

Sometimes it is like the heavy rolling of subterranean thunder. Fissures are frequently produced during the eruptions, extending over a considerable radius, as represented in the woodcut on page 57 of the fissures of Locarno (Fig. 11), where they present a singular appearance; the clefts radiating from a centre in all directions, not unlike the starred fracture in a cracked pane of glass. The eruption begins with a strong shock, which shakes the whole interior of the mountain; masses of heated vapour and fluids begin to ascend, revealing themselves in some cases by the melting of the snow upon the flanks of the cone of ejection; while simultaneously with the final shock, which overcomes the last resistance opposed by the solid crust of the ground, a considerable body of gas, and more especially of steam, escapes from the mouth of the crater.

The steam, it is important to remark, is essentially the cause of the terrible mechanical effects which accompany volcanic eruptions. Granitic, porphyritic, trachytic, and sometimes even basaltic matters, have reached the surface without producing any of those violent explosions or ejections of rocks and stones which accompany modern volcanic eruptions; the older granites, porphyries, trachytes, and basalts were discharged without violence, because steam did not accompany those melted rocks—a sufficient proof of the comparative calm which attended the ancient as compared with modern eruptions. Well established by scientific observations, this is a fact which enables us to explain the cause of the tremendous mechanical effects attending modern volcanic eruptions, contrasted with the more tranquil eruptions of earlier times.

During the first moments of a volcanic eruption, the accumulated masses of stones and ashes, which fill the crater, are shot up into the sky by the suddenly and powerfully developed elasticity of the steam. This steam, which has been disengaged by the heat of the fluid lava, assumes the form of great rounded bubbles, which are evolved into the air to a great height above the crater, where they expand as they rise, in clouds of dazzling whiteness, assuming that appearance which Pliny the Younger compared to a stone pine rising over Vesuvius. The masses of clouds finally condense and follow the direction of the wind.

These volcanic clouds are grey or black, according to the quantity of *ashes*, that is, of pulverulent matter or dust, mixed with watery vapour, which they convey. In some eruptions it has been observed that these clouds, on descending to the surface of the soil, spread around an odour of hydrochloric or sulphuric acid, and traces of both these acids are found in the rain which proceeds from the condensation of these clouds.