356 HISTORY OF GEOLOGY AND PALÆONTOLOGY.

the sediments above and assumed the form of eruptive massive protrusions.

The microscopic examination of micaceous schist led Sorby (1856) to the assumption that it had originally been a shale and had been altered probably by means of water, a high temperature, and crust pressure. He regarded the foliated structure as a result of mechanical pressure. Hitchcock, in 1861, also emphasised the action of mechanical strains.

Sir William Logan's discovery, in 1867, of the thick series of gneisses and schists forming the floor of the sedimentary succession in Labrador and Canada, gave for a time additional support to the view of the Archæan age of all metamorphic rocks; but every year stratigraphical researches were bringing new facts to light which could not harmonise with this simpler view of one primæval epoch of formation for the crystalline foliated rocks.

Zirkel, in 1866, made a complete resumé of the literature on the subject of the metamorphic gneiss, and after a careful criticism of the facts and arguments, concluded that there is probably an original gneiss and a metamorphic gneiss. Water and the plastic magma have participated in the formation of the former; it formed the first solid crust, and could, under certain circumstances, especially in the immediate vicinity of granite, partake of its eruptive character. Gneiss has either taken origin from shales and grits by contact metamorphism in the presence of heated water, or has arisen from the subterranean transformation of sedimentary strata by means of some simple processes of water-permeation, which have so far eluded discovery. Zirkel also explains the origin of granulite and the other crystalline schists upon principles of waterpermeation, but he regards micaceous and chloritic schists and phyllites as metamorphosed sediments.

Lossen initiated a new departure in the investigation of the metamorphic group, in so far as he succeeded in impressing geologists with the high value of accurate field investigations in assisting the solution of some of the intricate problems of metamorphism. During his examination of the Taunus mountains (1867), Lossen formed the opinion that most of the crystalline schists had originated as sedimentary strata containing a large amount of interstitial water, and had been cleaved and altered by the action of strong dynamic pressures during the mountain-making movements. Gneiss and mica