

fessors Nicholson and Lapworth, they may be provisionally divided into two groups, the lower consisting of dark flagstones and shales, distinguished by species of *Tetragraptus*, *Didymograptus*, *Phyllograptus*, *Diplograptus*, *Loganograptus*, *Temnograptus*, *Schizograptus*, *Ctenograptus*, *Dichograptus*, and the upper made up of black shales and mudstones, containing some of the same and some different species of *Didymograptus* and *Phyllograptus*, and species of *Trigonograptus*, *Trichograptus*, *Glossograptus*, *Diplograptus*, and *Climacograptus*. The Skiddaw slates have been invaded by granite and other eruptive rocks, and display around these a well-marked contact-metamorphism (p. 1003).

Toward the close of the long period represented by the Skiddaw slates, volcanic action manifested itself, first by intermittent showers of ashes and streams of lava, which were interstratified with the ordinary marine sediment, and then by a more powerful and continuous series of explosions, whereby a huge volcanic mountain or group of cones was piled up above the sea-level. The vast pile of volcanic material (estimated at some 12,000 feet in total thickness) consists entirely of lavas and ashes without the interstratification of ordinary sediment except at the base and the top. The lower lavas are varieties of andesite, which are also met with in the central and higher parts of the Borrowdale volcanic series, while rhyolitic felsites were specially poured out toward the close of the volcanic period. Enormous quantities of fine volcanic ashes were likewise discharged. These various volcanic rocks form the picturesque hills of the Lake District.<sup>79</sup> The length of time occupied by this volcanic episode in Cambrian geology may be inferred from the fact that all the Llandeilo and a large part of the Bala beds are absent here. The volcanic island slowly sank into a sea wherein Bala organisms flourished. In some places a group of shales occasionally 300 feet thick, and known as the Dufton shales, overlies the Borrowdale series, and contains among other characteristic species *Strophomena expansa*, *Leptæna sericea*, *Trinucleus concentricus*, *Homalotus bisulcatus*, *Illænus Bowmanni*. The most marked rock of the overlying series is the Coniston limestone, which

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<sup>79</sup> On the volcanic geology of this region consult J. C. Ward in the work above cited; Presidential Address to Geological Society, Quart. Journ. Geol. Soc. 1891, p. 137, and authors there given.