the material into iridiate and rhuthenate of potash, and the oxidation of the iron; when cold, the mixture is treated with cold distilled water. The iridiate of potash of a blue tinge will remain as a deposit almost insoluble in water, more especially if slightly alkaline, and also the oxide of iron.

This precipitate must be well washed with water charged with a little potash and hypochlorite of soda until the washings are no longer coloured, and then several times with distilled water.

The blue powder is then mixed with water strongly charged with hypochlorite of soda, and allowed to remain for a time cold, then warmed in a distilling vessel, and finally brought up to boiling point until the distillate no longer colours red, weak alcohol acidulated with hydrochloric acid.

The residue is again heated with nitre and potash water charged with hypochlorite of soda and chlorine, until the last trace of ruthenium has disappeared.

Further, to carry out the purification, the blue powder (oxide of iridium) is re-dissolved in aqua regia, evaporated to dryness, re-dissolved in water, and filtered.

The dark-coloured solution thus obtained is slowly poured into a concentrated solution of soda and mixed with hypochlorite of soda, and should remain as a clear solution without any perceptible precipitate, and subjected in a distilling apparatus to a stream of chlorine gas, should not show a trace of ruthenium when hydrochloric acid and alcohol are introduced into the receiver. In this operation the chlorine precipitates the greater part of the iridium in a state of blue oxide, which, after being collected, washed, and dried, is placed in a porcelain or glass tube, and subjected to the combined action of oxide of carbon and carbonic acid obtained by means of a mixture of oxalic with sulphuric acid gently heated.

The oxide of iridium is reduced by the action of the gas leaving the oxide of iron intact, the mass is then heated to redness with bi-sulphate of potash (which will take up the iron and any remaining trace of rhodium), and after subjecting it to many washings with distilled water, the residue is washed with chlorine water to remove any trace of gold, and finally with hydrofluoric acid, in order to take out any silica which might have been accidentally introduced with the alkalies employed or have come off the vessels used.

The iridium after calcination at a strong heat in a charcoal crucible, is melted into an ingot.

*Alloy of Iridio-Platinum*

Operating upon a charge of 450 ounces of platinum and 55 ounces of iridium, I commenced by melting these metals together and casting into an ingot of suitable shape, which I then cut into small pieces with hydraulic machinery. After re-melting and retaining in a molten condition under a powerful flame of oxygen and common gas for a considerable time, I re-cast and forged the mass at an intense white heat under a steam hammer, the highly-polished surfaces of which were cleaned and polished after each series of blows—when sufficiently reduced the alloy was passed through bright polished steel rollers, cut into narrow strips, and again slowly melted in a properly-shaped mould, in which it was allowed to cool. I thus obtained a mass of suitable shape for forging, perfectly solid, homogeneous, free from fissures or air-holes, and with a bright and clean surface.

A piece cut from the end of a mass so prepared, was presented to the French Academy of Science, and gave the following results :—

| | |
|---|---|
| Weight in air ... ... ... | 116·898 grms. |
| ,, water ... ... ... | 111·469 ,, |
| Showing a density of ... ... | 21·516 ,, |

thus proving that the necessary processes of annealing at a high temperature had caused it to resume its original density.

The analysis gave—

| | 1 | 2 |
|---|---|---|
| Platinum ... ... ... ... | 89·40 | 89·42 |
| Iridium ... ... ... ... | 10·16 | 10·22 |
| Rhodium ... ... ... ... | 0·18 | 0·16 |
| Ruthenium ... ... ... ... | 0·10 | 0·10 |
| Iron ... ... ... ... | 0·06 | 0·06 |
| | 99·90 | 99·96 |

From which is deduced :—

| | Proportion. | Density at zero. | Volume. |
|---|---|---|---|
| Iridio-platinum at 10 per cent. | 99·33 | 21·575 | 4·603 |
| Iridium, in excess ... ... | 0·23 | 22·380 | 0·010 |
| Rhodium ... ... ... | 0·18 | 12·000 | 0·015 |
| Ruthenium ... ... ... | 0·10 | 12·261 | 0·008 |
| Iron ... ... ... ... | 0·06 | 7·700 | 0·008 |
| | 99·90 | | 4·644 |

Density at zero, calculated after No. 1 analysis 21·510
Density at zero, calculated after No. 2 ,, 21·515

which coincide perfectly with the practical results obtained."

MM. Deville and Mascart find the coefficient of dilatation to be from 0° to 16° C. 0·00002541.

As we have already pointed out, work on which the accuracy of standards depends is of the highest importance, and Mr. Matthey is therefore to be congratulated on the success of his labours.

## *THE INFLUENCE OF THE TRANSVERSE DIMENSIONS OF ORGAN PIPES ON THE PITCH*

In NATURE, vol. xix. p. 172, Mr. Ellis gives, on the authority of M. Cavaillé-Coll, a rule determining a point of some interest in regard to organ-pipes. All those who are accustomed to organs know that the theoretical rule which makes the vibration-number of the note sounded vary inversely as the length of the pipe, does not hold correctly in practice, as the pitch is influenced by the *transverse dimensions*. A pipe of "large scale," *i.e.*, of large diameter, will speak a lower note than one of "small scale," the length of the tube being in both cases the same. I am not aware that this fact has been explained in acoustical works, or any rule given for the variation.

Mr. Ellis's formula provides for this, so far as cylindrical pipes are concerned, and he has found it to agree well with experiment. There is a misprint in his equation, which at first sight renders it somewhat obscure, and in correcting this I will venture to present M. Cavaillé-Coll's investigation more completely, as it was expressed by him in a paper presented to the Academy of Sciences many years ago, and a copy of which he was good enough to give me.

After calling attention to the theoretical rule, he remarks that the departure from it is due to the influence of the *mouth* of the pipe, *i.e.*, the rectangular opening at the lower end of the tube. He made many experiments to determine the effect of this, and came at length to the result that in open pipes of rectangular section the *effective length of the pipe* was equal to the *length of the sound-wave* due to its note [or the half wave-length according to our mode of calculation] *diminished by twice the internal depth* of the tube. By the "depth" is meant the transverse dimension from front to back; the other transverse dimension, the *width*, appearing to be of no consequence.

Thus, if $S$ represent the velocity of sound, $V$ the number of vibrations per second (*single* ones, according to the French mode of calculation), $L$ the length of the pipe, taken from the lower edge of the mouth to the end of the tube; and $P$ the internal transverse depth, then—

$$L = \frac{S}{V} - 2P.$$

M. Cavaillé-Coll gives two examples of applications he made of this formula :—

1. A wood pipe sounding what is called 4-foot C, 264 [single] vibrations per second at the normal French pitch, and having a depth of 8 centimetres, was found to have a length of $1^{m}\cdot13$. Taking the velocity of sound at 10° to 15° C. to be 340 metres per second, the equation would give—

$$\frac{340}{264} - 0\cdot16 = 1^{m}\cdot128,$$

differing only 2 millimetres from that actually found.

2. The large 32-foot pedal pipe of the organ of St. Denis was at first cut to a length of $9^{m}\cdot566$, the internal depth being $0^{m}\cdot48$. The number of single vibrations per second was intended, according to the standard pitch, to be 33, according to which the equation gave—

$$\frac{340}{33} - 0\cdot96 = 9^{m}\cdot36$$

as the calculated length. This showed the pipe to be too long, which proved to be the fact, the note being too flat. An opening was then made to reduce the effective length to that given, when the pipe was found to be in perfect tune.

In applying the formula to *cylindrical* pipes, M. Cavaillé-Coll found the same law obtain; allowing for the difference in shape, and for the flattening of the pipe necessary to form the mouth properly, he considered that the mean depth was about equal to five-sixths the diameter, or—

$$P = \frac{5}{6} D.$$

Substituting this in the above equation it becomes, for cylindrical pipes—

$$L = \frac{S}{V} - \frac{5}{3} D.$$

Taking now the mean velocity of sound given by M. Cavaillé-Coll, namely, 340 metres or 1115 feet per second; putting the dimensions of the pipe in inches, and altering $V$ to represent the number of *double* vibrations per second, according to our English custom; we obtain, finally, for cylindrical pipes—

$$L = \frac{6690}{V} - \frac{5}{3} D; \text{ or}$$

$$V = \frac{20070}{3L + 5D}.$$

Mr. Ellis's rule is—

$$V = \frac{20080}{3L + 5V}.$$

the letter $V$, however, in the denominator being clearly a misprint for $D$.

The foregoing rules, it must be stated, apply to pipes *open at the end*, which constitute the great bulk of those in an organ.

WILLIAM POLE

## GEOGRAPHICAL NOTES

THE letter from Sir Rutherford Alcock in yesterday's *Times*, announcing the death of Mr. Keith Johnston, will be received with surprise and sincere regret. As our readers know, Mr. Johnston was leading the Geographical Society's expedition from Dar-es-Salaam to the north end of Lake Nyassa, and, if possible, thence to Tanganyika. A start was made on May 14, and now the sad news comes that the young leader died of dysentery on June 28, at Berobero, about 130 miles inland. Mr. Johnston came of a famous geographical house, and had already done good exploring work in South America. He was enthusiastic on the matter of African exploration, and was well qualified to carry it out in a scientific method. His death is a real loss to scientific geography. We are glad to learn that the expedition will be continued under the leadership of Mr. Thomson, the geologist who accompanied Mr. Johnston.

IT is with great pleasure we learn from a letter of Dr. G. Nachtigal to the editor of Petermann's *Mittheilungen*, that the announcement of Dr. G. Rohlfs' retirement from the leadership of the expedition of the German African Society was premature. He did express a wish to resign, but has since been able to overcome all initiatory difficulties, and left Benghazi with his followers on July 4, and it is hoped will be able to reach Abesh, the chief town of Wadai, about the middle of next month. Dr. Nachtigal's account of his own great exploring work in North and Central Africa from 1869 to 1874 has just been published in Berlin.

AT the last sitting of the Paris Geographical Society, M. Paul de Soleillet explained his scheme for putting Timbuctu in communication with the Atlantic. A railway must be made from Dakkar, on the Atlantic coast and St. Louis, the head city of French Senegal. This work will be begun next winter. The Senegal must be rendered navigable from St. Louis to Bafoulabé, and a canal constructed from Bafoulabé to Bamakou, on the Niger. These projects having been adopted by the High Commission, the Survey for the canal will begin immediately. The Niger is navigable without works of any description from Bamakou to Timbuctu and other places below for a distance of 1,500 miles. The aggregate expense required for the whole of the work is estimated at a million sterling, and the number of people placed in close connection with French Senegal thirty-seven millions. A M. Fourreau has sent a letter to the President of the Society stating that he, with two friends, had established a farm in Oued Bish, about 150 miles southward of Biskra, in the direction of the intended Transaharian Railway *viâ* Biskra. The exploration committee of the Saharan Railway Commission has recommended the Government to send out M. Soleillet to visit the unexplored regions between 15° and 25° N. lat.

TAKEN as a whole, the August number of the Geographical Society's monthly periodical appears to be the best that has been issued. The papers are Major Serpa Pinto's notes of his journey across Africa; Mr. McCarthy's "Across China, from Chinkiang to Bhamo;" and the late Capt. R. R. Patterson's notes on Matabeli-land. The map of South Africa, accompanying Major Pinto's notes, is particularly interesting, as it embodies a good deal of original information. The geographical notes are unusually full and varied, and we are glad to observe that greater attention is being paid to this most essential department of a geographical magazine. Since the note on Major Tanner's exploratory visit to Kafiristan was written, news has unfortunately arrived that ill-health has compelled that officer to return to India. There is a useful summary of Dorandt's report, published by the Russian Geographical Society, on his astronomical and magnetic observations on the Lower Oxus, and of Mr. Hillier's account of his journey in North China at the beginning of this year. Climatology also claims a place among the notes. The remainder of the number is occupied with a report of the evening meetings, the proceedings of foreign societies, and notes on new books and maps.

NEWS has just been received at Copenhagen from the scientific expedition which sailed for Greenland in the *Ceres* on March 29 last. The expedition, which consists of two naval officers, MM. Jansen and R. Hammer, and a student of polytechnics, M. Kornerup, reached the Holsteinborg Colony, in Greenland, on April 30, and at once proceeded with their investigation and measurement of the coast and fjords between Holsteinborg and Egedesminde. They left the neighbourhood of Holsteinborg on May 15, travelling in small Greenland boats. From that date to the end of August, when they hope to reach Egedesminde, the explorers will have to camp in their boats or on the rocky shore. However, the summer nights are bright in those latitudes, and the expedition is well equipped with all necessaries.