

The shock was felt at Agram also, and at several other Croatian towns. On May 23, at 8.21 p.m., an earthquake was observed at Metkovich (Dalmatia). It lasted eight seconds, its motion was wave-like, and in a south-westerly direction; at 9.45 p.m. a second one followed. At Janina no less than seven different shocks were noticed on the same day; they varied considerably in strength, the first one occurred at 10.15 a.m., the last one at 10.57 p.m. All were accompanied by subterranean noise. At Stagno two violent shocks occurred at 8.23 and 9.3 p.m., and at Slano a moderate one at 8.35 p.m. On May 22 at 6.15 p.m. an oscillation of the ground was observed at Zwickau (Saxony); the direction was from north-east to south-west. On May 21 a moderate shock was noted about 11 p.m. at Copenhagen and in the vicinity. It lasted six seconds.

MR. W. SOWERBY, writing from the Botanical Gardens to the *Times*, states that the fresh-water jelly-fish described in NATURE a year ago by Professors Allman and Ray Lankester, has reappeared in the Victoria Regia tank in the Gardens. It is a curious fact that the date of its first discovery (June 9, 1880) should be so near the day of its reappearance—viz. June 12; as during the winter the tank is cleaned out and remains for some months empty.

THE numbers of the present year's issue of our northern namesake, *Naturen*, under the recent editorship of the eminent Norwegian geologist, Hans F. Reusch, continue to provide well written popular expositions of scientific questions. Dr. Leonhard Stejneger returning to a subject which he had treated of in early numbers, considers the causes which influence the migration of birds, which he is disposed to seek principally in the necessity originally imposed on earlier generations to seek food by change of locality, when the cold in one region, and the heat in another, destroyed the smaller animals, or the plants, from which these birds sought their nourishment, while the sense once developed became in process of time an hereditary instinct. The editor describes the working of the telephone system in Christiania, where, since June, 1880, a central station, in which the work is done by women, has been established in connection with Dr. Bell's Company in New York, and under the direction of Herr Hugo Ullitz. The apparatus used is the so-called Blake's microphone. Herr Geelmuyden draws attention to the expediency of adopting one mean time, viz., that of Christiania, for all Norway. The difficulty of establishing one normal time for the whole country is especially great in Norway, where, for instance, some districts—as Vardö and Vadsö—lie further east than Constantinople, while the west coast has nearly the same W. long. as Marseilles. As one of the curious results that would follow the adoption of the time of Christiania as the normal standard he mentions that the midnight sun at the North Cape would have to be looked for at 11 P.M. A colossal pine which was lately uprooted by an inundation at Pÿhajoki in Oulais, Finland, was found to have 1029 annual rings. The Norwegian Arctic Expedition has yielded a new fish bearing affinity with the Ophidiidæ, but presenting sufficient differences to justify its recognition as a hitherto unknown northern form, for which Dr. R. Collett has suggested the name *Rhodichthys regina*. The entire yield of fish in the trawl-nets at great depths (from 1300 to 1400 fathoms) was 234 individuals, belonging to thirty-two different genera, of which seven had been previously unknown to science.

THE deaths are announced of Dr. Jakob Bernays, Principal Librarian at the Bonn University, and of Dr. Richard Ladislaus Heschl, Professor of Pathological Anatomy at the University of Vienna (the successor of Rokitanski). Both were fifty-seven years of age, and both died on May 26.

THE Highbury Microscopical and Scientific Society gave a *conversazione* at Harecourt Hall, Canonbury, on Thursday, the 9th inst., which was numerously attended.

THERE is a regular mania in Paris at present for publishing periodicals connected with electricity. A new electrical weekly paper called the *Telephone* has issued its first number; it is the fifth in existence. We are told moreover that the first number of another, the *Electrophone*, will be issued in a very few days.

MR. HENRY WALKER has issued a useful little "Guide to the Popular Natural History Societies of London." In London and suburbs there are twenty such associations.

THE *conversazione* to commemorate the fiftieth anniversary of the Harveian Society of London will be held on Wednesday, June 29, at the South Kensington Museum.

EXPERIMENTS have been made during the past few days in lighting the House of Commons by means of the electric light.

SEVEN solar lamps were lighted by electricity about a week ago in Paris by a Siemens machine, situated in the *mairie* of rue Drouat. These lamps, which are perfectly regular, and placed in the most crowded part of the Paris Boulevards, near Passage Jauffroy, have created a sensation.

THE concerts of the Palais Royal will be resumed in a few days. The gardens will be lighted by no less than eighteen Jablockhoff lamps. It is intended to place a miniature electric boat on the basin manned by a little girl.

THE annual Congress in connection with the French Society of Archæology will be opened on June 28 at Vannes (Morbihan). A long and interesting programme has been prepared for the meeting.

THE additions to the Zoological Society's Gardens during the past week include a Chacma Baboon (*Cynocephalus porcaricus*) from South Africa, presented by Miss Agnes Robertson; a Rhesus Monkey (*Macacus erythreus*) from India, presented by Mr. Hamilton Kerr; a Malbrouck Monkey (*Cercopithecus cynosurus*) from West Africa, presented by Mr. H. Aylesbury, steam yacht *Albion*; a Common Ocelot (*Felis pardalis*) from America, presented by Mr. P. Leckie; two Common Peafowls (*Pavo cristatus*) from India, presented by Mr. George Stevenson; a Lesser Sulphur-cres'ed Cockatoo (*Cacatua sulphurea*) from the Moluccas, presented by Miss Rose Hubbard; three Waxwings (*Ampelis garrulus*), European, purchased; a Cape Buffalo (*Bubalus caffer*), a Japanese Deer (*Cervus sika*), born in the Gardens; nine Summer Ducks (*Aix sponsa*), a Jameson's Gull (*Larus jamesoni*), bred in the Gardens.

GEOGRAPHICAL NOTES

AT its last meeting the Russian Geographical Society announced the nomination of M. Yurgens as Director of the Polar Meteorological Station on the Lena, and of M. Eichner and Dr. Bunge as his assistants. The Society also voted sums of money for sending M. Kouznetsoff for the anthropological exploration of Tartarian tribes and for M. Malakhoff, who goes to the provinces of Vyatra and Oufa for the exploration of caverns and of remains of former settlements.

WE find in the *Ivestia* of the Russian Geographical Society the following information as to the geodetical work which was done by the Russian officers on the Balkan peninsula during the last war. The whole of Bulgaria and Eastern Roumelia was covered with a net of trigonometrical triangles, as well as the portion of Turkey between Adrianople, Dede-agatch, and Rodosto, and from Yambol, through Adrianople, to Constantinople and Bourgas. The net goes also into Servia and along the Danube, the total number of geodetically-determined spots being 1289; for all these spots there were also made determinations of heights. The highest determined summits on the Balkan mountains are Youmrouchkal (7791 feet), and Vajan (6217 feet); and in the Rhodope Mountains: Karlyk (9846 feet), Karlyk-moolah and Sutka (both 7189 feet high). The longitudes of eleven principal towns (Rouschouk, Sistova, Tirnova, &c.) were determined with great accuracy, and those of fifty-seven others either by telegraph or by chronometers, and

they were chosen in such a manner as to determine the influence of the Balkan chain on the deviation of the pendulum. As to the topographical work, no less than 133,750 square verstes were mapped during the war, of which 110,500 square verstes were mapped on the scale of $\frac{1}{220,000}$, and the heights of more than 110,000 spots were determined, so that there are all necessary data for making an embossment-map of the whole of the mapped parts of Roumelia and Bulgaria.

DR. RÆ sends us the following extract from a letter to him from Capt. Howgate, dated May 23, 1881:—"Our Arctic work here is progressing finely, so far as our fitting is concerned. The *Jeannette* search vessel is to get off early in June, if she fills up her complement of men. For our Lady Franklin Bay work the steam sealer *Proteus* of St. John's, Newfoundland, has been secured. She is a vessel of 688 tons burden, and contracts to deliver, with the colony and supplies, one hundred tons of coals at Lady Franklin Bay, which will guard against failure in the item of fuel, should the coal-seam not turn out so well as expected. The complement of men has been made up, and the shipment of stores to St. John's actually commenced, so there is every reason to expect that the expedition will sail from that port on July 4, as originally intended. The Point Barrow party is nearly filled up, and will be finished this week, I believe."

A SHORT time back it was stated that Mr. James Stevenson of Glasgow had offered to contribute 4000*l.* on certain conditions for the construction of a road between Lakes Nyassa and Tanganyika. The Foreign Missions Committee of the Free Church of Scotland have resolved to do their part by establishing a station among the Chungus at Maliwanda, a place about fifty miles on the proposed line of road from Lake Nyassa. The London Missionary Society have agreed to open a station at Zombé, twenty miles to the south-east of Lake Tanganyika. In order to found the Livingstonia Mission's new stations and superintend the construction of the road, Mr. James Stewart, C.E., left England on May 13 with three artisans, and another is to follow. In the autumn also it is probable that another medical missionary will go out to Lake Nyassa.

By the aid of a correspondent at the Gaboon who wrote on March 30 a contemporary has received the startling intelligence that M. de Brazza "got to Stanley's Pool from the Ogowé and came down the Congo." Some people however may be aware that this information was made public at the meeting of the French Geographical Society on January 21, when M. Duveyrier tried to make quite clear what is evidently not yet known at the Gaboon, viz. that after he had founded the Ogowé and Stanley Pool stations and descended the Congo, the mission confided to M. de Brazza by the French branch of the International African Association ceased, and the two stations, it is well known, are to be taken charge of by M. Mizon and another Frenchman. M. de Brazza is now engaged on an expedition for which the French Chambers have made a liberal grant, and in which he will be accompanied by his former colleague, Dr. Ballay. These two are to descend the Alima to the Congo in a steam launch, and then to make a thorough examination of the valley of the great river, part of their object being to divert trade to some extent to the Ogowé. The writer of the letter from the Gaboon believes that "Stanley will find de Brazza established there [Stanley Pool] when he gets up." This of course is a matter of chance, as M. de Brazza has now a sort of roving commission on the Congo, but, no doubt, Mr. Stanley will find some one at the Ntamo station (now called Brazzaville), as Messrs. Crudgington and Bentley in February found a French sergeant and two soldiers there, and by this time possibly M. Mizon or some one else will have arrived to take charge.

In consequence of the success of the preliminary journey which Mr. Crudgington and his companion have just made along the north bank of the Congo to Stanley Pool, the Baptist Missionary Expedition will now definitely adopt this route into the interior. As the result of a long conversation with Mr. Stanley on the subject, the party consider that it will be best to take advantage of his road as far as Isangila, and then to place a steel boat on the river above the falls there. Afterwards there will be no insuperable difficulty in the navigation of the river, except perhaps in two or three places where the boat will be taken to pieces and carried past the cataracts. A boat is now being built for the expedition in London from the plans and drawings of Mr. Stanley, who has willingly afforded the party the benefit of his advice and assistance. The adoption of this plan will obviate the necessity for passing through the country

of the troublesome Basundi, and will materially hasten the progress of the expedition.

HERR ERNST VON HESSE WARTEGG, the well-known traveller, has just returned to Europe from Africa, where he went up the Nile, and then crossed the desert between that river and the Red Sea, making important excavations and discoveries of ancient Egyptian remains, among which were a very interesting sarcophagus, pottery, statuary, &c. He recently gave a lecture before the Geographical Society of Alsace-Lorraine at Metz, exhibiting several hundred photographs and ethnographical objects. Some time ago Herr von Hesse Wartegg was elected Honorary Member of the Royal Belgian Geographical Society and Corresponding Member of the Geographical Society of Metz. His travelling companion, Dr. Theodor Hoerner, has gone from Suakin to Kassalla, and from there through the Kunama country to Massawah.

IN the *Colonies and India* we find some particulars respecting a projected expedition from New Zealand to New Guinea for the purpose of exploration and eventual colonisation. The promoters two years ago made a preliminary voyage there in the *Courier*, which for various reasons was not particularly fortunate, but from their past experience they now feel certain of success. The *Courier* then visited Astrolabe Gulf, on the north-east coast, and the natives were found very tractable and disposed to trade. Scented woods were met with in abundance, and tobacco and sugar were seen under cultivation. Mr. R. Mills, who was with this expedition, has brought away with him numerous views taken on the spot, which give a good idea of the natives and the aspect of the country.

LETTERS have been received at Vienna from the African traveller, John Freiherr von Müller. He intends to penetrate into the district south of Fazoglu and Fadazi, which hitherto have never been visited by any European. The geographical problems to be solved in these parts are the discovery of the bifurcation of the Sobat River (a tributary on the right bank of the White Nile), which was suspected by Karl Ritter, and also the discovery of the problematical Zamburu and Baringo lakes. The general circumstances in these districts do not justify the hope of success being oversanguine; yet Freiherr von Müller hopes safely to reach the Indian Ocean at Mombassa or Bagamoyo on his return journey.

ON Monday last week Dr. Ave-Lallemant delivered a lecture to the members of the German Athenæum, Mortimer Street, on the Orinoco River. The lecturer spoke mainly from personal observation, and the lecture was a highly interesting one.

A GENERAL Congress of German geographers, presided over by Dr. Nachtigal, met in Berlin last week. The second volume of Dr. Nachtigal's work on the Sahara and Sudan is expected shortly.

LIEUT. BOVE has just returned from the Argentine Republic, where he has been making arrangements for the projected expedition to the Antarctic regions. The Geographical Institute of the Argentine Republic has unanimously voted 2000 scudi for the enterprise. As soon as the Italian Government has arranged the diplomatic affairs of the expedition with the Argentine Republic, Lieut. Bove will return to Buenos Ayres.

HEFT VI. of *Petermann's Mittheilungen* commences with an interesting article on the Greatest Quantity of Rainfall in One Day, by Dr. H. Ziemer. Letters from Dr. Junker give interesting details concerning his sojourn in the Niam-Niam country, and an article, with map, on East Griqua Land and Pondo Land brings together recent information on these regions. Another article gives the leading results of some recent journeys in Arabia.

No. 4 of the *Mittheilungen* of the Vienna Geographical Society contains an account, by Dr. Emin Bey, of his journeys in the Upper Nile Region; and Joh. Ritter Stef. v. Vilnovo has a long paper on the side-courses of rivers. In No. 5 Dr. Holub has a useful paper on the industrial aspect of Austrian exploration; Dr. Jettel writes on the scientific exploration of Bosnia and Herzegovina; and Lieut. Kreitner on the Ainos.

THE murder is reported of an Italian exploring party in the Danakil country. According to the latest advices from Aden, the party was composed of the traveller Giulietti, and an escort furnished by the commander of the vessel stationed at Assab. The party, whose object is stated to have been scientific and

commercial, left Beilul last April to explore the source of the Gualima. Four days distance from that town they were attacked and slain by the natives. Signor Giulietti was well known for the difficult journey he accomplished from Zeila Hazar. He was asked by the Geographical Society to explore the interior of the west coast of the Red Sea. At first a journey to Lake Aussa was contemplated, but obstacles arising, the plan was changed for an expedition into the Assab Gallas country.

At the meeting of the Geographical Society on Monday last Capt. W. J. Gill, R.E., read some extracts from a long account of his explorations in Western Szechuen, which has lately been sent home by Mr. E. Colborne Baber, now Chinese Secretary of H.M. Legation at Peking. The extracts chosen dealt chiefly with the amusing side of Mr. Baber's journey, but the paper, nevertheless, contains abundance of solid information respecting the extreme west of China, and, as Lord Aberdare stated in his anniversary address, is considered by competent judges to be a noteworthy contribution to our knowledge of Asiatic geography. The most valuable part of the extracts read is probably that respecting the almost unknown Lolo country, in the neighbourhood of Ning-yüan-fu. Mr. Baber sent home copies of some pages of a Lolo manuscript, no specimen of which, we believe, has ever been seen in Europe before. These have been submitted to the well-known scholar, M. Terrien de la Couperie, who gave the meeting a brief account of the results of his examination of them. Mr. Baber's paper will be published by the Society, together with the valuable cartographical matter which accompanied it.

M. AND MADAME UJFALVY were to leave Simla for Kashmir, *viâ* Kangra, on June 6. From Kashmir they hope to penetrate into Thibet and Central Asia.

THE death is announced of Mr. Andrew Wilson, author of a well-known book of travel in the Himalayas, "The Abode of Snow."

SOLAR PHYSICS—CONNEXION BETWEEN SOLAR AND TERRESTRIAL PHENOMENA¹

II.

IN my last Lecture I alluded to the complicated periodicity which sun-spots exhibit. It is right here to quote the remark of Prof. Stokes, that until we have applied to solar phenomena a sufficiently rigid analysis we are not certain that this apparent periodicity will bear all the marks of a true periodicity. It cannot however be denied that solar phenomena are roughly periodical, and this apparent periodicity has influenced observers in their attempts to search for a cause. There have been two schools of speculators in this interesting region, consisting of those who imagine a cause within the sun, and of those who imagine one without. The former *may* be right, but apparently they cannot advance our knowledge much. We know very little of the interior of the sun, and no one has yet ventured on any hypothesis regarding the *modus operandi* by which these strangely complicated and roughly periodical surface phenomena may be supposed to be produced by the internal action of the sun itself.

Those who maintain the hypothesis of an internal cause are apparently driven to it by the *a priori* unlikelihood of any cause operating from without. No doubt we have around the sun bodies, the motions of which are strictly periodical, such as planets, comets, and meteors, but they are relatively so small and so distant, that it seems difficult to regard them as capable of producing such vast phenomena as sun-spots.

There is however this difference between the two hypotheses—those who assert internal action cannot convert their views into a working hypothesis. On the other hand, those who look to external sources can take the most prominent planets, for instance, and endeavour to ascertain whether as a matter of fact the behaviour of the sun with regard to spots is apparently influenced by the relative positions of these. Attempts of this nature have been made by Wolf, Fritz, Loomis, Messrs. De La Rue, Stewart, and Loewy, and others. These attempts have been of two kinds. In the first place observers have tried whether there appear to be solar periods exactly coinciding with certain well-known planetary periods. By this means the

following results have been obtained by the Kew observers (Messrs. De La Rue, Stewart, and Loewy):—

(1) An apparent maximum and minimum of spot energy approximately corresponding in time to the perihelion and aphelion of Mercury.

(2) An apparent maximum and minimum of spot energy approximately corresponding in time to the conjunction and opposition of Mercury and Jupiter.

(3) An apparent maximum and minimum of spot energy approximately corresponding in time to the conjunction and opposition of Venus and Jupiter.

(4) An apparent maximum and minimum of spot energy approximately corresponding in time to the conjunction and opposition of Venus and Mercury.

Mr. De La Rue and his colleagues make the following remarks upon these results:—

"There appears to be a certain amount of likeness between the march of the numbers in the four periods which we have investigated, but we desire to record this rather as a result brought out by a certain specified method of treating the material at our disposal, than as a fact from which we are at present prepared to draw conclusions. As the investigation of these and similar phenomena proceeds it may be hoped that much light will be thrown upon the causes of sun-spot periodicity."

I may here mention that within the last month I have, in conjunction with Mr. Dodgson, applied a method of detecting unknown inequalities with the view of seeing whether there are any indications of an unknown inequality in sun-spots having a period near that of Mercury, and I find there are indications of such an inequality having a period which does not differ from that of Mercury by more than about three-hundredths of a day. Besides the four periods above mentioned the Kew observers have, they think, detected evidence of a periodicity in the behaviour of spots with regard to increase or diminution depending apparently on the positions of the two nearer planets, Mercury and Venus. The law appears to be, that as a portion of the sun's surface is carried by rotation nearer to one of these two influential planets, there is a tendency for spots to become less and disappear, while on the other hand when it is carried away from the neighbourhood of one of these planets there is a tendency for spots to break out and increase.

The Kew observers regard this latter species of evidence as being well worthy of a more exhaustive discussion when the sun-spot records are more complete. I have already mentioned that the chief difficulty in attributing solar outbreaks to configurations of the planets is the comparative smallness and great distance of these bodies, so that when we reflect on the enormous amount of energy displayed in a sun-spot we cannot but have great difficulty in supposing that such vast phenomena can be caused by a planet like Venus, for instance, that is never as near to the sun as she is to the earth. But this difficulty depends very much on what we mean by the word "cause." If we mean that the planets cause sun-spots in the way in which the blow of a cannon-ball or the explosion of a shell causes a rent in a fortification, the hypothesis is certainly absurd. But if we only mean that the planets act the part of the man who pulls the trigger of the gun, the hypothesis may be unproved, but it is no longer absurd. For we have reason to believe that there may be great delicacy of construction in the sun's atmosphere, in virtue of which a small cause of this kind may produce a very great effect.

We may therefore believe it possible that planets may act in this way on the sun—the energy displayed in a spot being however not derived from the planets, but from the sun itself, just as the energy of a cannon-ball is not derived from the man who pulls the trigger, but from the explosion in the gun.

All this is chiefly historical, and it leads to a very interesting query. If there is such an action of a planet on the sun, must not this have a reaction? If the earth influences the sun, must not the sun simultaneously influence the earth? Perhaps so; nevertheless it is not an influence of this kind which I shall now bring before you. The sun is periodically stirred up—no matter how—and being stirred up there is an increase in the light and heat which are radiated to the earth. This affects the meteorology of the earth, and also its magnetism, after a method which, if we do not fully understand it now, we may ultimately expect to comprehend. It is this kind of influence, and not an occult action, of which I shall now bring the evidence before you

¹ Lecture in the Course on Solar Physics at South Kensington; delivered by Prof. Balfour Stewart, F.R.S., April 27. Continued from p. 117.