

converted into chistolite-schists, or graphitic schists, but often show to the eye only trifling alteration. Other shaly beds have assumed a fine glimmering appearance; and, in the calcareous sandstone, biotite has been developed. In spite of the metamorphism, however, neither fossils nor stratification have been quite obliterated from the altered rocks. From all the stratigraphical zones fossils have been found in the altered belt, so that the true position of the metamorphosed rocks admits of no doubt.³⁵ Prof. W. C. Brögger has subjected the rocks of the zones of contact-metamorphism round Christiania to a searching microscopic examination, and has published a highly important and interesting memoir on the subject. He describes the unaltered and altered conditions of the more conspicuous stratigraphical bands, and thus provides new material for the investigation of contact-metamorphism. Especially interesting are his descriptions of the distinctive metamorphism of each band, the remarkably variable amount of alteration even in the same band, the persistence of recognizable graptolites even in rocks that have become essentially crystalline, the transformation of limestone into marble, of which a fourth or fifth part is composed of garnet, partly in large rhombic dodecahedrons, and partly as a mold inclosing *Orthis calligramma*.³⁶

One further European example may be cited from the observations of F. E. Müller, who has described round the granite of the Hennberg near Lehesten in the Frankwald the occurrence of knotted schists, chistolite-schists, knotted mica-schists, and andalusitic mica-rocks.³⁷

The same phenomena have been observed in many other parts of the world. One example from America may suffice to show how precisely the facts collected in the Old World are repeated in the New. An elaborate examination was made of the contact-metamorphism of the granite of Albany, New Hampshire, by the late Mr. G. W. Hawes.³⁸ His analyses indicate a systematic and progressive series of changes in the schists as they approach the granite. The rocks are dehydrated, boric and silicic acids have been added to them, and there appears to have been also an infusion of alkali directly on the contact. He regarded the schists as

³⁵ "Geologie Norwegens," 1880, p. 75. For the literature of the Norwegian locality see E. Reyer, Jahrb. Geol. Reichsanst. xxx. 1880, p. 26.

³⁶ "Die Silurischen Etagen 2 und 3 im Kristiania Gebiet," Kristiania, 1882.

³⁷ Neues Jahrb. 1882 (2), p. 205. ³⁸ Amer. Journ. Sci. xxi. 1881, p. 21.