forms—surrounding included and narrower bands of Llandeilo rocks, and enveloped in turn by still broader sheets of Llandovery strata, etc. The great *Gala* (*Tarannon*) terrane must be coloured as the prevailing visible rock-mass of the Uplands, sweeping along the central and southern parts of the plateau in a broad sheet (from 20 to 25 miles in width) from the North Channel to the German Ocean, only interrupted locally by long and narrow lenticles of pre-Gala rock, which decrease both in number and importance as we pass from south-west to north-east. Finally fringing the Gala Terrane along the south-east flanks of the Uplands from Burrow Head to the Cheviots will follow in natural superposition the slowly widening band of the *Wenlock Ludlow* (*Riccarton*) beds, the boundaries of which have been already sketched out by the officers of the Geological Survey.

In the accompanying Plate (Plate III.) I have given some sketch-sections across the Upland region illustrative of my views of the general disposition and inter-relationships of its strata; and in the following "Table of Correlation" will be found incorporated some of the more important palæontological data which bear upon the question of the Upland Sequence. (See Folding Table II.)

IV.—ON LOCAL THICKENING OF DYKES AND BEDS BY FOLDING.

By ALFRED HARKER, M.A., F.G.S.,

Fellow of St. John's College, Cambridge.

IN his "Geology of North Wales" (p. 102, 2nd ed.), Sir A. Ramsay figures a vertical cross-section of a greenstone dyke, which he describes as running along the cleavage-planes of the slate in the Ffestiniog quarries, and alternately "bulging and thinning off in a rapid succession of oval-shaped masses of 3 or 4 feet in length." He seems to imply that this is one of the dykes posterior to the disturbance which produced the cleavage of the district. The ordinary post-Carboniferous dykes of North Wales, however, strike nearly at right angles to the cleavage; and further it is not easy to imagine any circumstances attending the intrusion of this one that would account for the phenomenon of alternate thickening and attenuation described. A precisely similar peculiarity is to be seen in 'Dew's quarry' at Pen-y-bryn, Nantlle. The same thing is figured by Lehmann ('Altkrystallinischen Schiefergesteine,' pl. xiii. fig. 4) from granite-veins in the Saxon granulites.

At several places in the Cambrian *massif* of Rocroi, notably north of Mairus near Monthermé, beds of grit intercalated among the slates are seen to swell and contract in the same manner. Their thickness at the ventral segments is usually at least double of that at the nodes. The distance between the nodes seems to depend on the thickness of the bed. Gosselet has recently given a photograph of this 'almond-like' arrangement of the 'quartzites' in his great memoir on the Geology of the Ardenne. In these cases, at least, since we have to deal with sedimentary strata, it is clear that the

phenomenon must be referred to some peculiarity in the disturbances to which the rocks have been subjected.

To explain it, we must go to North Devon, a district, like North Wales and the Ardenne, deeply affected by great lateral pressures operating on the solid rocks. At various points of the coast east of Ilfracombe we find among the slates beds of limestone exhibiting a succession of swellings and constrictions analogous to those already described; and we see that this disposition is due to the welding together of the adjacent limbs of sigmoid folds under a powerful thrust. The stages of the process are clearly exhibited. After the formation of a series of S-shaped flexures in the ordinary manner (Fig. 1), the direction of the pressure relatively to the bed has

changed, and the folds have been pressed upon themselves in the fashion indicated in Figs. 2 and 3. A node corresponds to the attenuated middle limb of a fold, while a ventral segment represents the union of the complementary parts of two adjacent folds.

It appears probable that the process indicated is also that by which the varying thickness of the greenstone dykes and the quartzite beds has been brought about. It is also seen in various stages in thin bands of grit in the Ilfracombe district. It is not necessary, however, to suppose that the sharp sigmoid folds must be actually formed as a preliminary stage. A series of slight undulations, as in Fig. 4, affected by a shearing motion in the direction shown by the arrows, might equally give rise to the alternate nodes and swellings of Fig. 3.

V.—ON THE OCCURRENCE OF SODA-FELSITES (KERATOPHYRES) IN CO. WICKLOW, IRELAND.

By FREDERICK H. HATCH, PH.D., F.G.S.

(Communicated by permission of the Director-General of the Geological Survey.)

IN an Appendix to the Explanatory Memoir on Sheets 138 and 139 of the Map of the Geological Survey of Ireland (Dublin, 1888), I have given some notes on the petrographical characters of the igneous rocks of Co. Wicklow. One or two of the facts elicited by an examination of these rocks are sufficiently interesting to deserve a wider circulation.

Associated with various types of greenstone, which will form the subject of another communication, there occur in the Lower Palæozoic strata of this district (Bala) numerous beds of felsite. These are