

rocks (trachytes) scattered all over the face of the globe, which contain abundance of free quartz?" If he will refer to my Contributions to Lithology, just cited, he will find that I have insisted upon the presence of quartz in trachytes, and, also, upon the fact that such trachytes pass into granites, from which they differ only in structure (*Amer. Jour. Science* [2] XXXVII, 260). The obvious conclusion to be drawn from the presence of quartz in granites and trachytes, is that neither during nor subsequent to crystallization, have these rocks been subjected to a temperature sufficiently elevated to alter the quartz in the manner observed by Rose. In the paper last cited, I have devoted two pages to an analysis of the beautiful researches of Sorby on the microscopic structure of crystals, about which Mr. Forbes talks, though evidently without any conception of their geological bearing. Mr. Sorby, who makes of the cavities partially filled with watery solutions, which occur in many crystals, thermometers which registered the temperature at which these crystals were formed, concludes that the quartz, mica, feldspar, and tin-stone of the Cornish veins "were deposited from water holding various salts and acids, at temperatures varying from 200° centigrade to a low red heat," about 340°; while for some minerals from Vesuvius, which present, besides cavities holding liquids, others filled with stoney and glassy matters, he deduces a temperature of from 360° to 380°, and concludes them to have been formed "at a dull red heat, under a pressure of several thousand feet of rock, when water, containing a large quantity of alkaline salts in solution, was present, along with melted rock and various gases and vapors. I therefore think (he says) we must conclude provisionally, that at a great depth from the surface, at the foci of volcanic activity, liquid water is present along with the melted rocks, and that it produces results which would not otherwise occur." (*Quar. Jour. Geol. Soc.* XIV, 483.) One of these results, as is evident from the above citation, is the reducing of rocky matters to a *melted* condition, at a *dull red heat*, a point to be borne in mind when Mr. Sorby speaks in his paper of *igneous fusion* in this connection. A true igneous fusion of such matters, *without water*, would, as every one knows, require a vastly higher temperature; and I have elsewhere, after Scheerer, described this softening of mineral matters under the combined influences of water and heat, as an *igneo-aqueous fusion*.

Mr. Sorby has, moreover, calculated the temperature at which the quartz crystals in the trachyte of the Ponza Islands, cited by Forbes,