in a very bad condition, owing to a similar cause; but the greater part of this building is really as well preserved as can be expected, when it is remembered that the stones were admitted without selection, were taken from quarries before untried, and were for the most part made use of in the building shortly after being taken from the quarry. On the other hand, St. Paul's Cathedral and Greenwich Hospital, built of Portland stone, are specimens of the minimum of injury from exposure, the stones having been selected and worked in slowly. Many parts of Westminster Abbey are in a very indifferent state, and perhaps some of the restorations in Bath stone, not long completed, are as bad as any. On the other hand, the Geological Museum in Jermyn Street is very perfect, chiefly owing to care taken in the selection of the stone. It is to be hoped that the selection of material to be used in the new Law Courts will not be left altogether to the accident of a contractor's interest, as has sometimes been the case, or to the want of agreement between the architect and the Government, as was the case with the Palace at Westminster.

But the subject of the weathering of stone is in itself sufficiently extensive and important to justify a separate and elaborate memoir. It is a subject also that is very urgent, for there cannot be a doubt that all causes of deterioration are more energetic in recent times than formerly, owing partly to the great rapidity with which work is carried on, and partly to the increasing quantity of deleterious gases present in the air. A stone that may be safely used in one place, would rapidly decay in another, and a stone that with care and attention might be very durable, might turn out to be a complete mistake for the want of these considerations. The case requires that the chemist should combine with the geologist, and both must possess much practical experience before any valuable conclusions can be drawn.

Much may, however, be done by careful investigation, to determine the relative value and probable enduring power of different kinds of material. A definite method, known as "Brard's method," introduced by a French chemist of that name, was at one time much resorted to. By boiling limestones in a saturated solution of sulphate of soda, and subsequently crystallizing the salt within the stone, some idea was obtained of the relative enduring power of the more absorbent stones. There are some practical reasons why this determination has been found in certain cases incorrect, and it is not now much resorted to. Very careful and minute local examination, not only in the quarry, but in the laboratory, a consideration of the behaviour of the stone, when exposed to acid vapours, and a knowledge of its geological history, will give useful suggestions; but the best stone used carelessly will be a failure, and a very inferior material carefully treated, may turn out very well. No stone can be regarded as free from injury on exposure, and granites, as well as soft limestones, need examination before they are employed for purposes where permanence is important. In treating of this part of the subject, I must not omit to mention the well-known report of Sir H. de la Beche, and the other commissioners for selecting the stone for the Houses of Parliament, for it must not be supposed, that because the material has not turned out well, that this is necessarily the fault of the scientific and practical men who prepared this report. It must still be regarded as the best summary of knowledge concerning British building stones.

The method adopted by the commissioners in this enquiry was, I need not remind you, to visit the principal quarries, take samples of the stones, examine various buildings constructed of the material, and make a physical investigation and chemical analysis of the samples. They omitted what was, perhaps, most important, a consideration of the probable behaviour of the stones, when used in a London atmosphere; believing that if a stone would resist exposure in a country village, it could be trusted everywhere. The result has proved that such is by no means the case, but notwithstanding this, the report and references remain of great value. As you are in possession of an admirable series of specimens of the stones examined by the commissioners, selected by Mr. Charles Smith, whose intelligence and knowledge of the nature of material were well known and fully appreciated by all who had the pleasure of being acquainted with him, I can only recommend the study of these specimens to all who would obtain an idea of the resources of England in freestones of all kinds. The report has, I believe, been reprinted. It should be in the office of every architect.

An account of the various modes of resisting the destructive process of weathering, belongs to another department of geology applied to architecture, on which I must say a few words, but on which I must also touch very lightly, for here also chemistry and geology must combine to secure useful results, and the facts are too numerous and too important to treat of at the end of a communication already expanded to some length. Various processes have been recommended and adopted for the purpose of protecting the softer and more absorbent stones, especially limestones, from weather action. They have been applied very often after a building has been completed, and is already partly injured, and I fear we must all admit now, that under such circumstances very little permanent good can be done. Two very distinct classes of treatment are recognised, one being the application of an oleaginous skin, which will resist moisture as long as it resists oxidation, but not a day longer. Paint is of this kind. The other is the deposit within the substance of the stone, or on its surface, of some non-absorbent mineral, by a process of double decomposition. Of this kind are numerous contrivances, invented and patented, and some of them well known. The method of Mr. Kuhlmann, of Lille, involving a wash of silicate of potash or soda, called water glass, soaked into the substance of the stone, and forming a silicate of lime by slow decomposition and replacement, was the first commencement of a series of appliances of the same general nature. Perhaps the most simple, the most rapid, and the most economical, is that patented by Mr. Frederick Ransome, formerly of Ipswich. According to this, the deposit of a coat of silicate of lime is secured by following a wash of the soluble silicate of soda, by a wash of chloride of calcium. A double decomposition immediately sets in, and while on the one hand a very insoluble silicate of lime is rapidly thrown down to coat each atom of the stone that has absorbed the first wash, the chloride of sodium formed by the elements set free, is highly soluble, and can be removed by washing with clean water. I believe that this method if applied to Bath stone, or even to the less good porous limestones of the oolitic series, before any change has taken place, and before the stone is used in a building, they would be improved perhaps to the condition of good Portland. Such a result is no trifle, and would amply pay the expenses incurred. Mr. Spillman has recently patented a method of coating by the aid of phosphate of lime believed to be well adapted to porous limestones.

I am aware of no method that could be depended on, to convert the inferior absorbent sandstones, more or less mixed with marl, into really good grits. Almost all sandstones are very absorbent, and houses and public buildings built of them, are apt to be damp if the surface be not protected. Silicate of lime affords probably the best protection when the stone is otherwise sound.

6. Cements.—The subject of cements is also within the province of architectural geology. Of ordinary material, it is enough to mention common mortar, a substance varying much in quality, not only according to the way it is made and managed, but with the lime used for burning. The French architects and engineers have gone perhaps more fully into the theory of manufacture than the English, but I need not remind you that there are as many varieties of lime as there are of limestone. All mortar, worth anything, improves and strengthens by age when not destroyed by disintegration and weathering, and the fat varieties or pure carbonates of lime do this the most slowly, though at the same time more efficaciously. All admixtures of silica, of silicate of alumina, and of oxide of iron appear to act mechanically, and when they reach to a certain per-centage, they tend to convert the lime obtained by burning into hydraulic lime, which sets more or less rapidly, according to its composition. The composition of pozzuolana or volcanic dust is such as to form an admirable hydraulic cement, perhaps the best when mixed with fat limes instead of sand. It is not my purpose to detain you by accounts of so well known a material, but I wish to point out that some geological knowledge will often greatly assist the practical man in deciding on the material he shall use for certain definite purposes. Thus nodules (*septario* as they are sometimes called) are very common in certain clays, and are particularly valuable. The geologist in the selection of such material will be a useful aid to the architect, for whenever a material of special quality is needed, either for common mortar or for concrete, it is clearly important that the lime should be obtained, if possible, from the neighbourhood. It is only by knowing the peculiarities of the limestones that the proper ad-