Longevity of the Carp

LAST autumn, being at Fontainebleau, I was told by the servant of the Palace there that the German soldiers while in occupation of the place during the last war caught many of the carp in the pond of the Palace garden called "Jardin Anglais," and that some of these carp carried, attached by silver wire to their gills, little silver plates bearing inscriptions purporting that the plates were attached to the fish in the time of Francis I. and Henry II.—*i.e.* about 300 years ago.

Some of your German readers could easily ascertain by inquiry of the corps in occupation whether such fish were in fact caught. If it should turn out that they were, then, although the well-ascertained proof desired by Mr. Suffield (NATURE, vol. x. p. 147) would not of course be given, yet the fact would be evidence worth noting. F. G.

Cannes, June 28

*THE "CHALLENGER" EXPEDITION**

V.

INACCESSIBLE AND NIGHTINGALE ISLANDS

THE first of these islands, the area of which is about four square miles, is situated about twenty-three miles W. by S. of Tristan d'Acunha. The cliffs rise to the height of about 1,000 feet in a perpendicular range on the north-east side. The tract beneath the cliffs is covered with *débris* of fallen rocks. On the cliffs themselves the plants are similar to those found in the same situation in Tristan. On the lower land are dense thickets of *Spartina arundinacea* Carm., a tall, reed-like grass, which here forms an extensive penguin rookery; patches of *Phylica arborea* Th. also grow on the summits of slight elevations; and under the shelter of the cliffs the trees attain a height of twenty feet, or even more. The trunks are seldom or never straight, but mostly lean over, or become partly procumbent, starting upright again towards the top. The largest trunk seen by Mr. Moseley measured a foot in diameter, but the trees on the upper plateau are said to measure 18 inches across, they do not, however, grow so high, being stunted by the force of the gales. The wood of the *Phylica*, though brittle, is said to be useful when properly dried, but in exposed situations it rapidly decays. Underneath the trees are ferns, mosses, and sedges, also *Acæna sanguisorbæ* Vahl., the leaves of which are used in New Zealand both as a tea and as a medicine. *Chenopodium tomentosum* Th., the tea-plant of Tristan, also grows in abundance, forming bushes with woody stems. A species of *Sphagnum*, *Carex insularis* Carm., and *Hydrocotyle capitata* Th. grew in a swamp near the penguin rookery. From the two Germans who were discovered on the island a good deal of information was obtained about the vegetation, more especially of that of the higher land, to which it was found impracticable to ascend from the side of the mountain where the ship anchored. The plants found there were similar to those which grew below, but in addition grew the species of *Empetrum*, found on the other islands, *Lomaria boryana* Willd., which in some instances attained a height of four feet, *Lycopodium insulare* Carm., and *Lagenophora commersonii* Cass., a small Composite plant with a daisy-like flower. The Tussock grass, which appears closely similar to *Dactylis cæspitosa* Forst., of the Falklands, grows in patches of considerable size on the upper plateau, and straggles up the cliffs to the summit. *Nertera depressa* Banks also grows on the plateau, and its berries form a favourite food of the *Nesocichla eremita*, the native thrush of the Tristan group; while the Bunting (*Emberiza brasiliensis*) feeds on the fruits of the *Phylica*.

The two Germans had cultivated the ground in the neighbourhood of their dwelling, growing potatoes, cabbages, and other European vegetables. Two species of clover also introduced by them were spreading rapidly, and a convolvulus was growing in quantity on the cultivated ground.

The other island of the Tristan group is named Nightingale Island, and is distant 20½ miles from Tristan d'Acunha, and 12 miles from Inaccessible Island. It is, comparatively speaking, a mere speck about one square mile in extent, and to the west are two small outlying islands covered with Tussock grass. A rocky peak 1,100 ft. high rises on the north side of Nightingale Island and is continued into a ridge stretching across the island, a valley separating this from a lower ridge which runs nearly at right angles. On the lower tract *Phylica arborea* occurs in patches, and on the high ground was seen *Lycopodium insulare* and a species of *Cotula* different from that found in Tristan and not seen at all in Inaccessible Island. *Sonchus oleraceus* L., which grows abundantly on the other islands, is, together with several other plants, absent from this. The Tussock grass forms a dense growth over nearly the whole island, growing in thick tufts or clumps to a height of five or six feet, and so matted together near the base of the clumps as to be almost impenetrable. The abundant growth of this grass causes the island to become an enormous penguin rookery, and the thick deposit of the excrement of the birds imparts a greater vigour to the plants, so that the lower parts or bases of the clumps become of a peaty character, beds several feet in thickness, of a black peaty richly-manured soil, being thus formed. It was with the greatest difficulty that a way was made through this thicket, the grass being too high to allow the planning of any definite track, and the screaming and biting of the penguins, together with the stench from the thick deposit of dung, being anything but agreeable. Indeed Mr. Moseley says that the specimens of Tussock grass which he gathered on Inaccessible and Nightingale Islands were lost in the continued fight with the penguins and the long grass. In one place a quantity of the trees of *Phylica arborea* had been blown down by the wind, and the trunks were lying dead on the ground. Lichens, as well as two fungi, were found on these dead trunks.

A dark green ulva forms a thin coat on the rocky shelves of the coast near the caves of the seals, which, when dry, as was the case during the *Challenger's* visit, has a peculiar metallic appearance. The island is never visited except during the sealing season.

Though it has been stated that the vegetation of the Tristan group knows no change of seasons, it is proved that some of the plants mentioned in these notes have their periods of flowering; thus the *Pelargonium* is said to flower in the middle of the summer, when a large number of the flowering plants are at their best, and the shore is covered with the fallen petals. At the time of the *Challenger's* visit in October few plants were in flower, but the phylica trees all bore fully developed green fruits.

From the geological as well as the botanical similarity of the three islands forming this interesting group, it may be surmised that a former connection existed between them. The different currents which sweep the Tristan group bring with them many foreign seeds, which are cast up on the shore. Amongst them was seen those of *Guilandina*, which are sometimes washed up on the Irish coast by the Atlantic current. These seeds are known in Tristan d'Acunha, as well as in Bermuda, where they are also occasionally cast up, as the sea-bean, the popular belief in the islands being that they are the seeds of a plant which grows at the bottom of the sea.

* These Notes are founded on letters addressed to Dr. Hooker by Mr. H. N. Moseley. Continued from vol. ix. p. 486.

THE FIGURE OF THE EARTH IN RELATION TO GEOLOGICAL INQUIRY

THE elevation and depression of different parts of the surface of the earth above or below a mean ocean level has frequently formed the subject of communications to NATURE, but in no instance, as far as I am aware, have any of these changes been referred to the remarkable shape of the equatorial circumference of the earth, and to the changes which it is not improbable are constantly but slowly taking place in the position of the major and minor axes of the equatorial circumference. On p. 98 of the second edition of "The Heavens," by Amedée Guille-

min, edited by J. Norman Lockyer, F.R.S., the following note is introduced in brackets by the editor :—

"The most recent results arrived at by geodesists have taught us that the earth is not quite truly represented by an orange, at all events, unless the orange be slightly squeezed, for the equatorial circumference is not a perfect circle, but an ellipse, the larger and shorter equatorial diameters being respectively 41,852,864 and 41,843,896 ft. That is to say, the equatorial diameter which pierces the earth from long. 14° 23′ east to 194° 23′ east of Greenwich is two miles longer than that at right angles to it."*

The history of these "results" may be briefly stated as follows :—

Capt. Clarke, R.E., in a communication to the Royal Astronomical Society, read April 6, 1860, and published in vol. xxix. of the "Memoirs," investigates the figure of the earth resulting from the best existing data. He concludes :—

"The result of our investigations then is this : that the ellipsoid which best represents the existing meridian measurements has its major (equatorial) axis in longitude 13° 58′·5 east from Greenwich."

The greatest and least values of the meridian compression are—

$\frac{a-c}{c}$ . . . . $\frac{1}{286{\cdot}779}$ in longitude 13° 58′·5 E.

$\frac{b-c}{c}$ . . . . $\frac{1}{309{\cdot}364}$ in longitude 103° 58′·5 E.

and the length of the polar semi-axis, 20,853,768 ft. "The difference of the equatorial semi-axis is 5,308 ft., or, in round numbers, just one mile."

The investigation from which result the above figures was undertaken by Capt. Clarke, in consequence of remarks by the Astronomer Royal in the "Monthly Notices" of the Royal Astronomical Society, vol. xx. p. 104 (January 1860), on General Schubert's "Essai d'une détermination de la véritable figure de la terre." The results arrived at in General Schubert's memoir is that the earth is an ellipsoid, whose elements are—

Polar semi-axis	20,855,605 ft.	
Maximum compression . .	$\frac{1}{292{\cdot}109}$	
Minimum ,, . .	$\frac{1}{302{\cdot}004}$	
Longitude of major axis of equator . .	41° 4′	221° 4′
,, minor axis of equator . .	131° 4′	311° 4′

the longitudes being measured from Greenwich eastwards.

For the dimensions of the earth on the elliptic hypothesis, Capt. Clarke prefers the following values, given at p. 773, of the "Account of the Principal Triangulation (Ordnance Survey)," viz.—

Equatorial . .	20,926,348 ft.	Compression $\frac{1}{293{\cdot}76}$
Polar . .	20,855,233 ft.	
Mean degree .	364,613·33 ft.	

The volume was published in 1858.

It appears, then, that somewhere between long. 13° and long. 41° east of Greenwich the major equatorial axis is about two miles longer at the present day than the equatorial axis at right angles to it; and during earlier geological epochs, when the crust of the earth was in a more plastic condition, these differences may have been considerably greater, and the effect on the geological structure of the earth intensified.

The point to which I wish to draw the attention of those who have studied the successive variations in the level of certain parts of the earth's surface, relates to the effect which this equatorial "bulge" must have produced upon various geological phenomena, and particularly if the longitude of the bulge varies according to a determinable law.

* Mem. R.A.S. vol. xxix. 1860.

It will be readily seen that its influence will be felt—

1. On the elevation and depression of the land, especially near the equator.

2. On simultaneous elevation and depression on opposites sides of the earth.

3. On ocean currents, consequently on climate, &c.

4. On the thickening and thinning of formations to the east and west.

5. On the flow of rivers, hence on river and lake terraces, beaches, &c.

Observed facts, especially in North America, appear to show that the subsidence and subsequent elevation of that continent has always taken place very gradually and with a progressive motion from west to east and from east to west. In other words, these changes of level have assumed the form of a vast equatorial undulation progressing with extreme slowness, at one epoch in an easterly, and at another in a westerly, direction. This appears to be shown by the very gradual thinning out, or the very gradual thickening, of Tertiary, Cretaceous, and even Palæozoic formations. In Post-tertiary times, where we are brought nearer to the records of past changes, and may compare antipodal illustrations, it is apparently manifested by the stupendous escarpments which for 1,000 to 1,700 miles rear their wall-like fronts from 200 to 600 ft. above the Ontario, Red River, and Saskatchewan plains; and it is further indicated by the symmetrical river terraces and lake beaches which are developed to a very remarkable extent throughout the whole of the northern part of North America.

These occur both on the east and west flanks of the Rocky Mountains, and are found in the various passes *through* that great range. To enumerate examples would be to select any large river issuing from the Appalachian Chain, the Laurentides, or the Rocky Mountains, at elevations varying from 400 ft. to 4,000 ft. above the present level of the sea. I hope that some of your correspondents may supply illustrations of similar geological phenomena occurring as near as it may be possible to find records on opposite sides of the earth and during the same geological period of time.

To the supposed motion of the equatorial bulge may also be partly attributed the changes in the direction of the flow of certain rivers, and the elevation of an axis across the North American continent from east to west between lat. 35° and 45° N., by which the drainage of the great Canadian Lakes (excepting Ontario) was diverted from the Gulf of Mexico into the Gulf of St. Lawrence. The ancient river channels through which the great lakes sent their waters to the sea are now filled with drift to a depth varying from 200 ft. to 600 ft. During the period of depression the great lakes were in direct communication with the sea, and their waters were brackish or salt. The dredging operations which have been conducted in Lake Michigan show the former marine character of the fauna of the waters of this lake.

The origin of beaches and terraces appears to be intimately connected with an easterly or westerly progress of elevation simultaneously with a northerly and southerly elevation, such as would be produced by the slow movement of an equatorial bulge in an east or west direction. In North America, where terraces and beaches exist in perfection at altitudes varying, as already stated, from 400 ft. to 4,000 ft. above the ocean, the phenomena may be studied with some prospect of elucidation.

I have been credibly informed that data do not at present exist which would enable astronomers to state definitely that the bulge in the equatorial circumference of the earth between longitudes 13° and 41° east of Greenwich is stationary, or whether it has an easterly or westerly motion, and thus partakes of the character of an undulation. Perhaps, on consideration of the causes which produce this ellipsoidal form of the equatorial cir-

cumference of the earth, we may assume that the longitude of the major axis is constantly changing and progressing from west to east within certain limits, and then returning from east to west; in other words, oscillating through a determinable space.

I have ventured to bring this interesting subject under the notice of the readers of NATURE in the hope that it may receive the attention which it appears to merit, and that satisfactory illustrations will be forthcoming to show that the differences between the equatorial major and minor axes of the earth are competent to explain or throw light on many disputed points in geological inquiry, and to lead to a rational solution of some difficult problems. On the other hand, it does not appear unreasonable to suppose that known geological facts may serve to point out a line of investigation which may lead to a more correct knowledge than we appear to possess at present of the figure of the earth, the probable changes which are slowly taking place, and the relation which these bear to geological inquiry.

HENRY Y. HIND

Windsor, Nova Scotia

REPORT OF PROF. PARKER'S HUNTERIAN LECTURES "ON THE STRUCTURE AND DEVELOPMENT OF THE VERTEBRATE SKULL" *

V.

WHEN the investing bones, mentioned in the last paper, are removed, the chondro-cranium of the axolotl is seen to have a far lower structure than that of the salmon. The hinder part of the skull-floor is constituted by a flat plate of cartilage (Fig. 13, B.O) formed from the investing mass, and answering to the basi-occipital, but unossified. From this rises up on each side a narrow cartilaginous pedicle, which, uniting above with its fellow, forms the occipital ring inclosing the foramen magnum. An ossification—the exoccipital—is formed on each side of this arch where it bears the occipital condyles; but, as in all amphibia, the supra-occipital, like the basi-occipital region, remains cartilaginous.

From the front edge of the basilar plate proceed two cartilaginous rods, uniting between the nose capsules as an expanded inter-nasal plate (I.N) and rising up to form the walls of the brain-case, but leaving its floor and roof to be covered in by the investing bones—the parietals and frontals above and the para-sphenoid below. These rods are, clearly, the very slightly altered trabeculæ; they bear a single pair of ossifications, placed considerably in front of the optic foramen, and answering to the lateral elements of the "os en ceinture" or "girdle-bone" of the frog. The nasal capsules, situated immediately outside the expanded cornua trabeculæ (hypo-trabeculars), are as far apart as in the ray.

The auditory capsules are largely cartilaginous, but contain three bones—the prootic, the epiotic, and a small ossicle nearly filling up a membranous space in the capsule between the prootic and opisthotic regions; the space is the first appearance of a *fenestra ovalis*, the bone of a *stapes*, so that in the tailed Amphibians is seen the earliest foreshadowing of the delicate apparatus by means of which vibrations of the air are communicated to the membranous labyrinth. The apparatus is, however, in a very rudimentary condition, there being neither tympanic membrane nor external meatus, and the stapes being connected, not with a chain of ear-bones, but with a band of fibres, the stapedio-suspensorial ligament (s.s.l), which unite it with the hinder part of the suspensorium.

The upper end of the mandibular arch is not let down to a considerable distance from the skull like that of the salmon, but forms the whole of the suspensory apparatus of the lower jaw, thus taking on the function performed in the fish by the proximal portion of the hyoid arch. The suspensorium is a stout cartilage sloping downwards and forwards, rounded below into an articular surface for the jaw, and divided above into three processes, the pedicle (p) or true apex of the arch, the ascending process (a), and the otic process (o). The two former are coalesced with the hinder ends of the trabecula, the latter with the auditory capsule; the first division of the fifth nerve passes out between the pedicle and the ascending process. A granular deposit of calcific matter (Qu) in the lower part of the suspensorium is the only representative of the bony quadrate of the fish, the meta-pterygoid region remains wholly unossified.

The pterygo-palatine arcade is very rudimentary, being represented only by a thin bar of cartilage (Pl.Pt) passing forwards from the front edge of the suspensorium, but not coming into contact with the ethmoidal region. Two bones are, however, developed in connection with this cartilage—the small tooth-bearing palatine, and the enormous triangular pterygoid.

As in the salmon, the lower jaw, stripped of its investing bones, consists of an articular and Meckel's cartilage; the latter, however, is large and stout, and not reduced to a more slender root on the inner side of the dentary.

The hyoid apparatus (Fig. 12) is a strong bar of cartilage connected by ligament with the suspensorium and mandible; it is divided into cerato- and hypo-hyal, but is entirely unossified, and never comes into relation with the auditory capsule. The branchial arches are four in number; the two hinder are split up into a long epi-branchial, a short cerato-branchial, and a small wedge-shaped basi-branchial.

One of the most important points to be noted in the development of the skull is the formation of the stapes; this was formerly believed to be the apex of the hyoid arch, but its true nature—as a separated portion of the wall of the ear capsule—has been demonstrated in the frog, and confirmed in the newt, axolotl, and other forms. In the axolotl of about an inch long a crescentic slit is seen in the auditory capsule, formed by the degeneration of its cartilage into fibrous tissue; the ends of this slit extend and meet, and thus cut off a circular plug of cartilage set in a ring of fibre, producing at once the stapes and the fenestra ovalis.

The investing mass remains long in the condition of indifferent tissue, and even after chondrification has set in the two halves remain separate until a very late period, thus approximating to the state of things found in Menobranchus and Proteus, in which the two parachordals are permanently united only by fibre.

The trabeculæ are at first parallel with the post-oral arches, and only at a comparatively advanced stage come to lie almost at right angles to them, as in the first stage of the salmon. The pterygo-palatine process is very late in its development, arising as a bud from the mandibular arch, and growing forwards towards the trabeculæ, with which, however, it never actually unites. The minor changes which the arches undergo will not be described here, as they have been worked out at far greater length in the frog.

VI. *Skull of the Frog* (Rana temporaria).—As far as its general aspect is concerned, the skull of this well-known Batrachian is by no means unlike that of the axolotl: it presents, however, many important differences, and shows a marked advance towards the sauropsidan and mammalian type.

Among the most important of these characters may be mentioned the backward slope of the suspensorium (see Fig. 14), the large size of the maxilla and its connection, through the intermediation of a small separate bone (the quadrato-jugal, Q.Ju), with the quadrate, the union of the palato-pterygoid cartilage with the ethmoidal region, the disappearance in adult life of the branchial arches, and, most important of all, the separation of the upper end

* Continued from p. 108.