

fore, the light emitted by the cometary matter exceeded by many times the reflected solar light. I reserve for the present the theoretical suggestions which arise from the new information which the photographs have given us.

THE second evening of its appearing I examined the head of this comet with a McClean spectroscope (with slit) and also with a Hilger's half-prism instrument (a half-size model of the Greenwich one).

The appearances were mainly those seen by other observers, viz., a bright continuous spectrum from the nucleus and a much fainter one crossed by bright lines from the coma. There were however two points of interest which struck me, as I see by NATURE, vol. xxiv. p. 261, they did M. Thollon in Paris. These were: (a) The continuous spectrum from the nucleus had a mottled or striated look, but I could not be certain whether dark lines or bright lines or spaces predominated in causing this effect; (b) the presence of shorter and additional lines to the three carbon ones, extending beyond the continuous spectrum.

These appearances, I admit, I only recognised indistinctly and with doubt at the time, but, corroborated as they now seem to be, I do not question that there was some ground for them. With reference to the nucleus spectrum it could only have comprised a small portion of solar light as shown by the few Fraunhofer lines detected by Dr. Huggins and others in it. The residue of the bright stripe has been attributed (because continuous) to some incandescent solid or liquid substance; but is this necessarily the case? Is it not possible that the matter yielding this spectrum is still in a truly gaseous form, and do not the appearances above described rather point to the character of a gas spectrum passing from the line or band condition to the continuous one, under its existing circumstances of ignition, pressure, &c. (whatever these may be)?—an effect not without parallel, I fancy, at least in the case of hydrogen.

J. RAND CAPRON

Guildown, July 23

A COMET is now visible here. I saw it last Thursday, June 30, at 3:10 a.m. It was in the west, and appeared to me about 30° from the pole star, and 20° above the horizon. The tail was straight and directed towards the pole star. A local paper says this comet was seen to the east at 8 p.m. the preceding day, and that the tail was 20° in length—it appeared to me only 5°.

I regret I cannot send fuller information, but probably the comet is to be better seen in England.

Karachi, July 2

F. C. CONSTABLE

SEA-SHORE ALLUVION

IT is somewhat remarkable at the present day to find even professional men, when dealing with works of coast defence, attributing the movement of littoral shingle to the tidal currents.

The late Mr. Palmer, C.E., in a well-known paper read before the Royal Society nearly half a century back, Col. Reid, R.E., in an essay published in the commencement of the series of quarterly papers by officers in the corps of Royal Engineers, Mr. Redman, M.Inst.C.E., in a paper on the South Coast of England, read before that society some thirty years back, and another on the East Coast of England seventeen years back, as well as in very numerous reports made by him for a Government department (the War Office) during the last quarter of a century, have all shown that these shingle formations are in no way affected by the tide, which must exercise only a negative influence, the flood and ebb setting in contrary and opposite directions, equal in duration, and neutralising each other. Shingle moles are in effect resultant on the wind waves alone, and are deposited in two parallel ridges or hummocks locally termed "fulls," marking the relative range of neap and spring tides, the

crest of the last being normally (except in some exceptional cases such as the *Chesil*) ten feet above high water of spring tides with a broad, gently sloping foreshore of sand down to low water; an abnormal tide, resultant on exceptional gales occurring at rare intervals, sometimes breaches the crest and produces great mischief, as at Seaford on the Sussex coast a few years back, which was inundated by the sea, and where the authorities are about to carry out artificial works of defence.

The prevailing movement in the English Channel is to the eastward, or up Channel, due to the fact that south-west winds prevail for nine months in the year; and along the East Coast the movement is southward, due to the particular trend of the coast and the North Sea offing. It really hardly appears necessary to insist on these well-known facts to any one practically acquainted with the subject, or to hydraulic engineers conversant with the surrounding physical conditions of our tidal harbours, estuaries, and rivers.

Notwithstanding this, strangely enough we find a contemporary journal, the *Engineer*, in a series of articles on the Brighton, Hove, and Shoreham beaches, professedly written for the education of public opinion on the subject, themselves ignoring the fundamental laws governing the motion of this marine alluvion, and attributing it to tidal currents instead of to the wind waves, and yet insisting at the same time that the question, as doubtless it is, is an imperial one, demanding the attention of the Legislature.

Thus, October 3, 1879, "Brighton Beach" (*The Engineer*):—

"A very strong tidal current sets up the Channel to the eastward, and sweeps with it the rolling shingle" (*sic*).

"So rapidly did this disappear under the influence of this current that it became necessary to stay its travel by the erection of heavy timber groynes."

"Knowing what we do also of the effect of sea currents, it is in our opinion exceedingly questionable if their carrying powers can be arrested by anything short of a check which shall produce almost dead water"

One of the last papers read at the Institution of Civil Engineers, on "Upland and Tidal Scour," also attributes the movement of the Norfolk and Essex beaches to the tidal currents.

Nor are local authorities, highway boards, vestries, district boards, and large landowners any more at one than these would-be educators of public opinion on the subject, for we find farmers as a rule sending down their teams and waggons to the sea-shore during winter slack time to collect boulders and pebbles from the sea moles of Nature's forming; railway companies where allowed, and a convenient communication effected, removing it wholesale for ballast of the iron road; lords of the manor conveying it equally wholesale to shipping craft for ballast, until stopped by the strong arm of the law brought to bear on the question by some Government department.

Local magistrates are equally offenders, as recently, about twelve months back, the magistrates sitting at Canterbury authorised their surveyor, after long discussion, as the order was given with the fear of an impending injunction hanging, "Damocles" like, over their heads, to quarry shingle from the sea-shore at Herne Bay for the repairs of the highways; thus robbing the supply travelling up the estuary of the Thames to the westward (the general movement of the belt of shingle being diverted up such estuaries as those of the Thames, Wash, &c.), the material being at the same time so much wanted along the Blue Town frontage at Sheerness, where grave fears have long prevailed, due to the insufficiency of the sea-shore works of defence. This Canterbury decision, taken in the month of January in last year, appeared to us at the time the extreme of rashness, when the interests to

leeward of the proposed road quarry at Herne Bay were considered. The Trinity Corporation would be affected in reference to the defences of the Reculvers—the two spires of the ancient church having been maintained by them for many years as sea marks with stone slopes and groynes for the protection of the cliff. From the fact of their being to the eastward of Herne Bay they may be said to be to windward of the site, still the hastening of the recession at Herne Bay, which has from natural causes alone increased in a marked degree of late, would tend to increase the projection and consequent exposure at the Reculvers.

Next we have the entire landowning interest of the Isle of Sheppy affected by this Canterbury decision, for its northern seaboard retreats at a rapid rate, evidenced by the recent removal of Warden Church, which had been left on the extreme verge of the cliff, due to the extensive slips in the London clay to the westward, which must of course be aggravated if the natural barrier formed by the sea at the base of the cliff is weakened by cutting off the supply coming from the eastward, tending always in its normal state to travel onwards to increase Garrison Point at Sheerness at the outfall of the Medway.

Lastly we have the whole Mile Town and Sheerness frontages affected, where the Government have erected from time to time sea-walls and groynes for the collection of this very beach that the Canterbury magistrates covet for the repairs of their roads. Nor is Sheerness alone affected, but the Queenborough district also, as was evidenced in the great tide of February, 1791, when the whole of the marsh forming the north-west promontory of the Isle of Sheppy was under water, and great loss and damage sustained.

Canvey Island, on the opposite Essex shore, suffered in a similar manner at the same time.

For some years past this practice of removing littoral gravel has been stopped on the Kentish southern coast since Mr. Redman reported for the War Office on the condition of the beaches at Sandown, Deal, Walmer, Dover, Eastbourne, &c., who strongly urged the suicidal nature of the practice, since which the Government and local authorities have had notice-boards planted along the beach imperatively forbidding the removal of shingle.

This general *leeward* movement of shore detritus, due to the prevailing wind waves, has been of late years so clearly demonstrated by the authorities cited, and accepted generally by marine engineers, that it appears strange to find editorial articles for months in a magazine of wide circulation dealing with engineering science which resuscitate the old and exploded theories on the question which are to be found in early geological works, and these articles, if not accepted, have at least remained hitherto apparently unchallenged.

We would sum up this perhaps somewhat lengthy review of a topic, of no mean importance however, having reference to our insular position, by saying that the passage of the heavier particles (the shingle) of a marine mound or natural mole is due universally to the action of the waves, although attributed by many early geological writers to the ocean currents—and its influence on the tidal harbours of our shores, is very important.

The masses of shingle are heaped up coincident in direction with the waves which sort the material in regular gradation; an alternate renewal and withdrawal, due to change of wind, produces a resultant leeward motion due to the wind the particular coast is most exposed to, and the largest pebbles in all these marine alluvion are universally accumulated on the summit, and to leeward of the prevailing winds, due to their greater momentum and to their being less influenced by the recoil wave, compared with sand and the smaller stones.

At the last meeting of the South-Eastern Railway Company we find the chairman (Sir E. W. Watkin, M.P.) stating in reference to the proposed Lydd Railway and the line to Dungeness, that it not only would secure in the

future the shortest route to the Continent, but that it also gave them access to an important bed of shingle, from the sale of which they anticipated great benefit! and that they saw their way to *do a large trade* in its conveyance. It was important for road-making, railway-ballasting, and concrete foundations and walls.

This is the not over scrupulous view of the chairman of a leading railway company of one of the most important natural breakwaters on the south-eastern coast, and the uses to which it may be applied as a quarry for the benefit of his company.

The great land-slip which left Warden Church on the verge of the cliff, causing its ultimate recent removal, occurred in September, 1859, and this had been preceded by a similar great fall to the westward about the year 1856, that of 1859 being in effect a prolongation or extension of the earlier one towards the eastern end of the island. The falls are the result of a gradual subsidence occupying some hours, due to the thorough saturation of the London clay by land drainage down several small chimes, and the effect of atmosphere and weather on the face of the cliffs and their degradation at the base by the sea during spring-tides. In effect a broad belt of land moves seaward (not a mere abrasion or undermining of the cliff alone), settles vertically downwards, or spreads out, and slides seawards, presenting a new cliff landward at the last parallel fissure, the moving mass attaining a state of rest in the shape of an under-cliff, with a series of parallel terraces rising and falling in the valley of the fall, with the turf and vegetation undisturbed; and the foreshore and shingle are ploughed up by the fall, forming a kind of "moraine" at the base. After a fall the ordinary waste goes on at an average rate of one yard per annum. Some of the trees near the church had settled down bodily on the prisms of earth to which they were attached, some fifty feet lower in level than when they were *in situ*, showing how gradual and vertical had been the subsidence.

The question arises, To what extent are the cliffs in the Tertiary formations saturated or affected by percolation through fissures from the sea, and how far this may be the first cause? There are no appearances of land springs from the cliff face. The whole appears to have squeezed down into a saturated or partly fluid base. The rapid degradation of the Sheppy cliffs was pointed out in an article in the *St. James's Gazette* of May 23, and the absence of any attempts to arrest it. But this constant loss has been eloquently described by Lyell in his great work, "The Principles of Geology," affording as it does a constant supply to the fluctuating foreshores of the River Thames carried up by the superior power of the flood compared with its ebb tide, and brought down again by the prolonged duration of the ebb, aided by upland waters in steps downwards.

SCIENCE AT ETON

ALTHOUGH Eton still ranks as a purely classical school, and has not established a modern side as her rival Harrow has done, yet the study of science is pursued within her walls to an extent which—in some respects at least—is unequalled at any other school. The numbers of the school vary somewhat on each side of 900 boys, about 120 of whom, constituting the Fourth Form, do no science. About seventy boys more from the Fifth Form make up the Army Class, and do no Science unless they take in Physical Geography and Geology for their final examination. But in the Remove and in the greater part of the Fifth Form, which constitutes the chief mass of the school, two lessons a week in science enter into the regular work of each division.

At the present time the Head-Master has twenty-two Classical Assistants, and the Lower Master two. There are nine Mathematical Masters, and four for science, two