Geology. — *Geochemistry and the total amount of sediments.* By PH. H. KUENEN. (Communicated by Prof. L. RUTTEN).

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In a former paper I tried to calculate the total amount of sediments from the rate of recent sedimentation, as measured by SCHOTT. The amount found was over 20×10^8 km^3. CLARKE and others, and later GOLDSCHMIDT, followed a different method. They calculated the percentage-loss of sodium that igneous rocks sustain on transformation to sediments. Supposing the sodium of the oceans to represent this loss, they found a total amount of sediments of the order of only 3×10^8 km^3.

An attempt should be made to bring these results in closer agreement. Probably the recent sedimentation is somewhat above the average, especially for the tropical Atlantic, where the measurements by SCHOTT were made.

On the other hand various corrections are also needed on CLARKE's result. The sodium content of deepsea deposits is higher than that of continental sediments, but only the latter were used in the sodium method. Most sediments contain salt water in the pore space. Extrusive rocks play a relatively important part in the production of sediments in consequence of their exposed position and loose composition. There are, moreover, a number of considerations that render the result of the sodium method less trustworthy than would appear at first sight.

Weighing the various arguments and the reliability of the methods against eachother, I believe that the total amount of weathered sediments may be estimated at about 8×10^8 km^3. To this amount must be added all sediments formed by mechanical disintegration. Especially before plants successfully cloaked the continents, the importance of disintegration must have been considerably greater than at the present time. A much larger percentage of fine unweathered products was carried by dust storms into the oceans and swelled the bulk of deposits, without adding to the store of sodium of the ocean waters. This would bring the grand total to over 10×10^8 km^3.

The geochemistry of calcium is of special importance. Before the Cambrian the CaO liberated through weathering must have been precipitated in the sea. But from then onwards animal life withdrew the calcium from the oceans and deposited most of it on the continents in the form of shallow water limestones. A considerable store of calcium was thus preserved and a steady and ever increasing circulation was kept going through dissolving by rain water and precipitation by orga-

nisms. During the Cretaceous planktonic Foraminifera first started their activity. Much of the lime was afterwards abstracted from the circulation and permanently buried in the deepsea in the form of Globigerina ooze. The store of lime is thus being gradually used up and calculation shows that in some 100 millions of years a lime famine must set in.

In conclusion the rate of oceanic sedimentation for the geological past can be roughly indicated. Before the Silurian: 1 cm solid in 5000 years, later 1 cm in 10.000 years. Globigerina ooze before the Tertiary negligeable, since then 1 cm in 5000 years.

In a later more detailed paper the author hopes to show how the results here indicated were arrived at, and along which lines further investigations may aid in finding more precise data.

LITERATURE.

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