

associated minerals are most frequently at some distance from the points of contact; and the formation of these minerals is probably due to the combination of water and heat, although this last ceases to be the principal agent.

The hydrated volcanic rocks, such as the basalts and trappean rocks in general, continue to produce effects of metamorphism, in which heat operates, although its influence is inconsiderable, water being much the more powerful agent. The metamorphosis which is observable in the structure and mineralogical composition of neighbouring rocks is as follows:—The structure of separation becomes fragmentary, columnar, or many-sided, and even prismatic. It becomes especially prismatic in combustibles, in sandstones, in argillaceous formations, in felspathic rocks, and even in limestones. Prisms are formed perpendicular to the surface of contact, their length sometimes exceeding six feet. Most commonly they still contain water or volatile matter. These characters may be observed at the junction of the basalts which has been ejected upon the argillaceous strata near Clermont in Auvergne, at Polignac, and in the neighbourhood of Le Puy-en-Velay.

If the vein of Basalt or Trap has traversed a bed of coal or of lignite, we find the combustible strongly *metamorphosed* at the point of contact. Sometimes it becomes cellular and is changed into *coke*. This is especially the case in the coal-basin of Brassac. But more frequently the coal has lost all, or part of, its bituminous and volatile matter—it has been metamorphosed into anthracite—as an example we may quote the lignite of Mont Meisner.

Again, in some exceptional cases, the combustible may even be changed into graphite near to its junction with Trap. This is observed at the coal-mine of New Cumnock in Ayrshire.

When near its junction with a *trappean* rock, a combustible has been metamorphosed into *coke* or anthracite, it is also frequently impregnated by hydrated oxide of iron, by clay, foliated carbonate of lime, iron pyrites, and by various mineral veins. It may happen that the combustible has been reduced to a pulverulent state, in which case it is unfit for use. Such is the case in a coal-mine at Newcastle, where the coal lies within thirty yards of a dyke of Trap.

When Basalt and Trap have been ejected through limestone rock, the latter becomes more or less altered. Near the points of contact, the metamorphism which they have undergone is revealed by the change of colour and aspect, which is exhibited all around the vein, often also by the development of a crystalline structure. Limestone becomes granular and saccharoid—it is changed into marble. The