

note by metamorphism. The term has been, indeed, much too loosely employed: but it is now generally used to express a change in the mineralogical or chemical composition and in the internal structure of rocks, produced at some depth from the surface, through the operation of mechanical movement, combined with the influence of heat and heated water or vapor. A metamorphic rock may be more compact and crystalline than the parent mass from which it has been derived, like which, also, when exposed at the surface, it again undergoes alteration by weathering.

Various kinds of metamorphism have been distinguished by special names;² but they may be included in three main groups. 1st, change of texture, including the induration and other minor phenomena of "contact-metamorphism"; 2d, change of form, including all paramorphic transformations, such as the conversion of a pyroxenic into a hornblendic rock, and the alteration of a clastic into a crystalline mass by the crystallization of its original constituents; 3d, change of substance, where a chemical change has been superinduced either by the abstraction or addition of one

² For instance, metasomatism, metasomatic, methylosis, methyloitic, and metachemic applied to chemical metamorphism or alteration of constitution or substance; metastasis, indicating changes of a paramorphic nature; metacrisis, denoting such transformations as the conversion of mud into a mass of mica, quartz and other silicates; macro-structural metamorphism, having the external structure (morphology) changed, as where an amorphous condition becomes schistose; micro-structural, having the internal structure (histology) wholly changed, with or without a macro-structural alteration; mineralogical, having one or more of the component minerals changed, with or without an alteration of the chemical composition of the rock as a whole. See King and Rowney, "An old Chapter of the Geological Record," 1881; Dana, Amer. Journ. Sci. xxxii. 1886, p. 69. Bonney, Quart. Journ. Geol. Soc. 1886, Address, p. 30 *et seq.* G. H. Williams, Bull. U. S. Geol. Surv. No. 62, 1890, p. 43. Various terms have likewise been proposed for metamorphism from the point of view of its cause, as Dislocation-metamorphism (Lossen), Mechanical metamorphism (Heim and Baltzer), Dynamical metamorphism (Rosenbusch), Heaping-up metamorphism (Stauungs M., Credner), Pressure metamorphism (Bonney).