

(comparatively speaking) descending currents may very likely, as it appears to me, be the cause of these appearances. Now just as at the surface of the earth these minor currents of convection are continually going on, and mixing up the heated portions below with less heated portions above, till at last a great catastrophe takes place, and we have a thunderstorm or even a cyclone; so the same thing may take place at the surface of the sun, and minor currents of convection may gradually cause a cooling of a greater stratum, and at last the equilibrium becomes unstable, and a great change takes place between the superficial portions and those which lie beneath, and we have the manifestations of faculae and spots. According to this view the faculae would consist of the heated portions on a larger scale coming from the interior, and the spots of a subsequent down-rush on a large scale of the portions which had been erupted and had cooled by radiation. Kirchhoff supposed that the spots were due, not to depressions of the sun, but to clouds of comparatively cool gases or vapours rising above the general surface. This was in contradiction to the relative altitudes of the sun-spots and the general surface as made out originally by Wilson, and subsequently confirmed by the observations of others; and moreover there are some other difficulties connected with it. Let us suppose that there is an eruption of hydrogen which has got cool, then if that exists and there is a cold draught at some distance above the sun, we cannot say it would absorb any longer the rays which it is capable of absorbing when glowing, because the correspondence of emission and absorption only necessarily holds good on condition that the substance is at a given temperature. If the temperature changes it is possible, and in many cases we know it is a fact, that the mode of absorption may change with it. We know that the cold hydrogen is transparent; we know, theoretically at any rate, that glowing hydrogen must be opaque with regard to light of the particular refrangibility which it emits; hence a cool mass of gas might cease to be opaque even by virtue of its being cooled. Again, if we had a cloud of, say, vapour of iron, and if this were condensed into actual drops or globules of molten iron in the upper portion of the atmosphere, they would form such a very rare sort of mist as would be something like a very rare haze which barely obscures the sun, and would not give rise to more than a slight general darkening. But if the gases in descending got warmed again, they would then be in a condition to absorb light specifically; but being at a lower temperature than the sun they would not give out nearly so much light as they absorb.

That seems to me to be the most natural explanation of the spots and of the phenomena attending them. I may have something more to say about this on a future occasion; but, as I see the time is going on, it would probably be more agreeable to you that I should postpone anything further I have to say to you upon this subject until my next lecture, in the course of which I hope, as I have said, to point out a speculation as to the connection which exists between sun-spots and certain phenomena which we know exist at the surface of the earth. There are probabilities to my mind in favour of it, but I will, with your permission, defer allusion to it to my next lecture.

(To be continued.)

THE HELVETIC SOCIETY OF NATURAL SCIENCES

THIS Society held its sixty-fourth annual session at Aarau on August 8, 9, and 10, under presidency of Prof. Mühlberg, whose opening discourse treated of recent progress in physiology and chemistry. An account of the proceedings (of which we here offer a brief *résumé*) will be found in the *Archives des Sciences*.

In the Section of Physics and Chemistry Prof. Forel read a valuable paper on the periodic variations of glaciers. These periods of advance and retreat are proved to embrace several years (five to twenty and more); they are due in the first instance mainly to variation in velocity of the glacier, and this to small variations in the thickness of the *névé* repeated in the same sense for several years, the consequent variation of velocity becoming much more pronounced as the glacier descends, and the ultimate effect being separated by many years from its original cause. The varying heat of summer appears to be of quite secondary importance. In one of three papers, communicated by M. Raoul Pictet, he described his new method of distillation and rectification of spirits by a rational use of low temperatures.

The two processes are performed at once; and with considerable economy a purer product is obtained. Another paper explained the principle of his rapid steamer, now being made, and the working of which will be watched with interest. The third treated of the different qualities of steel as regards magnetisation and permanence of magnetic power. (To this and the preceding, reference has been already made in our columns.)

M. Krippendorff exhibited a model of a balloon, to be propelled in light winds by escape of compressed air at the end of a wooden axis rendered horizontal or inclined according to the direction aimed at (by shifting the suspension of the car). The air would be compressed by four men into a small copper receiver at the other end of the axis; and a second reservoir holding liquid carbonic acid would be at hand in case of need. In a micro-telephone described by Prof. Amsler-Laffon, the flame of a manometric capsule (like those of König) is inserted in a telephone circuit; its conductivity being increased with vapours of potassium. Its change in form and size through vibrations of a thin plate of steel under sound, entails changes in electric resistance, and the telephone is affected accordingly. The apparatus is said to be very sensitive. Some useful hints on representation by projection of longitudinal and transversal vibrations are given in a paper by Dr. R. Weber. MM. Soret and Sarasin indicated a new method of determining the angle of rotation of quartz, and showed, in a curve, how the rotatory power varies with the wave length.

An interesting observation is reported by Prof. Dufour, who finds in deformation of images produced on large surfaces of calm water, a new proof of the roundness of the earth. This may often be witnessed on the Lake of Geneva, e.g. the reflected steeple of Montreux, seen from Morges; and in the case of ships some kilometres distant at sea. Prof. Forel, from a study of the recent earthquakes in the Cantons of Vaud and Neuchâtel, finds analogies to the phenomena of a vibrating plate in Chladni's experiments; the intensity and direction of a shock, e.g. being very different in places quite near each other. Guided by theoretical considerations, M. Chappuis has measured the liberation of heat through condensation when water is introduced suddenly into an evacuated tube filled with charcoal in temperature equilibrium with the water, and from the data, and the compressibility of water he infers the adherent water to be under a pressure of at least 36 million atmospheres. Among other subjects discussed were the measurement of radiant heat with the differential thermometer (Dufour), the determination of tartar and tartaric acid in wines of commerce (Piccard), and the action of bromine on a mixture of water and sulphide of carbon (Ureck).

In Zoology M. Fatio gave some account of his continued researches on disinfection with sulphurous acid. The vapours act in two ways on all organisms which depend on oxygen for life, viz. asphyxiating them by suppression of that element, and gradually burning them interiorly, the acid being dissolved in their humours or aqueous parts; the doses and times of application are varied accordingly. The more aqueous in substance an animal or plant is, the more quickly it is affected. The dose and time of application, in different receivers, will also be varied according to the temperature affecting diffusion of gas and the hygrometric state of the air and enveloping material. M. Fatio operated successfully on vibrations and bacteria in infusions submitted to an atmosphere mixed with sulphurous acid (the depth of the liquid here determines the time of exposure), and the range of application is evidently wide. M. Vogt gave some interesting facts showing the extensive adaptation of colours in animals of the Saharan Desert to that of the ground. With regard to the exceptional colour of nearly all Coleoptera, viz. black, he considers they find protection in their bad smell, and also their strong resemblance, when contracted and feigning death, to excrement of gazelles, goats, and sheep. The animals brought to the surface by water of Artesian wells in that region M. Vogt finds to be quite without the characters of animals living in caverns and subterranean water; their eyes are well developed, and their colours pronounced. They are indeed proved to live but temporarily underground. With albuminized paper Prof. Forel fixed 40 metres as the limit of penetration of chemical rays into water, but Dr. Aspen has, by a different method, got a photographic effect in the Lake of Zurich as far down as 90 metres. The researches of Dr. Yung on the influence of food on frog development have been formerly noticed; and of the remaining subjects we merely note the sense of colour in Cephalopoda (Keller), a peculiar mode of copulation in dendrocœle marine worms (Lang), and the conditions of production of

rhythmical contractions in the wing membranes of bats (Luchsinger).

In the Botanical Section M. Buser read a paper on Swiss willows, and Prof. Schnetzler gave some observations on the vegetation of *Lathraea squamaria* on tree-roots.

To the Section of Geology M. Jaccard submitted a project of maps of the "erratic phenomenon" in Switzerland, on the plan of those constructed by MM. Falsan and Chantre for the Rhone Valley. Dr. Rothpletz discussed the rôle of faults in the geology of the Alps, showing that these are by no means exceptional, and deserve more study than they have hitherto had. Dr. de la Harpe presented a collection of Egyptian nummulites. Dr. Gillieron had a paper on the age of the red schists of the Simmenthal. Prof. Mayer-Ermann furnished proof that the Loire must have flowed into the Parisian Gulf of the North Sea during the whole Eocene period, and that it was only at the end of the Inferior Neogene or Aquitanian epoch that it made the bend at Orleans and entered the Atlantic. The Pleistocene of Central Europe formed the subject of an instructive paper read by Dr. Rothpletz at the first general meeting.

In Medicine a paper was read by Dr. Bircher on the extension of deaf-mutism in Switzerland, and its relations with goitre and cretinism. He finds that these three are merely different manifestations of one and the same principle of degeneracy of race, a principle which, in Switzerland, is endemic in the Triassic, Marine Molassic, and Eocene formations.

THE ARCHÆOLOGICAL CONGRESS AT TIFLIS

THE proceedings of this Congress, recently held at Tiflis, were both interesting and animated. No less than 700 members arrived at Tiflis from various parts of the Caucasus, and fifty-five from various parts of Russia. The foreign members were few—Prof. Virchow, who took advantage of his stay in the Caucasus to make an excursion to Ossetia, and Messrs. Aeger and Hubsch from Vienna. The Congress was opened by Count Ouvaroff in one of the halls of the palace, before an audience of about 800 persons. The President of the Congress, M. Komaroff, pointed out that the Congress had met with much sympathy from all interested in the study of the Caucasus, as well as much help from the teachers of primary and secondary schools, who had sent in many interesting objects for the exhibition. We notice among the objects exhibited a most interesting collection of bronze antiquities from Ossetia, Bosphorian antiquities from a *kourgan* of the province of Kouban, stone implements from Tzalka, Georgian ornaments and stone implements from the provinces of Novgorod and Tver. Ossetia has been known for many years for a great find of interesting bronze implements, of figures of animals, curved hatchets with spirals and zig-zag ornaments and with figures of animals, as well as religious objects belonging to some unknown worship; the collection, which was bought some time ago by M. Chantre, is very complete, and will soon be described by him. The new collections from a *kourgan* at the Sievers Station consist of massive gold, and represent subjects of Greek mythology. On the same day the excellent Caucasian museum which was founded several years ago, but was closed for two years for unknown reasons, was re-opened.

Count Ouvaroff made an interesting communication on the remains of the Stone period which were found near Irkutsk, on the bank of the Angara River, at Talminkoy village. Many human skeletons, with stone and bone implements, and perforated teeth of animals, were found there, together with hatchets of jade (nephrite), which numbered as many as two hundred. This is the first find of jade implements in graves in Russia. This communication gave rise to an interesting discussion, during which M. Moushketoff, the well-known traveller in Turkestan, spoke of the great monolith of nephrite at Samar-cand, on the grave of Tamerlane. It has the shape of a parallel-piped, 7'8 feet long, 1'5 foot wide, and 1'2 foot high, and weighs about 1800 pounds, whilst the greatest pieces of nephrite which are found in boulders do not weigh more than 700 or 750 pounds. It is well polished, but is broken through its centre. The rock re-embles very much that of Khotan. As to the places where nephrite is found *in situ*, our knowledge is still very limited. Messrs. Shaw and Hermann Schlagintwert have seen nephrite mines in the Kwen-Lun, close by Balaktchi, at a height of 12,000 feet; according to Dr. Stoliczka it appears there as veins in chlorite-slates and quartzites. Two other places

where nephrite is found are known north of the Kwen-Lun Mountains, close by the Kilian Pass, at a height of 6070 feet, and near Kamat village on the highway to Khotan, at a height of 5790 feet; a fourth is presumed to be at the sources of the Yourson-tush, or Khotan River. But the nephrite implements which we found in graves were mostly made from boulders of this rock, which are often found in Eastern Siberia on the shores of Lake Baikal, and on the Boutogol Mountain in the Sayan Highlands; however, we do not know that nephrite was found *in situ* in these latitudes. All implements which are in the St. Petersburg museums were made of nephrite from Eastern Siberia, whilst the Kwen-Lun jade is used only in recent Chinese products.

Prof. Samokvasoff made a communication on his finds in the graves on the Caucasus, in the neighbourhood of Pyatigorsk. He excavated about 200 graves belonging to the Stone, Bronze, and Iron periods. In the larger graves he found bronze implements together with stone ones, and as there are in these graves, together with bones of sheep, several split human bones which do not belong to skeletons, he supposes that during the Bronze period the inhabitants of this part of the Caucasus were Anthropophagists. This opinion, however, was not concurred in by the majority of members of the Congress.

The chief work of the Congress was in the branches of History and Antiquities; but we notice also a special sitting for communications in French and German, during which several papers were read connected with the natural sciences. Thus Dr. Obst, Director of the Leipzig Ethnographical Museum, read a paper upon the results of the statistical researches on the colour of hair and eyes in Saxony, and M. Smirnof gave the results of the same inquiries with the Armenians and Georgians of Transcaucasia, as well as with the Russian population of the provinces of Kouban and Stavropol. Out of 2500 Armenian children there were 63 per cent. of dark, 4 per cent. of fair, and 33 per cent. of mixed (fair hair with dark eyes, or *vice versa*). Of 1400 Russian children there were only 14'5 per cent. of dark, and it is deserving of notice that M. Smirnof could not discover any difference between Great Russians and Little Russians, the number of fair children being 33'3 per cent. in the former, and 32'0 in the latter, whilst the mixed make respectively 52'2 and 53'5 per cent. As to Georgians and Imers, the observations are not sufficiently wide, but it may be stated that purely dark children are less numerous (50 to 55 per cent.) than with Armenians.

Prof. Virchow gave a long and interesting lecture on the chief problems of the Ethnology and Archæology of the Caucasus, accompanied with some remarks on the civilisation of its former inhabitants. Speaking on the usually-received opinion that the Caucasus was the highway for populations coming from Asia to Europe, Prof. Virchow expressed some doubts as to the crossing of the Caucasian passes by whole tribes at a time when the communications were so difficult and the ice-covering descended lower than now. It would be most important, therefore, to know if the first inhabitants of the Caucasus came from the north or from the south. Speaking further of the Ossetians, Prof. Virchow was astonished not to find among the adult population a single true fair type, which might seem contradictory of former opinions; only among children did he find fair-haired individuals with rosy Flemish cheeks. On the other hand, some measurements have brought him to the conclusion that the Ossetian skull is short and high, very different from the German type of skulls. Dolichocephalic skulls are very rare, and show that the tribes of the Caucasus have undergone much mixture with other people. As to the antiquities found in Ossetia, Prof. Virchow considers that the civilisation they speak of was far more recent than that discovered by Dr. Schliemann at Troy, as it does not contain stone implements, but has, on the contrary, curved fibulæ which were unknown at Hissarlik. The ornaments of the Ossetian bronze-implements, and especially the figures of stags, horses, and mountain-sheep, seem to show a connection between the former inhabitants of the Caucasus with those of the Altai Mountains.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—The following are the courses of instruction in natural science to be given this term at Oxford:—Prof. Odling lectures on the atomic theory, Mr. Watts on organic, Mr. Fisher on inorganic chemistry, and Mr. F. D. Brown on physical