

—when light was created, motion began, and after that, “the dry land appeared,”—since then there has been perpetual motion, during which, parts of the land have been submerged, while other parts have been elevated; and this process has been enacted over and over again. While the land was above the sea, “Frost and Fire,” with “Rain and Rivers,” have each in their appointed place done their work; neither was the sea idle, as it must have acted on the land as it was appearing above, or disappearing under the waters, carving out the main features afterwards to be remodelled by the other existing forces.

An observer who has seen the sea yearly carrying away a coast may be inclined to believe that it is the great destroyer; while those who live among soft strata that are easily denuded, may pin their faith to “Rain and Rivers,” and those accustomed to Alpine or Arctic regions to ice; but an unprejudiced observer will find that “all are right and all are wrong.” Moreover, if the advice of the Chameleon—

“When next you talk of what you view,  
Think others see as well as you,”

was generally adopted among geologists, it would not be so difficult a task as at present to find “keys to fit all the locks.”

The Biblical record may be sneered at because human remains have not been found except among the most recent of the Tertiary deposits. However, in answer to this I may be allowed to put forward Col. Greenwood’s suggestion; that *there is only negative evidence against the existence of Man and the other land animals from the earliest periods of the earth*; for to quote that author’s words:—“Where are the fossil remains of *land quadrupeds* found? In cavern deposits, in drift and alluvium ‘deposited on dry land,’ in filled up lakes, in bogs, or frozen up in polar regions. Now all these land museums are not only modern, but they are superficial and temporary. They are liable to be washed into the sea; and their fossil contents *must be destroyed* before they can be re-deposited in marine strata.”

G. HENRY KINAHAN.

CONNEMARA, Dec. 1st, 1867.

#### DENUDEMENT OF THE WEALD.

SIR,—In your December number, page 572, Mr. Mackintosh names me as “Colonel Greenwood, the father of modern subaerialism.” And thereupon he puts this question to me, “If rain has washed away the soluble chalk, what has become of the insoluble flints?” In reply I would ask Mr. Mackintosh where do “surface flints” come from? I have said “Everything on the surface of the earth which is not living is decaying. On this decay depends soil. On soil, vegetable life. On vegetable life, herbivorous animals. On herbivorous animals, carnivorous animals. So that all life depends on decay.” At page 211, of “Rain and Rivers,” is this passage,—“In chalk countries denudation leaves a *residuum* of flints on the surface, because though these flints disintegrate and though each is

<sup>1</sup> “Rain and Rivers,” 2nd Edition. p. 199.

surrounded with a white soft surface of decay, they do not decay so fast as the chalk. Notwithstanding the most sedulous *stone-picking*, these flints still make their appearance. And it is the universal opinion among farmers that they *grow*, not in size but in numbers. But, however we may laugh at the idea of the *growth* of flints on land, for the *fact* that surface flints increase in number it is impossible to suppose more competent witnesses than farmers. And how is the *fact* to be accounted for unless they are the residuum of denudation? When sheep in feeding off turnips have trodden the ground firm and the flints loose, I have seen them raked into rows and shovelled into carts. And were it not that the bulk of the layers of chalk which decay into soil, so infinitely exceeds the bulk of the layers of flint which decay into soil, the accumulation of surface flints would soon stop agriculture in chalk districts. But as rain gradually and annually washes away the soil, the plough brings up fresh flints. And this increase of surface flints in number proves a very universal denudation going on at this moment under our own eyes." With regard to "what has become of the insoluble flints," where large bodies of chalk have been removed, such as the ancient cap of the Weald Hill, have we no flint gravel beds? Have we no beaches of flint? What of the flint-gravel of Kensington and Hyde Park? What of the flints in the enormous beaches (Dungeness for instance) between Dover and the Weald at Hastings on the one hand, and between Beachy Head and Hastings on the other? These witnesses once existed in the chalk which surmounted the Weald Hill above Hastings. Countless myriads of tons of them have travelled to and fro in all directions, and these travellers still exist on our coast at Hurst Castle, at the Portland beach, at Slapton sands, at Hellstone, and round the Lands-end and to the north of it. Countless myriads of tons of them have been ground into sand. And as I have said in the chapter on the travelling of sea beach in "Rain and Rivers," "as the wind blows the wave flows, as the wave flows the beach goes." But the wave flows up the shore obliquely and down the shore straight. The water then would heap to leeward unless there was an under-tow to windward. This under-tow carries sand which is fine enough to be held in suspension, and this is the cause of blown sand at the windward end of large beaches. And from Bridport, which is the windward end of Portland beach, millions of tons of sand are exported to every part of the world to make "Portland Cement." This is "what becomes of the insoluble flints."

Mr. Mackintosh smashes what he calls "Colonel Greenwood's hard gorge and soft valley theory." I laid down the principle that "as sure as there are alternations of hard and soft strata in the course of a river or valley so sure will there be alternations of gorge and alluvial flat." I first generated this theory in accounting for the valleys along the stretch of the soft Weald clay, behind the gorges across the comparatively hard chalk of the North and South Downs. And I said that, owing to this principle, the original *single* Weald Hill had been cut by rain and rivers into *three* ridges, two

outside chalk ridges, and one inside Weald Hill. And that these three ridges of hills were as much *formed* by rain and rivers, as the statue is formed by the sculptor. I thought that this was quite simple. Mr. Mackintosh's receipt is more simple still. He first brings in fire to make "longitudinal cracks during axial elevation," then water in the form of currents "deflected and reflected so as to hollow out the curvilinear 'coves' by which the 'capes' are separated. But suppose it could be shown that powerful currents operating at a considerable, not 'too great' a depth, are incapable of scooping out the depressions bounded by escarpments, it would not be more inconsistent with uniformity to suppose a cyclically-recurring intensification of the action of currents caused by sudden upheavals of strata (here we have fire and water together) than to admit occasional strides constituting breaks in the otherwise continuous series of (organic) changes."

This seems so probable that if I remain of the same opinion still, it can only be from being convinced against my will.

In the same number of your Magazine, page 568, Mr. Hull says, "I adopt, though with some hesitation the views of Professor Ramsay, Dr. Foster, and Mr. Topley, regarding the subaërial denudation of the Weald." If Mr. Hull will do me the *honour* to read the chapter on the Weald in "Rain and Rivers," I think that he will do me the *justice* to say that the above-named gentlemen have "adopted" *my* principles, first published in 1853, and again in 1857.

GEORGE GREENWOOD, Colonel.

BROOKWOOD PARK, ALRESFORD,  
6 December, 1867.

#### THE VALLEYS OF LANCASHIRE.

SIR,—My friend and colleague Mr. Hull in the last number (page 568) has again brought forward and endorsed his views as to the formation of the valleys of Lancashire. As I have now for some time been at work in North-East Lancashire and the adjoining parts of Yorkshire, my silence would imply that the country on which I am engaged bears evidence in favour of his views, whereas the facts, so far as my experience goes, tend towards an opposite conclusion.

He says "Most of the valleys are really double valleys, the smaller being alone due to river denudation, *and the evidence of this lies in the fact* that, the larger, or primary, valleys are filled with terraces of Marine Boulder-clay, and are really plains of marine denudation in their earlier stages." (The italics are mine.) The fact I can corroborate with pleasure, but I must differ from him in the inference. I find myself obliged to go further than my friend and state, that in the district, with which I am acquainted, the Boulder-clay lies also in the "secondary" valleys, and in water-courses of every size and at different levels (even in some of the narrow cloughs down the hill-sides), in short, in many of those "channels and furrows," which Mr. Hull admits to have been formed "by the action of frost, rains, rivers, and glaciers." In fact many of the brooks of this part of Lancashire are simply re-excavating and enlarging fossil