

If we take into account the methods followed by Professor Brazier in making these analyses<sup>1</sup> we should expect to find all the clayey matter under the heading, "Portion soluble in Hydrochloric Acid." He treated the deposits with hydrochloric acid, evaporated them to dryness and re-dissolved them as far as possible; the insoluble residue was, after weighing, treated with boiling caustic potash, and so much of the residue as was then dissolved was looked upon as silica of easy combination, and classed along with the bodies soluble originally in hydrochloric acid. It is evident that the silica with alumina and iron remaining insoluble in the potash was simply indecomposable quartz or silicates. After such a treatment the clayey matter should pass entirely into solution, and to estimate the quantity of this substance we have merely to take account of the data given in the columns showing the substances soluble in hydrochloric acid. It must be remembered, however, that a certain part of the alumina indicated in the soluble portion does not exist as argillaceous matter in the deposit, but comes from the action of the acid and caustic potash upon the aluminous silicates and rocks present in the Red Clay. It has been pointed out that these fragments of rocks and minerals are often highly altered, of very small dimensions, and must necessarily have been partially attacked by the strong reagents used in this method of analysis. It follows then that the figures representing the alumina in the column of soluble substances are too high, if regarded as coming exclusively from matter existing in the form of clay.

The first conclusion arrived at after an examination of the general results presented by the analyses, is the great variety of chemical composition in the deposits comprised under the head of Red Clay. This was already indicated as the result of macroscopic and microscopic examination, but is proved in a very clear way by the figures showing the percentages of matters soluble and insoluble in hydrochloric acid, which vary in each one of the specimens analysed, and show, moreover, that argillaceous and other matters must be present in variable proportions. If we consider the soluble portion, which should give data for estimating the quantity of clay, and take as a point of departure the formula ( $\text{Al}_2\text{O}_3, 2\text{SiO}_2, 2\text{H}_2\text{O}$ ), which is that of pure clay, we find that there is always excess of silica. This is the case even in Station 19, 3000 fathoms, where the alumina is represented by the highest figures; admitting that all the alumina is here in the form of clay, we obtain 6.81 per cent. excess of silica. However, as has been already stated, this relatively small quantity of clay suffices to give to a deposit formed of very small particles a decidedly plastic and argillaceous character.<sup>2</sup> The excess of silica can be explained, as we have already indicated, by the presence in the deposit of the siliceous remains of Diatoms, Radiolarians, and Sponges, and probably also from silicic acid in the hydrated or colloid form which is probably always present when clay is forming, still the excess must

<sup>1</sup> See chap. i. p. 28.

<sup>2</sup> In some analyses of clays from the geological formations, presenting all the characteristics of clay, the total amount of alumina is very low; we may quote the plastic clay of Offenbach (14.65 %  $\text{Al}_2\text{O}_3$ ), "Tegel" of Baden (12.64 %), Oligocene clay of Hilscheid (14.06 %), Wealden clay of Salzbergen (14.51 %), Devonian dolomitic clay of Quistenthal (11.09 %). See J. Roth, *Allgemeine und chemische Geologie*, Bd. ii. p. 583, Berlin, 1887.