XI.—*Observations on Crystallogenesis.*

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THE number of planes is extremely variable in many crystals. Those of the same substance produced under modified conditions, even when issuing from the same solution, are occasionally very different in this respect. Generally the forms become less complicated and the number of planes diminishes, a certain number of them definitely disappearing, during the crystal's increase in volume. Such transitory planes are very frequently defective in parallelism.

Two kinds of planes may be distinguished on crystals of any system; some which are constant, others which may be termed variable; the latter being occasionally wanting, are in other cases very numerous. The forms of chemically and mineralogically identical crystals may offer an extraordinary variety. The full number of possible surfaces on a single crystal, is of extremely rare occurrence. Thus, the presence of variable surfaces contributes as much—if not more—to the variety of crystalline forms, as the variations arising from want of symmetry or the unequal extension of a pair of parallel surfaces. In some special cases the difference between the total number of possible surfaces of a crystal and the number of its constant ones is very considerable. All intermediate stages, from the total absence of inconstant surfaces up to their extreme prevalence, being possible, a single species of crystals may appear under the most diversified forms.

The artificial crystals issuing from laboratory operations, do not exhibit such a large number of combinations as certain mineral individuals, yet, considered in their totality, artificial crystals offer a far greater variety than crystallized minerals, on account of the greater number of chemical species known, and also on account of the different number of planes occurring within the same species. Each new plane ascertained on any crystallized mineral is justly considered as valuable for the detailed knowledge of crystalline forms. The greatest number of crystals issuing from one and the same operation, is insufficient for the complete know-

ledge of their modifying secondary surfaces, which can only be obtained by frequently repeating the same operation. This is especially applicable to crystals of the monoclinal, rhombic, and triclinal systems. It might be supposed that a surface, or a combination of them, had taken the place of each angle or edge of such crystals.

A great difference in the number of surfaces appears on crystals composed of chemically different substances, but of analogous composition (isomorphous substances), which, when mixed together, crystallize in the same fundamental form. Whenever one such substance is deposited upon an other, the one endowed with a great number of surfaces, still retains its peculiarity, forming successively surfaces over the angles and edges of its nucleous. An inverse proceeding provokes inverse results. A mixture of copper and cobalt-vitriol generally assumes the simplest crystalline form of copper-vitriol with only six surfaces.

A considerable number of such crystals, the result of different operations, offered successively ten truncature surfaces, not, indeed, simultaneously existing, but ascertained in a certain number of crystals. The variation in the number of surfaces, even on crystals issuing from the same operation, is most conspicuous in the bi-basic sulphate of potash and cadmium with 2 molecules of water. A compound of the bi-basic sulphates of potash and magnesia, and potash and zinc, with six molecules of water, assumes a very simple form of the monoclinal system, with only six surfaces, being thus isomorphous with the so called double sulphates of the magnesium group. Crystals of sulphate of potash and magnesia, isomorphous with the same double sulphate, offer as many as 13 planes, one of them wanting its parallel. The quadratic crystals of acetate of lime and copper, offer generally no more than six surfaces. The total of the surfaces appearing on one and the same individual, is in no case, however, more than double the number, the quadrilateral prisms frequently becoming hexagonal and the terminal angles and edges being variously truncated.

The causes of the greater or lesser number of surfaces on crystals identical in substance are still wrapped in nearly absolute obscurity, all knowledge of this subject being merely empirical. The presence of certain substances in the solutions is known in some cases to provoke modifications of forms. The position of a crystal immerged in a solution, or generated within it, seems to have some influence on the appearance of variable surfaces. More frequently a partial solution of a crystal, subsequently increased by a deposit of substance, offers variable surfaces. Under any circumstances, however, the strict geometrical laws, presiding over the construction of crystals, remain in full power, although the variety in extension and number of the surfaces gives rise to a great diversity of forms.