GEOGRAPHICAL NOTES

THE new volume (xi.) of the *Geographisches Jahrbuch*, edited by Prof. Hermann Wagner, begins a new series, and assumes a new form. It has been elongated from the small square form with which we have been familiar, into a respectable octavo, containing about 500 pages. Moreover the present volume is entirely devoted to what in former years was only a section : an account of progress in the various departments into which scientific geography is divided. The next volume will no doubt contain memoirs on various subjects of geographical interest. The subject of physical geography (or rather geophysics) is treated by Dr. Hergesell and Dr. Rudolph. Prof. Toula deals with the investigations of the last four years in the geognostic structure of the earth's surface in all parts of the world. The progress of oceanography is of course dealt with by the great authority on the subject, Dr. O. Krümmel, while Dr. Hann does a similar service for geographical meteorology, or climate. Botanical geography is treated by Dr. Oscar Drude, and zoological geography by Dr. L. K. Schmarda. Dr. G. Gerland gives the results of research in ethnology during 1884–86 in the various quarters of the globe. Under Dr. Wagner's sole editorship the *Jahrbuch* is becoming more valuable than ever as a book of reference in scientific geography.

THE Rev. George Grenfell, the explorer of the Mobangi and other important tributaries of the Congo, has arrived in London. Unfortunately his health is by no means satisfactory, and it will be necessary for him to rest for some time, therefore his appearance at the Royal Geographical Society must be delayed. He has brought home with him his original maps, which are admirable specimens of such work. They are on a scale of about 5 inches to a mile, and are evidently plotted with the greatest care; his work is therefore likely to take a high place. Dr. Lenz, who has arrived in Vienna, it is hoped will be in London at the end of this month, and as Dr. Junker may be here about the same time, it is just possible that both these eminent explorers may appear together at the first meeting of the Geographical Society in May.

UNDER Colonel Woodthorpe, the work of surveying our new Burmese territory is proceeding apace. Up to the end of January the out-turn of work amounted to 800 square miles on the ¼-inch, and 260 miles on the ⅛-inch scale.

THE narrative of Baron Nordenskjöld's memorable journey into the interior of Greenland in 1883, is now appearing in instalments in the German journal *Globus*, profusely illustrated.

Two Expeditions are being sent out by the Russian Geographical Society this year: one, under J. P. Kusnetzow, to investigate the flora of the Northern Urals; and another, under Prince Massalsky, to continue his Transcaucasian researches, which include both botany and ethnography.

VALENCY AND RESIDUAL AFFINITY[1]

II.

METALLIC CONDUCTION.—I do not propose in any way to discuss metallic conduction, but merely to call attention to some of the analogies between it and electrolytic conduction.

It is conceivable, and it would appear probable from the fairly regular manner in which the electrical resistance of most pure metals decreases as the temperature falls, the coefficients of change being practically very nearly the same in all cases, that the increase in resistance as temperature rises is mainly due to the increase in molecular inter-distances. As a rule, resistance increases on the passage of a metal from the solid to the liquid state, but there are noteworthy exceptions from which it would appear probable that even in pure metals conductivity to some extent depends on molecular composition: thus the conductivity of bismuth increases at the moment of fusion from 0·43 to 0·73 of that of mercury at 31°, and that of antimony from 0·59 to 0·84 (L. de la Rive, *Comt. rend.*, 1863, lvii., p. 691); it is well known that bismuth contracts considerably on fusion, and this is probably also the case with antimony. Again, according to Bouty and Cailletet (*ibid.*, 1885, c., p. 1188), the resistance of mercury decreases at the point of solidification in the ratio 4·08 : 1; this is a remarkable increase in conductivity, and it is difficult to believe that it is wholly due to mere contraction of volume.

That the behaviour of alloys is worthy of far more attention than it has hitherto received appears most clearly from the few data at disposal. I would specially call attention to the curve given by Prof. Lodge as representing the specific conductivities of the copper-tin alloys (Phys. Soc. Proc., 1879–80, iii., p. 158). The general resemblance of this curve to that given by F. Kohlrausch for mixtures of sulphuric acid and water appears to me to be in the highest degree suggestive.

Valency—Chemical Change.—Notwithstanding the fierce controversy which has been waged between the advocates of the doctrine of fixed valency, our views on the subject are still in an unfortunate degree unsatisfactory and indefinite. Even those—and they probably form a large majority—who regard valency as a variable, dependent both upon the nature of the associated radicles and the conditions—especially as to temperature—under which these are placed, often hesitate to attribute a valency sufficiently high to account for every case of combination; in fact, both parties agree in distinguishing "atomic" from "molecular" compounds, and differ only as to where the line shall be drawn.

It is difficult to over-estimate the importance of the theory of valency: its application has led to an enormous extension of our knowledge of carbon compounds especially, and it has furnished us with a simple and consistent system of classifying the mighty host of these bodies; but, on the other hand, it may be questioned whether it has not led us away from the search into the nature of chemical change, and even if the introduction of the terms saturated and unsaturated has not had a directly pernicious effect. The almost universal disregard of molecular composition as an important factor in chemical change in the case of solids and liquids, and the popular tendency to overlook the fact that our formulæ of such bodies are purely empirical expressions, has undoubtedly exercised a prejudicial influence.

No known compounds *are saturated*: if any were, such would be incapable, I imagine, of directly taking part in any interaction, and in their case decomposition would necessarily be a precedent change. The paraffins are apparently, of all bodies, the most inert and the most nearly saturated,[1] and next to them comes hydrogen—the unsaturated character of which is displayed in interactions such as occur at atmospheric temperatures between it and platinum and palladium, and when it displaces silver from silver nitrate or certain of the platinum metals from their salts. One of the most striking instances, perhaps, of popular error in this respect is water, which is always regarded as a saturated compound, although its entire behaviour, and especially its physical properties, characterise the molecule H_2O, I think, as that of an eminently unsaturated compound: I fail to see how, otherwise, we are to explain the high surface-tension and high specific heat of liquid water, its high heat of vaporisation, and its imperfectly gaseous behaviour up to temperatures considerably above its boiling-point, let alone its great solvent power and its tendency to form hydrates with a multitude of compounds—*especially oxygenated* compounds, be it added.

The theory was brought most prominently under the notice of chemists by Helmholtz in the last Faraday Lecture, that electricity, like matter, is, as it were, atomic, and that each unit of affinity or valency in our compounds is associated with an equivalent of electricity—positive or negative; that the atoms cling to their electric charges, and that these charges cling to each other. Thus barely stated, this theory does not appear to take into account the fact that the *fundamental* molecules, even of so-called atomic compounds, *are never saturated*, but more or less readily unite with other molecules to form molecular compounds—molecular aggregates; and unless the application of the theory to explain the existence of such compounds can be made clear, chemists must, I think, decline to accept it. The impression which the facts make upon the mind of the chemist certainly is (1) that no two different atoms have equivalent affinities; and (2) that affinity is a variable depending on the nature of the associated elements: but, owing to the recognised complexity of nearly all cases of chemical change, it is difficult to draw any very definite conclusion on this point.

If, however, the nature and properties of so-called molecular compounds generally be considered, and if an attempt be made to form any conception of their constitution, one striking fact is

[1] Revision and extension of a paper by Prof. H. E. Armstrong, F.R.S., communicated to the Royal Society last year. Continued from p. 572.

[1] It is probably more correct to place nitrogen first in the list, as being the most inert substance known.