and no doubt cones had been erected before the time of Cheops, and had their meaning and uses. Probably they were first made of earth, and the circular base would no doubt be set out by a cord, as above described. Cheops, by his architect, squared the circular base, getting thereby lines much better adapted to stone work, whilst still keeping the old sacred emblem, though in a developed form. It may, I believe, be traced down to many modern forms not often suspected of bearing any relation to it.

Belper, January 17 J. G. JACKSON

### Acoustical Effects of Atmospheric Pressure

ON tapping an ordinary bell-jar receiver after exhaustion, the following was noticed. The note derived from percussion after exhaustion was sensibly of a higher grade than that obtained from the glass containing air. On gradually letting the air in, the note sank directly as the amount of air so introduced. We conclude that the phenomena here recorded are connected with the atmospheric pressure, and that the note yielded is a function of the atmospheric pressure. Can any of your readers suggest a method for the investigation of the observed facts, if no investigations have been before made on the subject.

Rugby, January 19 G. RAYLEIGH VICARS

## TRANSATLANTIC LONGITUDES[1]

IT will be remembered that a preliminary account of the results of the transatlantic longitude determination of 1872 was published in Vol. xxii. of the *Proceedings* of the American Association for the Advancement of Science. We have now received the final report of Mr. Hilgard, which embodies not only the results, but also the observations, and which sets forth concisely the manner in which the former were deduced from the latter.

The importance of fixing with the greatest precision achievable, the longitude of some point in the coast survey triangulation with reference to Greenwich, led the U.S. Government promptly to make use of the means afforded by the completion of the Atlantic telegraph cable from Ireland to Newfoundland.

The first telegraphic longitude determination through it, made under the direction of Dr. B. A. Gould, in 1866, although it surpassed in exactness all results obtained by different methods was subject to a small but indeterminate correction, the "personal equation" between the American and the standard Greenwich observer.

Use was therefore made of the French cable in 1870 to make another determination under different circumstances, and under the charge of Mr. Dean the longitude difference between Brest and Cambridge, U.S., as before, was obtained; but as at that time no cable was in operation between Brest and England, the connecting link, Brest-Greenwich, remained undetermined until 1872, when Mr. Hilgard took charge of the work necessary to supply this deficiency, and since the opportunity was afforded, to repeat the Transatlantic determination. This time an intermediate station, St. Pierre, on the American side, was introduced, thus varying still more the conditions under which this third determination was made.

The general plan of operations was to unite at Brest time signals from St. Pierre, Greenwich, and Paris. The co-operation at the last-named stations of the Astronomer-Royal, Sir G. B. Airy, and of M. Delaunay, and the generosity of the telegraph companies, enabled Mr. Hilgard to finish the work successfully in September of that year.

We can only advert briefly to one or two points of interest. The accordance of the results appears to have been due in a great measure to the attention given to the accurate determination of the relative personal errors of the observers, which gave also indirectly the "personal equation" correction, lacking in the longitude determination of 1866.

[1] Final Report on the Determination of 1872, with a Review of Previous Determinations. By J. E. Hilgard. From the United States Coast Survey Report for 1874

Incidentally, the "wave-time" of the cable signals was deduced, and on the assumption of equality in time in either direction, the resulting wave-time from Brest to St. Pierre, through a length of cable equal to 2,979 statute miles, is given as 0s.·351 ± s.·003.

The final results are given as follows, and the author remarks "that the close agreement of the three independent determinations made in different years is no less surprising than it is satisfactory." Even if we assume, as Mr. Hilgard evidently does, the identity of the results as accidental within the limits of the probable errors assigned, the determination must be characterised as being of the highest order of precision.

*Longitude of Cambridge (Harvard College Observatory dome) west of Greenwich (meridian)*:—

| | h. | m. | s. | s. |
|---|---|---|---|---|
| 1866 ... ... ... ... | 4 | 44 | 30·99 | ± 0·10 |
| 1870 ... ... ... ... | | | 30·98 | ± 0·06 |
| 1872 ... ... ... ... | | | 30·98 | ± 0·04 |
| Mean ... ... | 4 | 44 | 30·98 | ± 0·04 |

Referring this mean value to Paris (meridian of France) we have:—

Cambridge—Paris ... 4h. 53m. 51s·95 ± 0s. ·06

These results, combined with elaborate determinations of the longitude difference, Washington-Cambridge, give:—

| | h. | m. | s. | s. |
|---|---|---|---|---|
| Washington (Naval Observatory) —Greenwich ... ... | 5 | 8 | 12·09 | ± 0·05 |
| Washington (Naval Observatory) —Paris ... ... ... | 5 | 17 | 33·05 | ± 0·07 |

We may, therefore, consider the geographical position of the Washington Observatory as one of the best determined in reference to others.

One of the incidental but highly important results of this expedition is the longitude difference Greenwich-Paris, the accuracy of which was checked by the conditions involved in the closing of the longitude triangle Greenwich-Paris-Brest. The result, 9m. 20s.·97 must now supersede the value obtained by Mr. Leverrier in 1854, which it exceeds by nearly half a second.

## ANTOINE CÉSAR BECQUEREL

IT is with regret that we record the death of the noted French physicist, Prof. Becquerel, which occurred on January 18, in Paris. Antoine César Becquerel was born at Châtillon-sur-Loing, in the Loiret department, March 8, 1788. After completing a course in the Paris Polytechnic, he entered, in 1808, the Imperial Engineer Corps. It was no time of idleness for young officers, and he was shortly in active service, taking part in the entire Spanish campaign under General Luchet. Here he was present at the sieges of Torbosa, Tarragona, Lagonte, and Valencia, and manifested such marked abilities that in 1812 he returned to Paris to receive the rank of captain, and be presented with the Cross of Chevalier of the Legion of Honour, from Napoleon's own hands. In the following year he was sent by the Emperor to complete the fortifications on the German frontier. At the fall of the empire, in 1815, he resigned his position as chief of battalion in the Engineer Corps, and devoted himself exclusively to physical and chemical research, accepting a position as teacher in the Musée d'Histoire Naturelle, of Paris. In 1837 he was made professor in this institution and occupied this position up to the time of his death. Shortly after entering upon his scientific career he commenced the remarkable series of investigations in electricity and magnetism which have been uninterruptedly continued during the past half-century, and have linked his name closely with every branch of these two leading departments of physics. In thermo-electricity Becquerel carried out a large number of experiments on the currents caused by heating both a single metal and two metals in contact, and formulated the well-known thermoelectric series, bismuth, platinum, lead, tin, gold, silver, copper, zinc, iron, and antimony. In his studies on atmospheric electricity he proved that the water of the ocean and the solid crust of the earth are in opposite electrical conditions, a fact which explains the positive state of the air immediately above the sea, while at a distance from the ocean the positive change is noticeable only at a certain height above the earth. The physiological effects of the electric current formed likewise the subject of numerous observations, and by means of delicate apparatus he was able to demonstrate the development of minute currents by the various operations of life, the movement of the muscles, &c. In view of the purely chemical character of these operations these observations harmonised perfectly with the theory which he advanced that electric currents were produced by all chemical unions and decompositions.

The effects of electricity on the colours of flowers, he showed to consist chiefly in a mechanical bursting of the cells containing colouring matter, and not in a chemical change. The conductive powers of a number of elements and compounds for the electric current, as well as the thermal phenomena in bad conductors, formed likewise the subject of numerous investigations. In magnetism Becquerel's researches were confined chiefly to the demonstration of the ability of all bodies to be magnetised, and to the phenomena of terrestrial magnetism. His favourite field of discovery, and that in which he obtained the most brilliant results, was electro-chemical action; in the variety and value of his contributions in this department he is certainly surpassed by no other physicist, while he was the first to grasp and sum together the scattered observations, and fairly mould them into a science. In 1834 he observed the deposition of metal on the negative electrode when the two poles of a pile were introduced into solutions of the salts of various metals. Shortly after he discovered that by using feeble currents the metal could be deposited very evenly and equally on the surface of the electrode, and that the two solutions required for the purpose could be kept from mingling by the use of gold-beater's skin or animal membranes, without hindering the current. These facts were at once made use of by De la Rive, of Geneva, who based on them his technical process of gilding in 1840. Although not the first to make the practical application of his discoveries, Becquerel rapidly improved the methods derived from them, and contributed in swift succession an enormous number of facts which serve as the fundamental principles of the art of galvano-plastic. These are to be found in a compact state in Smee's Elements of Electro-metallurgy. Becquerel's famous *Oxygen-circuit*, discovered at this time, made his name known at once to a large circle, on account of its simple, practical quantities. It consists of a glass tube covered at one end with linen, which supports a layer of kaolin, and designed for the solution of the metallic salt to be reduced. This is placed in a vessel containing a dilute acid, and the object to be electro-plated is immersed in the solution after being connected by a wire with a platinum plate in the acid. The action begins instantaneously, and is both rapid and regular. Another well-known apparatus is his *depolariser*, an arrangement designed to obviate the reverse currents produced by the gaseous deposits on platinum electrodes, and consisting essentially in a continuous shifting of each of the plates to the liquid of the other, so that they have no opportunity to become polarised. The oxygen-circuit, with its gentle regular current, was used by Becquerel for the decomposition of a large variety of chemical compounds. Among the more noteworthy preparations by its action can be mentioned aluminium, silicium, beryllium, sulphur, and the various earthy and metallic phosphates. Equally extensive were the preparations of crystalline salts, notably those occurring in nature, by the action of the electric current on mixed solutions or on solutions of soluble salts in contact with insoluble substances. During the past ten years his attention has been almost exclusively devoted to the novel and remarkable electro-capillary phenomena first observed by him in 1867. These can be observed in their simplest form when a cracked test-tube containing a solution of cupric sulphate, for example, is immersed in a solution of sodic sulphide. A deposition of metallic copper takes place at once on the crack. This elementary fact has been elaborated in a variety of directions with numerous solutions, and the laws regulating the development of electric currents by capillary action partially enunciated. The study of these phenomena is, however, still in its infancy. Becquerel regarded them as explanatory of the deposition of metals in veins in the rocks and of many physiological reactions taking place in the vegetable and animal tissues. A very detailed account of the experiments is to be found in vol. xxxvi. of the *Mémoires de l'Institut.*

Despite his manifold experimental investigations, Becquerel was an indefatigable author, and contributed a most valuable series of standard works to the physical literature of the past forty years. In the seven volumes of his "Traité expérimental de l'Électricité et du Magnétisme, et de leurs Phénomènes naturels," 1834-40, he presented these two sciences with a completeness and systematic arrangement which has been hitherto wanting in physical literature. This work was followed by "Éléments d'Électro-Chimie appliquée aux Sciences naturelles et aux Arts," 1843; "Traité de Physique considérée dans ses Rapports avec la Chimie," 1844, 2 vols.; "Éléments de Physique terrestre et de Météorologie," 1847; "Traité de l'Électricité et du Magnétisme; leurs Applications aux Sciences physiques, aux Arts, et à l'Industrie," 1856, 3 vols.; Résumé de l'Histoire de l'Électricité et du Magnétisme," 1858; and "Des Forces physico-chimiques et de leur Interprétation dans la Production des Phénomènes naturels," 1875.

In 1829 Becquerel was elected a member of the French Academy, and received in 1874 the Medaille Cinquantenaire, although he had been but forty-five years a member. His scientific communications are to be found in the *Comptes Rendus* of the Academy and in the *Annales de Chimie et Physique*. The Royal Society elected him as a corresponding member a number of years ago, and he was one of the three French *savants* who have been recipients of the Copley Medal. In 1865 Napoleon III. decorated him with the Cross of Commander of the Legion of Honour.

Prof. Becquerel leaves behind him a son, Edmond Becquerel, Professor of Physics in the Conservatoire des Arts et Métiers, who has assisted his father for a long series of years in the compilation of his numerous works, and whose researches in electricity fairly rival those of the latter. The funeral ceremonies took place on Monday in the church of St. Medard, at Paris.

## *DAVYUM* [1]

ABOUT the middle of this year (1877) I succeeded in isolating a new metal belonging to the platinum group. I named it Davyum, in honour of Sir Humphry Davy, the eminent English chemist.

The platiniferous sand from which it has been extracted [2]

[1] From an article by Sergius Kern in *La Nature.*

[2] The sand treated had the following composition:—

| | |
|---|---|
| Platinum | 80·03 |
| Iridium | 9·15 |
| Rhodium | 0·61 |
| Osmium | 1·35 |
| Palladium | 1·20 |
| Iron | 6·45 |
| Ruthenium | 0·23 |
| Copper | 1·02 |
| | 100·09 |