place during the last eighty years. On the whole this constancy in the form d'Arrest considers the principal result of all our studies of this object. The changes, which have been remarked, seem all reduced to mere variations in intensity, but such small alterations may greatly change the impression we get on looking at certain parts of the nebula.

The nebula has of late been well watched at the United States Naval Observatory. Prof. Holden has been hitherto engaged in making micrometric measurements of prominent parts of the nebula and noting the order of brightness of the various masses. He will even attempt a little photometry with the 26-in. refractor. The stars suspected to be variable by O. Struve, are nightly observed. From a provisory discussion of the observations, Holden alludes to changes of short period, and a preliminary sketch of the central part shows that his discoveries in nebular astronomy are likely to rank with those of Newcomb and Hall in other parts of the science. W. D.

AMERICAN GEOLOGICAL SURVEYS

NORTH-WESTERN WYOMING AND YELLOWSTONE NATIONAL PARK [1]

IN a former number of NATURE (vol. xii. p. 265) some account was given of the various independent surveys in progress among the western territories of the United States. Allusion was then made to the unfortunate want of concert among them which had led to a reduplication of the work, and consequently to a struggle at Washington between the different surveying staffs, one fighting for a continuance of power, another for very existence. By the decision adopted by Congress the Engineer Department retained control only of those surveys which might be required for military purposes, while the geographical, geological, and other surveys, carried on for the purpose of exploring new ground and making its features and productions known were to be taken charge of by the Department of the Interior. Such a limitation ought to be sufficient to prevent any future risk of the same tract of country being surveyed twice by different and independent officers. That it was needed became abundantly evident during the time of the contest which was finally settled by Congress. And the present volume furnishes fresh proof of its necessity.

Early in the year 1873 the Engineer Department organised a surveying party to make a military reconnaissance of the north-west of Wyoming territory lying between the Union Pacific Railroad and the line of the Northern Pacific Railroad in Montana. As this department had all along been in the habit of employing civilian geologists, naturalists, botanists, and other scientific observers, Captain Jones, who took command of the expedition, collected a party of nineteen persons, exclusive of a military escort under four officers. This military character which the engineers have given to their reconnaissances, though, perhaps, hardly avoidable, seems with good reason to have been regarded as irritating to the Indians. During the investigation into the question of reduplication of surveys, it was stated by the geologists of the Department of the Interior that they did not wish any escort of soldiers as they were never molested by the Indians, who would have been suspicious of their movements had soldiers accompanied them. Captain Jones, indeed, refers to a large war-party of Sioux Indians which came into Big Horn Valley shortly after he and his expedition had passed out of it, and he seems to think that he made a lucky escape. But the appearance of so large a body of armed men as he commanded within the lands reserved by treaty to the Indians could hardly fail to awaken their distrust and set them in motion.

[1] Report upon the Reconnaissance of North-Western Wyoming, including Yellowstone National Park, made in the summer of 1873, by W. A. Jones, Capt. U.S. Engineers, with Geological Report by Prof. T. B. Comstock. (Washington: Government Printing Office.)

The country passed over in the route lay across the formidable range of rugged snow-capped mountains which rise round the head-waters of the Yellowstone. By some travellers this lofty barrier had been pronounced to be inaccessible, one picturesque observer declaring that "a bird cannot fly over that without taking a supply of grub along." Once across the watershed the expedition descended upon the basin of the Yellowstone, which had already become famous for its wonderful hot springs, and had been pretty fully described and carefully mapped. Indeed when one remembers how much had already been done in the scientific exploration of North-western Wyoming, one is tempted to ask whether the elaborate preparations made by Capt. Jones were really needed. Nearly a half of the geological part of the Report is occupied with a description and discussion of the geyser phenomena of the National Park—a very interesting and important subject, but one which had already been largely treated of, and which does not appear to be quite in its proper place in the midst of a military reconnaissance. Dr. Hayden, who had done so much to make known the structure and the wonders of that region, is cited in the report, but not in such a way as to suggest any adequate notion of the relative importance of his labours and those of Capt. Jones's expedition. The most important geographical point established by the latter traveller was the existence of an easily traversible pass through the mountains between the head of Wind River and the sources of the Yellowstone. He named it Togwotee Pass, and found that though it reaches an elevation of 9,621 feet above the sea, the slopes leading to it are so gentle that a railway might be led through it at a reasonable cost.

Prof. Comstock, who was attached as geologist to the expedition, contributes a series of geological chapters to the Report. They are well written, and show him to be not only a good observer, but one who endeavours to group what he sees round some leading principles in science. In particular he adopts a systematic method of treatment in preference to the order of observation usually followed in such reports. This plan saves his readers at a distance much time and trouble, besides enabling them to grasp the main outlines of his work far more clearly than would be otherwise possible. He begins by giving a general outline of the physical geography of the region, connecting the area examined by the party with the rest of the Rocky Mountain tracts as far as explored by other observers. Availing himself of the previous labours of Hayden, Clarence King, Whitney, and others, he arranges his narrative of the geological history of the region in stratigraphical order, beginning with the most ancient metamorphic or archæan rocks, and leading his readers through the Silurian, Carboniferous, Triassic, Jurassic, Cretaceous, Tertiary, and Post-tertiary systems. In seven interesting chapters Prof. Comstock discusses the questions in dynamical geology suggested by the work of the expedition. In pointing out the evidences for glacial action in North-western Wyoming, he admits that even the hardest rocks fail to show traces of glacier-striation; that in all his journey he had only seen two or three faint scratches approaching the nature of a glacial mark, but which might have been made quite recently. He found, however, on the Wind River plateau long and high ridges composed of huge granite boulders and immense blocks of Silurian and other rocks, with intervening lakes or ponds, and he no doubt correctly regards these features as glacier-moraines. He finds evidence of enormous erosion in recent geological times, and points out the causes now at work in producing rapid disintegration and removal of rock. Among these he mentions the great altitude of the region allowing of the accumulation of large masses of snow, and of the alternate freezing and thawing of the snow by night and day; the steepness of the slopes favouring rapid erosion, and the character of the rocks powerfully influencing alike the amount of

waste and the nature of the resultant forms of surface. The wind plays a not unimportant part in modifying the scenery partly by transporting vast clouds of sand away from the mountains and forming sand-hills in the plains, partly by felling large quantities of timber which obstruct the flow of surface-water, dam up streams, and render the country for wide distances all but impenetrable. The action of vegetation in preserving the surface of loose soil from disintegration, and in giving rise to mould, turf, and other accumulations is illustrated by examples met with on the journey. The author enters with considerable minuteness into the dynamics of the Yellowstone geyser region. He carefully describes eighteen groups of thermal springs, and distinguishes these somewhat arbitrarily, as he admits, from the geysers or eruptive springs, of which he enumerates twenty-five. In two concluding chapters he gives some account of the archæology of the region and of the manners and customs of the Eastern Shoshone Indians, from jottings made by him in intervals of leisure during the march. The Report is illustrated by forty-nine small sketch-maps of each day's march, two large general maps of the region traversed (one coloured geologically), and numerous sketches and sections. As a record of three months of daily toil in a wild little-known region the volume is creditable to its authors, and as a source of information regarding one of the most interesting regions of North America it will be useful to geological and general readers.

ARCH. GEIKIE

NOTES

THE programme of the fifty-first meeting of the German Naturalists and Physicians (the German equivalent of the British Association) will be held this year at Cassel, from September 18 to 24. This, probably the most thoroughly scientific and efficient of all the Associations, consists of twenty-five sections, ranging from Mathematics and Astronomy to Veterinary Surgery. This year a number of addresses on leading topics by eminent men of science are promised. Among these are the following:—"On the Relation of Darwinism to Social Democracy," by Prof. Oscar Schmidt, of Strassburg; "On Symbiosis, Parasitism, and Allied Phenomena of Life," by Prof. De Bary, of Strassburg; "On the Education of the Physician," by Prof. Fick, of Würzburg; "On the Physician in his Relation to Research and Natural Science," by Prof. Hüter, of Greifswald; "On Harvey's Life and Work," by Dr. Baas, of Worms; "On the Colour-sense and Colour-blindness," by Dr. J. Stilling, of Cassel. Many other attractions are promised, including excursions, social gatherings, and the inevitable winding-up "Abschieds-Commers." The various German railways will afford great privileges to those attending the meeting.

WE have received a circular issued by the local committee of the American Association, which meets at St. Louis on August 21, giving detailed directions as to how to reach the place of meeting from different points. From this circular we learn that the railway companies, proprietors of Pullman and other luxurious cars, various express companies, and the local hotel-keepers, afford unusual facilities to members at greatly reduced rates. The concluding excursion of the meeting is to be to the Rocky Mountain region of Colorado, the details of which have not yet, however, been arranged.

THE thirty-fifth annual congress of the British Archæological Association will be held at Wisbeach, from August 19 to 27, under the presidency of Lord Hardwicke.

WE are sure that all our readers will be pleased to hear that a Civil List Pension of 200*l.* per annum has been granted to Dr. Prescott Joule.

THE Royal Society of Sciences at Upsala have shown their appreciation of Mr. Alex. Buchan's work as a meteorologist by electing him a foreign member of their body.

MR. P. S. ABRAHAM, M.A., B.Sc., of St. Bartholomew's Hospital, who recently catalogued the Nudibranchiate Mollusca at the British Museum, has been engaged to arrange scientifically, and to write a descriptive catalogue of the natural history collections at the Winchester Town Museum.

LAST week we spoke of the generosity of the United States Government in the distribution of the publication of their admirable surveys. We regret to see, from a speech in the House of Representatives by the Hon. O. R. Singleton, that the usefulness of Dr. Hayden's surveys threatens to be seriously crippled from want of funds. The appropriation for this survey in 1867 was only 5,000 dollars, which in 1873 had been raised to 95,000 dollars. In 1876, however, this was reduced by 30,000 dollars, and again, in 1877, by 20,000, leaving the appropriation at only 45,000 dollars. The largest sum is what is actually needed that the survey may be carried on with efficiency, and to reduce it is quite unworthy of a nation so advanced and liberal as the United States, and is really the worst possible economy. The additions which have been made to science by Dr. Hayden's survey have been immense and of the highest importance, and its economic value to the country can be no less great. The mere list of the many admirable publications of the survey is sufficient to prove that the money has been well spent; and we trust the United States Government and Congress will be able to rise above all party feeling, and prove to the world that they have the best interests of the country and the interests of scientific knowledge at heart by restoring the appropriation to at least its old amount. Mr. Singleton truly says not a small item in favour of these surveys is the check they place on mining and land swindles.

WE have received the first number of the *American Journal of Mathematics*, to which we have already referred on more than one occasion. It is a large quarto of 104 pages, the chief editor being Prof. Sylvester. Its contents will bear comparison with those of any similar publication on this side of the water. We can only give a list of the papers in this number: "Note on a Class of Transformations which Surfaces may undergo in Space of more than Three Dimensions," by Prof. Simon Newcomb; "Researches in the Lunar Theory," by G. W. Hill; "The Theorem of Three Moments," by Dr. H. T. Eddy; "Solution of the Irreducible Case," by Guido Weichold, of Zittau, Saxony; "Desiderata and Suggestions," by Prof. Cayley—"No. 1. The Theory of Groups;" "Note on the Theory of Electric Absorption," by H. A. Rowland; a review, by Mr. C. S. Peirce, of Lieut.-Col. Ferrero's "Espozione del Metodo dei Minimi Quadrati;" "On an Application of the New Atomic Theory to the Graphical Representation of the Invariants and Covariants of Binary Quantics," by Prof. Sylvester. The first announcement of Prof. Sylvester's remarkable application of the chemical theory was made in NATURE (vol. xvii. p. 284). The London publishers of the journal are Trübner and Co.

ON the 21st will be opened the new magnetic observatory at Pavlovsk in connection with the Central Physical Observatory of St. Petersburg. The new observatory covers about eight hectares of surface, and the situation is in all respects favourable. The establishment comprises three principal scientific buildings, the main building of stone and surmounted by a tower for meteorological observations; a double-arched structure in stone covered with earth for observations in magnetic variation; and a wooden pavilion, without a particle of iron, for absolute magnetic measurements and for determinations of time. Besides these three buildings devoted to the purely scientific work of the