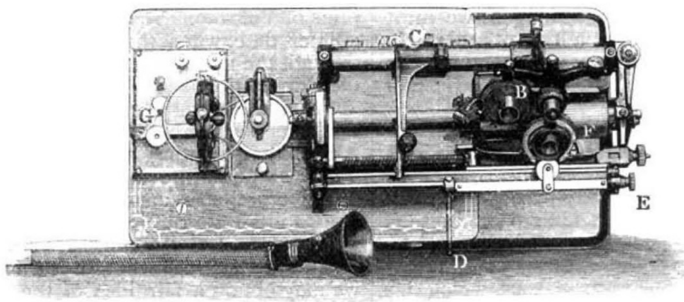
therefore, on hearing the reproduction through the magnifying funnel, are disappointed to find the effect below their expectations. As soon, however, as they listen through the tubes, they are proportionately surprised at the loudness and the clearness of the sound and articulation. While for most practical purposes audition through the tubes is quite sufficient, Mr. Edison is, we understand, constructing a means by which the sounds can be greatly magnified. Even as it is, with the present funnel the reproduction can be heard very well throughout a large room. For example, at a lecture on November 10, before Harrow School, a perfect *mélange* of speaking, singing, and whistling, made by Colonel Gouraud on the spot, was plainly heard all over the lecture theatre, in which about 600 persons were present.

Other improvements comprise an electric motor and speed governor, by which the phonogram and the feeding screws can be rotated at a constant speed. As this electric motor is itself the subject of a separate patent, we are only at liberty to say that it is an electro-dynamic multipolar motor, in which a ring armature acts as a fly-wheel, and that it is adjustable to different speeds—a necessary point in order to preserve the same pitch where the rapidity of utterance is subject to variation. The circuiting of the motor and governor is ingeniously arranged so that the field of the armature can be opened without interfering with the field-magnet circuit, thus securing greater sensitiveness and an absence of sparking.

The phonograms themselves are divided into two sorts, office-grams and mailing-grams. The former are cylinders, capable at the present time of yielding from thirty to fifty surfaces for record, which number, as Mr. Edison says in a letter only received a few days ago, can now, by improved methods, be increased to two hundred. Obviously, however, such a cylinder would be an awkward affair to send by post. Mr. Edison has therefore met this want by constructing the mailing-gram, and though this may seem a small matter from a scientific point of view, yet we venture to prophesy that among all his many achievements there will be none to which he will look back with greater pride, or which are destined to work a greater revolution in the history of the world than this apparently simple little mailing-gram. To say that it is capable of being posted, and reproduced at the other end without injury to the record, may perhaps give some idea of its practical value.



Instrument turned over so as to present a top view with recording diaphragm in position. A, recording diaphragm; B, reproducing diaphragm; C, rocking holding arm; D, bar for arresting record; E, turning bar; F, wax cylindrical phonogram; G, electric speed governor.

Regarding the way in which all this is accomplished, it is needless to say anything, except that the device bears the true stamp of genius, viz. simplicity. This portability of the phonograms is, in fact, one of the salient features by which the phonograph of 1888 stands out in marked contrast to the imperfect machine of 1878, and this improvement, in combination with the greater perfection and permanence of the record, at once raises it from the level of a pretty scientific toy or curiosity to one of immediate utility.

The practical working of the instrument, which has been greatly improved even upon what it was at the meeting of the British Association at Bath this year, may be gathered from the fact that Colonel Gouraud dictates all his correspondence through it, speaks to it in different languages, applies every conceivable test to try its powers, and with results which not only astonish him and everybody else, but even the inventor himself.

The purposes to which such an instrument can be applied—scientific, commercial, domestic, artistic, military—seem countless. The dreams which were indulged in when the phonograph of 1878 appeared, can now be realized; and we owe to Mr. Edison another substantial addition to the long list of direct results of scientific labour achieved during the present century.

FURTHER NOTES ON THE LATE ERUPTION AT VULCANO ISLAND.

MY friend Signor Gaetano Platania, who accompanied me on my trip through the Lipari Islands in June 1887, and stayed some days with me at Vulcano, has undertaken the task of describing that interesting event and the subsequent phenomena. He has very kindly forwarded me specimens of the ejectamenta, and to him I must express my thanks. He being already well acquainted with the products of that volcano, his observations will be of considerable value when published.

The first specimen submitted to me is that of the so-called bombs, common in other eruptions that have taken place from the present active crater of Vulcano. It is undoubtedly the *essential* ejectamenta, although included in the paste is much fragmentary *accessory* material. These so-called bombs are irregular polygonal masses of an obsidian-like material on the outside; the surfaces are traversed by a number of clefts or fissures V-shaped in section, which at their bottom and the deeper parts of their sides are seen to be composed of a spongy glass or even pumice. Their mode of formation is no doubt as follows:—The glassy magma from former loss of heat has become so viscous that the escape of vapours from the underlying magma is arrested until the tension rises, and the superincumbent pasty, almost solid, mass is broken up and ejected. This ejection has been preceded by some expansion and cracking, together with some cooling along the cracks, so that the blocks have partly consolidated as pumiceous obsidian, but when relieved from these conditions by ejection, the hotter material within each block expands, due to the liberation, as vapour, of the dissolved H_2O, and the formation of a vesicular structure, which may progress to such a point as to constitute a true pumice. This is accompanied by fissuring of the external hardened surface, just as the expansion of dough splits open the crust, as the air-bubbles expand before and after the loaf is in the oven—in fact, we could not adopt a better term to define this structure than *bread-crust structure*. These fissures often divide crystals, pieces of included rock, &c., showing that little plasticity was left on the surface when this expansion took place. In fact, the conditions necessary are that the glass be sufficiently cold to break with a strain or blow applied sharply, but to bend when the force employed is gradual in its action, such as may be seen well in all vitreous substances. If we warm a stick of sealing-wax, hardened Canada balsam, &c., we may gently bend it to any form, but if our attempt is too quick, the stick breaks. In these bombs many of the surfaces appear to have first bulged and then broken. As these are ejected, and consist of a hard crust and soft interior, I suppose we must use that unfortunate term bomb, though they are rarely round and certainly do not strike one as resembling as much a bomb as do those masses found on the surface of lava-streams.

The colour is buffish-gray, the surface somewhat glistening and scattered over by the exposed broken surfaces (split by the division fractures between the contiguous blocks) of a dark green mineral, chiefly pyroxene, glassy crystals of feldspar, smaller black metallic lustred grains of magnetite, more rarely typical grains of olivine, quartz, and pyrites. There are also very many grains of different sizes of a darker-coloured fine-grained rock which incloses many of the augites, feldspars, olivines. Microscopically, the vesicular structure is seen to extend, though becoming less marked, to within (in the specimen examined) less than a millimetre of the surface, though in larger blocks from other eruptions preserved in my collection this may attain 2 centimetres or more. The crystals of pyroxene are usually well formed, though often broken. They include, wholly or partly, large, rather irregular magnetites, and in some cases are surrounded by wreaths of either sanidine or, more commonly, triclinic feldspar, probably labradorite. Where included in foreign rock-fragments, this latter is seen to be composed of a network of magnetite, augite, and feldspar microliths, and is often much altered. The feldspars are principally sanidines which may attain half a centimetre long; they are very dirty from inclusions, and somewhat rounded. There are also groups of labradorite crystals, and another triclinic feldspar in which the striations are remarkably close and fine. In some cases a triclinic feldspar seems to be intergrown with the sanidine. Of the latter mineral there are many microcrystals and microliths. Here and there are to be met with a few ill-formed crystals of dark-green amphibole.

What part of these minerals belong to the essential magma, and what are simply imperfectly fused out of the surrounding rock, it is extremely difficult to determine, and chemical analysis of the rock would be obviously useless, on account of the numerous inclusions of other rock-fragments. The association of such basic minerals with a distinctly acid rock would be very remarkable, were it not for the distinct origin of them by inclusion of accessory materials. The eruptive rocks of this island range from a very rich olivine basalt through a dolerite to the typical obsidians and spherulites. There is little doubt that these included minerals are the churned-up fragments in the crater apex which almost certainly cuts through those older rocks, and even part of the present active cone of Vulcano is composed of dolerite.

That these bombs are the primary ejectamenta in this eruption there is no doubt, on account of their freshness and the sharp uneroded angles and edges, as observed by Signor Platania, together with the absence of any solfatarizing. The specimen examined was ejected during the month of August, probably early in that month.

The next specimen is dated August 18, and consists of coarse sand or fine lapilli, about the size of a mustard-seed, with a little fine gray ash. This I made into an artificial breccia, and cut sections of it. It is composed of broken fragments of dolerite and glassy rocks, both often solfatarized, with chips of pyroxene, magnetite, &c., and, no doubt, is chiefly *accessory* ejectamenta derived from the crumbling sides of the crater being churned, ground up, and ejected.

Next is a fine ash of light gray colour, ejected on August 26, which is, in great part, also composed of similar materials to the last, with an abundance of very minute microliths, many of a dark-green colour, and therefore probably pyroxene or amphibole, though they remain dark between crossed nicols, from their great minuteness. I have observed no trace of tridymite found in such abundance in the ash of one of the recent eruptions of Vulcano. This we should expect to be formed at a later date, when the more tranquil vapours, escaping through the material at the crater bottom, would allow of their deposition.

From the description of the eruption by Mr. Narlian that was given in my paper on this subject at the British Association meeting this year, and reproduced in the *Times* and other newspapers, from the examination of the eruptive products, and from the state of the volcano previous to its last eruption (see my paper, "The Islands of Vulcano and Stromboli," NATURE, vol. xxxviii. p. 13) taken together with what we learn from the ejectamenta, we may obtain a fair idea of the eruptive process in this case. The chimney of the volcano was, no doubt, filled by an acid magma, which, perhaps, after the last eruption, was of much higher temperature, and in which fragments of other rocks from the crater and chimney sides had been churned up and partially fused. The temperature and liquidity seem to have been low, as the olivines and augites, although they have apparently been fused out of their original matrix, especially the latter, retain most perfectly their crystalline angles, and no chemical fluxing or reaction seems to have occurred between the basic minerals and the surrounding acid magma. Also, the occurrence of pyrites points in a similar manner to the same physical state. The choking of the crater after the former eruption, together with the gradual cooling of the upper part of the magma column during the intermediate solfataric stage of the volcano, would result in a gradually increasing obstacle to the boiling-off of the H_2O dissolved by the magma lower down. Two processes would therefore be going on, viz. increased superincumbent pressure, and augmenting tension of the part of the subjacent magma within reach of water-supply. The latter must obviously, after a certain time, increase in a greater ratio than the former, until the plug is blown asunder.

This plug in great part would consist of the magma with its inclusions reduced to that critical state between a liquid and solid, as seen in vitreous bodies. When this is broken up by the sudden impulse of the expansion of the subjacent aquiferous magma, it would split into fragments; and, these immediately cooling on their surface by the molecular formation and escape of vapour near that surface, cooling and solidification would result, but before this extended far in, the hotter interior would undergo frothing, and so bend, crack, and fissure the nearly hard coating, producing in this manner the bread-crust structure. These blocks seem from Mr. Narlian's account, to have fallen nearly red hot, as his children's feet were burnt, and part of the house where they fell was burnt. After the first explosion, a series of feebler explosions took place, and, I believe, are still continuing with diminished force, just as is seen in boiling up an extremely thick syrup. Add to this the crumbling in of the crater-sides, their pulverization and ejection, and we have the picture of a typical paroxysmal eruption, tending towards an explosive one, of an obsidian volcano. H. J. JOHNSTON-LAVIS.

Naples, November 3.

Since writing the above, I have received the following letter from Mr. Narlian, which will form a fitting appendix to his former one read at the British Association, and published in the *Times* and elsewhere.

"*Lipari, Italy, November* 3, 1888.

"MY DEAR DR. JOHNSTON-LAVIS,—I have your kind note, for which I thank you. Our crater (*i.e.* Vulcano) is still in a very active condition. The eruptions succeed each other nearly every minute or two. Columns of thick black ashes are ejected to heights that cannot be less than 15,000 feet. The stones, red hot, are also thrown out in immense quantities and to great heights. Sometimes these eruptions are accompanied by loud detonations, which are indistinguishable from those of a gun, only they are so overpoweringly loud that at Lipari they are heard as if a piece of 100 tons had gone off near at hand. Till now there is no lava, and we hope there will not be any.

"I observe a difference in the ejected matter: in the beginning of the eruption they were stones, in time they began to show a burned calcined appearance, became quite black and friable by the action of the fire, and now they are nearly pumice of a dark and rough kind.

"I shall be glad to send you some few specimens by the first boat for Naples.

"I am, dear Sir,

"Yours faithfully,

"A. E. NARLIAN."

This prolonged activity is a most interesting phenomenon, and two explanations are open to us—viz. either the supply of igneous magma has increased, and the volcano is passing from the solfataric stage to a strombolian or Vesuvian phase, or the supply of dissolved H_2O in the magma extends to great depths, or is derived from a very large mass of magma. The change in the ejectamenta would rather point to the latter; as if, the first boiled paste being ejected, the more aquiferous paste from greater depths was undergoing discharge of its vapour. This may possibly be followed by the eventual outpour of lava, indicating the arrival at the surface of still deeper magma, comparatively poor in dissolved H_2O, so that the view of an obsidian stream may be in store for us before long—an event of considerable importance to vulcanological science. H. J. JOHNSTON-LAVIS.

NOTES.

WE lately noted that Mr. J. F. Duthie, Director of the Botanical Department, Northern India, had accompanied the recent military expedition to the Black Mountain country. The Black Mountain forms the northern boundary of the district of Hazara, which forms a long narrow valley, bounded on the west by Cashmir. Extending far into the heart of the outer Himalayan range, it is shut in on either side by mountains, rising to 17,000 feet. The flora is almost wholly unknown. But the time of year was unfavourable for botanical collecting, and Mr. Duthie writes to Kew: "I did not manage to find much of botanical interest on the Black Mountain; excepting the fine bits of forest, composed of *Abies Webbiana* and *Pinus excelsa* on the crests of the mountain, the country is barren in the extreme."

THE Kew Museum has lately received a choice collection of interesting objects from Corea, collected and brought home by Mr. T. Watters, who was Acting Consul in that country from January 1887 to June last. The specimens in question, which consist of hand-screens, fans, &c., made of paper from the paper mulberry (*Broussonetia papyrifera*, Vent.), together with samples of the paper itself, sun-blinds made of split bamboo, &c., illustrate in a remarkable degree the extreme neatness and accuracy of the Coreans in their handicrafts. The following are some of the specimens received and now exhibited in the Kew Museum. A series of different qualities of paper, all made from the bark of the paper mulberry. These comprise plain white or cream-coloured papers of various degrees of finish, used for drawing, writing, packing, &c.; also coloured papers such as are used by the people for writing birthday missives upon. It would seem that the Coreans, like the Japanese, use paper very extensively for a great variety of purposes. Thus, for fans, the handles of which are delicately ornamented, as well as for hand-screens, tobacco-pouches, coverings for hats in wet weather, paper is equally applicable; for the latter purposes, however, it is steeped in oil, which makes it thoroughly waterproof. The hand-screens are made by first forming a foundation of thin strips of split bamboo radiating from the handle, which is afterwards covered so completely on both sides with a thin paper film and varnished that a strong and durable article is the result. Some of the hand-screens presented by Mr. Watters to the Kew Museum were given to him by the King, and are of much finer workmanship than those that are purchasable. The oil-steeped paper tobacco-pouches and hat-coverings are a close imitation of oilskin; the latter, which when opened is cone- or tent-shaped, is used by all classes except the peasantry, even including the soldiers. The Corean boy's kite, which is also made of *Broussonetia* paper, consists of a piece of paper about a foot square with a circular hole in the middle, kept in form by thin strips of bamboo; a thin string is attached to each corner and brought together and connected to a single string, which is wound upon a wooden windlass. The perfection of splitting bamboo into thread-like strips seems to be divided equally between the Chinese and the Coreans, judging from a remarkably fine example of a blind which forms one of the exhibits. These very fine blinds are said to be used only by high mandarins, and the coarser kinds by the lower classes. Another illustration of very fine work is in the utilization of split rattans in the manufacture of articles of clothing, an undershirt and cuffs of very open ornamental workmanship being made entirely from this material, which is both soft and pliable. These shirts are said to be used next the skin in hot weather to prevent the oute shirt adhering to the body.

MR. J. S. JAMESON, of the Emin Pasha Relief Expedition, who died of fever at Bangala Station, on August 17 last, had accumulated a number of carefully-selected trophies and objects of natural history. These objects have been brought together at 166 Piccadilly, and arranged by Mr. Rowland Ward, so that they may be accessible to naturalists, and to his friends, who have been invited to view them to-day.

THE Russian Geographical Society has just published an "Instruction for Observations upon Shifting Sand Regions." The paper was carefully prepared by a Committee of persons thoroughly acquainted with the subject, and might with advantage be translated and communicated to other Geographical Societies.

AN important addition to school laboratories has just been completed at Eastbourne College, where the science teaching is undergoing great development. The laboratory, which has just been built there, affords working accommodation for twenty-four students, and has been thoroughly well fitted. The working