

dynamic action which had been already afforded by experimental attempts.

In 1887, a few months after Lossen's work on the Taunus had appeared, C. W. von Gümbel published his *Geognostic Description of the Eastern Bavarian Frontier Mountains*. In it he tried to demonstrate that gneiss and crystalline schist represented the oldest sediment which had separated out under peculiar conditions from a magma impregnated with superheated water. Gümbel regarded the cleavage of gneiss and the crystalline schists in the Bavarian forest not as a subsequent development, but as true stratification, and compared the succession of the gneiss and schist series, as well as the gradual transitions and frequent alternations of the different varieties, with the characteristic appearances observed in a series of sedimentary deposits. He described the occurrence of certain massive rocks, such as granite, syenite, diorite, sometimes in regular alternation with the gneiss and schist, sometimes as intrusive bosses and dykes. Judging from the resemblance in the mineralogical composition of all these massive rocks, Gümbel argued that the rock-material must in all cases have had a similar origin, and concluded that there was an underground magma constituted like the primitive earth, and from which either sedimentary schist and gneiss, or granitic bosses and layers, could develop.

Justus Roth, who was one of the founders of the German Geological Society, was an ardent supporter of the view that all gneissose and schistose rocks represented the products of the first consolidation of the crust. In his work on *General and Chemical Geology*, published in 1890, two years before his death, Roth gave an unfavourable criticism of all theories which advocated subsequent rock-deformation and metamorphism. He contended that the compact structure of gneisses and schists, the absence of any amorphous or glassy ground-mass, together with the mineralogical composition, are features which indicate a plutonic, aquo-igneous origin. Their bent and cleaved character was attributed by him to the contraction of the earth and the consequent strains acting during the formation of the series.

Many geologists were, however, finding in the field ample confirmation of Lossen's explanation of the mechanical deformation of rocks. The well-known writings of Heim and Baltzer on the Swiss Alps, of Renard on the rocks of the