

HECKFIELD SURFACE FEATURES.

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THE Hampshire Field Club has a wide horizon. The geologist looks below, the botanist with the zoologist looks around, the archæologist looks outside and in, and the geographer looks at all of it—for geography is a most comprehensive science whose purview is the earth and man. The interests, therefore, of a field club must be varied and relative, so that the surface features of the Heckfield Plateau, for example, suggest a wide field of interest. The plateau is mainly a mass of gravel. From whatever point you approach the cross-roads you must go uphill, and then you find yourself upon a pleasant heather-covered level that drops down with steeply furrowed valleys towards Riseley, Holdshott, Mattingley, and Strathfieldsaye, north, east, south, and west, and along footpaths in any direction. That thick deposit of water-worn gravel came from somewhere, and was dumped down by some agency upon a mass of London Clay. The geologist looks for evidence of two things—first, the place of origin of any such deposit; second, the transporting agents. In this case the pebbles are mostly flint, and mainly rounded and waterworn, but some are sharp and fresh, and all these have been derived from the destruction of a great thickness of chalk which has been denuded and scoured away along a great widening furrow expanding in the Thames estuary, centralized by the Kennet, and extending eastwards. There are other pebbles that have come from far. These flints may be seen *in situ* in any exposure of the Upper Chalk, where they lie in embedded bands with irregular outlines. They are of silica gathered out of the water in the former chalk gulf by millions of sponges, like *euplectella*, that lived in that far-away Chalk period. That is their origin. A chalk

gulf ; the sea floor raised to dry land ; and a broad sloping plateau exposed to denudation. From that plateau to the Heckfield Plateau is a very long and complicated story ; but it can be simply indicated. The chalk was gradually worn away—by rivers, by sea waves, by torrents, and, if not by ice, certainly by streams from the melting ice sheet in later times.

Almost any sea-shore in Southern England has a pebble beach. The pebbles are cleaner than the Heckfield pebbles, but are exactly similar and suggest a similar origin. The chalk plateau sank, was smothered by various clays and sands from rivers that have vanished, and finally over the whole affair—chalk, mud, sand, and pebbles—the sea rose, the waves dashed on the beach, and the rounded pebbles remained mixed with bands of sand and clay, and intermixed with these materials. Some of the gravel beds are clean ; some are composed of that “ rotten ” gravel which makes a transient and unpleasant road surface. There is a considerable amount of iron in this mass. This, when dissolved out, forms a cement of iron oxide, and so produces patches of conglomerate. So much for the plateau ; now for the valleys. There are in South-East England two main types of valley. One due to mechanical erosion, the other due to solution. The solution valleys are characteristic land forms in the soluble chalk and limestone areas.

In Cheshire there are valleys with similar contours that have subsided when the underlying salt was dissolved out by underground water localized in underground channels. These have profiles exactly similar to the chalk and to the limestone valleys, where similar but slower solution activity prevails. It was a great puzzle at first to find that the Heckfield valleys have similar contours. Salt, chalk, and limestone are soluble, gravel most certainly is not. So how was one to account for this striking similarity ? The worst vice of a field club is to be in a hurry. Observe and wait. I noticed that some wheel-tracks along a valley were filled here and there with blocks of stone. On inquiry, it seemed that the wheel-tracks sank

unaccountably in patches—subsided, in fact. If a wheel-track, why not a valley? But how? Following the wheel-tracks down towards a small wide alluvial "fan" of exceedingly fine mud ending in swampy ground, and later on watching the oozing water, it was seen that there is a constant slow removal of impalpable mud down the valley line. So the wheel-track sank. The next step was to observe the valley, and here again through the wet season the same impalpable mud was found oozing slowly and continuously from the plateau. Thus the plateau edges are weakened along definite lines, and there the plateau sags into the valleys which border the plateau in radial outward directions. They are subsidence valleys, not due to either surface erosion or to underground solution, but to the removal of fine material in suspension; and, so far as I know, they have not previously been classified.

The botanist will find interest in the mixed and varied plants and trees—oak, beech, ash, elm, larch, spruce, cypress, fir, birch, and pine, with heather and bracken and all the rest of the curious jumble of deciduous and coniferous, and bog and acid vegetation; the zoologist compares general, migratory, and local types; and the archæologist, if he does not care to go back to ice and mammoth and early man, has shown his interest in the attempt to localize the later spiritual expression of things unseen; while the geographer surveys the whole field of earth and man in his attempt, so far as he is able, *rerum cognoscere causas*.