

genealogies accompanied by portraits of *pilhua* = the heads or founders of large families as found recorded in native MSS. It is more probable that in a state of semi-barbarism individuals had to earn and win their own distinctions. No hereditary surnames were in use among the Mexicans anterior to the Spanish conquest. It is stated in a recent treatise on European Heraldry¹ that some of the peasants of the Jura Mountains did not possess them so late as the Election of 1789. We learn from the same authorities that surnames did not come into general use in Europe until after the second crusade of 1147, which gave such an impetus to the bearing of coat armor and heraldic insignia in general. In this regard it is interesting to note that it was to the intertribal wars waged in Mexico solely for the purpose of securing human victims for religious sacrifices that we can trace the development of Mexican heraldry. The independent invention and use of heraldic insignia in the New World is but another proof of the truth of the dictum that human nature is very much alike all the world over.

Brighton, England.

GAY HEAD.

BY P. R. UHLER.

THE steady flow of modern travel has opened an easy way to the delightful island of Martha's Vineyard, where the socially inclined may enjoy the advantages of summer schools of science, or participate in the exercises of the camp-meeting within spacious and airy pavilions. Here the artist finds a prospect of varied color, with long vistas of cliff and sea and sky standing forth in surpassing loveliness and inviting an effort to place on canvas his richest and brightest tints.

To the student of nature, however, there is access to an ever-increasing store of facts. The more he investigates the structure of the region, with its assemblage of creatures and plants, or views the struggles of atmosphere, land, and ocean to maintain an equilibrium, the more he finds himself beset by perplexing questions, which will not be answered at his bidding. A riddle, as yet but partly solved, lies involved in that wonderful piece of earthy structure called Gay Head. Here, at the western extremity of the island rests a huge pile of sand, rock, and clay, more than one hundred feet high, tinted with numerous vivid colors, which have been the wonder and delight of the voyager ever since the discovery of the country. The sparse settlement of the island has as yet produced but a short chapter of the history of its people; but the record of nature's changes and disturbances, which have affected the land and sea, would fill large volumes.

To one series of these changes, belonging to its geology, we would now direct attention. The greater part of the island shows evidences of having been submerged five times beneath the waters. At each emergence from the water, an increased thickness was given to the body of the land, so that at the beginning of the last glacial period it stood on the western side at a level of not less than two hundred feet above the surface of the tide.

At the close of that period and chiefly remaining to the present time, a deep deposit of fine sand, boulders, gravel, and broken stones, from ten to twenty-five feet in thickness, covered the upper slope of the ridge. The Potomac Clay, which forms the inner and also the lowest descending division of the deposits resting here, rises like a central core to near the summit of this hill. As most of the other members below the glacial deposits are either absent from, or only feebly represented on, the upper surface of the clay, a thin bed of sand and other glacial material forms the superficial covering. On both slopes of this ridge, the west and the east, the column of geological formations is present, although not in fully unbroken continuity, the Cretaceous Green-Sand Marl having not been found on the eastern slope by the

writer. On this side, however, the Raritan Formation, previously defined in Maryland as the Alternate Clay-Sand group, displays an exceedingly fine exposure, with the strata and laminated layers in original order. Here, also, it is enriched with the same plant fossils and lignitic wood so characteristic of these beds on the Raritan, Severn, Magothy, and other rivers of New Jersey and Maryland.

No evidences of mountain-folding appear in any part of the elevated division of the land. The underlying member which descends deep below tide, is the Variegated Potomac Clay, and this forms the foundation for all the other formations in their usual order of superposition.

Deep denudation and erosion followed the completion of the Potomac Clay, and it was cut to below the line of present low tide at the localities now occupied by Menemsha, Squibnocket and Nashaquitsa ponds. The broken surface of this clay and the presence of the Raritan and other beds above it on the low hills of Menemsha Bight, show how deeply the Potomac formation was here degraded before the next succeeding formation was laid down. Consequently in early Cretaceous time a high plateau of the clay was carved into sloping reliefs which had their most depressed surfaces spreading away towards the east and south.

The steep side of the island is on the west, and here it is that the modern surf has cut away large tracts of the ancient bluff. On the Gay Head division the sea has been digging away the cliffs at the rate, it is said, of sixteen to twenty feet in a year. The stretch of boulders called the Devil's Bridge, lying at a distance of fully half a mile from the present beach, shows where the outer border of the bluff formerly stood. The Potomac Clay not only extends out that far at the bottom of this shallow shelf of Vineyard Sound, but we are told that it sticks to the anchor in the channel which now runs on a course more than two miles distant from the present beach. A searching survey ought to show that this clay underlies the Elizabeth Islands and stretching away south-west passes under the borders of the mainland of Massachusetts and Rhode Island, and from thence under Long Island and Staten Island to beneath the lower clays of New Jersey.

The section as it is now exposed in the less-disturbed bluffs of Gay Head shows the Variegated Clay near the beach in strata or arched beds from three to more than ninety feet in thickness. The undisturbed upper part of this member is sometimes a whitish or red clay, and is often more or less mixed with sand.

Immediately above this, but not on the summit of the clay, rests the group for which we now offer the name Raritan Formation, from the river on the shores of which it is so extensively exposed. It consists of a few feet of brown, coarse sand at base, which is sometimes indurated into a moderately coherent sandstone. Above this is a bed, two or three feet thick, of white sand locally streaked with white clay. Over this the laminated sands, black and gray, charged with lignite, and parted with fine white sand, rise up into thin layers of a paler clay which alternates with seams of the white sand. This clay appears more massive in some sections of the bluffs, and occasionally forms a homogeneous stratum, from three to five feet thick. Next above this is a most conspicuous stratum of disintegrated granite, which is a kind of coarse rock-flour, white on the weathered surface, but gray in the covered mass. It forms a bed ranging from ten to more than fifteen feet in thickness. This forms the superior member of the group, while the whole Raritan Formation, as here recognized, reaches a maximum thickness of about fifty feet.

Next higher in the bluffs rest the ferruginated remnants of the Cretaceous Green-Sand Marl. The great body of this deposit has slipped down or been overthrown upon the steep side of the cliff facing Vineyard Sound. It appears in three separate piles, stretching from near the summit of the projecting buttresses down to the beach. The only part of it now remaining near the line of its original position is represented by a few inches of altered brown sand, in patches. These are the vestiges of the thin edge of the stratum which stretched out towards the sound, and which terminated in a bed eight to ten feet thick in modern time. Eighty or more feet outwards it is a thick body of dark-green

¹ A Treatise on Heraldry: British and Foreign. By John Woodward, F.S.A., and the late George Burnett, LL.D. (Lyon King at Arms). W. & K. Johnston, Edinburgh, 1891.

sand, resting in one place on end, and much mixed on the surface, sides, and end with gravel and fossils belonging to later formations. Bones of whales and fragments of shells of the Miocene Formation have settled into its broken surface; but in the unmixed interior of the mass, it has yielded to me soft casts of *Gryphea* and *Cucullea*, hard fragments of the bones of reptiles, with coprolites, and teeth of the shark *Otodus*. The component materials of this marl agree with those of the Lower Marl of New Jersey, and, like the latter, rest directly upon the upper member of the Rapitan Formation.

The Miocene Formation, so far as my own observation extended, is broken up, and so mixed with the drift at the base of the glacial deposits near the surface that the only evidence of its former presence here, below the belt of conglomerate, resides in the presence of vertebræ of Cetacea, fossil shells, and some teeth of sharks.

On the surface is the fine pale sand, forming a loose bed, underlain by about two feet of pebbly conglomerate which rests in a bed of broken rocks, gravel, and boulders. The sand is spread thickly over most parts of the island, and along the western ridge it is set with granitic boulders measuring occasionally twelve feet in length and width by six to eight feet in thickness.

The whole Gay Head promontory is a scene of disturbed equilibrium, where the beds of rock-derived material have been softened by atmospheric agencies, pressed down by a load of stone and gravel, undermined by oceanic strokes of oceanic surf, and let down into gullies by trenching storms of rain.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

A Mountain-Top Experience.

FREMONT PASS, Colorado, is 11,540 feet above the sea. To the east rises a peak by a rather steep slope, perhaps 2,000 feet higher. Its eastern slope is precipitous.

On Aug. 18, alone, I reached the summit of this peak. It was noon. Several miles away to the north a heavy thunder-storm was raging, while far to the west was another. Within a mile or two a massive cloud had formed between the lower mountains which shut in a gorge. I stepped to the very highest point of the peak. My contemplation of the extraordinary view afforded me was disturbed by a sharp buzzing as of bees seemingly beneath my hand which rested on the bulky pine sliver serving as my staff. But on lifting my hand I found no bees large or small.

As the buzzing continued, I vainly scrutinized the stick for signs of life. I then indifferently concluded that it was possibly caused by some boring insect in the wood. That settled (?), I lifted a large roundish rock to toss into the chasm below, when it, too, buzzed or crackled in my hand at a score of points. Close inspection revealed no bees or bugs on that rock. Can it be. I asked, that this rock is crackling from the change of temperature occasioned by a change of position? At that moment, the "bees" were swarming in my hat. Snatching it off, I was searching it for the buzzing things when they seemed to throng my hair. Immediately on raising my hand to my head the puzzling mystery was solved, as the strong flow of electricity fairly tingled and buzzed through my fingers, and, looking up, I saw a cloud forming overhead. I was acting as a lightning-rod to that mountain-peak. Ignorant of my possible safety or danger in the involuntary experiment, I lacked the valor or scientific devotion to prolong it. Securing my box of flowers and that buzzing staff, I discreetly retired some distance down the slope from that summit surcharged with possible electrocution if I remained. Ere I reached the pass, two hours later, the storm from the north had reached the peak, and soon that rocky summit was whitened with snow, while hail and rain fell in the pass.

During my descent, while the thunder-cloud rapidly approached the peak, a strong wind blew through the pass directly toward

the cloud until light rain began to fall. Is my experience as given a common one? Was it a dangerous one?


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Denton, Texas.

The Gemination of the Lines in Mars.



As far as one can judge from newspaper reports, the recent observations on Mars render certain the existence of the curious Schiaparelli lines, but as yet nothing has been seen of the doubling, or gemination, which has been claimed. If this negative result shall be sustained by the accounts yet to come from observatories in lower latitudes, there still remains the interesting question, How did such a mistake come to be made?

A bit of personal experience will, I trust, be pardoned, since it points to what seems to me the explanation of the error, if one exists; at least, it shows the existence of a *vera causa* able from single lines to produce double ones. The lens in my left eye possesses the power of double refraction. If I close the right eye and

look at a line drawn obliquely, thus  the paper being held

No. 1.

squarely in front of me, I see nothing peculiar; there is to me, as to anyone else, only one ordinary black line. But if the line

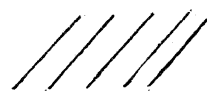
slopes thus  I see two lines  the lower one being

No. 2.

No. 3.

decidedly less deeply black than the other. As I now hold the paper, the bottom towards me, No. 1 appears as a single line, No. 2 as a double one, like No. 3. If now I turn the side of the page towards me, revolving it through an arc of 90°, No. 1 shows double and No. 2 single.

If I draw a set of single lines as below



No. 4.

and look at them with both eyes, or with my right eye alone, I see only so many single lines; but if I close my right eye, then with my left I see ten lines, each original line being geminated by a fainter one exactly parallel, and pretty close to it, as in No. 5.



No. 5.

If now I turn No. 4 to the right or left, the double images will approach each other, and at the same time slide by each other a little until I have turned the paper 90°, when the images will coalesce, each line appearing sharply defined, single, and very black, except at each end, where for about $\frac{1}{16}$ of an inch the color will be fainter and the line less sharply defined. I can vary my experiments in many ways, each time getting the well-known phenomena of double refraction.

The application to the lines in Mars is very simple. If a person possessing an eye with this power should see the planet's image in the telescope, and be able to perceive the Schiaparelli lines, he would see each accompanied by a twin line of the same length, but not quite so sharp and distinct. If the lines ran, as in No. 1, from north-west to south-east, he would not see the secondary ones, but if his other eye chanced also to have a double refracting lens with axis at right angles to the first, he would then see the secondary lines in the same way.

I know, from my own experience, that one may possess this power without being conscious of it. I discovered it only when experimenting on single vision. In ordinary use (i. e., with both eyes) I cannot perceive any indication of it, the greater illuminating power of the ordinary ray, plus that of my other eye, com-