Prof. Nordenskjöld, before his departure, received from his Excellency, as a present to the *Vega* expedition, an herbarium of the plants of Hongkong and South China, prepared by Mr. Ford, the head of the Botanical Department of the Colony.

ZANZIBAR advices report that the Abbé Debaize, the French explorer, was on the 13th of June at Ujiji, on Lake Tanganyika. He was waiting for some boats to go to the north of the lake, and meanwhile was examining neighbouring rivers and some points on the lake. At the beginning of September he expected to start for the Uzige country, there to leave a depôt of merchandise under trustworthy men while he proceeded with the rest of his effects to Aruwimi or Stanley river, which joins the Congo, leaving there a second depôt, exploring with his best men the western slope of the Blue Mountains and the region between Lakes Albert and Tanganyika, and then returning to Uzige to despatch reports and explain his further plans.

THE enlarged edition of Whitaker's Almanack for 1880 contains an article on geographical discovery, written in a somewhat perfunctory manner. As instances of the want of proportion observable in it, we may mention the space given to the voyage of the *Isbjörn* to Novaya Zemlya, and Mr. McCarthy's journey across China, the former of which was admittedly unsuccessful, while the latter, which did not occur in the period under review, added nothing whatever to our geographical knowledge. Accuracy hardly appears to be the writer's *forte*, otherwise he would hardly discourse about Mr. E. Colborne Ba*k*er's journey in Western China, nor would he turn one of the Portuguese African explorers' names into Ives, not to mention his inability to make up his mind how to spell Thibet.

IN the course of their explorations last year in the unknown highlands of Eastern Perak, a party of Englishmen met with several small settlements of Sakis, presumably the aborigines of the peninsula, who still hold themselves aloof from the Malays. Few of these people have metal or earthenware cooking utensils, but roast their sago in large bamboos. The majority of them speak Malay, with an accent not unlike the Chinese; their own language is described as soft and guttural. Two specimens of these people—a man and a woman—on being measured, were found to be 4 feet 6 inches and 4 feet 1 inch in height, and these appeared to be about the average. The women are said to be not bad-looking, with thick lips and flat noses; their figures are good, though rather inclined to stoutness; and they have remarkably pretty little feet and hands. The dress of both sexes consists of a strip of bark about 9 feet long and 1 foot 6 inches wide, wound round the bodies. The bark used is that of a species of fig, and is very soft and pliable; there are two descriptions of it, obtained from different trees, one of a dirty white and the other of a reddish brown colour.

THE new number of the *Bulletin* of the Société Commerciale de Géographie of Bordeaux, contains an article on Cabul, and from its "Chronique Géographique" we learn that the French Minister of Marine has ordered the Governor of Senegal to send an expeditionary column to the country between the Upper Senegal and the Niger. The object of the column will be to explore the region in order to see by actual survey and examination whether the two rivers can be joined by a railway. The expedition will be accompanied by a skilled topographer.

MR. H. CONYBEARE, of the Bengal Civil Service, has published a carefully prepared report on the Pargana Dudhí, which extends from 25° 52′ 17″ to 24° 21′ 21″ N. lat., and from 82° 59′ 28″ to 83° 28′ 7″ E. long. The first portion deals almost entirely with geographical matters, and furnishes much interesting information respecting the various aboriginal tribes, their language, customs, and style of cultivation, &c.

THE *Hiogo News* states that the Japanese Government has decided upon at once going on with the construction of a railway between Shiwotsu, at the head of Lake Biwa, and Tsuruga, a town at the head of a large bay, which will probably before long become an open port. Some high officials connected with the Board of Works are to proceed to Tsuruga on this business without delay. It is expected that the opening of the line in question will have a most beneficial effect on the trade of the treaty port of Kobe. A large extent of rich country will be opened up to commerce, and it is probable that the whole of the produce of the silk districts to the north of Lake Biwa will be brought to Kobe for shipment to Europe.

ON THE NATURE OF THE ABSORPTION OF GASES

MORE than seventy years ago Dalton made the assertion that gases, when absorbed by liquids (*e.g.*, water), remain only mechanically included in the latter, without losing thereby any property which belongs to them as gases. This hypothesis of the nature of absorption is opposed by a still older one—the chemical—which considers the phenomenon as the consequence of an affinity between gases and liquids, and explains, for example, the absorption of CO_2 and N_2O by water by the formation of H_2CO_3 and HNO. Since the time when these two hypotheses were started, their proof has always been attempted with the aid of the statical method; *i.e.*, by the determination of the proportion in which the absorbed and absorbing bodies maintain their equilibrium under given conditions; or, in other words, by the determination of the coefficients of absorption. Mackenzie, who in this way has lately most thoroughly examined into the absorption of carbonic acid by means of a solution of salt in water, says that it would be presumptuous, on the basis of existing observations, to attempt yet to solve the problem whether absorption is a purely physical phenomenon or whether it belongs rather to the domain of the so-called chemical phenomena.

After these two hypotheses there comes yet a third, set forth by Graham, according to which gases are transformed into the liquid state in the case of their absorption by bodies such as liquids, caoutchouc, or by glowing metals. This hypothesis is supported on the one hand by the circumstance, already remarked by Mitchell, that membranes of caoutchouc are most easily penetrable for those gases which are most readily capable of being rendered liquid and are most soluble; on the other, by two assertions of Graham's—(1) That a body in the form of a liquid penetrates another body more easily than in the form of a gas; and (2) That liquids and such colloid substances as caoutchouc, have no pores at all, and, in point of fact, are, even in the thinnest film, impenetrable, to gases as such. According to Graham, then, it is impossible for a gas to penetrate such a substance without this conversion into a liquid state, which may or should be favoured in some measure by the chemical affinity between the gas and the absorbing substance.

My researches in the domain of diffusion gradually led me to the conviction that a much nearer approach will be made to a solution of the problem of absorption if conclusions are drawn, with reference to the state in which gases exist in these substances from the study of the phenomena of motion, which exhibit them in their diffusion through absorbing substances. Availing myself of the kind invitation of the editor of NATURE, I shall take the liberty of here briefly describing the results which I have in this way obtained. They refer to what takes place in the case of caoutchouc.

The application of the laws of the diffusion of gases through absorbing substances[1] to the phenomena which appear in caoutchouc shows that the quantity of gas which passes through a membrane of caoutchouc in a unit of time is, conditions being equal (*i.e.*, equal surfaces of diffusion, equal thickness of the membrane, and equal difference of saturation on both sides of the membrane) in proportion to the product $D\,S$. D is the *constant of diffusion* of a gas in caoutchouc, and corresponds to the thermometric conductivity of a body in the theory of the conduction of heat. S is the *coefficient of saturation*, and is expressed by the equation—

$$S = A_\theta \frac{p}{76},$$

in which A_θ denotes the coefficient of absorption of caoutchouc for the gas under consideration at the temperature θ, and p the pressure (in centimetres of mercury) under which the gas is. The coefficient, then, is that volume of gas reduced to 0° C. and under 76 cm. of mercury which can be contained in the unit or volume of caoutchouc at the given temperature and under the given pressure. It corresponds to the specific heat of the unit of volume of a substance in the theory of heat.

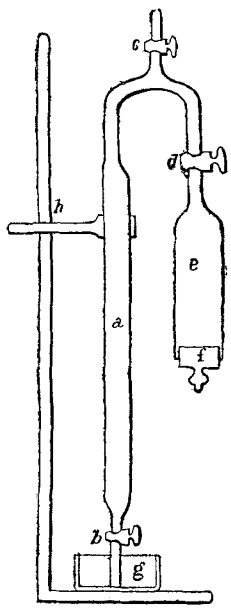
Mitchell and Graham, during their experiments with caoutchouc, have always measured the product $D\,S$ only, which can give us absolutely no explanation of the nature of the absorption of gases, and which has led Graham, as we shall see further on, to false inductions.

In order to determine the constant D, which shall form the basis of our examination, it is necessary to know the coefficient of absorption, by means of which the coefficient of saturation

[1] Wroblewski in Wiedemann's *Annalen*, ii., 481-513.

can then be ascertained. The determination of the coefficient of absorption presupposes, moreover, that the Henry-Dalton law of absorption holds good for caoutchouc as well. That this law is valid is proved by the experiments which I made several years ago on the passage of gases through membranes of caoutchouc,[1] and by means of which I have shown that, at the various differences of pressure between 74 cm. and 2 cm. mercury, the quantity of gas which passes through is proportional to the actual pressure of gas upon the membrane. This relation between the quantity of gas passing through and the pressure is only *possible* in the case of the coefficient of saturation being proportional to the pressure, or, in other words, when the Henry-Dalton law holds good for caoutchouc within the given limits.

The absorptiometer which I have constructed for the determination of the coefficients of absorption, consists of glass throughout. *a* is a tube which is divided into tenths of cubic centimetres, and from which even hundredths of cubic centimetres may be read off; *b*, *c*, and *d* are glass stopcocks; *e* is a space which serves as a receptacle for the caoutchouc, and is closed from beneath by a glass stopper which renders it air-tight when shut. The apparatus stands in a glass trough, *g*, of mercury, and is held



in a vertical position by the holder *h*. Its use is very simple. The membranes of caoutchouc upon which our experiment is to be made, and whose specific gravity has been previously ascertained, is cut into strips of about 10 centimetres in length, and 1·5 centimetres in breadth, dried, weighed, and introduced into the space *e*. The apparatus is first of all put in communication with the Jolly quicksilver air-pump by means of the stopcock *c*, and is pumped empty. Then both the stopcocks *d* and *e* are shut, the apparatus is separated from the pump, a drop of water is introduced at the bottom of the tube *i* above the stopcock *e*, and the gas to be examined enters from above into the space inclosed by the stopcocks *b*, *c*, and *d*. The further working of the apparatus explains itself. If the volume of gas which has been allowed to enter has been measured, and also the pressure under which it is, the stopcock *d* is opened, and after the lapse of from three to twelve hours, the volume of gas and the pressure is again ascertained. The calculation of the coefficients of absorption is made according to the known formula.

I will here remark that the pressure of the gas which remains in the caoutchouc after the apparatus has been pumped free therefrom can only be measured by the hundredth part of a millimetre of mercury, which at the same time is the limit of the power of action of the Jolly pump.

For the experiments, red vulcanised caoutchouc of about one-third of a millimetre in thickness was employed. Its specific gravity at 15° C. was 1·02685.

The coefficient of absorption of the four following gases was

[1] Wroblewski in *Poggendorff's Annalen*, clviii., 539-568.

ascertained: nitrous oxide (N_2O), carbonic acid (CO_2), hydrogen and atmospheric air.

It was shown that the coefficient of absorption of caoutchouc for gases, within the limits of the examination, are linear functions of the temperature, and that they diminish with an increase of temperature in the case of nitrous oxide and carbonic acid. The coefficient of absorption of hydrogen, on the other hand, grows larger with increase of temperature, and atmospheric air shows a similar tendency. The coefficient of absorption is as follows:—

	At 5° C.	At 10°.	At 15°.
For N_2O	1·8229	1·6896	1·5564
,, CO_2	1·1991	1·1203	1·0416
,, H	—	0·06121	0·08157
,, Air	—	0·09832	0·11710

With the assistance of these values the constant *D* can now be ascertained. For the description of the diffusiometer which I have constructed for that purpose and for the method of observation, I must refer the reader to my paper in Wiedemann's *Annalen*, vol. viii. pp. 29–52.

The experiments showed that the constant *D* amounted to—

	At 12° C.	At 14° C.	
For N_2O	56	62	$\times 10^{-8} \frac{cm^2}{sec}$
,, CO_2	54	61	

Nitrous oxide and carbonic acid have thus almost equal constants, a somewhat greater value being accorded to nitrous oxide (being the somewhat specifically lighter gas). The constant for these two gases increases with the temperature, and is at 10° 50 times smaller than *D* for carbonic acid in water,[1] and 300,000 times smaller than the constant of free diffusion for carbonic acid and air at the same temperature and the same pressure.

If the great difference in the coefficients of absorption of caoutchouc for both gases is taken into account, it is at once seen that the constant *D* depends neither upon the chemical nature of the gas nor upon the value of the coefficients of absorption. It can, in this case, depend only upon the physical properties of the gases, and since specific gravity is the principal property in which gases differ from each other in physical respects, the constant *D* must depend upon the specific gravity of the gases. Proof of this is afforded by the determination of the constant *D* for hydrogen gas: it comes to $353 \times 10^{-8} \frac{cm^2}{sec}$. The constants for these three gases is thus nearly in inverse ratio to the square root of the specific gravity of the gases.

If the behaviour of the nitrous oxide is held as normal, it is found that *D* is about 27 per cent. greater for hydrogen than it would be if the constant under consideration were exactly in inverse ratio to the square root of the specific gravity of the gas. The same variation here appears which Graham has observed in the diffusion of gases through plates of graphite. Hydrogen diffused itself through a plate of 0·05 centimetres in thickness—supposing the air to show its normal behaviour—about 9 per cent. quicker than is prescribed by the above relation. A similar variation was observed when hydrogen diffused itself in oxygen or carbonic acid instead of air. Granted that this deviation is in inverse ratio to the specific gravity of the gas; it would, in the case of the aforesaid graphite, amount to about 23 per cent. for hydrogen in comparison with nitrous oxide. The deviation is thus with such heterogeneous bodies as vulcanised caoutchouc and compressed graphite, not only of the same direction, but also of the same order, hence there is no ground for supposing that the gas, in its passage through a non-absorbent porous partition like a plate of graphite, should change its aggregate condition, and since the dependence of the constant *D* of a gas upon its specific gravity can only be considered a sign of the gaseous form of the aggregate condition of the diffusing body, it follows, then, that *gases cannot possibly exist in caoutchouc in a fluid form, and they retain also during their absorption by caoutchouc all the properties which belong to them as gases. Graham's hypothesis of the nature of absorption of gases must certainly, therefore, be regarded as false,* and a greater or less degree of penetrability of the layer for one or other of the gases

[1] The constant *D* for CO_2 in water is, according to my experiment, about $0·000025 \frac{cm^2}{sec}$. It depends neither upon the coefficient of absorption nor upon the coefficient of saturation. On the other hand it depends upon the viscosity of the fluid. If any body, *e.g.*, a crystalloid or a colloid, is dissolved in water, and a more viscous fluid is thereby obtained, the constant *D* decreases. This constant, however, as is shown by my experiments with glycerine in water, cannot be diminished at will by increasing progressively the viscosity of the medium in which the diffusion of the gas takes place. (See Wiedemann's *Annalen*, vol. iv. pp. 268-277, and vol. vii. pp. 11-23.)

has nothing—as Mitchell asserted—to do with its solubility or compressibility. *Just as little practicable is the chemical hypothesis upon what takes place in caoutchouc, and the absorption of gases such as nitrous oxide, carbonic acid, and hydrogen by caoutchouc must be considered as a purely physical phenomenon.* A layer of caoutchouc is, then, to be conceived as a *porous* substance, endowed with powers of condensing as well as of rarefying gases whose porosity is of the same order as the porosity of graphite. The motion of the gas takes place through the pores of the caoutchouc.

It is much to be regretted that Graham's experiments upon the passage of gases through metals were so conducted, that they cannot now be calculated with the help of the laws of the diffusion of gases in absorbent substances. I have been able to calculate only those numbers which, as they are not without interest, I will here communicate. They are the constant D for hydrogen in platinum at bright red heat, and D for carbonic oxide and hydrogen in iron at full red heat.

A platinum wire absorbed at red heat 0·17 volumes of hydrogen (taking the average of four experiments). A tube drawn out of the same mass of fused platinum, 0·11 centimetres in diameter, let 489·2 cubic centimetres of gas in the minute pass through a surface of 1 square metre; therefore

$$D = 0{\cdot}00053\ \frac{\text{cm}^2}{\text{sec}}.$$

A tube of malleable iron, 0·17 centimetres in diameter, let 0·284 cubic centimetres of carbonic oxide and 76·5 cubic centimetres of hydrogen through the square metre in the minute. Since one volume of this metal can contain four volumes of carbonic oxide, so is for this gas

$$D = 0{\cdot}00000002\ \frac{\text{cm}^2}{\text{sec}}.$$

Since the coefficient of absorption of this metal for hydrogen was less than four, so is the constant D for this gas greater than $0{\cdot}00000054\ \frac{\text{cm}^2}{\text{sec}}$, whence it follows, if there can be any comparison between these two numbers, that in metals greater constants D belong to specifically lighter gases.

It has lately been asserted by Stefan that the constant D, in both water and alcohol, is greater for oxygen and nitrogen than for carbonic acid, and that the greatest constant pertains to hydrogen. It would be, however, premature to wish to draw from his experiments any conclusions with regard to the nature of absorption of gases in fluids.

Franz Exner has already shown, several years ago, that, on the passage of gases through a lamina consisting of a solution of soap in water, the interchanged volumes of two gases are directly proportional to their coefficients of absorption and in inverse ratio to the square root of their specific gravities. Hence Stefan has concluded that the constant D in fluids is in inverse ratio to the square root of the specific gravity of the gas, and that the gas molecules move by themselves and not in connection with the molecules of the fluid, which would correspond with Dalton's views on the nature of absorption in fluids. Meanwhile, these conclusions are contradicted by the experiments of Pranghe, who has shown that the above-mentioned relation in the case of the lamina is not at all borne out when pure unboiled linseed oil is used. We see from this, then, that what takes place in the case of fluids must be much more complicated, and that we must subject the matter to a much more searching and extended inquiry before we shall be in a position to say anything definite upon the nature of the absorption of gases in liquids.

S. WROBLEWSKI

NOTE ON PREHISTORIC STATIONS IN CARNIOLA[1]

THE most important of these prehistoric stations is the burial-field of Klenik, near Waatsch. During the year 1878 about 250 graves, covered with stone slabs, were opened at a depth of from ½ metre to 2½ metres. They contained skeletons, some remains of burnt corpses, and a great number of various objects. The bronze and other articles are very similar to those found in the well-known cemetery near Hallstadt, in Upper Austria. No Roman remains were met with. Thus there is no doubt of the pre-Roman age of these stations and cemeteries near Waatsch. They may be ascribed with great probability to the Taurisci, a Celtic tribe, known to have worked the salt at Hallstadt, and to have extended from Upper Austria, through Styria and Carinthia, as far as the Julian Alps. Strabo asserts explicitly that the very ancient landing-place Nauportus (now Ober-Laibach) was a settlement of this people, and, according to him, Italian merchandise was brought by carriage from Aquileja over Mount Okra (now Birnbaumer Wald), then by the River Savus to Siscia (now Sissek) and the Danubian districts. Thus it must be admitted that before the reign of Augustus a much-used water-communication existed on the Save and the Laibach between Siscia and Nauportus. The tradition ascribing the foundation of Emona to the Argonauts is an indication of the very remote beginning of this intercourse. Prof. Müllner, of Marburg, has lately offered some forcible arguments to the effect that Emona did not occupy the present position of Laibach, but was at the south end of the Laibach Moor, where Brundorf and Sonnegg now stand.

The graves, with skeletons, at Rojé, near Morants, contain objects referable to the Merovingian Period (fourth to seventh centuries); and a skull from one of them is of the type of those found in the successional sepultures.

[1] From the First Report of the Prehistorical Committee of the Vienna Academy, with 22 plates. By F. von Hochstetter and Ch. Deschmann. (*Proceedings*, Imper. Acad, July 3, 1879.)

GEOLOGY OF GREECE

1. *The Thessalian Olympus.*—In treating of the geology of Greece, as determined by a recent survey, Herr M. Neumayr, in the *Proceed.* Imper. Acad. Sciences, Vienna, July 17, 1879, describes this mountain-group as having a north and south direction, and consisting of a somewhat flattened dome of strata, with a subordinate syncline on the west. The limits on both sides are defined by lines of fracture. The constituent rocks are schists, of many kinds, with enormous intercalated limestones, at some places 3,000 metres thick. These latter are partly saccharoidal, partly semicrystalline, and sometimes nearly compact. In the last variety there are, in some localities numerous indeterminable organic remains.

2. M. Neumayr and L. Burgerstein state that the broad peninsular mass in South Roumelia, below Salonica, known as Chalkidiké (Chalcidica), is for the most part composed of micaceous and other schists, excepting its south-west portion and the Athos promontory. At some places considerable beds of marble are intercalated. The middle promontory of the three terminating the great peninsula is called Longos, and consists of gneiss, the oldest rock of the region.

3. The Island of Cos, according to Neumayr, consists for the most part of schists, marble, and Hippurite-limestone (with Rudistæ). The remainder is occupied by upper tertiary and diluvial deposits. Of the tertiaries the lower pliocene paludina beds strikingly resemble, in their fauna, the analogous Sclavonian deposits, and over them lie marine pliocene beds and rhyolitic tuffs; and eruptive rocks, trachytic in character, are also present. Being the extreme eastern member of the Cyclado-Sporadic series, traversing the Egean, and being connected with the neighbouring volcanic islands, Cos is well adapted to afford an insight into the nature of this submarine mountain-chain, and it yields an indication of the South-Egean basin being a depressed area of diluvial origin. The freshwater pliocene fauna offers interesting materials for the discussion of the upper tertiary freshwater deposits of the Egean region at present known, and of the evolution of the Eastern Mediterranean area. A number of passages have been collected by Prof. Hörnes from the Greek Classics, mentioning "giants' bones," which may point to places where remains of fossil mammals have been found.

NOTES FROM NEW ZEALAND

Wild Pigs and Wekas (*Ocydromus*).—Early in the spring of 1876 I spent several days in fern-collecting and botanising in the Malvern Hills district of Canterbury. Whilst so engaged, in many places I came across fresh pig-tracks and rootings, now and then sighting a boar. On one open hillside, bordered with fagus woods, I found three nests of that curious rail, the weka (*Ocydromus*); each of the nests contained eggs. It seemed remarkable that the nests should have remained unravaged by the wild pigs that were constantly roaming about the neighbourhood. It is highly improbable that the keen-scented swine were not aware of the weka's haunts. The trail of this bird is strong, readily followed by dogs; indeed, dogs take to this pursuit with so much of pleasure and relish that many good sheep-dogs