on the particular days during any of the forty years—the mean of these maxima of the five days from the 6th to the 10th May being 80°·3, but of the five days from the 11th to the 16th only 77°·6.

A Report of Microscopical and Physiological Researches into the Nature of the Agent or Agents producing Cholera. (Second Series.) By T. R. Lewis, M.B., and D. D. Cunningham, M.B. (Calcutta: Government Printing Office, 1874.)

MESSRS. Lewis and Cunningham are already well known for their minute and valuable researches on the agencies by means of which diseases are spread. The paper before us, which is one of the Appendices to the "Tenth Annual Report of the Sanitary Commissioner with the Government of India," is divided into three parts. Part I. is concerned with the microscopic examination of the blood, giving the results of such an examination in health, in cholera, and in diseases other than cholera; part II. describes the results of experiments on the introduction of choleraic and other organic fluids into the system; and Part III. gives an account of experiments on the section of the splanchnic and mesenteric nerves. In addition to a discussion of the results of the experiments, the details of the experiments themselves are carefully arranged in a number of tables throughout the work. While the experiments herein described are of high value from a practical medical point of view, they cannot fail to shed some light on the broader scientific question of the origin of Bacteria. From the latter point of view, those parts of the Report bearing on the question of the existence of living organisms in the tissues of healthy subjects after death, and also those portions referring to the effect of heat on morbid products, are of special importance. How do these organisms originate in the glandular and other tissues, and why don't they develop whilst the tissues are in a normal living state? We hope that in a future Report the authors will be able to present some data which will help towards a solution of these questions.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

Ocean Waves

IN reference to the letter in NATURE, vol. xi. p. 386, respecting the "Height of Waves," it may be noted that the data presented would give about 110 ft. for the height above the sea

underneath the observer, and the distance from crest to crest 1,125 ft., and so the one would be one-tenth of the other.

It may be suggested that such measurements would be more reliable if taken from a point above, on the tops or shrouds of the masts of a ship (*vide* Admiralty Manual, p. 94, for directions), so that one could just get a view of the upper horizontal level, so as to see the crests of the other waves advancing.

This computation of wave height much exceeds previous recorded observations by double the amount, so that there may be some error in apprehension, or in statement of the account, or in the calculation.

Dr. Scoresby's observations in the North Atlantic record 24 ft., 30 ft., the highest 43 ft., and the mean 18 ft., in westerly gales; and the frigate *Novara*, 20 to 30 ft. off the Cape Promontory.

French observers in the Bay of Biscay state a height of wave of 36 ft.; Capt. Wilkes, U.S.N., writes of 32 ft. in the Pacific, and Sir J. Ross of 22 ft. in the South Atlantic.

Heights of waves in N.W. gales off the Cape of Good Hope were computed at 40 ft., those off Cape Horn at 32 ft., in the Mediterranean seas at 14 ft. 10 in., and in the German Ocean at 13½ ft., but in British waters they are only found to average 8 to 9 ft.

The velocity of ocean storm waves was observed by Dr. Scoresby in the North Atlantic to be about 32 miles per hour; Capt. Wilkes recorded it at 26½ miles in the Pacific, and French sailors in the Bay of Biscay at 60 miles an hour; and I have noted it myself in the South Indian Ocean at 22½ miles an hour in the great westerly swell after gales.

Further, Dr. Scoresby has estimated the distance between or breadth of his Atlantic storm waves at about 600 ft. from crest to crest, which is only about half of that stated in the letter, and with a proportion of only $\frac{1}{20}$ for height to breadth. (*Vide* Report, British Association, 1850.) Dr. Scoresby states that his waves of 30 ft. in height move at the rate of 32 miles per hour, which hardly accords with the observers of 110 ft. in height, with 25 miles per hour of motion. It would be very desirable that more data should be got on storm waves, for here is another discrepancy of proportion of length to breadth of $\frac{1}{10}$ to $\frac{1}{20}$, which cannot be surely common or correct.

The accompanying diagram is constructed according to Dr. Scoresby's scale of measurements, 600 ft. breadth, 30 ft. height, and 220 ft. vessel, with rates of wind, wave, and vessel, and from it one may ponder on what small dimensions these terrific looking waves are constructed, and that a ship after all looks only like a cork or chip on the great seas.

The account of the peculiarities of storm seas, also therein mentioned, from the S.W. and N.W. directions in the Atlantic, may be extended to the effects of other winds elsewhere on the ocean surface.

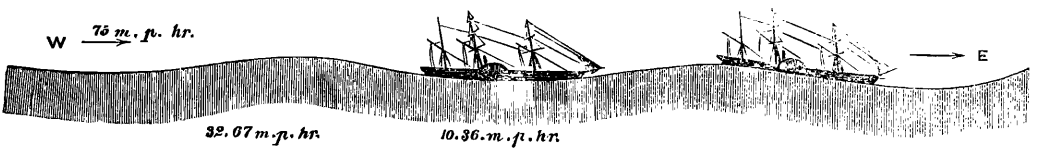
North-east gales in the North Atlantic, and south-east ones in the South Atlantic, appear to have similar effects on the seas and vessels exposed to them.

The waves raised are short, brisk, feathery, and clear, and make a peculiar rushing din, and they do not cause a ship to plunge so much as to roll, and are not accompanied by wet so much as by dry weather.

They are generally not dangerous to navigation in the open sea, as they carry light, clear, swift driving clouds, which do not obstruct marine observations or a view of the horizon all round.

On the other hand, the north-west gales in both hemispheres are attended by heavy, dark, rolling waves of huge bulk, momentum, length, and breadth, up which a ship is driven like up a hill-side, and down which it scuds as into a valley.

Here the vessel plunges more than she rolls, and is subject to



lurches on one side or other, and labours much in consequence of the wetness of the sails and rigging, increasing the weight of the top hamper and its hold by the gales.

These winds are more dangerous to navigation, as they are accompanied by thick heavy clouds lying low in the atmosphere, and shedding much rain and obstructing the view of the horizon all round, and so prevent marine observations by day or by night.

The grand westerly gales of the northern hemisphere, seen on the passage to and from America, occur amongst the latitudes of the counter trades, and are reciprocated by the similar belt in the southern hemisphere below 40° latitude, and are called by Maury the "brave west winds."

This region is traversed by the Australian and New Zealand liners, south of the Cape, and the voyages along this tract are as exciting as a race, and the ship is in much the same predicament as the man in the song with a steam leg.

As much sail as can be safely and possibly carried is spread, as speed is a vital necessity in order to keep the canvas and rigging from being blown away, and to prevent the ship being pooped by a following wave.

The frail bark then boldly scuds along before the wind, down one mountain wave and up another, with cordage creaking and masts bending, as fearless as the wild albatross following in its wake, or the gay porpoise careering in its front.

The difference to the passenger between these two classes of winds seems mainly to depend upon their wetness or dryness, so that the rainy weather adds to the discomfort of the one and the clearer weather in the other gives him some consolation in the storm.

The ship itself would no doubt have a preference, while in the one case its canvas and cordage are soaked with water and its decks deluged or sloppy; in the other its rigging is allowed to retain its natural trim, or even to get slackened by over-dryness, and the decks remain comparatively dry.

As to the waves themselves, it still remains to be explained why they should be greater with winds laden with rain than with dry winds, in the open sea and far away from land, unless the weight of the atmosphere above them should be allowed to count, as the barometer rules higher of course in the north and south easterly winds than in the north or south westerly gales.

Admitting there might be a difference in certain instances, even over the same tract of latitude, of one inch in the height of the mercury in the barometer between westerly and easterly gales, we may find on calculation that this would make a difference of 896,091 tons of weight of the superincumbent atmosphere on the surface of a square mile of the sea. This difference of atmospheric pressure would cause or allow a greater mobility to impression by the winds in the seas outside the tropics and under low barometric indication anywhere, and also a tendency in them to flow in towards these regions, and into storm tracts, as is narrated in accounts of cyclones, where great floods are sometimes produced.

The movements of the ocean swells after gales, it may be hazarded, might be accelerated by the tendency of the disturbed equilibrium to restore itself in the efflux of the seas from the storm region to calmer exteriors.

There might therefore appear to be as much movement and commotion in the waters below as there are in the atmosphere above, in all disturbances of the equilibrium mutually arranged between these two fluid coverings to the surface of the earth.

Edinburgh J. W. BLACK

Walker's System of Geometrical Conics

IT is remarked in NATURE, vol. xi. p. 404, that Walker's "generating" circle appears to have dropped out of recent text-books; but I may be allowed to add to the statement of your reviewer that Walker's method was revived in the *Messenger of Mathematics*, vol. ii. p. 97. I had been acquainted with his

method for some years previously, and had communicated it to several mathematicians, but omitted it from my elementary "Geometry of Conics" (1872), hoping that I might soon have leisure to develop it more fully in a larger work. Shortly before the publication of my article in the *Messenger*, Mr. R. W. Genese rediscovered the circle and its properties. Mr. Day uses this circle in his work on the Ellipse (1868), but has overlooked one of its characteristic properties.

C. TAYLOR

St. John's College, Cambridge

Destruction of Flowers by Birds

"P. B. M.," in NATURE for April 1, refers to the destruction of the crocuses in a garden at Burton-on-Trent, by birds. This may also be observed in the flower-beds in Hyde Park, near Park Lane. It is remarkable, however, that while the yellow flowers are very extensively destroyed, the white ones remain uninjured. The reason for this is not very evident, and I should be glad to see it explained.

C. ROBERTS

Bolton Row, April 6

OUR ASTRONOMICAL COLUMN

RED STARS, &C.—We lately referred to the incompleteness of the first catalogue of isolated red stars formed in 1866 by Prof. Schjellerup of Copenhagen. In the last part for 1874 of the *Vierteljahrsschrift der Astronomischen Gesellschaft* is a second and much extended catalogue by the same astronomer. The first list, which was published in *Astron. Nach.*, No. 1,591, with additions in No. 1,613, contained 293 stars; in the new catalogue the number is upwards of 400. The notes attached have also been considerably extended. The author remarks that his first list was instrumental in the discovery of a number of variable stars, and that Secchi found in it many stars of his Type III. and the whole of Type IV. Those who are interested in the discovery and observation of variable stars will do well to provide themselves with Schjellerup's new catalogue. The same part of the *Vierteljahrsschrift* (which accidental circumstances have delayed in publication) contains an ephemeris of most of the variable stars for the year 1875; also a notice of Prof. Schönfeld's researches on S Cancri from observations to April 1872; the period is found to be 9d. 11h. 37m. 45s., and the epoch of minimum is fixed to 1867, August 31, at 14h. 12m. 15s. Paris mean time. This star has long been known to resemble Algol in its law of variation; the diminution of light commences somewhat suddenly, 8½ hours before minimum, and about 13 hours after minimum the star recovers the brightness at which it continues to shine for the greater part of its period.

THE COMET OF 1812.—Of those comets discovered during the present century which appear to have periods of revolution approximating to that of Halley's Comet, it is probable that the one detected by Pons at Marseilles on the 20th of July, 1812, will be the first to revisit these parts of space, and this visit may be looked for within a few years' time. We are indebted for our knowledge of the elliptical form of this comet's orbit to Encke, who, working when assistant at the Observatory of Seeberg under the guidance of his "great tutor Gauss," discovered early in the year 1813 that no parabola would represent the observations, and that an ellipse with a period of revolution rather exceeding seventy years was very far preferable. His further and definitive investigation of the elements is found in *Zeitschrift für Astronomie*, ii. p. 377. He made use of observations between July 23 and Sept. 27, taken at Paris, Marseilles, Vienna, Milan, Seeberg, Bremen, Berlin, and Prague, 110 in number, and finally arrived at an elliptical orbit, with a period of 70·69 years, the probable uncertainty of this result allowing of it being as short as 66·54 years, or as long as 75·27 years. Encke does not appear to have had the advantage of the original observations taken at Paris, which appear in the folio volume of observations 1810-20, nor yet of the original observations by Flaugergues at Viviers, which were not printed until the end of the year 1820, when they found their way into Zach's *Correspondance Astronomique*. Mr. W. E. Plummer, of the University Observatory, Oxford, has reduced the Paris and Viviers observations with every care, and, making use of Leverrier's Solar Tables, has deduced an ellipse quite verifying Encke's computations; he has hopes of being able to assign limits to the period of revolution. We are also informed that the return of this comet is engaging attention at the Observatory of Strassburg, and that under Prof. Winnecke's superintendence sweeping ephemerides will be prepared there to facilitate the rediscovery of the comet. It approaches nearer to the orbit of Venus than to that of any other body in the planetary system, but there could have been no material perturbation from this cause during the last appearance. The comet was detected by Bouvard at Paris on August 1, 1812, and it was also independently discovered on July 31 by Wisniewski (the last observer of the great comet of 1811), at Novo Tcherkask, as stated in a letter from Von Fuss to Bode, though he is not credited with this discovery in our cometary catalogues. The other comets which appear to have periods of revolution of similar length are the comet of 1815, usually known as Olbers' Comet, which is the subject of a masterly investigation by Bessel in the Berlin Memoirs, 1812–15; the comet discovered by De Vico at Rome, 1846, February 20, of which the best orbit is by Van Deinse, in his "Inaugural Dissertation," Leyden, 1849; and the comet detected by Brorsen at Altona, 1847, July 20, which has been calculated by D'Arrest and Gould, but may yet admit of further investigation.

METEOROLOGY IN ENGLAND

THE address of the President and Report of the Council of the Meteorological Society of England for the present year will be read with a lively interest, awakened and strengthened by a growing conviction that the Society has reached a critical turning point in its history. Hitherto the Society has been regarded as little more than an association of amateur meteorologists,—the national work, falling properly within the province of such a society, of collecting the data of observation for the elucidation of the laws of the weather and climate of England, having been independently carried out by their late energetic, able, and popular secretary, Mr. Glaisher, whose great and in many respects valuable labours in this department are somehow passed over in the documents before us.

The Society, however, has now resolved to undertake the work of collecting meteorological statistics, and in carrying out this resolution has already established ten stations pretty well distributed over different districts of England. It is fitting that on private observers should fall the labour of investigating Climatic Meteorology, leaving the Government to look after the physical side of the science. In making it imperative on all their observers that verified instruments alone be used, consisting of at least a barometer, dry and wet bulb thermometers, maximum and minimum thermometers, and a rain gauge; that the adoption of Stevenson's Thermometer Box be *sine quâ non*, and that it be not placed within ten feet of any wall; that the rain gauge has its rim placed one foot above the ground; and that the hours of observation be 9 A.M. and 9 P.M.—the Society deserves our hearty commendation.

We must, however, point to a serious omission in the system of observation which has been adopted. No imperative condition is laid down, and no recommendation made, so far as we can see, with reference to the vital question of the height of the thermometers above the ground. If this point be not definitely settled and made an imperative condition of observation, the Society will collect materials on which no scientific inquiry into the climate of England can be based, and on which little, if any, scientific value can be placed. The

point is of paramount importance, especially since temperature observations are not merely the most important popularly, but they form besides the very groundwork of meteorology.

It is a remarkable circumstance that no country in Western Europe could be named, with perhaps the single exception of Ireland, of the meteorology of which so little is known as of England. The meteorological institutes and societies of Scotland, Norway, Denmark, Italy, Austria, Holland, Belgium, &c., have published discussions of atmospheric pressure, temperature, rain, and other of the meteorological elements based on the observations of many years, but we look in vain through the pages of the Journal of the English Society for the discussion of a single one of these elements for England. For any information which is to be had on these matters we must have recourse to the Journal of the Scottish Meteorological Society, in which the barometric and thermometric observations for England have been partly discussed. It is scarcely necessary to say that this essential part of the work of a meteorological society can only be properly performed by its paid officials. Viewed in this connection, it may be worth the consideration of the Council of the Society whether the tendency of the arrangement entered into with the Meteorological Office to supply that office with copies of observations, thus constantly throwing on their officials an enormous amount of mere copying, be not to preclude the Society from properly discharging this part of its work and taking a position among kindred societies which it ought to occupy.

We dissent from the position assumed by Dr. Mann when he states that "the practical outcome of the recent Conference of Meteorologists at Leipsig, of the Meteorological Congress at Vienna, and of the Maritime Conference in London, is an unmistakable and most satisfactory movement on the part of the leading authorities of meteorological science towards concerted and uniform action in the prosecution of their favourite pursuit." We have already stated (vol. x. p. 56) that the Vienna Congress did good work in the treatment of certain details which lie on the outskirts of meteorology, but it would be a mistake to suppose that at these international assemblies of meteorologists any concerted action was taken which would lead to uniformity of observation of atmospheric temperature, pressure, humidity, or rainfall—anything, in short, that would place the observation of these phenomena on an international basis for the subservience of international objects ; in truth, the Congress can scarcely be said to have got the length even of attempting any concerted action towards uniformity of observation of these elements which are the very life-blood of the science.

*DR. BECCARI'S DISCOVERIES IN HERPETOLOGY**

NOT long ago we called the attention of our readers to the herpetological discoveries of a German naturalist and traveller in New Guinea and the adjoining islands. We are now indebted to the Marchese G. Doria, of Genoa, for an account of the investigations of an Italian explorer, Dr. O. Beccari, in the same countries, although not quite in the same localities. The memoir before us treats of a collection of Reptiles and Batrachians made by Dr. Beccari in Amboyna, the Aru Islands, and the Ké Islands, in 1872 and 1873, which contained altogether 670 examples referable to fifty-three species. As regards Amboyna, not much novelty could be expected, this island having been thoroughly explored years ago by the Dutch naturalists. But the two other groups of Papuan islands to which Dr. Beccari devoted his attention were almost *terræ incognitæ* as regards herpetology; Mr. Wallace, their previous explorer, having devoted himself mainly to birds and insects. Here, therefore, Dr. Beccari's collections prove to have contained much interesting material, of which our author gives us an excellent account, illustrated by some carefully executed plates.

The species actually new to science in Dr. Beccari's collection are not numerous, but it is of interest to find that the general character of the reptilian fauna of the Aru and Ké Islands is, like that of their birds, essentially Papuan. In the latter group, however, there is rather a stronger infusion of Indo-Malayan forms. In the Ké Islands the Australian Death-adder, *Acanthophis antarcticus*, which spreads over the whole of the Papuan region, is very abundant. In Aru the Saurians are more numerous in species than the Ophidians, but in the Ké Islands the contrary is the case. No Batrachian was met with by Dr. Beccari in the latter group of islands, whereas three were found in Wokan, the northernmost of the Aru group, one of which was the widely-spread *Pelodryas cæruleus* of Australia.

This memoir forms part of the sixth volume of the "Annals" of that young and flourishing institution, the Museo Civico of Genoa, of which its author is the originator and director; and, like most of the papers published in the five preceding volumes, contains much matter that is interesting to the naturalist.

* "Enumerazione dei Rettili raccolti dal Dott. O. Beccari in Amboina, alle Isole Aru ed alle Isole Kei durante gli anni 1872–73," per G. Doria. Estratto dagli Ann. del Mus. Civ. di St. Nat. di Genova. Vol. vi. 1874.

ARCTIC GEOLOGY

THE following notes on this subject will be of some interest at the present time.

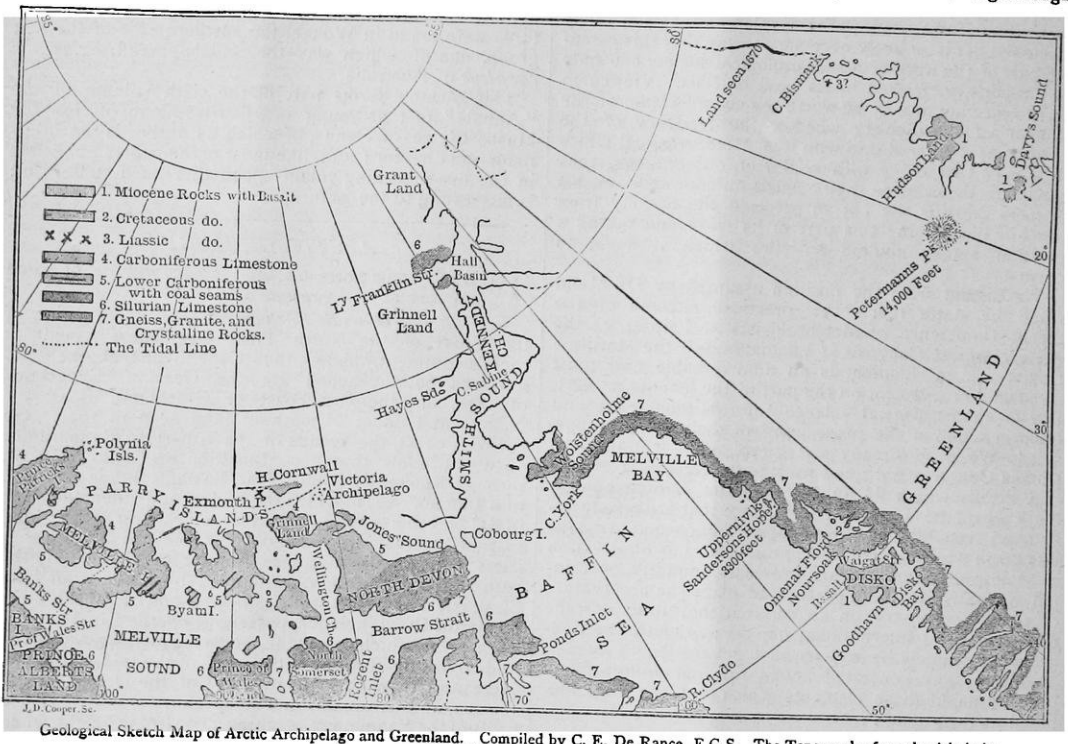
Greenland.—Glacial Phenomena.—An examination of the Chart of the North Polar Sea lately issued by the Government,* shows that Cape Bismarck, the most northern point reached by the German Expedition of 1870, on the east coast of Greenland, is in 77° N. lat., and about 2° south of land seen in 1690. On the west coast, the results of the American Expeditions, 1859–73, show that a continuation of Smith's Sound, through Kennedy Channel, Hall Basin, Robeson Channel, into Lincoln Sea, of which the broken and indented coasts in 84° N. lat. are only 40 degrees north-west of the land seen on the east coast in 1690, give evidence of a series of islets forming the northern frontier of Greenland, the entire coast of which is surrounded by a circlet of bare bleak islets 2,000 feet in height, separated from each other by fjords, through which passes the overflow of the great *mer de glace* which covers the country to an unknown depth, and covers up all sight of the rocks of the inland districts. Here and there this "inlands iis" of the Danes reaches the sea, and terminates in a steep cliff, *Sermik Soak* (ice-wall), of the Esquimaux, reaching 3,000 feet in height, where deep glens and fjords penetrate into the country. From the top of these ice-streams Dr. Rink found the surface rising by a series of steps, to the general level of the ice-field, which Dr. Kane describes as the "escaladed structure" of the Greenland Glacier. Once on the ice-field, and leaving the coast, the effect has been described as being similar to that of the land fading away when sailing out to sea—the ice rises gently and almost imperceptibly inland; Prof. Nordenskjöld, who travelled thirty miles inland, found its surface there to be 2,000 feet above the sea. Thus the surface of Greenland beneath the ice must be considerably lower than the islands surrounding it, between which and the ice-wall is the narrow strip of ground on which, and on the islands, the Danish settlements are situated. In summer the snow which covers the great ice-desert melts, and rivers of icy-cold water flow over the surface and fall into the crevasses of unknown depth. These are exceedingly numerous, and apparently increase in number, on penetrating into the

* Chart to accompany Paper and Correspondence relating to the equipment and fitting out of the Arctic Expedition of 1875.

inland district, where not one trace of life, one patch of earth, or one single stone occurs to enliven the monotony of a silent and to the eye motionless ocean, extending for 1,200 miles from north to south, with a breadth of 400 miles. When the additional matter of eight months' snow is poured upon it the glacier overflows, finding a way through the fjords, the overflow corresponding to the effluent glaciers, some of which, like the Humboldt Glacier in Smith's Sound, are sixty miles in width. Where no fjords are available, the ice pours over the cliffs, hanging until gravity overcomes its cohesiveness.

Dr. Rink believes that the outpour of the Greenland precipitation of snow and rain in the form of glacier ice amounts to only two inches, while he estimates the fall at twelve inches; so that, as the evaporation must be exceedingly small, a large portion of the remaining ten inches must be carried off by sub-glacial rivers: Dr. Rink instances a lake which rises whenever the glacier river disappears. The effect of these streams on the *moraine profonde*, or *couche de boue*, as Agassiz called it, the result of the trituration of the rocks over which the ice passed, must be considerable, and accounts for the muddy water found opposite the entrance of all ice fjords, and the eventual choking up of the channels through which the bergs, broken off from the face of the "Iis-blink" (ice-glance) of the Danes, plough their way on their journey seawards, the direction of which is entirely governed by that of the currents, and not invariably, as often imagined, from the north to the south.

Ground-ice has been shown by Dr. Henry Landor to form in Canadian streams, when the thermometer is at zero, being most abundant where there is no surface-ice; as it gradually thickens, it becomes honey-combed in the direction of the current, the water flowing through



Geological Sketch Map of Arctic Archipelago and Greenland. Compiled by C. E. De Rance, F.G.S. The Topography from the Admiralty N. Polar Chart.

the tubes. In course of time it floats, bearing up the stones to which it is anchored, often of large size, descends the stream, and becomes frozen up in the surface-ice. The movement of these ice-floated boulders often produces grooves on the faces of cliffs, as well-marked, according to Sir W. Logan, as those of glacial times.

Ground-ice laden with sea-weed, stones, and gravel, often rises in the shallow portions of the Baltic, where sheets of boulder-laden ice are driven by storms, and packed on the coast to a height of 50 feet. In Davis Straits the sea-water has a specific gravity, according to Scoresby, of 1·0263, and freezes at 28½° F., when the salt, 5¾ oz. to the gallon, is precipitated, and the "bay-ice" of the whalers is formed, which eventually becomes a floe, and afterwards pack-ice. The ice, in summer, melts on the sides of the channel before that in the centre, which constitutes the middle ice of the whalers; but between the open water and the land a narrow fringe of ice still hangs to the cliff, the "iis-fod" of the Greenland Danes. This, receiving large quantities of land-slips and other débris from the cliffs, afterwards breaks up and floats seawards, grazing the rocks at low tide, and on melting, deposits the fragments at the bottom of the sea; thus forming a close analogy to those conditions which prevailed when the English boulder-clay was deposited, beneath which the rocks are smoothed and scored, in positions that render it improbable that it was done by glacier ice; the latter prevailed, however, in Britain both before and after the period of submergence. The occasional patches and nests of sand and gravel found in boulder-clay may well have been derived from portions of the gravel-laden ice-foot which became entangled in the pack-ice. Masses of débris-laden ice-foot derived from one district are often driven by winds and high tides on to the coasts of other districts, which well explains the lines of more or less rounded tumultuous gravels found in many parts of Britain.

Kane's and Hayes' expeditions found distinct terraces

at various levels from 32 to 110 feet above the high-tide mark of Smith's Sound, and everywhere along the known coast of Greenland. The hollows are described as being filled up with glacier-clay, containing in places Echinodermata, Crustacea, and Mollusca of local Arctic species, with the exception of two, *Glycimeris siliqua* and *Panopœa norvegica*, and extending up to 500 feet above the sea. In the banks overlooking the glaciers, and in nodules of this clay, occur the well-known impressions of the Angmaksaett (*Mallotus arcticus*, O. Fabr.), a fish still living in Davis Straits; of which nodules several examples are preserved in the British Museum, split longitudinally. The great density of the nodules is noticeable, and the analogy to the iron-stone nodules of the coal measures containing plants very striking.

Recent depression of West Coast of Greenland.—Arctander, between 1777-9, noticed that land in a firth called Igalliko (60° 43′) was submerged at spring tides, though buildings with walls five feet in thickness still remained on it; half a century later, the tract was entirely submerged, the ruins being alone visible.

Julianshaab was founded at the mouth of the firth in 1776, near a rock called the "Castle" by the Danes, by which they erected a storehouse, submerged when Dr. Pingel, of Copenhagen, described it in 1835; and he found a village deserted near the glacier which now separates Fredrikshaab from Fiskernaes, on an island now overflowed. The Moravian village of Lichtenfeld, founded in 1758, had to be moved forty years later, and the poles to which the omiaks (women's boats) were tied still remain uncovered at every low tide. Houses of the time of Egede, the Apostle of Greenland, 1721-36, have now the sea flowing into them at high tide.

Attempt to advance from the coast on the inland ice.—In 1728 a Danish expedition was sent to endeavour to re-discover the lost (East) Greenland, but failed. In 1751 a Danish merchant, Dalager, advanced inland from about 62° 31′, and in two days reached some mountain peaks projecting above the ice, eight miles within the ice-field, but was then obliged to retreat, and returned to Fredrikshaab. In July 1870 Prof. Nordenskjöld and Dr. Berggren advanced from the head of Auleitsivik-fjord over the inland ice thirty miles, to a point 2,200 feet above the level of the sea, in lat. 68° 22′ N., passing magnificent rivers, which, flowing between walls of blue ice, eventually disappeared in vertical chasms in the ice, probably 2,000 feet in depth. On the surface of the ice they found a sandy trachytic mineral, scattered like a grey sand, which has been named Kryokonite, and on it, and sometimes on the ice, brown polycellular algæ, the dark masses of which, absorbing the sun's rays, cause the ice to melt, forming the deep holes which traverse the surface.

In Melville Bay, N.W. Greenland, Sutherland describes the glaciers reaching the coast and forming a continuous wall seventy to eighty miles in length, and 1,200 to 1,500 feet in height, of which about one-eighth is above; the Esquimaux required 300 fathoms of line to reach the bottom of the face of the ice, in halibut fishing. In lat. 68°, near Clanshaven, and where valleys come down to the coast, the thickness of the ice is sometimes as much as 2,400 feet. The largest icebergs are launched from Melville Bay. Further north, beyond Cape York, the glaciers are smaller, through greater cold, producing smaller evaporation, while further south the air is charged with watery vapour from the Atlantic.*

M. Delesse describes shelly deposits on sand beds in the Arctic seas east of Southampton Island and in Fox's Channel, and as far north as 77° near Smith's Sound, at depths of more than 200 metres in some instances, the cold being less intense at this level. In Hudson Straits, Baffin's Bay, and the various straits intersecting Arctic lands, muddy sediment prevails, due to the waste of the palæozoic schists of the North American continent and the precipitation of sediment being favoured by the impeding effect of the land-locked and ice-locked seas on the agitation of the waters, and to the immense quantities of mud brought into the sea by the glaciers which extend over the Arctic regions.

In Davis Straits, from Cape Farewell to Smith's Sound, the channel, varying in depth from two to 200 fathoms, is stated by Dr. Sutherland to swarm with Echinoderms and brittle Starfish. In Melville Bay, Ascidians, Cirripedes, and seaweed attached to the rocks, do not appear to be often grazed by the bergs, though at times they reap immense crops of Laminaria, with broken shells of *Mya* and *Saxicava*, entangled in their leafy masses, torn from a depth of 100 fathoms. When the bottom is very hard the berg is brought to a stand, and even when consisting of soft mud or clay the same effect is produced by a berg, moraine or talus being pushed up by the movement of the berg. In Davis Straits the bergs are so covered with earthy matter as to resemble rocks, boulders weighing 100 tons often lying on their surface or frozen into their mass. Submarine banks thrown up in this way constantly increase in size by the clustering of small bergs on them, and form the haunt of shoals of cod and halibut, and myriads of sharks. As the ice melts, brown slime, liberated from the ice, is rolled into pellets by the ripple of the water, and is deposited in beds near the coast, resembling the berg-mehl of Sweden.

Prof. A. E. Nordenskjöld, who accompanied the Swedish Expedition to Greenland in May 1870, describes the water off that coast as being a decided greyish brown colour, especially in Davis Strait, off Fiskernaes, and at other times greyish-green. This was found to be due to brown and green slimes of organic origin, which spread over hundreds of thousands of square miles, and afford food for not only Crustacea and Annelides, but to swarms of birds and to the whale; this slime was examined by Dr. Öberg, and found to consist of various species of siliceous Diatomaceæ.*

South Greenland.—Prof. G. C. Laube,† the geologist attached to the second German North Polar Expedition, in his geological map of South Greenland, represents the east coast, as far as 61° N., as chiefly composed of granite and gneiss, which also extends from Cape Farewell to Julianshaab, near which, at the head of Tunnudleorbik, red sandstone and amphibolite occur, between which and the sea there is a large arm of hornblende granite with a belt of zircon granite intervening. Westward is a syenite granite, as far as Nunarsoit.

Dr. Karl Vrba,‡ who examined microscopically more than 200 rocks collected by Laube, of which the exact locality was known, found the following varieties:—Gneiss, granite, eurite, syenite, orthoclase porphyry, diorite, diabase, gabbro, and weichstein, including serpentine, &c.

South-West Greenland.—In lat. 61° N., Dr. Pingel, the geologist attached to the Danish Expedition of 1828, under Graah, to seek the lost Icelandic colonies, discovered the red sandstone of Igalliko and of the fjord of Tunnudleorbik. No fossils have been discovered, but it is believed to be of Devonian age; the rock is hard and composed of fused quartz particles. This is probably the same bed as that found by the German Expedition a little to the south.

The gneiss, mica schist, hornblende schist, syenite, &c., pierced by granite veins§ of Southern Greenland, continue throughout the whole of the west coast. From it the Greenlanders derive the steatite from which they make their lamps and other utensils. C. E. DE RANCE

(*To be continued.*)

* Quar. Journ. Geol. Soc., vol. ix.

Geological Magazine, vol. ix. p. 298. *The Farmer*, Jan. 1, 1868, p 16.

† Sitzungsberichte der Kaiserlichen Akad. der Wissenschaften, 187 p. 17.

‡ Op. cit., 1874, p. 62.

§ From these narrow veins of granite, rich in felspar, Von Cotta records the presence of orthite and titanite.

THE PROGRESS OF THE TELEGRAPH *

II.

ELECTRIC force pervades all matter. Our planet and the atmosphere surrounding it are vast storehouses of electrical energy in a constant state of unstable equilibrium. Electricity is one of the forces of nature, and may be developed in various ways and under various conditions. The aurora, the thunderstorm, and the earth's magnetism, are each grand displays of electrical force upon a vast scale. Electrical energy may be excited by chemical action, friction, heat, induction, magnetism; and currents of electricity so obtained may be employed for telegraphic purposes. Thermo-electricity, as the name implies, is that generated by electric currents in metallic bodies by the disturbance of the equilibrium of temperature, the essential conditions being, that the extremities of the dissimilar metals should be in opposite states as regards temperature. The discovery of thermo-electric currents is due to Seebeck of Berlin in 1821; the generation of electric currents by the application of heat to a pile or series of dissimilar metals, however, remained in abeyance until the researches of Nobili and Melloni, who constructed the thermo-electric pile, consisting of alternate parallel bars of bismuth and antimony, placed side by side. Fig. 10 is a representation of the thermo-electric pile as arranged by Melloni. The brass frame on the left contains the compound bars, the wires from the antimony and bismuth poles being connected to a galvanometer, shown on the right-hand side; the quantity of electricity passing from the poles of the pile (regulated according to the difference of temperature of the bars) causes the needle of the galvanometer to be deflected. With thermo-electric currents the quantity of electricity developed depends upon the difference of the temperature of the two poles of the dissimilar metals; the currents may be so delicate that a difference of temperature equivalent to $\frac{1}{2200}$th part of a degree may be measured.

Frictional electricity, as the name implies, is that produced by the rubbing together of certain substances. An ordinary form of the frictional electrical machine is shown at Fig. 11. It consists, first, of a hollow glass cylinder supported on brass bearings resting upon glass rods; and then of an exciting rubber of a cushion of leather stuffed with horsehair; this is mounted on glass supports, and the amount of pressure on the cylinder is regulated by screws.

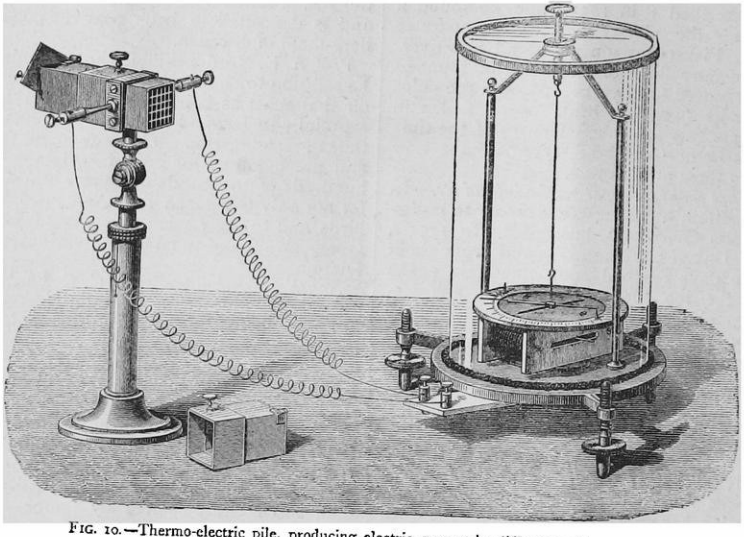


FIG. 10.—Thermo-electric pile, producing electric current by difference of temperature.

A flap of oiled silk is attached to the rubber to prevent the dissipation of the electricity from the surface of the cylinder before it reaches the points of the prime conductor, which draw the electricity from the glass cylinder on the other side. On turning the cylinder the friction of the cushion occasions the evolution of electricity, the production of which is more rapid when the surface of the rubber is smeared with a metal amalgam. When the cylinder machine is arranged for the development of either positive or negative electricity the conductor is placed with its length parallel to the cylinder, and the points project from its side as shown in the figure. The *negative* conductor supports the rubber and receives from it negative electricity by *communication*, and not by induction, as is the case with the positive conductor. If it is desired to accumulate positive electricity, a chain must be carried from the negative conductor to the ground; if, on the other hand, negative electricity is required, the conductor must be placed in communication with the earth, and the rubber insulated.

Continued from p. 392.

For the purpose of telegraphic transmissions, the current obtained from chemical action, or from a permanent magnet, is generally employed, and will be sufficient for the purposes contemplated in the present summary. The laws and phenomena that come into play during the propagation of an electric current require examination.

Electricity may be thus developed in the form of either a quantity or an intensity current, according to the arrangement of the elements composing the battery. A quantity current is one which, as its name implies, has great surface development. An intensity current is one of series development and of high tension. Quantity and intensity in an electric current may be combined together in different proportions, according to the work required to be performed.

As an example, suppose a battery or pile of twelve elements (Fig. 12), each element consisting of a carbon and zinc plate immersed in a glass jar containing for the exciting fluid a saturated solution of common salt. Now, if the twelve carbon plates of the series are all connected together by a common wire, and the twelve zinc plates are similarly

attached, an arrangement is formed producing a quantity current, the exponent of which will be measured by the superficial area of the individual plates. Thus a current is produced of low tension but great quantity.

If, contrariwise, the zinc and carbon plates of the series are connected together alternately, an intensity current will be produced of high tension. It is thus seen that quantity and intensity may be combined together according to the disposition of the elements composing the battery. For instance, the twelve cells may be arranged either as a quantity arrangement of six cells each, connected together as two for intensity, or in groups of three for quantity, connected as four in series as an intensity current; or again, as a series of four for quantity, connected together into a group of three for intensity. It is evident, therefore, that some ratio between quantity and intensity must be determined to produce that character of current which shall be best adapted to the work to be performed. The effective force of every electric current depends therefore on two conditions—the electro-motive

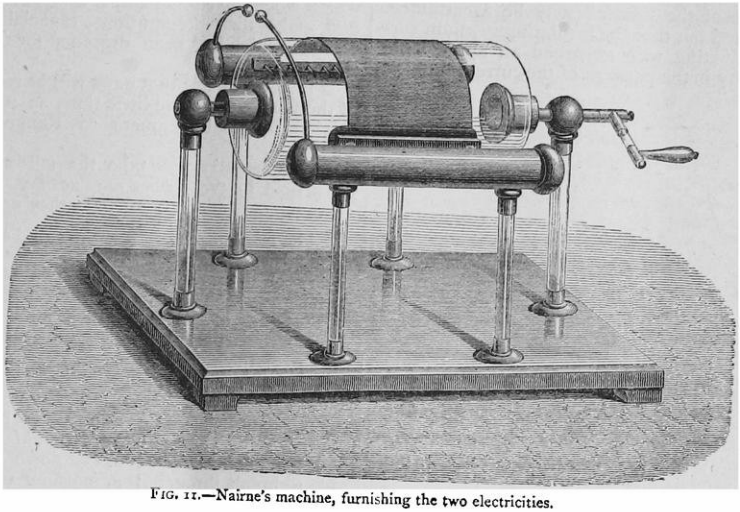


FIG. 11.—Nairne's machine, furnishing the two electricities.

force or tension, and the resistance it has to overcome in passing through the metallic conducting wire. The electro-motive force of a voltaic current varies with the number of the elements and the nature of the metals and liquids which constitute each element, but is in no degree influenced by the dimensions of any of the parts. Submarine telegraphic circuits vary in length, from one mile across the Thames to 2,000 miles in a continuous stretch across the Atlantic, and a current of electric force effective for the shorter distance would be absolutely useless for the Atlantic circuit.

The chemical power of the voltaic pile was discovered in the year 1800, and water was the first substance decomposed. If water is made a part of the electric circuit, so that a current of electricity passes through it, it is decomposed, and yields up its elements oxygen and hydrogen gases in obedience to certain laws. To decompose acidulated water it may be confined in two glass

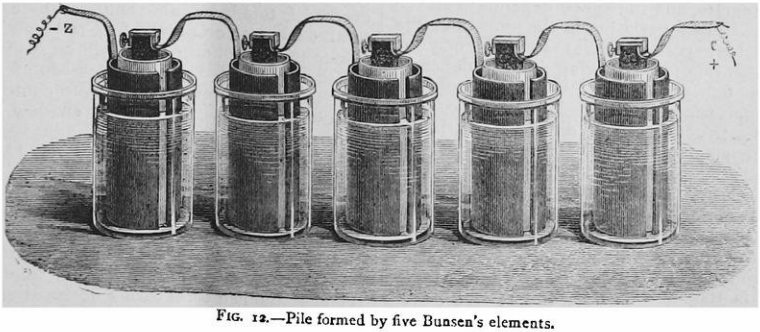


FIG. 12.—Pile formed by five Bunsen's elements.

tubes (Fig. 13), sealed at one extremity, and made part of the electrical circuit by being placed over the two electrodes of the poles of the battery. Gas will then be collected in each tube, but that in connection with the positive pole of the battery will be about half the volume of that in connection with the negative pole, the former being oxygen and the latter hydrogen, as oxygen and hydrogen gases are to each other in water exactly as two to one, by volume.

It has already been stated that all substances, however well they may conduct electricity, offer some resistance to the passage of the current; thus, the copper conducting wire offers more or less resistance according to its length. If the resistance of a mile of the copper conducting wire is ascertained, each successive mile, if the copper is of equal purity, will have the same measure of resistance; therefore, the resistance of the copper conductor in a cable 2,000 miles long will be 2,000 times the resistance of one mile of the conductor; in other words, the resistance of the wire is in direct proportion to its length.

This is a very important fact to bear in mind, as by the measurement of the copper resistance of the conductor in a cable, a basis is at once established by which to determine the distance of a fracture. Knowing the value of the resistance of the whole length of the cable conductor —assume for 2,000 miles the value to be 2,000 units (the measure of the unit being the resistance of one mile of the copper conductor)—an interruption occurs, continuity is broken, and the copper resistance only gives 760 and 1,240 units respectively when measured from either end. Thus is clearly established a basis upon which the approximate distance of the "fault" may be ascertained. Again, it was pointed out that the insulating medium surrounding the conducting wire absorbed an appreciable amount of electricity in the passage of the current through

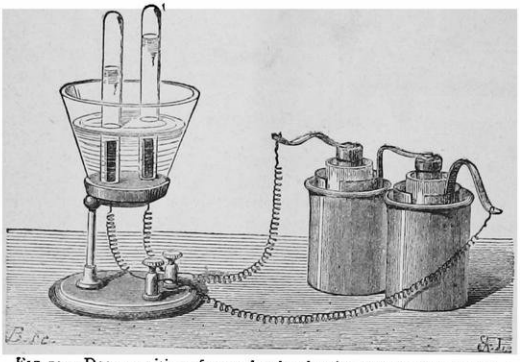


FIG. 13.—Decomposition of water by the chemical action (electro-motive force) of the voltaic battery.

the conducting wire. This absorption may be taken as a constant quantity, and the absorption for any length of cable be determined from given data as regards the time of electrification or the saturation of the circuit, and the time of discharge, or the percentage of leakage from the mechanical imperfections of all the insulating substances. Thus again is established a process by which, under certain conditions of injury to a cable, by correctly measuring the discharge, the position of a fault may with more or less accuracy be localised. The commercial value of a submarine cable depends upon the rapidity of its transmitting capacity, and the speed depends upon the time required to produce a variation in the tension of the current at the distant end sufficient to influence the recording instrument. The working speed depends, therefore, upon the delicacy of the apparatus employed, as then a small difference in the tension will suffice. In cables similarly constructed, but of different length, the speed of each is inversely proportional to the square of the length; because, when the length is doubled, the capacity for charge is doubled, and the electrical waves of charge and discharge have twice the distance to travel; therefore the retardation is increased fourfold. When the dimensions and weight of the insulating medium are fixed, there is a loss of speed if the conducting wire is too small; and again, if the conducting wire is too large, the speed is reduced by the increased capacity of the wire in a greater degree than it is augmented by the reduced resistance of the wire. The best accepted ratio of the insulator to that of the conductor is when the insulator is somewhat less than $3\frac{1}{2}$ times that of the copper conductor, or, more accurately speaking, in the proportion of 3·41 of insulator to 1 of copper. On long cables and where high speed is required, every current transmitted through the cable should be at equal intervals and of equal duration, so that the charge may be maintained constant between the signals.

(*To be continued.*)

ECLIPSE OF THE SUN, APRIL 6

AS no telegram has been received from Dr. Schuster's party on its arrival at Singapore, we are compelled to estimate the date of its arrival by the telegram in yesterday's papers, which informed us that the *Pera*, in which vessel the Expedition was conveyed from Galle, arrived at Shanghai. The vessel was due there on the 3rd, and arrived on the 5th. Assuming all the delay to have occurred on this side of Singapore, Dr. Schuster's party would have reached that place on the 24th of March, which would give them ample time to reach Chulai Point and make their preparations, especially as the colonial steamer which has been detached for the service is very swift.

It is not probable that news will be received from either of the parties for some little time, as it will probably be carried by local steamers to Rangoon, Singapore, or Calcutta.

In the meantime we take the following extracts from an article in the *Times* of Tuesday, showing the final arrangements adopted so far as they are known:—

"The advantages of scientific, and especially of astronomical expeditions, are by no means confined to the record of those special phenomena which the observers go out to see. The growing interest taken by all classes in the study of nature, while it makes a large number anxious to participate in the results obtained, at the same time puts them in presence of a class of facts which the stay-at-home student finds it hard to realise for himself. The total eclipse of the sun, which is visible in the Nicobar Islands, Burmah, Siam, and Anam to-day is a case in point. While early risers are breakfasting this morning, with the beams of the sun, low down in the east, not yet able to break through the morning mists, some quarter of the way round the world there will be at least three parties of anxious observers battling with the fierce noontide heat of that same luminary nearly overhead, soon, indeed, to have his light and heat entirely withdrawn for a time, but, all the same, under conditions so different from those we are familiar with here, that the sun and the surroundings of the observers might seem to form part of another universe. Another point—and this is one which will doubtless disappoint many—is that this eclipse, which, as we stated in a former article, on the high authority of Mr. Hind, in the time of obscuration will not be surpassed by any other available one during the present century, is totally invisible here. Although there is almost total darkness for nearly five minutes in Burmah and Siam, no trace of an eclipse will be seen in these islands, for the reason that although it began as early as two minutes to four this morning, and continued till sixteen minutes past nine, the moon's shadow falls first to the south, and then to the east of us. In fact, the line of total eclipse runs from the Cape of Good Hope to Burmah and Siam, and thence to the North Pacific. We lie, therefore, in no part of the track of the shadow.

"To pass from what may be considered geographical considerations, we may remind our readers that in a former article (the *Times*, Jan. 11, reprinted in NATURE, p. 201) we pointed out the value which many men of science attached to securing observations of this eclipse, and we attempted to give a general statement of the various questions pressing for solution, which, in the opinion of the Council of the Royal Society, justified an application to the Government for aid, not only in sending out expeditions from this country, but in organising a party of observers in India. Our readers have also been informed (the *Times*, Jan. 16) of the fact that the application to Government was at once acceded to in the warmest manner, and that Sir Stafford Northcote, the Marquis of Salisbury, and the Viceroy of India, as well as the Admiralty authorities, have been unceasing in the encouragement and assistance which they

have afforded. Nor was this all. The assistance afforded by the directors of the Peninsula and Oriental Steam Navigation Company in aid of the grant from Government was of so material a kind that the committee were enabled to send no less than six fully equipped observers from Europe to take part in the observations, as well as spare instruments for the use of the Indian parties.

"As a final result of all the efforts made, both in England and India, the location and composition of the various parties this morning, so far as is known, are as follows :—

"Camorta, in the Nicobars.—Capt. Waterhouse, Messrs. Meldola and Reynolds.

"Mergui (British Burmah).—Professors Pedler, of Calcutta ; Tacchini, of Palermo ; and Vogel, of Berlin, and assistants.

"Chulai Point (Siam).—Dr. Janssen and assistants, Dr. Schuster, Messrs. Lott and Beasley.

"The Royal Society Committee will certainly have to be congratulated if it has really been able to secure the valuable co-operation of all the distinguished foreign workers it has enrolled. We know that Herr Vogel joined at Suez, and that Prof. Tacchini, who was in India when the invitation reached him, joined at Calcutta, and that his instruments, which had been despatched to Europe, were only stopped by telegram at Aden ; but with regard to Dr. Janssen, it is not yet known whether he really joined at Singapore or not ; indeed, no telegram has yet been received from the Siam party since they left Galle, and there parted from the Camorta party, which was then transhipped to the *Enterprise*, a despatch boat belonging to the Indian Government, which left Calcutta on the 11th of March, having Capt. Waterhouse and Professors Tacchini and Pedler, with their assistants, on board. The *Enterprise* was to land the Camorta party and then proceed to Mergui to establish a second station. We may also mention that the Siam party was to proceed from Singapore to Siam on board the steamer belonging to the Government of the Straits Settlement, the *Charybdis* having been disabled by an accident.

"From this digression as to arrangements we may return to the question of *personnel*. In no eclipse expedition, perhaps, has such a large percentage of the observers been under fire before. Dr. Schuster and Mr. Meldola, the chiefs of the English part of the Siam and Camorta expeditions respectively, and Mr. Lott, are the only ones who have not taken part in the observation of former eclipses. Mr. Reynolds assisted Mr. De la Rue to photograph the eclipse of 1860. Professors Tacchini, Vogel, Pedler, and Mr. Beasley formed part of the expeditions of 1870. Capt. Waterhouse assisted Major Tennant to obtain the beautiful series of photographs of the eclipse of 1871 at Ootacamund, which are so valuable when taken in connection with those obtained at Baikul by the British Association party. With regard to Dr. Janssen, we are unable to say how many eclipses he has seen ; he has certainly been at most which have occurred since 1860, if not before that date.

"With regard to the objects to be obtained and the instruments to be employed, the Instructions drawn up by the Royal Society, and issued to the observers by its authority, come to our aid, and, by the minute and careful references to each instrument and to each part of the attack which they contain, enable us almost to picture to ourselves each observing party with its complement of telespectroscopes and prismatic cameras, the 'time-teller' going through his terribly responsible task, the silent activity of the photographic 'dark room,' and, above all, the ever-sharpening 'cusps,' and final total extinction of the Lord of Day—an extinction out of which, however, is born one of those sights for gods and men, which, once seen, so impress every power of the mind that they can ever afterwards be recalled as transcendent instances of the beauty and glory which attach themselves to some of the rarest as well as to some of the more common phenomena of nature.

"The most striking thing about the Royal Society programme is its simplicity. For the first time in eclipse expeditions, no eye observations are arranged for ; all the phenomena are to be photographically recorded. Here we see the enormous advance which has lately been made in these studies ; for we may remind our readers that in 1871, when the Astronomical Society were appealed to to use their influence to secure observations of the eclipse of that year, a committee of that Society would not agree to employ photography at all !

"There is another point. It is now more than probable that not even polariscopic observations will be attempted, although, thanks to the care of Mr. Spottiswoode, arrangements have been made for photographing the polariscopic corona, as it may be called, if a spare observer presents himself.

"The ground has been cleared in yet another way. The photographs of the corona, which were so strongly insisted upon by Mr. Lockyer in the observations of the eclipse of 1871, and objected to by the Astronomical Society, were necessary to determine the solar or non-solar origin of the corona. This question has now been set at rest by showing that part of it is really at the sun, and this is now termed the coronal atmosphere. When this was settled, it was suggested by the same observer that this atmosphere would be very likely found to vary in shape and dimensions with the sun-spots. This is the question, then, that is to be attacked in the old way on this occasion ; and, on the suggestion of the Royal Society Committee, the Viceroy has charged Capt. Waterhouse with this duty. He will use the same instrument that was used by Major Tennant and himself in 1871, on Dodabetta.

"The instruments termed 'prismatic cameras' are ordinary $3\frac{3}{4}$-inch achromatics, with a large prism of small angle ouside the object-glass, and a camera replacing the eye-piece. Such an instrument will give a spectra of small dispersion.

"Of course with such an instrument as this employed on the full sun, the impression on the plate would be a blurred spectrum containing no detail, but as the advancing moon reduces the part of the sun still remaining visible to a thin silver crescent, then the instrument will begin its work ; the actual shape and thickness of each stratum of vapour above the photosphere will be impressed by each coloured ray its light contains, and will stand out on a band of continuous spectrum, which will get feebler and narrower as the silver crescent thins to nothingness. Then the whole ring of chromosphere and coronal atmosphere which will burst upon the eye will be sorted out, if all goes well, into its various metallic constituents, by means of a chain of rings of greater or less thickness and regularity upon the photographic film. The vapours extending furthest outwards from the photosphere will be represented by the broadest rings, those lying closest to the photosphere by the narrowest. The Instructions are careful to insist upon complete rehearsals before the day of the eclipse, so that we may be assured that the simple programme we have sketched may be simply carried out, and that the observers will not attempt too much. It is as well to state this because persons unaccustomed to observations might imagine from the multiplicity of detail in the Instructions that the labours of the observers will be more than ordinarily complicated.

"Each party will have a telespectroscope and a prismatic camera. In addition to this equipment, Prof. Pedler will use a heliostat, focussing the image of the sun on a spectroscope from which the slit has been removed. As a camera, he uses a Janssen slide, which he has arranged so as to get thirty pictures.

"We are reminded incidentally by the Instructions on 'the multiplication of results,' of the enormous advan-

tage of the photographic method; there is no chance of error or forgetfulness. The observations sent home to the Royal Society will enable those on whom the labour and responsibility of reducing them will fall to almost reconstruct the eclipse for themselves.

"We may remark in conclusion that not only may we hope for many important results in solar physics if the weather be favourable, but that the benefit to science arising out of the expedition will be by no means limited to the eclipse results. Already Drs. Vogel and Schuster, the latter of whom is a distinguished pupil of Owens College, have done some important work on the varying intensities of the different parts of the solar spectrum at different times of the day, and in different climates on the voyage out, but both will remain some months in India to pursue their inquiries—Dr. Vogel in photographing the solar spectrum, with variously coloured photographic films; Dr. Schuster in establishing himself at a considerable height for the purpose of photographing the various solar phenomena and the spectra of some of the most important of the southern stars. The observers, all of whom have made considerable sacrifices in travelling a quarter round the globe and back again in the pursuit of science, certainly command our sympathy and deserve success. The Government grant of 1,000*l.* has been the means of calling forth, and, we hope sincerely, rendering fruitful, a vast amount of individual effort which would have been powerless without it. We may add that all the instruments have either been purchased by the Royal Society out of its own funds or lent by private individuals."

*ON THE DISSIPATION OF ENERGY**

THE second law of thermodynamics, and the theory of dissipation founded upon it, has been for some years a favourite subject with mathematical physicists, but has not hitherto received full recognition from engineers and chemists, nor from the scientific public. And yet the question under what circumstances it is possible to obtain work from heat is of the first importance. Merely to know that when work is done by means of heat, a so-called equivalent of heat disappears, is a very small part of what it concerns us to recognise.

A heat-engine is an apparatus capable of doing work by means of heat supplied to it at a high temperature and abstracted at a lower, and thermodynamics shows that the fraction of the heat supplied capable of conversion into work depends on the limits of temperature between which the machine operates. A non-condensing steam-engine is not, properly speaking, a heat-engine at all, inasmuch as it requires to be supplied with water as well as heat, but it may be treated correctly as a heat-engine giving up heat at 212° Fahr. This is the lower point of temperature. The higher is that at which the water boils in the boiler, perhaps 360° Fahr. The range of temperature available in a non-condensing steam-engine is therefore small at best, and the importance of working at a high pressure is very apparent. In a condensing engine the heat may be delivered up at 80°Fahr.

It is a radical defect in the steam-engine that the range of temperature between the furnace and the boiler is not utilised, and it is impossible to raise the temperature in the boiler to any great extent, in consequence of the tremendous pressure that would then be developed. There seems no escape from this difficulty but in the use of some other fluid, such as a hydrocarbon oil, of much higher boiling point. The engine would then consist of two parts—an oil-engine taking in heat at a high temperature, and doing work by means of the fall of heat down to the point at which a steam-engine becomes available; and secondly, a steam-engine receiving the heat given out by the oil-engine and working down to the ordinary atmospheric temperature.

Heat-engines may be worked backwards, so as by means of work to raise heat from a colder to a hotter body. This is the principle of the air or ether freezing machines now coming into extensive use. In this application a small quantity of work goes a long way, as the range of temperature through which the heat has to be raised is but small.

If the work required for the freezing machine is obtained from a steam-engine, the final result of the operation is that a fall of heat in the prime mover is made to produce a rise of heat in the freezing machine, and the question arises whether this operation may be effected without the intervention of mechanical work. The problem here proposed is solved in Carré's freezing apparatus, described in most of the text-books on heat. There are two communicating vessels, A and B, which are used alternately as boiler and condenser. In the first part of the operation aqueous ammonia is heated in A, until the gas is driven off and condensed under considerable pressure in B, which is kept cool with water. Here we have a fall of heat, the absorption taking place at the high temperature and the emission at the lower. In the second part of the operation A is kept cool, and the water in it soon recovers its power of absorbing the ammonia gas, which rapidly distils over. The object to be cooled is placed in contact with B, and heat passes from the colder to the hotter body. Finally, the apparatus is restored to its original condition, and therefore satisfies the definition of a heat-engine. M. Carré has invented a continuously working machine on this principle, which is said to be very efficient.

Other freezing arrangements depending on solution or chemical action may be brought under the same principle, if the cycle of operations be made complete.

When heat passes from a hotter to a colder body without producing work, or some equivalent effect such as raising other heat from a colder to a hotter body, energy is said to be dissipated, and an opportunity of doing work has been lost never to return. If on the other hand the fall of heat is fully utilised, there is no dissipation, as the original condition of things might be restored at pleasure; but in practice the full amount of work can never be obtained, in consequence of friction and the other imperfections of our machines.

The prevention of unnecessary dissipation is the guide to economy of fuel in industrial operations. Of this a good example is afforded by the regenerating furnaces of Mr. Siemens, in which the burnt gases are passed through a passage stacked with fire-bricks, and are not allowed to escape until their temperature is reduced to a very moderate point. After a time the products of combustion are passed into another passage, and the unburnt gaseous fuel and air are introduced through that which has previously been heated. The efficiency of the arrangement depends in great degree on the fact that the cold fuel is brought first into contact with the colder parts of the flue, and does not take heat from the hotter parts until it has itself become hot. In this way the fall of heat is never great, and there is comparatively little dissipation.

The principal difficulty in economy of fuel arises from the fact that the whole fall of heat from the temperature of the furnace is seldom available for one purpose. Thus in the iron smelting furnaces heat below the temperature of melting iron is absolutely useless. But when the spent gases are used for raising steam, the same heat is used over again at another part of its fall. There is no reason why this process should not be carried further. All the heat discharged from non-condensing steam-engines, which is more than nine-tenths of the whole, might be used for warming or drying, or other operations in which only low temperature heat is necessary.

The chemical bearings of the theory of dissipation are

* A lecture given at the Royal Institution on Friday, March 5, 1875, by Lord Rayleigh, M.A., F.R.S., M.R.I.

very important, but have not hitherto received much attention. A chemical transformation is impossible, if its occurrence would involve the opposite of dissipation (for which there is no convenient word); but it is not true, on the other hand, that a transformation which would involve dissipation must necessarily take place. Otherwise, the existence of explosives like gunpowder would be impossible. It is often stated that the development of heat is the criterion of the possibility of a proposed transformation, though exceptions to this rule are extremely well known. It is sufficient to mention the solution of a salt in water. This operation involves dissipation, or it would not occur, and it is not difficult to see how work might have been obtained in the process. The water may be placed under a piston in a cylinder maintained at a rigorously constant temperature, and the piston slowly raised until all the water is evaporated, and its tension reduced to the point at which the salt would begin to absorb it at the temperature in question. After the salt and vapour are in contact, the piston is made to descend until the solution is effected. In this process work is gained, since the pressure under the piston during the expansion is greater than at the corresponding stage of the contraction. If the salt is dissolved in the ordinary way energy is dissipated, an opportunity of doing work at the expense of low temperature heat has been missed and will not return.

The difficulty in applying thermodynamical principles to chemistry arises from the fact that chemical transformations cannot generally be supposed to take place in a reversible manner, even although unlimited time be allowed. Some progress has, however, recently been made, and the experiments of Debray on the influence of pressure on the evolution of carbonic anhydride from chalk throw considerable light on the matter. By properly accommodating the pressure and temperature, the constituents of chalk may be separated or recompounded without dissipation, or rather dissipation may theoretically be reduced without limit by making the operation slowly enough.

The possibility of chemical action must often depend on the density of the reacting substances. A mixture of oxygen and hydrogen in the proper proportions may be exploded by an electric spark at the atmospheric pressure, and energy will be dissipated. In this operation the spark itself need not be considered, as a given spark is capable of exploding any quantity of gas. Suppose, now, that previously to explosion the gas is expanded at constant temperature, and then after explosion brought back to the former volume. Since in the combination there is a condensation to two-thirds, the pressure required to compress the aqueous vapour is less than that exercised at the same volume by the uncombined gases, and accordingly work is gained on the whole. Hence the explosion in the expanded state involves less dissipation than in the condensed state, and the amount of the difference may be increased without limit by carrying the expansion far enough. It follow that beyond a certain point of rarity the explosion cannot be made, as it could not then involve any dissipation. But although the tendency to combine diminishes as the gas becomes rarer, the heat developed during the combination remains approximately constant.

It must be remembered that the heat of combination is generally developed at a high temperature, and that therefore work may be done during the cooling of the products of combustion. If, therefore, it is a necessity of the case that the act of combustion should take place at a high temperature, the possibility of explosion will cease at an earlier point of rarefaction than would otherwise have been the case.

It may probably be found that many mixtures which show no tendency to explode under ordinary conditions will become explosive when sufficiently condensed.

NOTES

THE *Bonner Zeitung* publishes a letter of Dr. Seeliger, containing the first detailed reports from the German party of observers sent to the Auckland Islands to observe the Transit of Venus. Dr. Seeliger speaks of the weather in these islands as the most wretched imaginable; enough, he says, to drive an astronomer to despair. "Clear evenings are very rare, and sunshine a phenomenon." On Dec. 9, at 12.45 P.M., "Venus was to appear on the sun's disc; one minute passes after another, and still all is covered. At last the clouds thin a little, and without dark glass we can easily see Venus, that had just entered on the sun's disc. The two first contacts, which, however, were of less value to us, were lost therefore. A quarter of an hour afterwards a little gap shows itself in the clouds, the sun breaks through, and we at once set to work, so as not to lose a single moment. And now comes the wonder! For nearly four hours the sun remains completely free from clouds. In the east and in the west thick clouds; only where the sun stands it is clear. Hardly has Venus passed off the sun's disc, therefore hardly have we completely succeeded with our measurements, when the sky is again overcast all over. To-day the day is dull, as usual. As affairs stand we shall very likely have to stop here two or two-and-a-half months longer, because we have not yet been able to do anything for the other astronomical data, which are indispensable. On the one hand it is hardly possible to do anything in this climate at this time, and then we finished our general preparations only a long time after we thought we should do so."

WE regret to record the death of Carl Ludwig Christian Becker, who has for so long been known to students of physical science in this country in connection with the firm of Elliott Brothers. He was born at Ratzeburg, in the Grand Duchy of Mecklenburg Strelitz, July 16, 1821, and received his general education at the Gymnasium of his birthplace, of which his father was Rector. He studied his profession with Repsold at Hamburg, Kraft at Vienna, and Steinheil at Munich, and came to London in 1849, joining the firm of Elliott Brothers in 1858. Within the last few years he became a member of the Society of Telegraph Engineers and Fellow of the Royal Astronomical and Physical Societies. We believe that there is no one who has pursued physical inquiries in England who will not look upon his loss as that of a personal friend, while his skill in providing new appliances for investigation reminds us how often the most important scientific work is dependent upon the skilled mechanician.

THE Royal Academy of Medicine at Brussels has given its opinion on the so-called "miracle," Louise Lateau, who, it is said, by divine assistance abstains from taking food, and has done so for years together. Moreover, this miraculous creature has some wounds in her hands, side, and feet, which are said to be true representations of those of Christ, and which bleed profusely every Friday. Dr. Virchow, the celebrated German anatomist, has made her the subject of a little pamphlet, "Ueber Wunder." The opinion of the Brussels Academy, which is quite in accordance with that of Dr. Virchow, is as follows:—"Louise Lateau works and requires heat; every Friday she loses a certain quantity of blood by her wounds. When she breathes, she exhales water vapour and carbonic acid; her weight has not decreased since she has been observed; she therefore consumes carbon which is not furnished by her system. Where does she take this carbon from? Physiology simply replies, 'She eats.' The alleged abstinence from all food of Louise Lateau is contradictory to all physiological laws; it is therefore hardly necessary to prove that this abstinence is an invention. Whoever alleges that Louise Lateau is not subject to physiological laws, must prove it; until this is done physiology will denote the miracle to be a deception. Could Louise Lateau be

closely observed night and day by scientific men, the deception would soon come to light. It is of no use to talk of miracles, even when eleven doors are shut against deceit, as long as the twelfth is left open."

THE International Congress on Silk-culture is to hold its fifth meeting at Milan during 1876. The Committee has sent a programme of experiments to be made during 1875 to all silk-culturists of Europe. This programme treats of the most important questions connected with the keeping of silkworms, the prevention of their diseases, particularly of their "inactivity;" the latter is a disease which has done great damage of late years. M. Pasteur has proposed as a remedy to isolate the deposits of ova into separate cells; but this has proved totally ineffective. However, with investigators like Cornalia, Duclaux, Bolle, and others, on this field, it may safely be expected that means and ways will soon be found to prevent any serious diseases from raging among silkworms and their ova.

SWEDISH newspapers report the discovery of a large deposit of hæmatite iron ore in the district of Nordland, Norway, some fifteen or twenty miles from Bodö, and only about ten or twelve miles from a Norwegian port which is completely free from ice. The analysis of the ore shows that it contains between fifty-four and sixty-seven per cent. of iron, and only a very small percentage of phosphates.

PROF. Haeckel, of Jena, has been lecturing at the Karlsruhe Museum on the coral reefs of the Red Sea. Prof. Michelis has asked him in the *Karlsruher Zeitung* whether he will give him the opportunity of a public discussion. It is said that Dr. Michelis will soon publish a purely scientific refutation of "the German Darwin's" *Anthropogemy*.

Dingler's Polytech. Journal contains an account of researches made by Dr. Otto Krause, of Annaberg, on tobacco smoke, which he finds contains constantly a considerable quantity of carbonic oxide. The after effects of smoking are said to be principally caused by this poisonous gas, as the smoker never can prevent a part of the smoke from descending to the lungs, and thus the poisoning is unavoidable. The author is of opinion that the after effects are all the more energetic, the more inexperienced the smoker is, and he thus explains the unpleasant results of the first attempts at smoking, which are generally ascribed to nicotine alone.

A MALADY which threatens great loss to owners of lemon plantations has attacked the lemon plant, the origin of which is believed to be the forced cultivation of the fruit, which has taken place during the last few years. The lemon plant is very hardy, and infinitely easier to cultivate than the orange, and this fact has probably induced a certain amount of carelessness in its treatment, from which growers are now suffering. The tree was originally a native of the dry and hot soil of Persia, whence it has been transferred to various other countries, where, under different circumstances of soil and climate, it has been made largely to increase its yield of fruit. The disease which has now made its appearance is called *la sécheresse*, or dry rot, and seizes the extremities of the plant, sometimes the roots, sometimes the branches, whence it gradually spreads through the whole tree, drying up its sap in its course. Hitherto attempts have been made to check the ravages of the new disease, but without success. It is said that similar appearances have been noticed in orange plantations. It is suggested that by grafting cuttings of the healthy lemon plant on the wild orange tree, a new stock of plants may be obtained, and the fruit cultivated on trees which have not been subjected to forced growth. If this plan succeeds, it is to be hoped that the cultivation of the new race may be carried on with greater care in the future.

VICE-CONSUL ALLEN, in his report of the trade of Tamsuy and Kelung, describes the distillation of the camphor of commerce from *Cinnamomum camphora*, Fr., Nees et Eb., as a most hazardous trade, the distillers having to be constantly on the alert for fear of attack by the aborigines, who are naturally opposed to the continual encroachments into their territory for the purpose of cutting down the trees for extracting the camphor. No young trees are planted to replace those cut down, nor do the officials take any cognisance of the diminution which is being surely effected in the supply of a valuable commercial article. The stills are described as being of a very simple construction, and are built up in a shed in such a manner that they can be moved as the Chinese advance into the interior. A long wooden trough, coated with clay and half filled with water, is placed over eight or ten furnaces; on the trough boards pierced with holes are fitted, and on these boards are placed jars containing the camphor-wood chips, the whole being surmounted by inverted earthenware pots, and the joints made air-tight by filling them up with hemp. When the furnaces are lit the steam passes through the pierced boards, and saturating the chips, causes the sublimated camphor to settle in crystals on the inside of the pots, from which it is scraped off and afterwards refined. During the summer months the camphor often loses as much as 20 per cent. on its way from the producing districts to the port of shipment.

MR. BARNUM is said to have made an agreement with Mr. Donaldson, the aëronaut of the U.S. *Daily Graphic*, to build six balloons of 70,000 cubic feet each, and to make ascents next spring and summer, in order to ascertain whether there is a current from America to Europe. The sum paid to Donaldson as fees is said by the *New York World* to be 4,000*l*.

THE Clothworkers' Company have founded in King's College, London, one annual exhibition of 25*l*. for two years for proficiency in science, open not only to actual students of the College, but to all under nineteen years of age who are intending to devote themselves to the study of mathematics, mechanics, physics, chemistry, botany, and zoology. Each candidate may select any four of these subjects.

DR. EDOUARD HITZIG, of Berlin, who is well known for his researches on the functions of the brain, has been elected to the chair of Psychology in the University of Zürich.

PROF. ARMSTRONG, of the London Institution, and Mr. E. J. Mills, D.Sc., Assistant Examiner in Chemistry in the University of London, are candidates for the vacant Jacksonian Professorship of Natural and Experimental Philosophy in Cambridge University. The other candidates are Mr. W. N. Hartley, Mr. James Stuart, and the Rev. J. C. W. Ellis.

Mr. A. H. GARROD, of King's College, Cambridge, has been appointed Fullerian Professor of Physiology to the Royal Institution for the next three years.

A TELEGRAM has been received by the Berlin African Society from Lisbon announcing that Herr Homeyer, the African traveller, had safely reached Loanda, whence he proposed starting for the interior on the 11th of February. Herr Homeyer had been everywhere very well received.

THE Scottish Meteorological Society, through its president, the Marquis of Tweeddale, has addressed to Sir Stafford Northcote a letter urging the claims of that Society on Government for support. As our readers are aware, this is not the first time this Society has urged its claims for assistance on Government; it is advantageously situated, and has done very much both for the advancement of the science of meteorology and for the practical application of its results in directions beneficial to the country at large. It assuredly deserves the countenance of the Government,

were it for nothing else than the practical results of its labours, and we have no doubt that the statements forwarded to the Chancellor of the Exchequer will be seriously considered, with the result that the prayer of the Society will be granted.

WE take the following from the *Times*:—The vote proposed this session for Aid to the Science Commission is but 597*l*. It is fully expected that the labours of the Commission will be completed by the end of December; but there is much work yet in hand. Five reports have been published, and five more are in preparation, on—1, Science Teaching in Public and Endowed Schools; 2, the University of London; 3, the Scotch Universities; 4, the Irish Universities; 5, the Advancement of Science. Reports on science teaching in public and first-grade schools in England and on the aid given by the State to science in France have been prepared by the secretary. It is proposed that three of the Commissioners should visit the various colleges in Germany to make inquiry with regard to scientific instruction and the advancement of science in that country.

FROM the Annual Report of the Geologists' Association, we learn that that Society is in a prosperous condition. The increase to its numbers during last year was thirty-one, and the total number of members of all classes was, on Jan. 1st, 339.

THE *soirée* of the Paris Observatory, which took place on the 1st of April, was a very brilliant one. The saloons were crowded with provincial *savants* and their families. The great glass of the new reflector had been arranged on its edge in the Meridian Hall, so that visitors might admire the perfection of its polish. The company retired at a late hour, and on the following morning, we regret to say, M. Leon Leverrier, the eldest son of the illustrious astronomer, was found dead in his bed. He was thirty-seven years of age, a pupil of the Polytechnic School, and the consulting chemist of the Western Railway.

THE competition for prizes in connection with the University of Aberdeen, to which we alluded in our number for March 25 (p. 413), is, we are informed, confined to those who were matriculated students of the University during Session 1874–75.

THE African explorer, Dr. Mauch, who fell from a window at Blaubeüren on the 27th ult., died on the 4th inst.

WE have received from Dr. H. Hildebrand Hildebrandsson, of Upsal, a valuable paper just published on the upper currents of the atmosphere. Systematic observations of the movements of the cirrus cloud were set on foot at most of the Meteorological Stations in Sweden in December 1873. This paper, which is an able discussion of these observations, is an important contribution to the vital question of the circulation of the atmosphere; we shall give a detailed notice of it in an early number.

AN international conference for telegraphy will be held at St. Petersburgh on the 1st of June. Twenty-four nations and twenty submarine companies are said to have agreed to send delegates to deliberate on a new telegraphic convention.

BY the will of the late Mr. James Young, of Bournemouth, the testator leaves, amongst other legacies, the sum of 100*l*. to John Stenhouse, M.D., F.R.S., to show his appreciation of his services to mankind by the great discovery of charcoal as an air-filterer.

PART 3 of *Petermann's Mittheilungen* contains the beginning of a report on Livingstone's travels in Central Africa, from 1866 to 1873, with extracts from his journals, and a large map drawn by Petermann after the English edition of Livingstone's journals. Even the most recent discoveries are entered on the map; for instance, the outlet of the Tanganyika Lake, discovered by Cameron, by which this lake is in direct communication with the source-district of the Congo, which Livingstone visited, without being able, however, to discern all its relations and connections. It is very doubtful whether in England a map can already be found, which is in the least to be compared to that of Petermann.

THE *conversazione* of the Royal Society, which we announced in a recent number, took place last evening; we hope to be able to give details next week.

SUPPLEMENT No. 40 of *Petermann's Mittheilungen* consists of a detailed description of the Alpine region lying between the valleys of the Rhine and the Inn, the author being A. Waltenbergen. It is accompanied by one large general and two smaller special maps.

THE meeting of the delegates of the French learned societies was inaugurated on the 31st March, and was held on the 1st and 2nd of April, at the Sorbonne. The concluding *séance* was occupied with the distribution of rewards, under the presidency of M. Wallon, the new Minister. M. Wallon gave a summary account of all the works which are carried on with the help of Government. He alluded to a recent law passed by the National Assembly, and which now regulates grants to travelling expeditions. A special commission has been established to appoint explorers and determine the amount of money required in each case in order to fulfil the ends of the journey. Each person sent out has to write an account of the work done, and the commission must report on the value of results thus obtained.

A NEW notation for thermometers has been invented by the present director of the Copenhagen Meteorological Board, and consists merely in taking the complement to 100° of each negative degree. Although it has been intended for the Celsius thermometer, it can be extended to Fahrenheit with much advantage in the rare cases in which negative degrees are used on that scale. Suppose the following series of temperatures has been obtained: $+7-3+1-5+4-3-2+5$, for the minimum of successive days in March, according to the new style it should run so: $+7+97+1+95+4+97+98+5$. The sum is 404 minus 400 = 4. Mean is equal to $\frac{4}{8}=\frac{1}{2}$. If possible, it is more difficult with Fahrenheit than with Celsius to commit any error, and means are taken with each scale with an equal facility.

FROM the Tenth Quarterly Report of the Sub-Wealden Exploration, we learn that the total depth of the new boring commenced February 11 is 373 feet. From the surface to the gypsum, say about 127 feet, the beds consist of alternating shales, limestones, and calcareous clays, all effervescing with acid; more or less fissured, varying in compactness and hardness from that of Purbeck kerbstone to that of Windsor soap. A considerable thickness, over 30 feet, of pale grey sand and sandstone immediately succeeds the gypsum, followed by calcareous shales, to the Kimmeridge clay at about 290 feet. This sand is supposed by the authorities to be the representative of the Portland series. It contains casts of annelides and the claws of one or two small species of crab. The report contains an account of the boring at Sperenberg, about twenty-three miles south of Berlin, which was prosecuted to a depth of 4,172 feet.

THE additions to the Zoological Society's Gardens during the past week include a Red-bellied Wallaby (*Halmaturus billardieri*) from Tasmania, a Vulpine Phalanger (*Phalangista vulpina*) from Australia, presented by Mr. Bolton Glanvill Corney; a Lesser Sulphur-crested Cockatoo (*Cacatua sulphurea*) from Moluccas, presented by Mr. William Holborn; a Crowned Partridge (*Rollulus cristatus*) from Moluccas, presented by Mr Barclay Field; an Indian Python (*Python molurus*) from India, presented by Mr. A. J. S. Terris; a Nisnas Monkey (*Cercopithecus pyrrhonotus*) from Nubia, deposited; a Wheatear (*Saxicola œnanthe*) European, purchased.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, March 18.—"On the Absorption-Spectra of Metals volatilised by the Oxyhydrogen Flame," by J. Norman Lockyer, F.R.S., and W. Chandler Roberts, Chemist of the Mint.

The authors state that the researches which have recently been published on the absorption-spectra of various metals, first by Roscoe and Schuster, and subsequently by one of themselves,* establish beyond all question the facts that—

1. In addition to the well-known line-spectra, channelled-space spectra are produced by the vapours of certain metals; and,

2. Such spectra are produced by vapours which are competent to give, at other times, not only line-spectra, but continuous spectra in the blue, or blue and red.

As the temperature employed for the volatisation of the metals in these experiments did not exceed bright redness, the range of metals examined was necessarily limited. It was therefore considered desirable to extend these observations to the less fusible metals, as well as to ascertain whether the spectra of those which volatilised at the lower temperature would be modified by the application of a greater degree of heat. For this purpose they employed an oxyhydrogen blowpipe, and the lime still used by Stas for the distillation of silver, his arrangement being modified in order that the metallic vapour might be conducted into a lime tube or tunnel heated to whiteness, so placed that a beam from an electric lamp could readily traverse it.

The apparatus employed consists of a block of lime traversed by a tube 16 centims. long and 30 millims. diameter. A receptacle, open at the upper surface of the lime-block, in order to admit of the introduction of the oxyhydrogen blow-pipe, communicates with the centre of the tube. The ends of the tube or tunnel in the lime were closed by glass plates held on by a suitable clip. Small lateral orifices were cut in the lime for the insertion of tobacco-pipe stems, through which a stream of hydrogen could be passed into the tube and receptacle.

An electric lamp was placed opposite one end of the tube and a spectroscope opposite the other This last instrument was by Desaga, of Heidelberg, and its single prism, the angle of which was 60°, was capable of distinctly separating the D lines, at the same time that it enabled us to see the whole spectrum in a single field of view, an essential point in such inquiries.

Some preliminary experiments indicated the advisability of increasing the length of the column of vapour. To effect this, a tube 30 centims. long was made in a fresh block of lime, the cavity being arranged as before; in each end a short accurately fitting iron tube, luted with a mixture of graphite and fire-clay, was inserted; and the total length of the column thus became 60 centims.

The lime-block with its fittings was then placed in a charcoal furnace, by means of which the whole could be raised to a high temperature. As soon as the block was heated to bright redness, the metal, the vapour of which was to be examined, was introduced into the receptacle, and the flame of the oxyhydrogen blowpipe was allowed to play on its upper surface, care being taken to employ an excess of hydrogen. In almost every case the metal experimented on was rapidly volatilised (the exceptions being gold and palladium). As the glass plates rapidly became clouded by the condensation of the metallic vapours, it was necessary to adopt an arrangement by which they could be easily replaced. The authors assured themselves that oxides were not present to disturb the accuracy of the results.

They ascertained that the effect of oxides, and of the metallic rain due to condensation, was to produce a general absorption obviously different from the special effects of absorption which they record. Silver may be given as an example of the method.

Fifty grammes of pure metal were placed in the cavity, and this amount produced a continuous supply of vapour for about ten minutes.

With the smaller thickness given by the first lime block, and with a less powerful blast, the spectrum of silver consisted of an absorption in the blue which at times extended almost to the green.

With the elongated tube and a stronger blast an exquisite channelled-space absorption was observed, the channels being far enough apart to render them very conspicuous in the field of view; at the same time there was continuous absorption in the blue. It was specially observed that there was no absorption in the red.

The results of experiments on the following metals and metalloids are then described:—Copper, sodium, calcium, aluminium, zinc, cadmium, manganese, iron, cobalt, nickel, chromium, tin, antimony, bismuth, lead, thallium, gold, palladium, selenium, and iodine.

The authors conclude that these experiments, conducted at the high temperature of the oxyhydrogen flame, go far to support the conclusions which were drawn from the experiments at a lower temperature. First, in passing from the liquid to the most perfect gaseous state, vapours are composed of molecules of different orders of complexity; and second, this complexity is diminished by the dissociating action of heat, each molecular simplification being marked by a distinctive spectrum. There is also an intimate connection between the facility with which the final stage is reached, the group to which the element belongs, and the place which it occupies in the solar atmosphere.

"On Traumatic Inflammation of Connective Tissue," by G. Thin, M.D. Communicated by Prof. Huxley, Sec. R.S.

Linnean Society, April 1.—Dr. G. J. Allman, F.R.S., president, in the chair.—The President, on taking the chair, said: "I cannot allow the business of the evening to commence without one word expressive of the deep sorrow which we all feel in the death of one of our most distinguished Fellows and ablest officers. In our late treasurer we had a man of refined and cultivated mind, of honest and straightforward purpose, and of a simplicity and kindliness of character that endeared him to all who knew him. Mr. Hanbury has been taken away from us at a time of life when we might still have looked forward to much and valuable work, and it now only remains for us to accept in sorrow the loss which deprives the Society of a conscientious and efficient officer, and many of us of a valued friend."—The following papers were read:—Notes on *Octopus vulgaris*, Lam., by Mr. W. S. Mitchell.—On the connection of vegetable organisms with small-pox, by Dr. E. Klein, Assistant-Professor at the Laboratory of the Brown Institution. A report of this paper will shortly appear in the Proceedings of the Royal Society.

Chemical Society, April 1.—Prof. Abel, F.R.S., in the chair.—Researches on the action of the copper-zinc couple on organic bodies (viii.): on chloroform, bromoform, and iodoform, by Dr. J. H. Gladstone and Mr. A. Tribe, was read by the latter.—Dr. W. A. Tilden then read a paper on the action of nitrosyl-chloride on organic bodies (ii.): on turpentine oil. The action gives rise to a molecular compound of terpene and the chloride, which, by the action of alcoholic potash, yields *nitroso-terpene*, $C_{10}H_{15}NO$.—Dr. A. W. Hofmann made two communications to the Society: one, on the decomposition of the fulminates by ammonia and by sulphuretted hydrogen; the other, a striking lecture experiment showing the atomic relations of oxygen and chlorine.

Royal Horticultural Society, March 17.—Scientific Committee. Mr. P. Edgeworth, F.L.S., in the chair.—Flowering specimens of *Bambusa gracilis*, Hort., were sent from Trentham Gardens by Mr. Stevens.—Mr. Grote, F.L.S., sent extracts from the Proceedings of the Agri-Horticultural Society of India, relative to the growth of fungi in the interior of ant-hills. According to Dr. Cunningham the species was an *Agaricus* of the section *Lepiota*. They arise from a peculiar substance found in the ant-hills, and which probably consists of vegetable débris permeated by mycelium. According to Belt, a similar substance is found in the nests of the leaf-cutting ants of Nicaragua, and is supposed by him to serve as food, the ants cutting and storing the leaves for the sake of the fungi which are subsequently developed in the débris.—Prof. Thiselton Dyer exhibited, under the microscope, examples of the ascospores of yeast. They were obtained by cultivating yeast on moist slabs of plaster of Paris in a damp atmosphere. After about ten days the cells of the yeast, which had been starved by this treatment, developed from two to four spores in their interior. These, when placed under appropriate conditions, were found to be capable of germinating, and so of reproducing actively growing yeast. De Seynes had observed them in *Mycoderma vini* in 1868, but they had been first described by Max Reess in 1870, in yeast.—Copies of the Meteorological Society's report on the observations of phenological phenomena were placed on the table.—Dr. Masters called attention to the beautiful specimen of the fruit of *Hedychium Gardnerianum*, sent by Mr. Bennett from Hatfield. It had not hitherto been known to fruit in cultivation.

Lockyer: Proc. Roy. Soc., v. xxii. p. 371.

General Meeting.—W. A. Lindsay, secretary, in the chair.—The Rev. M. J. Berkeley called attention to the various objects of interest exhibited.

Anthropological Institute, March 23.—Col. A. Lane Fox, president, in the chair.—The President communicated a note on the chest measurement of recruits for the army, pointing out how the departure from a uniform method of measuring gave rise to unnecessary public expenditure, and often to the loss of good and sound men to the service. The method employed by Col. Fox himself at his depot was explained, and a table of statistics was exhibited in illustration of his remarks.—The Rev. Dunbar I. Heath, M.A., read a paper entitled "Molecules and Potential Life." The object of the author was to adduce arguments to show that there is a physical foundation for the measurement of vitality. The labours of Dr. Lionel Beale enabled us to put the amount of protoplasm, or living matter in the adult human body, at about 15lbs. in weight. Every vital action of every sort or kind kills a portion of that matter, and the mechanism by which its death is compensated, by the vitalisation of fresh pabulum, was anatomically and physiologically described. Hence it followed that every unit of physical action corresponds to the death of a unit of protoplasm, and a unit of vital action is at the same time exhibited. The death of protoplasm at the outside of a cell was described as diminishing the velocity and therefore the pressure of the outside dissociated atoms, the consequence of which was the deposit of the proximate principles such as fibrine, &c., and a rush of fresh pabulum inwards into the cell.—Mr. G. H. Kinahan, F.G.S., contributed a paper on a prehistoric road at Duncan's Flow, Balbyalbaugh, Co. Antrim.

Entomological Society, March 15.—Sir Sidney Smith Saunders, president, in the chair.—Mr. Sealy exhibited specimens of an *Ornithoptera* bred from larvæ taken in Malabar in great numbers on *Aristolochia indica*.—Prof. Westwood exhibited drawings of several undescribed Coleoptera of remarkable forms, of which he intended to communicate the descriptions. Amongst them was an insect from the collection of M. Mniszech which bore a strong resemblance to a *Rhysodes*, and which he had named *Rhisodina Mniszechii*, but was really a Heteromerous insect.—Mr. M'Lachlan remarked that on close examination the species of *Lepisma* exhibited at the last meeting by Mr. F. H. Ward did not correspond with the description of *L. domestica* of the United States, nor with the descriptions of any species with which he was acquainted.—Mr. Butler communicated some critical remarks on the recently published work on the *Sphingidæ* by Dr. Boisduval.—The Rev. R. P. Murray read some remarks on the species of *Terias*, forming the Hecabe group, which tended to show that the insects which had hitherto been considered distinct species under the names of *Æsiope*, Mén., *Brenda*, Doubl. and Hew., and *Sari*, Horsf., were mostly, if not all, referable to but one species, *T. Hecabe*, Linn. Prof. Westwood suggested that the case might be analogous to certain species of *Pieris*, where certain forms, e.g. *P. napææ*, Esp., and *P. Sabellicæ*, Steph., now universally recognised as varieties of *P. napi*, Linn., had long been considered as specifically distinct. Prof. Westwood also suggested that attention should be paid to the times of appearance of the various forms, and the period noted during which they remained in the pupa stage. Mr. Butler remarked that the latter circumstance had an important bearing in the case of *Papilio Ajax*, Linn.—Mr. J. S. Baly communicated descriptions of new genera and species of Phytophagous Coleoptera.—Mr. C. O. Waterhouse communicated a paper on the Lamellicorn Coleoptera of Japan.—Mr. F. Smith read descriptions of new species of Indian Aculeate Hymenoptera collected by Mr. G. R. James Rothney, and also descriptions of new species of bees of the genus *Nomia*, Latrielle.

Institution of Civil Engineers, March 23.—Mr. Thos. E. Harrison, president, in the chair.—The papers read were on the Hull Docks, by Sir William Wright, Assoc. Inst. C.E.; and on the construction of the Albert Dock at Kingston-upon-Hull, by Mr. John Clarke Hawkshaw, M.A., M. Inst. C.E.

Victoria (Philosophical) Institute, April 5.—Mr. C. Brooke, F.R.S., in the chair.—A paper on the relation of the Scripture account of the Deluge to Physical Science, by Prof. Challis, F.R.S., was read.

MANCHESTER

Literary and Philosophical Society, March. 23.—Mr. Edward Schunck, F.R.S., president, in the chair.—On discoveries in a cave at Thayingen, near Schaffhausen, by Arthur Wm. Waters, F.G.S.

RIGA

Society of Naturalists, Sept. 2, 1874.—A number of specimens, mainly of ornithological interest, were presented to the Society by Dr. C. Berg, of Buenos Ayres, and others.—Prof. Schweder then spoke at length on self-ignition of hay; he attributes the first cause of the rise of temperature in bundles of hay to the chemical decomposition of the hay itself.

Sept. 16.—M. Behrmann spoke on the constitution of red and yellow prussiate of potash, and gave the graphic representation of both, showing the four free atomicity bonds in Cfy (Fe″ Cy_6), and the six in Cfdy (Fe‴$_2$ Cy_{12}).

Oct. 14.—Prof. Kieseritzky presented a number of rare species of plants for the herbarium of the Socieyt. The paper read was "On Microscopic Investigation of Rocks," by Prof. Petzhold.—Dr. Nauck then exhibited some specimens of *Stegoporus pisciformis* bred by him.—The publication of the Society contains a detailed list, by J. H. Kawall, of all the work done by the new Russian societies of naturalists, and comprises the societies of Charkow, St. Petersburg, Moscow, Kasan, and Odessa.

STOCKHOLM

Kongl. Vetenskaps Akademiens Förhandlingar, Sept. 9 and Oct. 14, 1874.—The following papers were read:—On some peculiarities in the isothermal curves and the relations amongst different kinds of specific heats in the mechanical heat theory, by Prof. G. R. Dahlander.—On the influence of birds upon the composition of fossiliferous strata, by Dr. G. Eisen.—On two deductions from Cauchy's theorem of mathematical roots, by G. Mittag-Leffler.—On the magnetic measurement of iron ore deposits, by Prof. R. Thalén.—Calculation of the relative disturbances of planet (112) Iphigenia, by Dr. J. O. Backlund.

GÖTTINGEN

Royal Society of Sciences, Dec. 1874.—The following papers were read:—On the influence of the position of sun and moon upon volcanic eruptions, by S. von Waltershausen.—On the Sanskrit verbal root *sâ*, and its derivatives in Greek and Latin, by Th. Benfey.—On the laws of voltaic induction, by Ed. Riecke.—On the molecular motion of two particles, with reference to Weber's law of electric force, by the same.—On the morphology and physiology of the facet eye of Articulata, by Dr. Grenacher of Rostock; an elaborate treatise on the subject, with a view to prove that the morphology of the compound eyes is perfectly compatible with Darwin's theory.

PARIS

Academy of Sciences, March 22.—M. M. Frémy in the chair.—The following papers were read:—Study of the process in the human mind in the research of the unknown, by aid of observation and experience, &c., by M. Chevreul. This is the author's second paper on the subject, and treats of the laws of vision and of the simultaneous contrast of colours.—On the stability of the salts of the fatty acids in the presence of water, and on the reciprocal displacement of these acids, by M. Berthelot. Mainly the alkaline salts are considered in their behaviour with excess of water, base or acid, and the acids treated of, with regard to substitution of each other, are formic, acetic, butyric, and valeric acids.—On the association of native platinum with rocks of a chrysolite base in the Ural; original relation of this metal to chromite, by M. Daubrée.—On the variations or periodical changes in the temperature (tenth note); period of the twelve-fold twentieth day, by M. Ch. Sainte Claire Deville.—The Academy then proceeded to the nomination of a new correspondent to its Mechanical Section, in lieu of the late Mr. Fairbairn. M. Boileau was duly elected in his stead.—The President then addressed a few words to M. Bouquet de la Grye, the chief of the expedition sent to Campbell Island to observe the Transit of Venus, and thanked him and the other members of the expedition, in the name of the Academy, warmly for their untiring efforts to obtain satisfactory results. After a short acknowledgment M. Bouquet de la Grye read a paper on the scientific documents recording the observations made at Campbell Island; the observations of the Transit of Venus were not successful, but the observers have brought home numerous results of other scientific observations, which in some degree atone for the disappointment with the rare phenomenon of the Transit.—A note by M. Mannheim on M. Ribaucour's paper read at the last meeting, on some properties of curves traced on surfaces.—A note by M. Moutard, on the linear differential equations of the second order.—On the quantity of oxygen which the blood can absorb at the diffe-

rent barometrical pressures, by M. P. Bret.—On the embryogeny of *Lamellaria perspicua*, a species of Gasteropoda, by M. A. Giard.—On the influence of the nervous system upon the respiration of insects, with special reference to *Dytiscus marginalis*, by M. E. Faivre.—On a new electro-medical galvanoscope, by M. J. Morin.—A note by M. L. Hugo, on the scientific basis of the decimal and metric system.—A memoir by M. L. A. Raimbert, on the treatment of carbuncles by sub-cutaneous injections of antivirulent liquids.—A memoir by M. Barot, on an apparatus with continuous and graduated extension for the treatment of fractured legs.—M. Churchill then made some communications relating to cholera, and MM. Crussard and Molins some on Phylloxera.—Through M. José da Silva Mendes-Leal, the Portuguese Minister, the Academy received an original letter from Senor Manoel Godinho de Heredia, indicating the discovery of Australia by the Portuguese.—M. Boussingault then read a translation which he had made of this letter, and M. de Lesseps made some highly interesting observations on the same subject.—A note by M. Langley, director of the Alleghany Observatory, on the relative temperature in different solar regions. This is the first communication on the subject, and it treats principally of the temperature of the black nuclei of sun-spots.—A note, by M. Maurice Levy, on the theory of continued straight beams.—On the equations of the fifth degree, by M. Brioschi.—A memoir, by M. Max. Marie, on the classification of cubical integrals of terminated volumes by algebraic surfaces; geometrical definition of surfaces which are capable of algebraic cubature.—A note, by M. J. M. Gaugain, on the theory of the processes of magnetisation.—On the molecular equilibrium of solutions of chrome alum, by M. Lecoq de Boisbaudran.—On the boiling-point determinations of the chlorinated derivatives of toluene, by M. G. Hinrichs.—M. Des Cloiseaux then presented to the Academy an instrument constructed upon the indications of M. Jannettaz, for the determination of the axes of ellipses in crystals.

March 29.—M. Frémy in the chair.—The following papers were read.—On the observations of temperature, made at the Jardin des Plantes, during the meteorological year 1874, with the electrical thermometers, under naked and grass-covered soils; by MM. Becquerel and Edm. Becquerel.—Researches on sugar beet-root, by MM. E. Frémy and P. P. Dehérain.—A note by M. Des Cloiseaux, on the pyroxenic element in the rocks associated with platinum, in the Ural.—A memoir by M. Boussingault, on the comparative analysis of glutinous biscuits and some other feculent aliments. MM. Thenard, Bouilland, and Chevreul then made some remarks on this subject.—The Academy then nominated M. Joly as correspondent to its section for Zoology and Anatomy in lieu of M. P. Gervais, who was elected a member of the Academy; and a number of commissions were nominated to superintend the competitions for the different prizes of the Academy.—On the dissolution of hydrogen by metals and the decomposition of water by iron, by M. L. Troost and P. Hautefeuille: researches treating principally of iron, nickel, cobalt, and manganese.—On the chemical equilibrium among gases: iodine and hydrogen, by M. G. Lemoine.—A note by M. Fordos, on a quick way of assaying solderings containing lead.—On the influence of the roots of living plants on putrefaction, by M. Jeannel.—On the natural wells of the coarse limestone, by M. Stan. Meunier.—A note by MM. Trève and Durassier, on the relation existing between the nature of steel and its coercitive force.—A note by M. Decharme, on a new means of producing sonorous vibrations and phenomena of interference on mercury.—M. F. Garrigou then made a communication of his new researches on the mineral waters of the Pyrenees.—A memoir by M. Peaucellier, on the application of articulate systems ("à liaison complete") to the arts and the sciences of observation.—M. J. J. Cazenave then read an abridged history of the probes and uretro-vesicular sounding instruments used up to the present day.—M. de Molon, *à propos* of a recent communication of M. Menier, reminds the Academy of his observations which prove the necessity of crushing the nodules of phosphate of lime to render their use efficacious in agriculture.—A note by M. J. Tardres, on the reflexion of light.—A note by M. Maillard, on the treatment of cholera.—MM. B. Dugas, A. Mornard, Barthelémy, A. Bouteille, and Dupoux, then made some communications on Phylloxera.—The Minister for Foreign Affairs transmitted to the Academy a letter from the French Consul at the Cape of Good Hope, announcing the arrival at Table Bay of the members of the Commission sent by the Government of the United States to Kerguelen Island to observe the Transit of Venus. The observations were generally successful, as well as those of the English party of observers at the same island.—MM. Sivel, Crocé-Spinelli, G. and A. Tissandier, and Jobert, then announced the success of their balloon ascent made on March 23 and 24, under the auspices of the French Aëronautical Society. They remained twenty-two hours and forty minutes in the atmosphere, and they hope shortly to communicate to the Academy the scientific results of their observations and experiments.—M. Dumas then produced before the Academy the copy of a document existing in the archives of the city of Paris, and discovered there by M. Read, relating to Salomon de Caus, with a view to complete the information regarding this sage, who died in Paris in 1626.—A note by M. G. Fouret, on some consequences of a general theorem relating to an implex and a system of surfaces.—A note by M. Hugo Gylden, on a method to calculate the absolute perturbations of comets.—On the residues of the seventh power, by M. P. Pepin.—A note by M. Brioschi, on his paper read at the last meeting on equations of the fifth degree.—On the relative temperature in the different regions of the sun, by M. Langley. This is the second paper on this interesting subject (the first was read at the last meeting), and treats of the equatorial and polar regions.—A note by M. Laguerre, on a theorem of geometry. M. Ossian Bonnet then made some remarks on the subject.—On the error in Poncelet's formula relating to the evaluation of areas, by M. Chevilliet.—On the double interior reflection in doubly refractive uniaxial crystals, by M. Abria.—Chemical researches on the uric group, by M. E. Grimaux.—On the Amphipoda of the Gulf of Marseilles, by M. J. D. Calta.—On the saline deposits in the lavas of the last eruptions of Santorin, by M. F. Fouqué. M. Ch. Sainte Claire Deville then made some remarks on this paper. The same gentleman presented to the Academy the meteorological observations made at Barèges, at the Plantade Station, and on the summit of the Pic du Midi. M. H. Resal presented a new publication of the Society of Civil Engineers of Great Britain, and made some remarks upon it.—M. Chasles remarked on a note of M. Genocchi *à propos* of a recent communication of M. Roberts, on the expression of the arcs of Descartes' ovals in the function of three elliptical arcs.

BOOKS AND PAMPHLETS RECEIVED

BRITISH.—Report of the Thirteenth Annual Meeting of the West Riding Consolidated Naturalists' Society, 1874.—Annual Report of the Geologists' Association, 1874, together with List of Members and Catalogue of Library, Laws of the Association, &c. (University College).—On the Establishment in connection with the India Museum and Library, of an Indian Institute: J. Forbes Watson, M.A., M.D. (William H. Allen and Co.)

AMERICAN.—Remarks on the Family Nemophidæ: F. W. Putnam (Boston Society of Natural History).—Remarks on the Mammoth Cave and some of its Animals; Bulletin of the Essex Institute.

FOREIGN.—Les Fourmis de la Suisse, Neue Denkschriften: Auguste Forel (Zürcher and Furrer, Zürich).—Expériences sur la température du Corps Humain dans l'acte de l'ascension sur les montagnes: 1st, 2nd, and 3rd series: F. A. Forel (H. Georg, Genève).—Une Variété nouvelle ou peu connue de Gloire Etudiée sur le lac Léman: Dr. F. A. Forel (Rouge and Dubois, Lausanne).—Carte Hydrographique du lac Léman: F. A. Forel.—Note sur les tremblements de Terre en 1871: Alexis Perrey (l'Académie Royale de Belgique).—Uber das studium der Mineralogie auf den Deutschen Hochshulen: Von P. Groth (Strasburg; Karl J. Trübner).—Ergebnisse der Beobachtungsstationen au den Deutschen Küsten über die physikalischen Eigenschaften der Oztsee und Nordsee und di Fischerei, January 1874 (Berlin: Wiegandt, Humpel, and Parey).—Les Bois-Indigènes et Etrangers: Adolphe E. Dupont and Bouquet de la Grye (Paris, J. Rothschild).

CONTENTS