

Élie de Beaumont was the first to point out the contrast between widespread or normal metamorphism and the contact metamorphism which was limited to smaller zones of rock, and especially to the contiguous parts of eruptive and sedimentary rocks. Daubrée afterwards applied the term of regional metamorphism to distinguish these processes which had acted throughout vast regions of the crust and altered thick formations of rock.

One of the extreme Neptunists was Johann Fuchs, who explained the crystalline schists, gneiss, granitic and porphyritic rocks as segregation products from a watery or pasty material. The American geologist, Professor Dana, in 1843 thought that the Huttonian doctrine did not attach sufficient importance to the agency of heated water in effecting rock-metamorphism. He compared gneiss with volcanic tuffs, and held the opinion that during invasions of granitic magma into the upper zones of the crust a granitic ash also escaped, and under the influence of superheated water became caked and cemented into the form of gneissose and schistose rocks. J. Bischof, in several papers published between the years 1847 and 1854, agreed with Keilhau in assuming that the oldest sediments were for a long time supersaturated with water, and that chemical changes had slowly altered their constitution, converting argillaceous sediments first into clay-slate, and by continuance of the chemical processes into micaceous schists.

Scheerer contributed in 1847 a suggestive paper on the origin of gneiss, in which he took the standpoint that it might be produced in various ways and from various rocks. He explained the gneiss of the Erz mountains as a rock that had been metamorphosed from sedimentary strata *in situ*, whereas the red gneiss during the time of its metamorphism had undergone flow movements comparable to those of an eruptive magma. Again, in many cases gneiss was a fundamental Archæan rock representing a portion of the primæval crust of the earth. Cotta also thought that most gneiss had formed part of the original crust, but he regarded the crystalline schists as the culminating result of a process of metamorphism undergone by all sedimentary rocks which had already been, or were now in process of being, covered by a thick mantle of younger deposits. The change, he thought, had been effected by heat and pressure, possibly in combination with water; and although the crystalline schists were in many places now ex-