

## DISCUSSION.

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Mr. Henderson (a visitor) said:—The paper, though short, considering the nature of the subject, contained matter all very much to the point, and the tests were also very interesting, especially as they had been carried out by an authority that could be so much depended upon—Mr. Owen Blackett, of the Technical College. The speaker was surprised to notice in the tests the very small compressive strength of the bluestone from Victoria. Another matter was the comparison with what was generally called Bowral trachyte and the Sydney sandstone. He would have thought that the trachyte would have taken a pressure considerably over that mentioned in the paper. The basalt from Victoria only reached 4.87 tons to the square inch, whereas, some of the sandstone went as high as 3.19 tons to the square inch. With regard to the sandstone, however, there would be very few cases so far as building was concerned where the stone would be required to stand anything like the pressure it was able to bear. The author mentioned that the trachyte had exhibited some curious cracks, and though cracks and fissures had been known to occur from apparently inexplicable causes, yet trachyte was such a very expensive stone, not only to quarry, but to work, he did not think it would be used in preference to the Sydney stone, except for appearance in such cases as piers and columns, particularly as it took a very excellent polish. Referring to the matter of the decay of sandstone, as mentioned in the paper, the amount of moisture in the atmosphere and the amount of moisture that would be in the stone according to the different seasons of the year, as well as the acids in the atmosphere, the author had gone into the matter very carefully. It was mentioned that Sydney had a moist atmosphere on account of the number of days when rain fell, and the amount of rain.

These data would incline the speaker to the conclusion that the Sydney climate was not a very moist one, and in comparison with a great many other parts of Australia it showed a very dry climate. Taking England, for instance, there were at least 50 per cent. more days in the year upon which rain fell, with just about the same rainfall—speaking from memory, about 50 inches. With regard to the Sydney sandstone, it was noticeable that in a great many instances it had fretted away, principally in the cornices of buildings, but in some cases on the face of the walls. In most cases where it was to be seen fretted away on the face of the walls it was in buildings that were erected a great many years ago, when the scientific laying of the stone was not a matter to which much attention was given, and these particular stones were placed upon their edge instead of being laid in their natural bed. As members were aware, the sandstone is formed in layers, or, rather, is of a stratified formation, and the effect of putting this in position on its edge was to enable the atmosphere to get under the first layer, and pursue this course with every layer until the face of the stone was completely gone. In the more recent buildings, where this matter of bedding had been attended to there would be found much less evidence of the stone fretting away. Exception must be made, however, even in modern building, in the case of cornices, where stones would fret away even within twelve months of being placed in position. This was probably due to the rain falling upon the top surface of the cornice and soaking through to the bottom of the stone where it remained, there not being sufficient to cause a drip; consequently, the top was dry, and the lower portion was saturated. It was impossible for the sun to get at the inside of the cornice and the lower side remained moist for a long time and that was the portion that fretted

away first as a rule. He did not say this was the only cause of the fretting away, because, no matter how they used a stone, if it contained chemical constituents which were soluble, its disintegration is bound to take place, and he thought that was one of the reasons of the Sydney sandstone fretting away as it does. One peculiarity of the sandstone was the hard surface it obtained after a short exposure. When the stone first came out of the quarry it was very soft and easily worked, in some cases it could even be worked with a knife; but after a few months it gets a very hard skin, which took a deal of scraping to get off. There was one cause of fretting, so far as Sydney building was concerned, and that was the proximity of the city to the sea. Concerning the marbles, there were a great many fine marbles in the colony. In Orange there were several different kinds of marble, and also near Tamworth; and in the former place, considerable quarrying had taken place; but he thought most of the quarries were not now in use. At Tamworth there had never been an attempt made to quarry whilst marbles were being imported from Italy, France, and England; although, he believed, some of the manufacturers were using some of the Orange marble now; but as a rule it appeared to him that Australians preferred materials from Europe to our own national productions. There were a great many articles produced here that were as good as anything that could be obtained from Europe, and if our people would only be satisfied to use our own products, it would result in a very much larger field of employment being opened in the Colony. The speaker would have liked the author to have dealt more freely with the subject, but, perhaps, the author at some future date would go more fully into the matter, and favour the members with another paper.

Mr. T. Raw, in answer to Mr. Henderson's remarks concerning the non-use of colonial marble, said that in the Bathurst Gaol it was being extensively employed.

Mr. Howarth asked whether the adoption of our own marble in preference to that imported did not depend more or less upon the question of cost. With reference, for instance, to the Lands Office, built a few years ago in Sydney, and the use of foreign marble for panelling and pavements, the reason was that though colonial was to be used, it was found that the imported was very much cheaper, and it was chiefly on this account, and not because of the difference of quality, that the material was decided upon.

Mr. Henderson explained that the cost, to a great extent, depended upon the difficulties of quarrying, and this would be overcome by the fact that the more the marble was quarried the cheaper it would become to quarry it.

Mr. J. S. Fitzmaurice had seen a splendid exhibition of marble from Orange (dressed and undressed) which was subsequently, he believed, manufactured by Messrs. Crane & Sons into mantelpieces. Referring to the tests as a means of comparison, for small pieces, they were probably all right; but, considering their small bulk, he doubted whether the real strength of the material was obtained. With regard to the moist atmosphere he thought it was somewhat due to the North-Easterly winds, but more especially to the proximity of the sea. He knew of two instances of stone fretting away. One was at Government House, where it was particularly noticeable where some portions had appeared to him to get a full share of sunlight. With regard to colonial production, he thought, with Mr. Henderson, that too little was thought of our local industries. He felt compelled to mention an instance concerning a pottery works whose

productions in sanitary ware were of the best class, and sold at a reasonable price. As an illustration of the ability possessed by the firm, he said that a very large firm of chemists were in the habit of importing all their chemical appliances from the well-known firm of Doulton's as they had tested some of the colonially made ware and the acids used to eat them away, but they had given this firm's manufactures a trial, with the result that they found them quite equal to the imported, and suitable to their purpose. He believed the preparation of marble, as far as cheapness was concerned, was merely a matter of starting the industry properly, when the cost of preparation in comparison with the manner employed at the present time, would be much cheapened.

The Chairman, referring to the shape of blocks used in the tests, said that, as a rule, they were rectangular. With regard to an oblong shape for an absorption test, it was bound to soak in water to a greater degree than a cubical form. Another thing was that it has been found in tests where the quality of the stone could be guaranteed and relied upon for uniformity, that the larger stones have given out higher than the smaller ones. In the ancient buildings of Egypt, very heavy stones were placed together and rubbed one over the other until they were water tight, no cementing material being used. The trachyte and syenitic stones are all more or less unreliable when extraordinary strains are brought to bear upon them. Of course, to a certain point, they gave an exceedingly high unit of resistance, but when this point was reached, it meant fracture, whereas there was a certain amount of elasticity in sandstone. He believed the chemical composition of the stone was a considerable factor in the life of the stonework. For instance, in Sydney, in the same building, it would be noticed that although all the stone came from the same quarry, great

differences existed in the colours and wearing qualities of the different blocks. He had a conversation with a chemist upon this matter, and the difference in color of the Sydney sandstone is due to the fact that it is all more or less charged with ferric oxide, and when it comes into contact with the atmosphere, it becomes rusty. With reference to the use of marble, he presumed Mr. Henderson advocated the use of magnesium limestone, but where the atmosphere was not of the greatest purity, there were distressing examples of its failure, and the Houses of Parliament, London, where it was used were continually being repaired. The stone used in this building was the result of the recommendation of an investigating committee, which sat for nearly two years, but they had neglected the question of chemical analysis, and the sulphurous fumes, together with the moisture of the atmosphere coming in contact with the calcide of the lime, produced something like sulphuric acid, and this caused the stone to decay away. There was one matter mentioned by Mr. Henderson with regard to the proper bedding of the stone; but he, of course, was aware that a first-class specification was never issued without the words, "Each stone to be set on its natural bed." And, speaking of the cornices fretting away, was that not probably due to the stones being thus set?

Mr. Nangle, in reply, said:—With regard to the size of the specimens there were two reasons why he chose it. One was that they were usually so made, and another was that the testing machine could not deal with larger blocks. He desired to point out that these results were comparative only; but taking these tests as a factor and using them in a building, he thought they would not be far out. As a comparative investigation, these figures were valuable. At the beginning of the present year, he remembered the Professor of Engineering at the Univer-

sity reading a paper in which he advocated the extension of what was then being dealt with in the other countries, i.e., a uniformity of testing, so that results obtained all over the world would be comparable, and be able to estimate the value of materials here with the value of materials in the Old Country. He did not touch upon the chemical side of the question because it was such a well-known fact that from the same quarry there often came blocks with diverse chemical constituents. He did not place much reliance upon the value of chemical analysis, except generically. Speaking of marble and magnesium limestone, there was a great difference between the two. marble was a stone of a crystalline nature, closely grained, and this was its prime qualification. If a stone were to be durable, it must have the power of resisting water, and some of our stones, especially appeared to possess that power to a great degree. Some of our marbles possessed the crystalline structure and were not limestone, but true marbles.

