has no accompanying vegetation to use up the carbonic acid of respiration and decomposition, and this gas would therefore become accumulated in its depressions.

Silica: Quartz and Opal Silica.

Silica in solution does the greater part of its geological work when aided by heat. Still much consolidation has been carried on by cold solutions, especially solutions of alkaline silicates, as potassium and sodium silicates. The former of these silicates is the waterglass of the shops, $K_2O.4SiO_2$, much used for making artificial stone and for other purposes.

Waters percolating through beds of volcanic ashes, by decomposing the feldspar present, take up silica and deposit it in the form of quartz and opal, making silicified wood and the finest of opals. In this way petrified forests have been made. In Napa County, California, according to the descriptions of O. C. Marsh, in 1871, one of the prostrate trunks of the silicified forest, exposed to view by the washing away of the tufa and tufaceous sandstone, was 63 feet long, and 7 feet in diameter. In the Yellowstone Park, according to W. H. Holmes, in his paper of 1878, the forest trunks, from one to ten feet in diameter, are at several horizons in a deposit of tufa 5000 feet thick, indicating successive disastrous showers of volcanic ashes, at intervals long enough for the growth of a great forest. In Arizona, near Carrizo, in Apache County, there is a noted locality which affords agatized wood of great beauty, which has been well named Chalcedony Park. In such cases heat from hot springs may often have given aid; but it is probable that the temperature in the Yellowstone region was only that of the descending volcanic ashes and accompanying rainfall. The decomposition of the outside of trap sets silica free, which coats the surface with a whitish pearly layer of opal silica.

Beds of Diatoms and other siliceous organisms are sometimes converted by percolating waters into opal. The siliceous organisms that were originally disseminated in the calcareous materials out of which limestones and chalk were made were the source of the flint and chert, that occur in these rocks. Siliceous sponge-spicules constitute a chief part. This was early proved for flint, and for Lower Devonian and Lower Silurian cherts; but it has been proved to be true, by Dr. G. J. Hinde, for cherts or flints of all geological ages, whatever the size of the beds.

The silicification of wood referred to above is in part due to silica from siliceous organisms.

The amount of silicification of fossils that has taken place in cold rocks makes it probable that more consolidation is due to the process than has been supposed. Cases of the hardening of the exposed surface of a sandstone or quartzyte, making a hard crust, described by M. E. Wadsworth (1883), have an important bearing on the subject. He speaks of a block of white Potsdam sandstone, in Wisconsin, which was friable on the protected side, but on the side exposed to the prevailing storms was nearly a quartzyte; and a surface freshly exposed by fractures was found, six months later, to be much

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