tance of the Zodiacal circle; now it is certainly true that a much smaller weight will suffice to produce equilibrium. Suppose, for instance, that the Zodiacal circle has a radius equal to the distance of the moon, or sixty times the earth's radius; then 22,400÷3600, say, 6 lb., suspended near the earth's surface at the end of the string, some 240,000 miles long, will suffice to balance 100 tons in the other scale pan, close up to the Zodiacal circle. But if the 100 tons is also lowered down by another mathematical string to the surface of the earth, then 100 tons is required to equilibrate it; and so it will for any intermediate position, when the lengths of the strings are equal; so that it does not tend to any clear or useful end to say that the weight of 100 tons at the distance of the moon is only about 6 lb. On the contrary, the weight of 100 tons is everywhere 100 tons.

The *weight* of a body is the *that which* is measured in lb., tons, kilogrammes, or other standards of weight; and these standards are certain lumps of metal licensed by Acts of Parliament, and carefully preserved against change or degradation.

The weight of the Earth, for instance, as determined by the Cavendish experiment, is about 6×10^{21} tons; and it is not necessary to dig up the Earth and to weigh the fragments at the surface of the Earth for the determination of this weight.

It is too late now to change the meaning of a word that has been in immemorial use in all languages; such a quasi-Gothic revival would have to restore all literature, as, for instance, the lines of Ovid (Art. Am. 3, 319):—

"Quæ nunc nomen habent operosi signa Myronis
Pondus iners quondam duraque massa fuit."

A. G. GREENHILL.

The Niagara River as a Geologic Chronometer.

WHEN we quote an author whose views coincide with our own, we are apt to speak of him as an authority on the subject; but when we dissent from the views we quote, we are not so apt to recognise the high authority of that author. This reflection on a phase of mental bias is suggested by a personal experience with reference to the age of Niagara Falls. The geologists and others who have discussed the length of post-glacial time may be rudely classed as minimists, maximists, and agnostics. Within the past five years I have been frequently and approvingly quoted by the minimists as estimating the portion of time consumed by the Niagara River in cutting its gorge at 7000 years, and the reputation thus acquired has not been noted without personal appreciation. But self-complaisance in that regard has been somewhat impaired by the thought that the honour is ill-founded, and that the insecurity of its foundation would sooner or later be discovered. Not less disturbing was the fear that when the maximists or agnostics took their turn at writing, I should be classed with the goats instead of the sheep. There can be no doubt that the manly and in every way proper course would have been followed had I years ago disclaimed the glory accidentally thrust upon me; but it is easy to bask in the sunshine of even unmerited applause, and conscience was too weak to determine action until another motive was added by a blow from the agnostic side. In his recent book Dr. James Geikie, after quoting me as an authority for the 7000-year estimate, adds that "all such estimates are in the nature of things unreliable." I now hasten to declare that I never said or thought that the period in question was about 7000 years. What I did incautiously say was, in effect, that the time allowance for the cutting of the gorge would be about 7000 years if the rate of the cutting were uniform, but that there was good reason to believe the rate had not been even approximately uniform.

Dropping personalities, which lack interest for your readers unless they involve principles, I beg to say a few words on the actual value of Niagara Falls as a chronometer. In 1844 James Hall made a map of the brink of the Falls, and established bench marks to which changes could be referred. Within a few years several other surveys had been made and connected with the first bench marks. It has thus become known, first, that in the middle of the Horseshoe Fall, where the principal body of water descends, the brink retrogrades at the rate of four or five feet per annum; second, that the American Fall, carrying a much thinner sheet of water, retrogrades so slowly that its rate is concealed by errors of survey. The gorge, which has been cut since the ice sheet retreated from the region, is six miles long, and the division of this distance by the annual rate determined for the Horseshoe Fall yields a period agreeable to the minimists. Had the conditions remained uniform, no fault could be found with this estimate, but there is reason to believe that the conditions have varied enormously in nearly every particular. The thickness of the resistant bed at the crest of the Falls is far from uniform, and it was altogether wanting for part of the distance. During the period of gorge-cutting, the height of Lake Ontario, which gives base-level to the river, has varied through a range of several hundred feet. The volume of the river has doubtless varied somewhat through climate, but it has probably varied enormously by reason of changes in drainage systems, resulting chiefly from differential uplift. The Niagara now carries surplus water from the basins of Lakes Erie, Huron, Michigan, and Superior. There was probably a post-glacial epoch during which three of these lakes discharged their water in other directions, and only the basin of Lake Erie fed the Niagara River. During that epoch the volume of the river was so small that canyon-cutting was effected only by the feeble process now illustrated by the American Fall, instead of the vigorous process illustrated by the Horseshoe Fall. These considerations, which the inquiring reader may find more fully set forth in the annual report of the Smithsonian Institution for 1890, tend strongly to sustain the agnostic view of the Niagara River as a geologic chronometer.

G. K. GILBERT.

Washington, April 30.

The Teeth and Civilisation.

ON the 8th inst., Dr. Wilberforce Smith read a short communication before the Anthropological Institute on the teeth of ten Sioux Indians attached to the Wild West Show. His investigation showed that in regard to molars and premolars (the only teeth examined), these Indians were wholly free from caries. In the discussion which followed the reading of the paper, it was mentioned that the same fact was revealed in the skulls of the Fourth Egyptian Dynasty brought to England by Dr. Flinders Petrie, and in some skulls examined by Dr. Wilberforce Smith himself, which were derived from the ruins of Pompeii. The teeth of the Indians, both old and young, and those in the skulls just referred to, all showed more or less wear of the cusps, which is a most unusual circumstance in the teeth of modern civilised people, and it was thought that some difference in the food, or its mode of preparation, would be required to account for the absence of signs of wear in our time.

Now, it has never been proved that the increasing prevalence of caries is due to weakness of the teeth owing to comparative disuse, but there is nevertheless great probability in the inference, especially as signs of wear and freedom from caries appear to occur together, and *vice versâ*. There is, however, a further point in regard to the existing liability to the attacks of caries which I think can be best explained by a transference of nourishment to other parts governed by the same nerves. On inquiry of several dentists, I find that the teeth most subject to decay are the molars, and of these the upper molars are more often attacked than those in the lower jaw. The molars of the upper jaw are fed by a branch of the fifth nerve, and in modern life this nerve has, perhaps, more strain put upon it than any other in the body. We use our eyes, partly supplied by the ophthalmic branch of this nerve, not at intervals, but often closely throughout a long day. And it seems, therefore, that with so many increasing calls on this bundle of nerve fibres, the filaments sent to the teeth are, by an automatic economy of expenditure, robbed of the energy necessary to perform their functions properly. The teeth through lack of use may not excite the nerves to natural action, and thus from both sides there is a failure of function, and the teeth are consequently more and more unable to resist the attacks of caries. I am disposed to attach some importance to this explanation, as I find that those who have great calls on their nervous energy are more liable to caries than people of quieter habit and slower temperament. Dr. Wilberforce Smith mentioned the alarming increase of dental decay amongst hospital nurses, whose occupation is certainly one demanding a constant drain on their nervous energy. It was also noted that people in towns lose their teeth more rapidly than those living in the country, which also bears out the idea here suggested. On the other hand, the savage is seldom required to strain his facial nerves continuously for any length of time, and in reference to general nervous expenditure he enjoys long periods of rest which are wholly denied to the civilised man in towns. No doubt in consequence of the excessive calls on our nervous energy the distribution of it is

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