a steel magnet can be approached at will. The receiver is an ordinary Bell telephone. It is claimed that the voice is transmitted with less alteration of timbre than is usual with other telephones, and that there is a remarkable absence of the scraping noises that are almost inseparable from the employment of carbon transmitters.

If rumour speaks truly, we are to hear shortly of another scientific invention worthy to stand beside the telephone or the phonograph in point of interest. Announcements of a mysterious *telephote* or *diaphote*, the discovery of two rival American inventors, have lately appeared in the paragraph columns of the non-scientific press, the instrument or instruments in question being declared capable of transmitting light as the telephone transmits sound. The rumour to which we allude, however, and of the truth of which we have authoritative information, is based upon the fact that Prof. Graham Bell has deposited in the Smithsonian Institution a sealed package containing the first results obtained with a new and very remarkable instrument first conceived by him during his sojourn in England in 1878.

M. Marcel Deprez has recently described two important instruments to the Physical Society of Paris. The first is a galvanometer adapted for measuring very strong currents of electricity, and consists of a series of soft iron needles placed between the limbs of a steel horseshoe magnet of great directive force. Parallel to the plane of these needles and of the poles of the magnet are wound a few coils of stout wire to carry the current. The needle sets itself almost instantly in the position of equilibrium; hence it is suitable to measure currents which exhibit rapid variations in strength. The second invention of M. Deprez is an apparatus adapted for continuously registering the total amount of energy developed by a current; an industrial problem of great importance. The current is passed through an electrodynameter, being, however, bifurcated; the larger portion traversing the outer coils, the smaller portion traversing a wire of high resistance and then passing through the movable inner coils. The product of these two partial currents is proportional to the energy of the current; and as the mutual action of the two coils is also proportional to the product of the two partial currents, nothing more is needed than an appropriate registering apparatus to integrate the various portions of the total amount of energy. In this manner the amount of energy expended in the production of an electric light under any particular circumstances may be determined.

At a recent lecture before the Society of Arts Dr. Heaton exhibited a large number of applications of Balmain's luminous paint, a substance based upon the famous "phosphorus" of Canton, and upon the phosphorescent powders investigated by Becquerel. Amongst other interesting matters it was shown that a can of hot water placed upon a shining surface of the paint dims its brilliance, though it recovers on cooling. The application of a lump of ice produces a contrary effect. A tube of "Canton's phosphorus," prepared more than a century ago by Canton himself, was shown still to possess phosphorescent properties.

With regard especially to the spectra and composition of nebulæ, M. Fiévez, of the Brussels Royal Observatory, has recently, following the example of Huggins, experimented as to whether an alteration in the luminous intensity of a gas, *without modification in the temperature or the pressure of this gas*, may involve disappearance of one or several lines in the spectrum. The method he adopted was that of projecting, by means of a lens, on the slit of a spectroscope, a real image of the luminous body (part of a Plücker tube), and then altering the intensity of this image, either by reducing the aperture of the projection-lens or by displacing a diaphragm pierced with a circular opening between the lens and the image projected. Hydrogen and nitrogen were the gases. With the former, as the brightness diminished the line H disappeared first, then the line C, the line F remaining last. The lines which disappeared did so by gradually diminishing in length. Nitrogen gave like results, and the following additional experiment was of a confirmatory nature:—If, at a moment when most of the lines are extinguished, the aperture of the slit be increased without changing the position of the screen, the lines that had disappeared return. It seems, then, well established that a gas, though possessing several spectral lines, may be manifested in the spectroscope by presence of a single line, the others remaining invisible by reason of the little brightness of the luminous body. On this ground certain nebulæ showing the lines of nitrogen and hydrogen which longest resist extinction are considered by M. Fiévez (with Dr. Huggins) to contain those gases, and the *relative* invisibility of the other lines (*relative* because they might probably be perceived with more powerful telescopes) is attributed to an absorption in space acting equally on rays of any refrangibility.

Some experiments by M. Ziloff on the magnetisation of liquids are described in the *Journal de Physique* for March. It appears, *inter alia*, that the magnetic coefficient of the aqueous solution of perchloride of iron is not constant, but that it is a function of the magnetising force. As the latter is increased the magnetic coefficient increases, reaches a maximum for a determinate value of this force, and then diminishes, at first rapidly, and then slowly.

The action of salts on water-absorption by roots, as studied by Sennebier, Sachs, and Burgerstein, having been left in some doubt, M. Vesque has recently made fresh experiments, and on the following plan:—First, the influence of salt and salt mixtures was tried on the absorption of water by the roots of uninjured plants whose aërial parts were subject to unchanged atmospheric conditions. Then their influence on water absorption by a severed branch, then on that of severed roots. M. Vesque's conclusions from the first series of experiments are as follows:—1. Under ordinary conditions, *i.e.* the plants suffering no lack of mineral nutriment, distilled water is better absorbed than solutions of salts and nutritive liquids. 2. When plants have been exposed a longer or shorter time to the influence of distilled water they absorb better the solutions of salts and nutritive liquids than pure water. 3. Even a short contact of the roots with distilled water acts favourably on the absorption of salts, and conversely a temporary contact of the roots with a salt solution on that of distilled water. 4. The influences are greater the more concentrated the solutions of the salts and the nutritive liquids. 5. There is no qualitative difference between absorption of the solution of an isolated salt and a nutritive liquid. The experiments with severed roots and branches yielded similar results. These also absorbed more distilled water when they had previously been in salt solution, and took up more salt solution when they had stood for more or less time in distilled water.

At a recent lecture at the Conservatoire des Arts et Métiers, on the Industrial Applications of Artificial Refrigeration, M. Raoul Pictet produced a veritable sensation by coining a medallion in frozen quicksilver of the weight of fifteen kilogrammes.

GEOLOGICAL NOTES

Devonian Rocks of Belgium.—We have just received the first descriptive memoir issued by the Geological Survey of Belgium. It is a quarto pamphlet of some seventy pages by Prof. Malaise, containing an account of fossiliferous Devonian and Cretaceous localities. The author has been at work collecting his materials for more than twenty years, and he now publishes a list of 173 places in Belgium from which Devonian fossils have been obtained. These places are arranged stratigraphically, and the names of the fossils found at each are given. As a contribution to the local geology of Belgium the pamphlet will doubtless prove of service. It is evidently a piece of laborious and painstaking work, of the kind that ought to precede the broad generalised summaries which the Survey will eventually be able to present for the information of the world. There is attached to it an index map, on which each of the fossiliferous localities is marked with a coloured spot, to which is attached a symbol indicating its geological horizon. Though the map is not, in the ordinary sense, a geological one, it tells its story clearly, and will be a convenient guide to those who purpose to visit the fossiliferous sites among the Belgian Devonian rocks. Prof. Malaise prefixes to his statistics a short introduction, in which he traces the history of Devonian classification in his own country and gives the subdivisions of the Devonian system which his own labours have led him to adopt. He modifies Prof. Gosselet's arrangement, taking the Couvin shales and limestone with *Calceola* out of the Inferior and placing it in the Middle Devonian group, together with the Givet limestone, but leaving the shales with *Spirifer cultrijugatus* in the Lower. These shales he regards as containing a fauna transitional between that of the Lower and that of the Middle division of the Devonian system. Prof. Gosselet has observed that if the Couvin limestone is

bracketed with that of Givet, we must also place there the limestone of Frasne, as was done by Dumont. But M. Malaise replies that Dumont's classification was founded on mere lithological considerations, and that we can now trace palæontological differences among these subdivisions. It is interesting to observe among his fossils from the Upper Devonian Psammites du Condroz some of the forms which occur in the Barnstaple and Marwood beds of Devonshire, with remains of fishes (*Holoptychius nobilissimus*) of the Upper Old Red Sandstone of Scotland, and of ferns (*Palæopteris Hibernica*) identical with those of Kiltorcan in Ireland.

GEOLOGY AND PHYSICAL GEOGRAPHY OF THE ARALO-CASPIAN BASIN.—The veteran geologist Count von Helmersen last year presented to the Imperial Academy of Sciences of St. Petersburg an interesting communication relative to the geological changes which have taken place within tertiary and recent times in the remarkable depression in South-Eastern and Asiatic Russia. Considerable activity has for some years past prevailed among Russian officials in regard to railway communication with the new acquisitions in that part of the empire. In June, 1877, the Grand Duke Nicholas placed himself at the head of an expedition which started from Orenburg with the view of exploring the shortest railroad route to Tashkend—the chief point in the central area of Russia in Asia. During the progress of this expedition a sketch-geological map was constructed and a collection of specimens was made which, carefully labelled and accompanied with notes, were sent to Count von Helmersen, whose life-long acquaintance with Russian geology enables him to make the data thus supplied tell a connected and interesting story. He points out that a much larger area of Southern Russia and adjoining lands was covered by the sea in Jurassic than in Cretaceous times; that the expanse of salt water was further diminished in the Eocene and Miocene, and still more in the Pliocene and Post-pliocene periods, and that it is visibly decreasing now in the remnants of it left in the Aralo-Caspian basin. That this should not be regarded as a mere local phenomenon he thinks to be made clear by well-known facts in Northern Russia and the surrounding regions. In Siberia, for instance, the shells of molluscs still living in the Arctic Sea are found southwards to a distance of 700 versts (nearly 500 English miles) from the northern coast, and all round the Baltic recent marine shells are found up to heights of sometimes 600 feet above the present sea-level. Whether this retreat of the sea is to be explained by a general subsidence of the ocean or an elevation of the land, or by both causes combined is, he believes, a question which still awaits solution for the whole northern hemisphere, though it has been studied by so many observers from the times of Linnæus and Celsius down to our own. After the floor of the Miocene sea had been in large measure raised into land, the United Aralo-Caspian Sea must have been connected with the Black Sea, and must have had the form of a large arc, of which the vertex passed through the country of the Turcomans and Khiva, and of which the eastern limb stretched northwards beyond the present Aral Sea. It has been commonly supposed that during some part of the later Tertiary or Post-Tertiary periods a connection existed between this united Aralo-Caspian Sea and the Arctic Ocean. But the Count holds that for this belief there is no proper foundation. At the eastern base of the Ural Mountains, he asserts, there are in the superficial deposits no vestiges of any living species of marine shells. The mollusca cited by Pallas and others from the plains of Western Siberia are all referable to freshwater species. With regard to the probable cause of the subsidence of the level of the Caspian, Count von Helmersen believes that it is to be sought in the gradual sinking of the ground. In the deeper southern half of the Caspian, notably about Derbend and Baku such a sinking is actually proved. Not there only, but over the area of the sea itself, as far as the island Tscheleken, on the eastern shore, an enormous quantity of carburetted hydrogen escapes from the ground, and has perhaps been doing so for thousands of years. The area over which this takes place loses in substance, the ground gets looser, and is unable to withstand the great pressure of the water of a deep sea and of the superincumbent rocks. It is consequently pressed together, and sudden infalls sometimes occur. The wide extent of the area which supplies the gas and naphtha emanations of the Caspian may be understood from the statement that even as far north as Astrakhan carburetted hydrogen gas instead of water has come up in Artesian borings. But besides this subterranean cause of diminution the Count is of opinion that the facts indicate an absolute decrease in the waters of Central Asia. Though the dwindling down of the Miocene and Post-miocene seas gives no certain proof of such a decrease, yet the desiccation of the rivers of the Steppes and the drying up of the lakes point to a change of this nature. The author instances the rivers Särafscham, Emba, and Irgis, and all the streams descending from the north towards the Lake Balkash. This lake is fed only from the mountainous country lying to the south. Everywhere all over the vast Steppes and across into Persia and Afghanistan ancient wide lakes are now represented by greatly diminished sheets of water, which the rivers in many cases are unable to reach, as their currents are gradually lost in the wastes. An interesting practical question is connected with these discussions. Is it possible to form a continuous water-way from St. Petersburg, by the Volga, Caspian, and Oxus, to Khiva or the borders of Bokhara? Could the ancient channel of the Usboi again be filled with water so as to afford a route from the Caspian eastward? This matter is being investigated by an expedition sent out for the purpose. Count von Helmersen, however, believes that the desiccation of the Usboi is only part of the vast continental diminution of rainfall and water-supply, and that the artificial restoration of that channel is impossible. Still it is difficult sometimes to define what is impossible to modern engineering skill.

GEOGRAPHICAL NOTES

As an example worthy of being followed by our own and other geographical societies, we call attention to the "Memorie della Società Geografica Italiana," vol. ii., parte prima (Rome, 1880), which is the first part of a volume intended to be dedicated entirely to the zoological results of the Italian expedition to equatorial Africa, under the command of the Marquis Antinori, whose portrait serves for frontispiece. It is prefaced by a communication from the Secretary of the Society (Sig. G. della Vedova), giving an itinerary of the expedition, and in connection with this there is a very excellent map showing the route. As is well known, the expedition principally explored the kingdom of Schoa, immediately south of Abyssinia—a district of which we have heard a good deal lately in connection with Egyptian politics, and of which we shall no doubt hear a good deal more. We have here an enumeration of the lepidopterous insects of the expedition, drawn up by M. Charles Oberthür, of Rennes, illustrated by a folded plate, apparently carefully executed after the manner of lepidopterists, on which eight presumably new species are represented. The list of known species shows but little of the palæarctic element; this has already become dissipated, and we enter upon African ground as such; but the species captured were conspicuous, and include several of extremely wide distribution. A note explains that this part is not absolutely original, and that it also appears in the "Annali del Museo Civico di Storia Naturale di Genova," vol. xv., and the introduction indicates that the whole of this zoological volume will receive attention from the naturalists on the staff of, or in connection with, the now renowned Genoa Museum.

AT the meeting of the Geographical Society on Monday evening the Rev. Chauncy Maples, of the Universities' Mission, read a paper on Masasi and the Rovuma district of East Africa. Masasi appears to be the name of a district rather than of a town, lying in about 11° S. lat. and 38° E. long., and some 120 miles south-west from Lindi on the coast; it consists of four mountains lying east and west, and rising out of a dense forest. The station of the Universities' Mission, which was formed in 1876, is situated at the western extremity of the region, and to their west again a vast forest stretches away towards Lake Nyassa. In describing the nature of the route to Masasi, Mr. Maples took occasion to remark that if a road should ever be constructed to connect Lindi with Lake Nyassa, it would have to pass along the valley of the Ukeredi, which presents no engineering difficulties. A noteworthy feature of the Masasi district is its great fertility; the cassava attains an enormous size, and the rice, &c., grown are famous for miles round. The water is strongly charged with iron, and salt is obtained in large quantities from the moist ground under the hills. Ironstone is common, and extensively worked. The missionaries have introduced several kinds of fruit, and intend to try wheat. Mr. Maples afterwards described a journey which he made in November, 1877, to the valley of the Rovuma River and the Makonde country. Throughout his paper he furnished many interesting particulars respecting the tribes inhabiting the country between the coast and Lake Nyassa.