

recurrent groups in the rock-succession, and he treated them as "suites" or series, characteristic of each successive epoch in the earth's history. Largely following the precedent of Bergman, who had distinguished four principal rock-formations, Werner erected five so-called formation-suites in his chronological scheme of the rocks:—

5. *Volcanic rocks*, sub-divided into true volcanic (lava, volcanic scoriæ and ashes, pepperino, tuff) and pseudo-volcanic rocks (burnt clay, jasper, polishing-stone, slag).
4. *The transported or derivative rocks* with the formations nagelflue, sand, clay, pebbles, calcareous tufa, bituminous wood, soapstone, aluminous earth, etc.
3. *The Flötz rocks* with the formations old sandstone, coal, old Flötz limestone, the ore-bearing or "Zechstein" rocks, bituminous lignite, Muschelkalk, freestone and chalk, basalt, pitch-coal, brown-coal, etc.
2. *The transitional rocks* with the formations clay-slate, crystalline schist, greywacke, transitional greenstone, gypsum and the first organic remains.
1. *The primitive rocks* with the formations granite, gneiss, mica schist, slate, primitive greenstone and limestone, quartzite, hornblende schist, porphyry, serpentine, chlorite and talc schist, primitive gypsum, etc. No organic fossil remains.

According to Werner, the primitive rocks originated during the first chaotic period of the earth before the existence of organic creatures, by chemical crystallisation of rock-material from an aqueous solution. In the *transitional* period, the slates and shales were held to represent chemical precipitates; the greywackes to have been mechanical deposits. During the accumulation of the *Flötz* series, periods of disturbance alternated with periods of quiet deposition; the waters frequently receded from land areas, and again inundated the young continents. These varying conditions continued during the succeeding epoch of active transportation, and finally gave place to an epoch of violent volcanic outbreaks, the immediate cause of which Werner believed to be the ignition of deposits of coal in the earth's crust.

Werner's practical knowledge of mining methods served him in good stead when he came to study the strike and dip and relative position of the rocks from a scientific point of view. His application of more exact methods in taking field observa-