Machairodus and other Felines. The author suggests that *Titanosuchus* found its prey in the contemporary *Pareiosauri*, Oudenodonts, and Tapinocephalans of the same locality.

3. "Notes on the Consolidated Beach at Pernambuco." By J. C. Hawkshaw, Esq., M.A., F.G.S.

The consolidated beach at Pernambuco, which has already attracted considerable notice, is a ridge of sandstone from 25 to 75 yards wide, and, as shown by borings made under the author's direction, from 10 to 13 feet thick. The landward or higher edge is nearly at the spring-tide high-water level, and it slopes seaward; the river (with a depth of 28 feet at low water 60 feet from the rock) flowing along the former face. The rise and fall of spring tides is 7 feet. Beneath the above rock is a stratum of sand with shells and stones about 8 feet thick, and then a second layer of sandstone rock.

The consolidated beach is cemented by carbonate of lime, which the author considers to have been deposited by the action of water percolating through the rock, probably when the level of the land differed somewhat from what it is at present. He thinks it possible that this and other similar beaches on the Brazilian coast may mark periods of repose in the slow vertical movements which the coast has undergone.

CORRESPONDENCE.

ON THE FORMER CLIMATE OF THE POLAR REGIONS.

SIR,—In the GEOLOGICAL MAGAZINE for December, 1878, page 552, in a paper by the Rev. O. Fisher, M.A., on "The Possibility of Changes in the Latitudes of Places on the Earth's Surface," the following passage occurs in reference to the question of the possibility of the crust of the earth slipping over a fluid substratum, thereby causing changes of latitude:—"That theory belongs to Dr. Evans; and he has ably defended it against Dr. Haughton's somewhat formidable objections in his recent address to the British Association at Dublin. The supposition alternative to Dr. Evans', by which Dr. Haughton would account for a former warm climate at the Pole through residual heat in the earth, has, I think, been disposed of by anticipation in Sir W. Thomson's paper on the Secular Cooling."

I am not at all prepared to admit either horn of the foregoing dilemma, but shall confine myself at present to the first.

Dr. Evans' address was delivered at the opening of the Geological Section of the Association Meeting, and my paper, showing the impossibility of accounting for the Tertiary plant-remains in the Arctic Regions by any change in the position at the Pole, was the last paper read before the Geological Section of that meeting.

I believe that I am correct in stating that neither the President, Dr. Evans, nor any geologist present, gave anything like a satisfactory answer to what the Rev. O. Fisher has called my "somewhat formidable objections."

My contention, in brief, was this, that the Tertiary plant-remains indicating a climate similar to that of Lombardy (so far as heat is concerned) are so situated round the North Pole that no possible change in the position of that Pole (even were such permitted by mechanical considerations) would give them the climatic conditions as to temperature which they require. It was urged at the meeting, as an objection to my view, that the presence of evergreens among the Arctic Tertiary plants was inconsistent with the prolonged absence of light, which they must have sustained if the Pole were in its present position. To this, my reply was the following statement by Professor W. R. McNab, M.D., of the Royal College of Science :—

"4, Vernon Parade, Clontarf, *7th April*, 1878.

"Dear Dr. Haughton,—I fear I cannot give you a direct answer to your question, and I have not found any papers on the subject in the 'Botanischer Jahrsbericht,' Sachs' 'Lehrbuch der Botanik,' in Sachs' 'Handbuch der Experimental-Physiologie der Pflanzen.' The general facts of the case can, however, be very readily stated.

"Plants containing green chlorophyll grains, when placed in darkness, partial or complete, change colour from the destruction of the chlorophyll. Sachs says (Text-book of Botany, page 669) that in the leaves of rapidly-growing Angiosperms the absorption and disappearance of the chlorophyll takes place in a few days if the temperature be high. He adds, Cactus stems with slow growth, and the shoots of Selaginella, remain green for months in the dark. It is probably true also of Conifers, as I have seen them kept in the dark during the winter months without injury. This I saw in Berlin. Large plants requiring protection from the cold were laid on their sides, and a covering of mats and leaves on a wooden frame placed over them.

"The evergreens in your list are all *Conifers*, and I am of opinion that the absence of light for a considerable period would not injure them.

"It is well known that *cold* alters the colour of the leaves of many Conifers at once, but in your paper you state the temperature at 48° F., a temperature much too high to influence the colour.

"Your question places an isolated physiological fact in a very important light, at least it appears to do so to me. I give it in Sachs' words (Text-book, page 665): 'If the temperature is sufficiently high, the green colouring substance is found in the *cotyledons* of *Conifers* and in the leaves of Ferns, in *complete darkness* as well as under the influence of light. . . . Provided, therefore, that the temperature is favourable, the chlorophyll in the cotyledons of Conifers and the leaves of Ferns does not require light in order to assume its green colour, while that in Angiosperms does require it, and in both cases the change does not take place at low temperature.'

"My answer to the objection that has been made to your paper is this: '*Grant that the evergreens cannot stand prolonged absence of light—that refers to Angiospermous forms. Here all the forms are Coniferous; and Coniferous plants with Ferns have the peculiar property of forming green chlorophyll grains in the dark.*'

"I think a few evergreens do stand prolonged darkness, as I have certainly seen myrtles and rhododendrons placed during the winter in *very dark sheds*.

"As I can only refer to the books in my own library to-day, I shall try to find out some reference to the St. Petersburg observations, and let you know the result in due course.—I am, very truly yours,

(Signed) W. R. McNab."

"Rev. Prof. Haughton, F.R.S., etc., etc."

During the discussion on my paper in the Geological Section, it was observed by Mr. Pengelly that "magnolias" are mentioned by Professor Heer as occurring among the Greenland Tertiary plants. To this my reply was, that although some of the magnolias are evergreens, some of them also have deciduous leaves, and that the occurrence of plants or trees having deciduous leaves should cause us

no surprise in the Arctic Regions, provided a suitable temperature were provided for them.[1]

I cannot give here all the details explained in my paper, but I claim to have surrounded the North Pole with such a network of Lombardic plants, requiring Lombardic heat, but not Lombardic light, as to render the escape of the Pole from its present position as difficult as that of a "rat in a trap surrounded by terriers."

If the Lombardic light as well as heat were present in these Tertiary times, it would be difficult to explain the *absence* of a multitude of evergreen plants which require light to develope chlorophyll grains. Such evergreen plants ought to have migrated from North America and Europe into Greenland as easily and as rapidly as the peculiar groups of evergreens found there in Tertiary times.

In my opinion, the natural selection in the Tertiary Flora of Greenland of such evergreens only as require Lombardic heat, but can dispense with Lombardic light, is a fact which my opponents in the Geological Section not only did not answer, but entirely failed even to see the force of.

S. HAUGHTON.

TRINITY COLLEGE, DUBLIN, 17*th January*, 1879.

FACTA NON VERBA.

SIR,—The Devonian question being already hampered with so much theory, I venture to hope that you will insert the following facts, arrived at after a series of traverses by almost all the river-courses in North Devon. Prof. Hull's description of the rocks of this county and West Somerset contains serious errors, into which I am sure he would not have fallen had he been acquainted with the area.

Firstly. The Pilton beds consist of bluish grey and grey schistose and slaty rocks, with local developments of grey and brownish grit. The calcareous element is represented by thin, trivial, and impersistent beds of limestone.

Secondly. The Baggy Sandstones are buff-grey and brown, apparently confined to a definite horizon, but by no means equally developed thereon; they rest upon olive slates. For stratigraphical survey lines these may be included in the Pilton beds, from which they cannot, in disturbed districts, be readily distinguished.

Thirdly. The Pickwell Down beds are strangely mixed up with the Morthoe Slates in Prof. Hull's table, which would be fatal to the supposition of unconformity between them (vide GEOL. MAG., 1878, p. 531, lines 18 and 19). The Pickwell Down series is distinguishable through North Devon by its characteristic interstratification of slates, not shales; these are almost invariably lilac or purple, and toward the base of the division seem to pass into the Morte group by intercalation with buff and greenish slates, especially on Exmoor.

Fourthly. The Mortehoe slates are simply an unfossiliferous upper portion of the Ilfracombe group; the former being greenish and glossy; the latter grey, bluish, steel grey, and silvery, with local

[1] So far as I can understand, it would be difficult, if not impossible, to distinguish between evergreen magnolias and those with deciduous leaves, in fossil remains.