there are many varieties, such as Syenite, Talcose granite, and others One of these varieties is sometimes found exclusively prevailing throughout an extensive region, where it preserves a homogeneous character; so that having ascertained its relative age in one place, we can easily recognize its identity in others, and thus determine from a single section the chronological relations of large mountain masses. Having observed, for example, that the syenitic granite of Norway, in which the mineral called zircon abounds, has altered the Silurian strata wherever it is in contact, we do not hesitate to refer other masses of the same zircon-syenite in the south of Norway to the same era.

Some have imagined that the age of different granites might, to a great extent, be determined by their mineral characters alone; syenite, for instance, or granite with hornblende, being more modern than common or micaceous granite. But modern investigations have proved these generalizations to have been premature. The syenitic granite of Norway already alluded to may be of the same age as the Silurian strata, which it traverses and alters, or may belong to the Old Red sandstone period; whereas the granite of Dartmoor, although consisting of mica, quartz, and felspar, is newer than the coal. (See p. 580.)

Test by included fragments. — This criterion can rarely be of much importance, because the fragments involved in granite are usually so much altered, that they cannot be referred with certainty to the rocks whence they were derived. In the White Mountains, in North America, according to Professor Hubbard, a granite vein traversing granite, contains fragments of slate and trap, which must have fallen into the fissure when the fused materials of the vein were injected from below,* and thus the granite is shown to be newer than certain superficial slaty and trappean formations.

Recent and Pliocene plutonic rocks, why invisible. — The explanation already given in the 29th and in the last chapter, of the probable relation of the plutonic to the volcanic formations, will naturally lead the reader to infer, that rocks of the one class can never be produced at or near the surface without some members of the other being formed below simultaneously, or soon afterwards. It is not uncommon for lava-streams to require more than ten years to cool in the open air; and where they are of great depth a much longer period. The melted matter poured from Jorullo, in Mexico, in the year 1759, which accumulated in some places to the height of 550 feet, was found to retain a high temperature half a century after the eruption.† We may conceive, therefore, that great masses of subterranean lava may remain in a red-hot or incandescent state in the volcanic foci for immense periods, and the process of refrigeration may be extremely gradual. Sometimes, indeed, this process may be retarded for an indefinite period, by the accession of fresh supplies of heat; for we find that the lava in the crater of Stromboli, one of the Lipari Islands, has been in a state of constant

* Silliman's Journ., No. 69, p. 123. † See "Principles," *Index*, "Jorullo."