

the foot of these mountains, on the side both of the Adriatic and the Mediterranean, are found a series of tertiary strata, which form, for the most part, a line of low hills occupying the space between the older chain and the sea. Brocchi, as we have seen (p. 110), was the first Italian geologist who described this newer group in detail, giving it the name of the Subapennines; and he classed all the tertiary strata of Italy, from Piedmont to Calabria, as parts of the same system. Certain mineral characters, he observed, were common to the whole; for the strata consist generally of light brown or blue marl, covered by yellow calcareous sand and gravel. There are also, he added, some species of fossil shells which are found in these deposits throughout the whole of Italy.

We have now, however, satisfactory evidence that the Subapennine beds of Brocchi, although chiefly composed of Older Pliocene strata, belong nevertheless, in part, both to older and newer members of the tertiary series. The strata, for example, of the Superga, near Turin, are Miocene; those of Asti and Parma, Older Pliocene, as is the blue marl of Sienna; while the shells of the incumbent yellow sand of the same territory approach more nearly to the recent fauna of the Mediterranean, and may be Newer Pliocene.

The grayish-brown or blue marl of the Subapennine formation is very aluminous, and usually contains much calcareous matter and scales of mica. Near Parma it attains a thickness of 2000 feet, and is charged throughout with marine shells, some of which lived in deep, others in shallow water, while a few belong to freshwater genera, and must have been washed in by rivers. Among these last I have seen the common *Limnea palustris* in the blue marl, filled with small marine shells. The wood and leaves, which occasionally formed beds of lignite in the same deposit, may have been carried into the sea by similar causes. The shells, in general, are soft when first taken from the marl, but they become hard when dried. The superficial enamel is often well preserved, and many shells retain their pearly lustre, part of their external color, and even the ligament which unites the valves. No shells are more usually perfect than the microscopic foraminifera, which abound near Sienna, where more than a thousand full-grown individuals may be sometimes poured out of the interior of a single univalve of moderate dimensions.

The other member of the Subapennine group, the yellow sand and conglomerate, constitutes, in most places, a border formation near the junction of the tertiary and secondary rocks. In some cases, as near the town of Sienna, we see sand and calcareous gravel resting immediately on the Apennine limestone, without the intervention of any blue marl. Alternations are there seen of beds containing fluviatile shells, with others filled exclusively with marine species; and I observed oysters attached to many limestone pebbles. The site of Sienna appears to have been a point where a river, flowing from the Apennines, entered the sea when the tertiary strata were formed.

The sand passes in some districts into a calcareous sandstone, as at San Vignone. Its general superposition to the marl, even in parts of Italy