

In this connection the experimental work carried out by Spring¹⁹ should be mentioned. Although certain of Spring's results have been called in question by Friedel²⁰ and Jannettaz,²¹ the whole field has been reviewed by Johnston and Adams,²² of the Geophysical Laboratory at Washington, and the bearing of Spring's work clearly set forth. Spring has demonstrated that under high pressure certain substances unite chemically with the production of new compounds. Thus copper and sulphur when compressed to 5,000 atmospheres unite to form a black crystalline cupreous sulphide, while barium carbonate and sodium sulphate yield under a pressure of 6,000 atmospheres barium sulphate and sodium carbonate. Johnston and Adams, however, have pointed out that a careful distinction must be made between simple cubic or hydrostatic compression and differential pressure which gives rise to a shearing movement or flow within the mass. The former produces but little effect in developing chemical change; the latter, however, does in many cases produce important alterations in chemical composition and is in a way analogous to a long-continued grinding together of the reacting substances in a mortar. In some cases the apparent interchange may be due to a process of diffusion occurring between the particles of the two substances brought into intimate contact by the pressure to which they are submitted. We have, by submitting a mixture of certain salts to such differential pressure, giving rise to flow, obtained foliated structures with a development of new compounds, which reproduce in a striking manner certain structures seen in the crystalline schists of highly contorted portions of the earth's crust.

Another very important fact is that when minerals of an acicular habit are developed in a rock which is undergoing deformation by differential pressure these new minerals grow in the mass with their longer axes orientated at right angles to the direction in which the pressure is being exerted, as shown by the experiments of F. E. Wright²³ on certain glasses which were allowed to crystallize when flowing under differential pressure, as well as by a series of experiments by the writer, the results of which have not as yet appeared, in which gypsum is converted into a lower hydrate while submitted to heavy differential pressure. In these cases crystalline rocks result, showing distinct foliation, the plane of this

¹⁹ Recherches sur la Propriété que possèdent les corps de se souder sous l'action de la Pression. *Revue Universelle des Mines* (and many other papers).

²⁰ *Bull. Soc. Chem.* (2), vol. xxxix, 1883, p. 626.

²¹ *Ibid.* (2), vol. xl, 1883, p. 51.

²² On the effect of high pressures on the physical and chemical behavior of solids. *Am. Jour. Sci.*, March, 1913.

²³ Schistosity by crystallization—a qualitative proof. *Am. Jour. Sci.*, Sept., 1906.