from the logs of some of the vessels caught in the Straits of Sunda at the time (see *Nature*, 1884, Jan. 10, p. 240).

A careful consideration of the data there available would seem to render it almost certain, that, in this Krakatoa explosion, something like two or three cubic miles, perhaps more, of earth which formed the northern part of the volcanic island and its underlying strata, were blown into the air to some unknown height, and clearing entirely Lang Island, lying immediately north-east, came down again six or eight miles to the northward and eastward. As this probably took place at a single explosion, and as large amounts of gases under enormous pressure were almost certainly suddenly set free, to say nothing of the sudden generation of steam, it is, perhaps, not to be wondered at, that this immediate demand for 'more room' should have started a series of waves in the atmosphere (like those in a mill-pond from the plunge of a stone) which travelled several times round the globe.

The vessels' logs above referred to — one reporting the barometer fluctuating between twenty-eight and thirty inches and violently agitated, and another the same rising and falling from half an inch to an inch in half an hour — show how violent was the local disturbance, which, by the time it reached this country, amounted to only about two millimetres.

Doubtless some slight effect of this kind must follow every large explosion, like that of a powder-mill, over some limited area; and it is worthy of note, that Mr. Scott, the secretary of the London meteorological council, in his paper communicated to the Royal society on Dec. 4, 1883, states that the traces of these Krakatoa waves "exhibit considerable similarity to that of the King's barograph at the Liverpool observatory, at the Waterloo docks pierhead, on the 15th of January, 1864, when the Lottie Sleigh, loaded with about twelve tons of gunpowder, blew up. The ship was lying about three miles from the observatory." But this phase of such explosions is entirely distinct from their sound and their window-shattering character.

H. M. PAUL.

Washington, April 21.

## Osteology of the large-mouthed black bass (Micropterus salmoides).

Very recently my studies have required me to make several dissections of the large-mouthed black bass, and carefully prepare two or three skeletons of this fish. These skeletons are now before me, and in two of them I notice a very interesting anatomical point. During the course of my reading upon the skeletons of fishes, I have failed to discover any account of a similar condition in any of the Teleostei, and note it here, trusting that I may learn from others, interested in the anatomy of this class of vertebrates, whether or no they have ever observed the same. This consists in a pair of freely articulated ribs at the base of the occiput. Their heads are received in a shallow facet on either side, situated just above and rather internal to the foramen for the vagus nerve. Immediately below each rib occurs the projection of bone that bears upon its entire posterior aspect one of the pair of articular condyles for the first free vertebra of the spinal column. Still beneath these condyles is seen the conically concave facet for articulation, with a similarly formed surface occurring on the centrum of the vertebra just mentioned, and the one which I believe would be described as the atlas.

This pair of ribs is directly in sequence with the abdominal ribs on either side. Their occurrence in this situation might be accounted for by saying that several of the anterior vertebrae of the column had been absorbed by the occipital elements. Mr. Bridge found such a condition in Amia, though no free ribs were present (*Journ. anat. phys.*, xi. 611, Lond., 1877). In the cranium of Micropterus, however, I should think that this would be highly improbable. Both the first and second vertebra of the spinal column of this bass support each a pair of free ribs, and a mid-series of the other abdominal ribs bears epipleural appendages. Dr. Günther states in his account of the osteology of the Teleostei, in article 'Ichthyology,' of the Encyclopaedia Britannica (vol. xii., 9th ed.), that "the centrum of the first vertebra or atlas is very short, with the apophyses scarcely indicated. Neither the first nor the second vertebra has ribs." I have a yellow perch (Perca americana) in my possession where both of these vertebrae support a pair of free ribs.

Should an examination of the young of the black bass show that none of the anterior vertebrae of the column were included with the occipital segments, but that these ribs are truly occipital ribs, then they become of interest from several points of view.

R. W. SHUFELDT.

Washington, March 31.

## Caulinites and Zamiostrobus.

As *Science* has devoted a page of its valuable space to Mr. Joseph F. James's copies of Mr. Lesquereux's figures of these plants and his remarks thereon, in which, without having seen the specimens, he essays to overthrow the determinations of the venerable paleontologist, a word in reply may be justified as tending to correct the impression, already quite prevalent, that the determinations of vegetable paleontologists are in large measure mere guess-work.

As regards Caulinites fecundus, little need be said, since its problematical character was sufficiently insisted upon by Mr. Lesquereux in his description. The 'capsules' are much smaller than those of Onoclea sensibilis, and are found in intimate relation with the stems which have been called Caulinites. The matrix is a light, fine-grained shale, showing the longitudinal, parallel nervation of these stems very clearly. It also contains fragments of dicotyledonous leaves which may have belonged to the plant that bore the fruit; but no ferns are present, as these would be clearly shown by their characteristic nervation. It is safe to say, that, if Mr. James had examined the fossils, he would not have said that there was "no doubt" in his "mind that Caulinites fecundus is nothing but a part of the fertile frond of Onoclea sensibilis."

As regards Zamiostrobus, however, there is 'no doubt' that Mr. James is egregiously in error. His confident statements well illustrate the folly of discussing mere figures of objects that are in existence. He has entirely misapprehended the nature of the specimen; and this is not altogether the fault of Mr. Lesquereux's figure. The fossil is a segment of a zone, cut out of a cylindrical or conical body which must have measured about eight inches in diameter. This segment was placed with the exterior surface upward in the drawing, in order to show somewhat in perspective both this surface and the radiate structure of the cross-section from the direction of the centre. The figure is defective in not showing the manifest angle which all the dark spots have on one side, and which fixes their true character as scars of former leaves. It is probably not a cone, as Mr. Lesquereux supposed, but a fragment of one of those

dwarfed cycadean stems or trunks which formerly went by the name of Cycadoidea, but which the Marquis Saporta (Paléontologie française, Végétaux, II.) now divides up into the two new genera, Bolbopodium and Clathropodium. From an examination of his figures, I am inclined to refer it to the latter of these genera. Although found at Golden, Col., which is cretaceous or Laramie, still it is not impossible that this specimen may have been in some way brought to this spot from a locality higher up the adjacent slope, having a position stratigraphically lower. LESTER F. WARD.

### The Greely search.

Safely assuming that *Science* admits within its domain facts only, and willingly dismisses errors of observation, I respectfully offer the following corrections of some inadvertences found in your notice, March 28, of the action of the Navy department, and its board of relief for Lieut. Greely.

It is an error to suppose that the report was founded, 'in great part, on the counsels of Capt. Nares and his associates;' for the joint letter of Nares, Markham, and Fielden, dated, as the report shows, London, Feb. 1, could not have been in the board's hands until nearly a month after their submitting that paper, the publication of which was delayed for these and other valued counsels.

The necessity of leaving the ice-navigation 'absolutely' to the judgment of the ice-navigators, that is, to ice-pilots, is also in this case a fallacy. Neither the whalers nor the sealers go north of 70° north latitude, and can have no knowledge of the ice movements in Kane basin, for action in which, the commanding officers are likely to gain as much knowledge as ice-navigators, so far as this *can* be gained in lower latitudes. Once in the basin, the whole problem depends on the judgment and skill of the officer, who must, by careful observation of the local tides and weather, determine when and where to advance. The writer of your notice has ignored the plain fact that the commander, as the only responsible person, must also be the absolute judge of the ship's movements among the most fickle of all known conditions, — the ice-changes. He must, almost without ceasing, be on the watch and in the crow's-nest. In that 'sort of tub,' Hartstene, when out in the search for Kane, "stayed for thirty-six hours on the stretch, with but a bowl of soup sent up to keep body and soul together;" and, according to Markham, Nares almost lived there, from the nest closely scrutinizing the ice motions, the tides, the currents, and the influence of the wind on the pack. "It was entirely due to this that the expedition advanced, although inch by inch." That an ice-navigator of the ordinary type should be equal to this watchfulness, is scarcely among the possibilities; and in this connection the experience of the Proteus is most unfortunately cited by your correspondent, if the captain of that vessel was correctly reported as being confessedly very rarely in the nest. Nor, in another point, is the case a parallel one, inasmuch as the needed naval qualifications could not be expected to be found in an army officer, however marked were his courage and admitted sagacity.

The statements in regard to the failure in providing for scientific observations, and as to the programme of the cruise, are equally at fault. The final decision of the programme for the expedition could not have been made at the date of the writing, and, indeed, has not yet been made known. From the nature of the case, much must be left to the discretion of the officer commanding: he must, as in the case of previous expeditions, sail 'untrammelled.' So far as opportunity shall offer for scientific observations, these will be made by the use of two complete scientific outfits, including photographic apparatus, carefully prepared for meteorological and magnetic work, if the ships should winter north. For this, as well as for previous expeditions, special instructions have been laid down by the department for such observations as will not interfere with the main object. The ships will take out three young officers of the number, which, under the sanction of Secretary Chandler, have been recently on duty at the Smithsonian, under training for just such work. They will be thus prepared to carry out the instructions of Professor Baird, so far as the ever-changing circumstances of the cruise shall permit.

May not the very grave responsibilities of this errand of mercy be intrusted to the department and its selected officers, conscious, as they assuredly are, of these responsibilities, and hoping for that success for which the hearts of the nation wait, as attested by the unlimited appropriation placed at the discretion of the president? When De Haven went out in the search for Sir John Franklin, Admiral Osborn openly said, "I was charmed to hear that officers and men signed a bond not to claim any part of the reward of £20,000 offered by the English government."

Unaware of the existence of any lower tone of character in those who now leave their homes on an errand of humanity, yet of grave uncertainty of success and of personal danger, I submit the preceding corrections, which might, indeed, be extended. They will commend themselves as due to the Navy department, to the officers, and to the mixed board from the army and navy, whose report itself evinces much previous arctic study, and close attention to the wants of the expedition. J. E. NOURSE.

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[The question as to whether an officer entirely without experience, and therefore necessarily without skill in meeting certain exceptional conditions, is as well qualified to do so as one who has gained skill by long experience, is one, which, divested of sentiment and class feeling can have but one answer. We are not aware that floating ice north of latitude 70° possesses any occult qualities which it loses on drifting south of that imaginary boundary. The skill and watchfulness of the ice-navigators of the sealing and whaling fleet is a fact which does not depend upon any one's opinion, but has been proved by long years of successful adventure. That the owners of this fleet should require some guaranty in case of success, for putting their property in jeopardy, for what many regard as a forlorn hope, is merely reasonable; and no just parallel can be drawn between them and officers of the navy, who have no pecuniary stake in the vessels to which they are temporarily assigned. The statement in regard to scientific work, 'not inevitable to the expedition' (like meteorological observations), was made on the best authority; and we shall be pleased to learn that the first intention of the commander of the expedition has been modified in the manner the writer intir 'es. That the counsels of Sir George Nares and 's had great weight in determining the repor' board, we judged from internal evidence, fi :ct that the report was delayed until those ( ere made known, and because it would have most reprehensible if they had not received respectful attention.]