

and another columnar bed of the same rock 10 feet thick is exposed at the bottom of the cliff. One of the leaf-beds consists of a compressed mass of leaves unaccompanied by any stems, as if they had been blown into a marsh where a species of *Equisetum* grew, of which the remains are plentifully imbedded in clay.

It is supposed by the Duke of Argyle that this formation was accumulated in a shallow lake or marsh in the neighborhood of a volcano, which emitted showers of ashes and streams of lava. The tufaceous envelope of the fossils may have fallen into the lake from the air as volcanic dust, or have been washed down into it as mud from the adjoining land. The deposit is decidedly newer than the chalk, for chalk flints containing cretaceous fossils were detected by the Duke in the principal mass of volcanic ashes or tuff.*

The leaves belong to species, and sometimes even to families, no longer indigenous in the British Isles; and "their climatal aspect," says Professor E. Forbes, "is more mid-European than that of the English Eocene Flora. They also resemble some of the Miocene plants of Croatia described by Unger." Some of them appear to belong to a coniferous tree, possibly a yew (*Taxus*); others, still more abundant, to a plane (*Platanus*), having the same outline and veining well preserved. No accompanying fossil shells have been met with, and there seems therefore the same uncertainty in determining whether these beds are Upper Eocene or Miocene, which we experience when we endeavor to fix the age of many continental Brown-Coal formations, those of Croatia not excepted.

These interesting discoveries in Mull naturally raise the question, whether the basalt of Antrim in Ireland, and of the celebrated Giant's Causeway, may not be of the same age. For in Antrim the basalt overlies the chalk, and the upper mass of it covers everywhere a bed of lignite and charcoal, in which wood, with the fibre well preserved, and evidently dicotyledonous, is preserved.† The general dearth of strata in the British Isles, intermediate in age between the formation of the Eocene and Pliocene periods, may arise, says Professor Forbes, from the extent of dry land which prevailed in the last interval of time alluded to. If land predominated, the only monuments we are likely ever to find of Miocene date are those of lacustrine and volcanic origin, such as these Ardtun beds in Mull, or the lignites and associated basalts in Antrim. On the flanks of Mont Dor, in Auvergne, I have seen leaf-beds among the ancient volcanic tuffs which I have always supposed to be of Miocene date. Some of the Brown-Coal deposits of Germany are believed to be Miocene; others, as will be seen in the next chapter, are Eocene, Upper or Middle.

Older Pliocene and Miocene formations in the United States.—Between the Alleghany mountains, formed of older rocks, and the Atlantic, there intervenes, in the United States, a low region occupied principally by beds of marl, clay, and sand, consisting of the cretaceous and tertiary formations, and chiefly of the latter. The general elevation of this plain

* Quart. Geol. Journ. 1851, p. 90.

† Duke of Argyle, *ibid.* p. 101.