petrifying agents in nature. Organic bodies which have been silicified retain, often with the utmost perfection, their minutest and most delicate structures.

Quartz may usually be identified by its external characters, and especially by its vitreous lustre and hardness. When in the form of minute blebs or crystals, it may be recognized in many rocks with a good lens. Under the microscope, it presents a characteristic brilliant chromatic polarization, and in convergent light gives a black cross. Where it is an original and essential constituent of a rock, quartz very commonly contains minute rounded or irregular cavities or pores, partially filled with liquid. So minute are these cavities that a thousand millions of them may, when they are closely aggregated, lie within a cubic inch. The liquid is chiefly water, not uncommonly containing sodium chloride or other salt, sometimes liquid carbon-dioxide and hydrocarbons.[16] Chalcedony exhibits under the microscope a minute radial fibrous structure.

Rock-crystal and crystalline quartz resist atmospheric weathering with great persistence. Hence the quartz-grains may usually be easily discovered in the weathered crust of a quartziferous igneous rock. But corroded quartz-crystals have been observed in exposed mountainous situations, with their edges rounded and eaten away.[17] The chalcedonic and more or less soluble forms of silica are more easily affected. Flint and many forms of colored chalcedony weather with a white crust. But it is chiefly from the weathering of silicates (especially through the action of organic acids) that the soluble silica of natural waters is derived. (Book III. Part II. Section ii. § 7.)

Tridymite has been met with chiefly among volcanic rocks (trachytes, andesites, etc.), both as an abundant constituent of those which have been poured out in the form of lava, and also in ejected blocks (Vesuvius).[18]

Opal, a hydrous condition of silica formed from solution in water, is usually disseminated in veins and nests through rocks. Semi-opal occasionally replaces the original sub-

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[16] See Brewster, Trans. Roy. Soc. Edin. x. p. 1. Sorby, Quart. Journ. Geol. Soc. xiv. p. 453. Proc. Roy. Soc. xv. p. 153; xvii. p. 299. Zirkel, "Mikroskopische Beschaffenheit der Mineralien und Gesteine," p. 39. Rosenbusch, "Mikroskopische Physiographie," i. p. 30. Hartley, Journ. Chem. Soc. February, 1876. The occurrence of fluid-cavities in the crystals of rocks is more fully described in Part II. § iv. of this Book.

[17] Roth, Chem. Geol. i. p. 94.

[18] Vom Rath, Z. Deutsch. Geol. Ges. xxv. p. 236, 1873.