biologist to trace out the evolution of its inhabitants, or whether with the astronomer, the chemist and the physicist we endeavor to unravel the constitution of the sun and the planets or the genesis of the nebulæ and stars which make up the universe, on every side we find ourselves surrounded by mysteries which await solution. We are only at the beginning of work.

I have, therefore, full confidence that the future records of the British Association will chronicle a still greater progress than that already achieved, and that the British nation will maintain its leading position amongst the nations of the world, if it will energetically continue its voluntary efforts to promote research, supplemented by that additional help from the Government which ought never to be withheld when a clear case of scientific utility has been established.

SOME NOTES ON DARLINGTON (S. C.), 'BAYS.'

Having noted on a surveyor's map of my school district of Darlington, S. C., several lake-like expanses usually represented as being at the head of some very small stream, I began inquiries concerning them and followed this up by visiting several of the largest.

Parenthetically, I may say that Darlington is well out on the loose sands and clays of the coastal plain (see Fig. 1), and while the main streams have cut down 30 to 40 feet beneath the general level of the country, yet their side streamlets are small, and much of the inter-stream surface is poorly dissected and but slightly changed from the condition in which it was uplifted from sea bottom. This inter-stream surface is very level, the slope being about one foot per mile; the streamlets are weak; and extensive systems of ditches are necessary to keep the upland drained for cultivation.

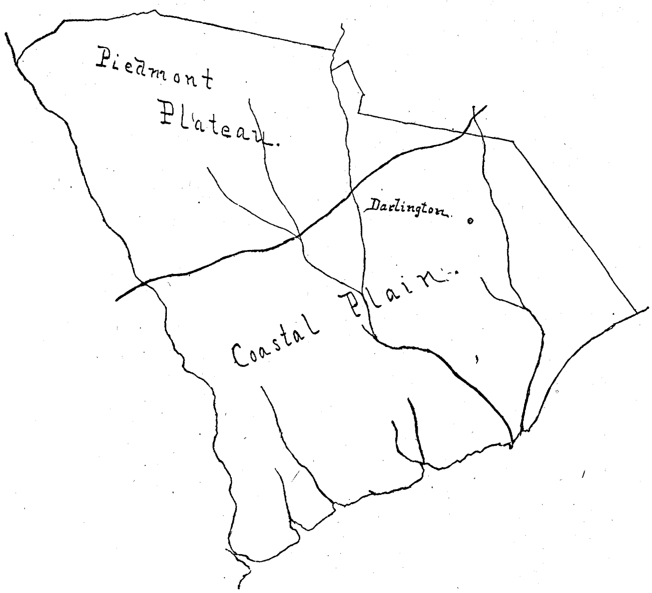

Fig. 1. *Map of S. C.*, showing position of Darlington on the coastal plain.

To the lake-like expanses the term 'bay' is usually applied, and by it is meant a perfectly flat, clayey area with a surface some two to four feet below the general level of the country and varying from a few acres in size to stretches a mile or two long and a half mile or more in width; the smaller ones being much more numerous and having usually an area of 20 to 30 acres. They are in some cases approximately round in shape, though they are usually ovoid or elliptical (see Fig. 2), and are covered with vegetation-stained water from a few inches to a foot or two deep, according to the season. Growing in this water, where the 'bay' is uncleared, are cypress, juniper or black-gum trees with a moderately thick swamp undergrowth.

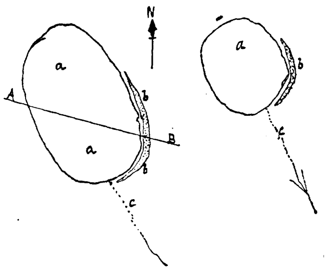

Fig. 2. *Sketch map of a 'bay.'* a, 'bay'; b, sand ridge; c, intermittent outflow to a stream near by.

Except when overflowed in a rainy season, there is often in the smaller 'bays' no permanent drainage. In the larger ones a small streamlet usually rises. When cleared for cultivation, the first requisite is to dig a ditch to the nearest stream or main ditch sufficiently deep for thorough drainage.

A *sand ridge* borders each 'bay' on the east and southeast and sometimes extends fairly well round toward the south, but is *never* found, so far as I could ascertain, on the *west* or *north* (see Fig. 2, b). The size of this sand ridge varies with the size of the 'bay,' rising in some well-pronounced cases 5 or 6 feet above the general level in the highest part and thinning out near both ends. In the usual case, however, it rises only some 2 or 3 feet above the general surface level. The width of the ridge varies from a rod to three or four rods. The transverse surface curvature is most often uniform, or if more precipitous on one side than on the other no law could be found governing such variation (see Fig. 3).

A gentleman owning large tracts of land containing 'bays,' and having been a close observer of them, gave me much information and went a number of times to visit them with me. He called my attention to the fact that on first attempting to drain them for cultivation he had tried cutting ditches through this sand ridge, but found that the sand caved so easily (being, in a few cases, very quick) that it was very difficult to dig and keep such ditches open. The sand I thus found extended down below the surface of the adjacent sands and clays. How deep I could not find by direct test, probably not deeper at farthest than 15 to 25 feet, if nearly as deep as that, which I doubt. It is a rounded sand and, though used in Darlington for mortar, is very poor for building purposes. No fossils could be found in it so far as I searched. No stratification was visible. It is agriculturally extremely poor, and from its characteristic whiteness may be detected in a field that has been tilled for years. It seems to be a beach sand.

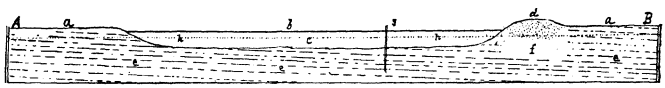

Fig. 3. *Section 'through a bay'* on line A B in Fig. 2. A B, general surface level; *b*, surface of 'bay'; *c*, clay filling basin of 'bay'; *d*, sand ridge; *e*, loose sands and clays dipping gently southeast; *f*, unknown part; *g*, pump; *h*, water level.

The basin (see Fig. 3, c) when drained shows a dark fertile, compact clay, impervious to water and with no fossils so far as a rough search could detect. This clay extends down some 15 to 25 feet, as is proved by driven wells that have been forced down through it. No water is gotten until the pipe reaches the underlying sand, when the water at once rises to the general water level, within 6 or 8 ft. of the surface. (See Fig. 3, g and h.)

Other duties prevented my mapping the large number of 'bays' that occur, to see what relationship, if any, could be discovered from their position. They seem to be scattered irregularly over the flat surface, some nearer the present coast than others. Whether they arrange themselves along certain lines I cannot say.

By some the sand ridges are attributed to wind action. This, however, would require a region free of vegetation, and we do not know that this one ever was so over any broad area. Besides, the wind would pile the dunes on *other sides* of the 'bays' than the east and southeast, unless it blew always from the east or southeast—a supposition of which no proof can be given. Finally, wind action is insufficient to account for the bases of the sand ridges extending beneath the general surface of the adjacent sands and clays.

From an examination of the Coast Survey charts of the Albemarle and Pamlico Sound region, I was at first led to conclude that I had in the 'bays' the results of numerous repetitions on a smaller scale of what is now going on in these sounds—the difference in the *size* of the bodies compared being great, but their agreement in *process* being strong. Each sound is a drowned valley with a bottom 15 to 25 feet deep at most and, being cut off from the ocean by the sand bar thrown across its mouth, they are slowly silting up with the very fine material brought down by the sluggish streams that empty into them. If present conditions continue long enough they will be filled with a fine, compact clay, and are already skirted on the southwest and east by a sand dune. There is an apparent analogy. The former sea where Darlington now stands—though deep shortly before this from the thick beds of fuller's earth which must have been very gently deposited far from shore sands—was shallow, as is shown by the marl deposits near the surface and by the sands over all the region showing false or cross bedding and containing in some places moderate sized quartz pebbles. The shore line must have been low. Streams were probably numerous and small, no large drainage basins having been formed. Allow time enough for a little cutting of their channels by these newly-born streams, then a very small downward oscillation of the land,* let the headlands be beaten off and bars thrown across the mouth of the drowned streams while the enclosed basin slowly fills with fine sediment, and finally let the whole region gradually rise as it has done in fact, and we have a theory of their origin (see Fig. 4).

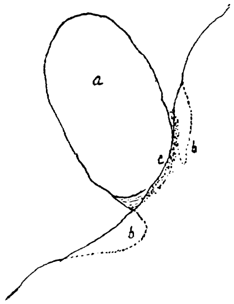

Fig. 4. *Theoretic Origin.* *a*, soundlet being enclosed; *b*, headlands beaten-back; *c*, bar thrown across mouth of sound.

This theory, however, is open to certain objections. No remains of an old stream channel entering this 'bay' is found. The existence of old beaten-off headlands on either side has been asked about. If these exist they are too faint to have made themselves noticeable when not looked for. They may exist in the case of the larger ones. The irregular distribution toward

*See Prof. Shaler's 'Fresh Water Morasses, etc,' 10th An. Rept. U. S. Geol. Sur., pp. 330–331, for numerous such oscillations recorded near this region.

the present shore is another difficulty. The prevailing rounded or elliptical shape is not explained.

That the sea, when this part of the coastal plain rose above it, left numerous inequalities somewhat similar to the ripple-made pittings seen in the sand in the bottom of a gutter after a rain has suggested itself to me. If so, these basin-like pittings —separated from each other by sand ridges highest above the general shore slope on their east side—might have formed the basins for these 'bays.'

Fuller observation and study is needed before anything but a tentative conclusion may be reached. Any additional observations or suggestions will be gladly welcomed.

L. C. GLENN.

DARLINGTON, S. C.

A NEW METHOD OF DETERMINING THE MOTION OF STARS IN THE LINE OF SIGHT.

A METHOD of measuring the motions of stars in the line of light, which does not require the use of an artificial comparison spectrum, and which is therefore adapted to slitless spectroscopes, has been proposed by Professor Orbinsky, of Odessa (*A. N.* 3289). It is of unusual interest because the object-glass spectroscope, which is so advantageous with respect to simplicity of construction and to the brightness of the spectra which it yields, has never yet been successfully applied to this branch of astronomical research.

The principles on which the method depends may be briefly described as follows: If a luminous body is moving in the line of sight, the distance between any two lines in its spectrum is not what it would be if the body were at rest, since the two lines are unequally displaced by the motion. In a normal spectrum the displacement of the lower line would be somewhat the greater, although the difference would scarcely be measureable under ordinary circumstances, but on account of the increasing dispersion of a prism toward the violet the effect in a prismatic spectrum is reversed, and the upper line is displaced more than the lower one. The differential displacement of the $H\delta$ and $H\beta$ lines, in an ordinary prismatic spectroscope, is, in fact, somewhat more than half the absolute displacement of the $H\gamma$ line. By measuring this apparent change of dispersion the motion of a star can be determined.

To avoid the errors attending the measurement of large distances on a photograph, and other errors which need not be specially mentioned here, the spectrum of a star whose motion in the line of sight is known is photographed on the same plate, and the apparent change of dispersion due to the motion of the first star is deduced from measures referred to corresponding lines in the spectrum of the second. The stars selected for purposes of comparison would naturally be bright stars with well-defined lines, and their motions could therefore be accurately determined by the usual methods. Only a comparatively small number of such standard stars would be required.

For slit spectroscopes it would probably be found that Professor Orbinsky's method is inferior to the usual one, although Professor Vogel finds that it can be applied to some of the photographs taken with the Potsdam spectograph. It not only depends upon a differential effect, and thus reduces the amount of the available displacement, but it requires the measurement of lines which are widely separated, and therefore badly defined in consequence of their great distance from the axis of the camera objective. Even if this lens were constructed with a view to giving a large field the definition would be inferior to that in the center of the field of an objective of the usual construction.