Highway Construction in Wisconsin. By E. R. Buckley, State Geologist of Missouri. Pp. xvi+339. (Published by the State at Madison, Wis., 1903.)

THIS book forms part of the Economic Series of works published by the State of Wisconsin, and is an evidence of the trouble that is taken in the United States to furnish the officers having charge of the various departments with the fullest information as to their work that is available.

It contains eight chapters, relating respectively to the classification of highways, and the agents that destroy pavements; materials used in improving highways; methods of constructing different kinds of pavements; drainage; pavements constructed in the larger cities; abrasion and cementation tests.

In the introduction the writer points out that a purchaser or seller who is separated from a railway station by ten miles of good roads is actually nearer his market than the person who is separated by five miles of unimproved roads. Good roads mean heavier loads, more rapid transit, and a longer life for vehicles and horses.

That such a work as that now under notice is urgently required in the State of Wisconsin may be inferred from a further statement made by the author, that a dog is able to draw a load to market in many European countries which a horse cannot draw in the United States, and that up to the present time highways in Wisconsin are simply narrow tracks connecting different parts of the country, the one idea of construction being to fill the gullies and level off the roadway with such material as might be closest at hand.

There is some useful information contained in the book as to the tests carried out by the State for ascertaining the relative wearing values of different kinds of stones used in road-making, from which a lesson might well be learnt by the county councils in this country as to the advantage to be gained by maintaining an establishment for supplying their road surveyors with trustworthy data of this character.

There is one kind of pavement in use in some of the cities that might with advantage be used in this country, that is, blocks made of asphalt and laid in the same way as granite pavings. This pavement is stated to be non-slippery, while at the same time it is noiseless and non-absorbent. The cost is about the same as sheet asphalt.

Practical Chemistry. Part ii. By William French, M.A., F.I.C., and T. H. Boardman, M.A. Pp. xiii+126. (London: Methuen and Co., 1904.) Price 1s. 6d.

THIS book contains a well arranged series of experiments of a kind suitable for young students who have already spent a fair amount of time at practical chemistry. The physical properties of gases, the laws of chemical combination, sulphur and its compounds, some nitrogen compounds, and carbon and its simpler compounds, are among the chief subjects included in the volume.

Marsh-Country Rambles. By Herbert W. Tompkins. Pp. xi+307. (London: Chatto and Windus, 1904.) Price 6s.

MR. TOMPKINS confines his rambles, with few exceptions, to the marshlands east of the road which leads from Prittlewell to Maldon and Colchester, and south of the road from Colchester to St. Osyth. He does not pretend to offer the reader detailed descriptions of villages and towns, but rather to provide an interesting narrative in which history and legend are incidentally touched upon. With the exception of a frontispiece the book is not illustrated.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Occurrence of Thorium in Ceylon.

THE Government of Ceylon determined last year to carry out, with the cooperation of the scientific and technical department of the Imperial Institute, a systematic survey of the economic minerals of Ceylon. Mr. A. K. Coomaraswamy and Mr. H. G. Parsons were selected to conduct the survey in Ceylon, and to dispatch specimens of the minerals found to the Imperial Institute for chemical examination and commercial valuation. Among the specimens thus received were those of a mineral existing in small black cubical crystals found in the refuse from gem washings near Balangoda, in the Sabaragamuwa Province, which had been identified by Mr. Holland, a resident in Ceylon, as probably uraninite or pitchblende. The same mineral has been since observed by Mr. Coomaraswamy in a vein of pegmatite at Gampola, in the Central Province of Ceylon.

The specific gravity of the mineral was found to be 9·32, and an analysis by Mr. G. S. Blake, of the scientific staff of the Imperial Institute, furnished the following results:—

		Per cent.
Thorium oxide	ThO_2	76·22
Cerium oxide	CeO_2	} 8·04
Lanthanum and didymium oxide	La_2O_3 Di_2O_3	
Zirconium oxide	ZrO_2	trace
Uranium oxide	UO_3	12·33
Ferric oxide	Fe_2O_3	0·35
Lead oxide	PbO	2·87
Silica	SiO_2	0·12
		99·93

The mineral is clearly not pitchblende, since the percentage of oxide of uranium is only about 12 per cent., whilst the principal constituent is oxide of thorium (thoria), which is present to the extent of more than 75 per cent., an amount far higher than that contained in any mineral hitherto examined. This mineral appears to be new, and I suggest for it the name of *thorianite*. Since it is radio-active, it will no doubt be found to be an important source of radium or radio-active earths, and will probably furnish helium, points which will be investigated as soon as more material has been obtained.

A second part of the same specimen furnished the following results on analysis:—

		Per cent
Thorium oxide	ThO_2	72·24
Cerium oxide	CeO_2	6·39
Lanthanum and didymium oxide ...	La_2O_3 Di_2O_3	0·51
Zirconium oxide	ZrO_2	3·68
Uranium oxide	UO_3	11·19
Ferric oxide	Fe_2O_3	1·92
Lead oxide	PbO	2·25
Silica	SiO_2	1·34
Insoluble residue		0·41
		99·93
Specific gravity		8·98

The two sets of analytical data prove that the material has essentially a uniform composition, the differences observed being apparently due to inclusions of zircon in the second portion analysed.

In the meantime Sir William Crookes has received a specimen of the supposed pitchblende from Ceylon, and has found it to be radio-active to about the same extent as Cornish pitchblende.

Sir William Crookes was good enough to give me a part of his specimen, which is being analysed.

The second mineral examined was found by Mr. Holland in the same gem washings at Balangoda, and was identified as probably monazite. This mineral was pale brown, and when fractured exhibited a purple brown interior with a resinous lustre. The specific gravity was 4·98. An analysis by Mr. Blake furnished the following results:—

		Per cent.
Thorium oxide	ThO_2	66·26
Cerium oxide (and Cerium earths)	CeO_2	7·18
Zirconium oxide	ZrO_2	2·23
Uranium oxide	UO_3	0·46
Ferric oxide	Fe_2O_3	1·71
Calcium oxide	CaO	0·35
Phosphoric oxide	P_2O_5	1·20
Silica	SiO_2	14·10
Water	H_2O	6·40
		99·89

This mineral is therefore thorite, consisting chiefly of thorium silicate. Both these minerals are under further investigation at the Imperial Institute. Careful explorations are now being made as to the extent of their occurrence in Ceylon.

It is obvious that apart from the scientific interest attaching to the determination of their composition, the discovery in Ceylon of two minerals rich in thoria, now so largely employed for the manufacture of incandescent gas mantles, may be of considerable commercial importance.

Imperial Institute, March 29. WYNDHAM DUNSTAN.

Ionisation of Air.

SOME experiments have been recently made at the Cavendish Laboratory which seem to throw light on the question of the "spontaneous" ionisation of air. The anticipation of a detailed report of these in a short summary of the results obtained may serve some useful purpose by preventing a waste of energy on the part of others who are engaged in investigating the same subject.

The experiments consist in the determination of the saturation current through rectangular vessels, lined with the metal under investigation, the volume of the vessels being capable of alteration by the motion parallel to itself of one of the sides of the vessel. On plotting a curve the ordinates of which are the saturations currents and the abscissæ the distance of the movable side from the side opposite to it, it becomes clear that there are two separate distinct kinds of radiation causing the ionisation of the gas:—(1) a radiation coming from the sides of the vessel which is completely absorbed by some 5 cm. of air, and which, therefore, when the volume is considerable, gives an ionisation proportional to the surface of the vessel; (2) a much more penetrating radiation, which at all volumes gives an ionisation proportional to the volume of the vessel. Further experiments were then made by surrounding the vessel with lead sheets about 3 cm. thick and repeating the determination of the variation of the ionisation with the volume. The lead screen diminished the ionisation; by this method it was possible to discover which part of the radiation suffered diminution.

Up to the present time four metals have been investigated, lead, aluminium, zinc and tin foil. Of these, in the absence of the screen, the first three gave approximately the same value for the penetrating radiation causing volume ionisation. The absorbable radiation causing surface ionisation was greater for the aluminium than for the zinc, and still greater for the lead. When the screen was applied the penetrating radiation was diminished to about two-fifths of its value for all three metals. In the lead and the aluminium the value of the surface ionisation remained unaltered by the screen, but in the zinc this was decreased, and fell to about three-fifths of its original magnitude.

The tin was quite peculiar in its behaviour. The normal volume ionisation was only about one-third of that in the other metals, and when the screen was applied both the surface and the volume ionisations fell in the same proportion to two-thirds of their former values.

It is pretty clear, therefore, that at least in the case of tin and zinc we have secondary radiation given off from the surfaces of those metals under the influence of penetrating radiation coming from outside.

Some numbers may be useful to give an idea of the respective magnitudes of the radiations mentioned. Taking an arbitrary unit, the values for the ionisation caused by one square centimetre of surface of the metals are as follows:—lead 38·6, tin 33, aluminium 10, zinc 7·9. On the same scale the values of the ionisations due to the penetrating radiation in 1 c.c. of air enclosed in a vessel of these metals is for lead, aluminium and zinc between 3·2 and 2·8; for tin it is 0·9.

It is probable that many of the discrepancies that have appeared between the results obtained by different physicists may be explicable by a difference in the metal of which their vessels were composed. For example, it is clear that it might be possible to detect the effect of a screen on a zinc vessel, while in a lead vessel the diminution of ionisation due to the same screen would be inappreciable; similarly, it would be possible to measure in a lead vessel effects due to the surface radiation which could not possibly be detected if zinc were substituted for the lead. Further experiments on different metals, and with other modifications, are in preparation, which it is hoped will throw more light on this interesting problem.

NORMAN N. CAMPBELL.

Trinity College, Cambridge, March 25.

Respiration in Frogs.

Is the buccal cavity of the frog a respiratory chamber? In a letter to NATURE, March 24, Mr. M. D. Hill accepts this conception of it, and yet the only evidence which can be offered in support of this view is the rich blood supply of its lining membrane. The lungs and skin, which are known to be respiratory surfaces, are supplied by a special circulation; the buccal cavity is neither more nor less supplied with blood than the other parts of the alimentary tract, which are certainly not respiratory.

The oscillatory movement of the frog's pharynx, which occurs when the lungs are filled and the opening to the larynx closed, is one of a number of points connected with the respiratory system which have not yet been satisfactorily explained. The other points are:—(1) the evolution of the reptilian method of respiration from the amphibian; (2) the meaning of the laryngeal and bronchial musculature found in amphibians, reptiles, birds and mammals; (3) the closure of the auditus laryngis of the amphibian during the respiratory phase; (4) the attachment of part of the transversalis and rectus abdominis to the pericardium and roots of the lungs; (5) the air in contact with the respiratory surface of the lungs is always very impure. All these points, with the exception of the last, find their explanation in the fact that the act of respiration in all forms of vertebrate life produces two effects within the lungs:—(1) air is drawn into the air spaces; (2) blood is drawn into the pulmonary capillaries. Further, the rate of flow in the pulmonary capillaries, which are situated in the septa between the air cells, is determined by the pressure within the air cells. The air within the lung is used as a brake for regulating the pulmonary flow of blood. That is to say, the act of respiration in reptiles, mammals and birds has two effects, one on the air and another on the blood within the lung. In amphibians these two effects are apparently obtained by separate means.

In the major movement of amphibian respiration the air is forced within the lungs by the muscles of the pharynx and expelled by the contraction of the muscles of the body wall. In both phases of that movement, which are for the renewal of air within the lung, the pulmonary circulation is retarded by the positive pressure of the breathed air. When the lungs are filled and the opening of the larynx closed, the minor movements set in. They vary in different genera of frogs, but taking the noisy frog (*Rana clamata*) as a type in which to observe these movements, it will be noticed that the body wall muscles, especially the transversalis, contract and rather expand the body at the same time as the larynx is drawn downwards. In all Amphibia the larynx, pharynx, and their muscles are so closely bound up with the lung that the pressure of the pulmonary air must be affected by their movement. In short, the oscillatory movements of the pharynx in the Amphibia (and also in turtles and tortoises) create a negative pressure within the amphibian lung, and thus regulate and accelerate the flow of blood through that organ. For that reason