

that water to contain in solution chemical agents of great power ; for instance, carbonic, sulphuric and muriatic acids, sulphuretted hydrogen and alkaline carbonates. There is no rock, except, perhaps, pure quartz, that could withstand their combined action. They would all be softened and made so plastic, that in the course of centuries all the changes exhibited by metamorphic rocks might be brought about.

We have a very striking example of such agencies in the account given us by Forest Shepherd, Esq., of the "Pluton Geysers, of California." These are hot springs, which throw out intermittingly and spasmodically, powerful jets of steam and scalding water ; their temperature varying from 93° to 169° Fahr. Sulphuric acid and sulphuretted hydrogen, at least, according to Mr. Shepherd's account, are present, and probably other energetic ingredients. Says Mr. Shepherd, "you find yourself standing not in a solfatara, nor in one of the salses described by the illustrious Humboldt. The rocks around you are rapidly dissolving under the powerful metamorphic action going on. Porphyry and jasper are transformed into a kind of potter's clay. Pseudo-trappian and magnesian rocks are consumed, much like wood in a slow fire, and go to form sulphate of magnesia and other products. Granite is rendered so soft that you may crush it between your fingers, and crush it as easily as bread unbaked.† The feldspar appears to be converted partly into alum. In the meantime the bowlders and angular fragments brought down the ravine and river by floods, are being cemented into a firm conglomerate, so that it is difficult to dislodge even a small pebble, the pebble itself sometimes breaking before the cementation yields." Mr. Shepherd adds: "the metamorphic action going on is at this moment effecting important changes in the structure and conformations of the rocky strata. It is not stationary, but apparently moving slowly eastward in the Pluton Valley." (Am. Journ. Sci., vol. xii., No. 3, pp. 157, 158).

This spot seems to be an opening into the great laboratory of nature, where we get a glimpse of the mighty work she has been carrying on in almost every part of the earth's crust during the past geological ages. We have reason, however, to believe that the action was more powerful in past times than at present, because the earth's crust was thinner, and volcanic agency more common and energetic. Yet at the Pluton Geysers it is energetic enough, and that too at a very moderate temperature, to melt and transform all known rocks, unless it be pure quartz.

But though a very high degree of heat does not seem to be necessary to most cases of metamorphism, yet it is essential that there should be an increase of it in newly formed strata, that they may be changed ; and how may we suppose this to have been accomplished.

An eminent mathematician, Professor Babbage, in 1834, pro-