TRANSACTIONS OF THE CANADIAN INSTITUTE.

538

[VOL. VII.

but from sedimentary rocks, or from what Sterry Hunt calls "fossil sea water, still to be found imprisoned in the pores of the older stratified rocks, and presumably in the younger as well." To answer this affirmatively would be of necessity to assert that the sodium which now goes to the sea as sodium chloride comes from the supply derived from and deposited by the sea in ancient geological strata-that is, what was at one time in the sea is being returned to it again. Fisher also points out that the strata which are now in the process of formation, imprison sodium chloride in their mass, taking it from the sea. There would thus be a constant circulation of sodium chloride from the ocean to the stratified rocks and back again to the ocean. That would also postulate that the sea was almost as rich in sodium chloride in Silurian times as it is now, and it would go far to support the view that "the sea was salt from the first;" but if we assume that the sodium of the sea is derived from those sodium compounds supplied by rivers other than the chloride, the estimate of the age of the earth, as given by Joly, would have to be multiplied several times in order to get the approximate length of the period which has elapsed since the oceans of the globe were first formed.

Another criticism of Joly's view, made along the lines followed by Fisher, is that advanced by Dubois,* who, from a comparison of the amounts of sodium and chlorine supplied to the sea by a large number of rivers, concluded that only a small portion, if any at all, of the sodium derived from denudation appears in river water as sodium chloride; that the sodium chloride discharged into the sea annually is derived from the rainfall, and the salt deposited in the older strata by the sea.

As Fisher has already pointed out, it is the sodium compounds other than the chloride that ought to be considered as being primarily derived from the disintegration of rock mass, and, therefore, primarily added to the sea. What the total amount of this sodium is cannot be determined with approximate certainty, but Dubois is inclined to regard it as about one quarter of the total discharge of sodium into the sea as given in Murray's tables, and, consequently, Joly's estimate of the length of the period which has elapsed since water first condensed on the earth's surface would have to be multiplied by four, the product being approximately 400 million years.

[•] On the Supply of Sodium and Chlorine by the Rivers to the Sea. Kon. Akad. v. Wetensch., Amsterdam. Proceedings of the Section of Sciences, Vol. 4, p. 388, 1902.