loss to discover. I remember that exactly the same kind of argument was used by Sir C. Lyell ("Principles," 3rd edition), to produce just an opposite result, namely, to prove the theory that *all the great classes of organic life* were created *at once*; and not successively, as inferred from geology. How would Mr. Hutton reconcile these opposite conclusions drawn from the same facts? Or does he expect *his* theory to be better received than Sir Charles'? In conclusion I assert that, while other considerations may be either for or against this theory, geology alone must *decide* it. By the supposed slowness of the operations of the assumed law it is thrown entirely beyond the scope of observation, and unless *actual facts*—facts conclusive and undeniable—can be cited out of the stony records, it must still be considered the mere speculation of a theorist.—Yours, &c., THOS. GRINDLEY, Glossop.

NOTE BY THE EDITOR.—We are sorry that our correspondent should express regret at the appearance of Lieut. Hutton's article on the Darwinian Theory in the "GEOLOGIST." Our readers will doubtless bear in mind what our correspondent has forgotten in this remark, that whenever an article bears the name of its author, *we* are *not responsible* either for its facts or its arguments. Our pages are alike open to Mr. Grindley or Lieut. Hutton—to one correspondent equally with another; and on this point we have always justly prided ourselves on our fair dealing; we have printed the labouring man's communication beside that of the most talented geologist; we have printed even communications against ourselves. Darwin's theory undoubtedly has a most important bearing on geology, and if not wholly accepted, still contains views which must exert a powerful influence on all future investigations.

Granting it to be an error, we would still wish to see it powerfully treated and defended by the ablest hands; for the more powerful the defence of an error, the stronger and mightier the intellect that wields the weapons of its defence, so much the more brilliant will be the victory of TRUTH in the end. We can not have discussions without the defence of error, and without discussions there would be no progress.

In concluding this note, the Editor wishes distinctly to say that he does not consider himself as in any way advocating doctrines contained in any articles excepting in those which are written by himself. On the other hand, he considers the magazine to be, and always to have been, open to the fair expression of any opinion deserving of attention. Moreover, he trusts that friendly discussion and correspondence will be more developed in this magazine than even it has hitherto been.

FOREIGN CORRESPONDENCE.

SPECIMENS of minerals have been sent from Chili by M. Domeyho, for the School of Mines in Paris. 1. Black copper-ore, fibrous, (a silico-aluminate), brought from the mines of Taltat, in the desert of Atacama. 2. Arseniate of copper from the Gerro of las Yeguas, in the district of Rancagua. 3. Arseniate of copper, with sub-oxide from the same locality. 4. Two specimens, arseniate of silver, with antimony from Chauarcillo (one washed in a tube, the other in its original state). 5. Arsenical silver-ore from the mines of Bandurrias. 6. Bi-arseniate of nickel, mixed with arsenical acid, and sub-arseniate of nickel, brought from the mines of San Pedro, situated a few leagues from the port of San Framenco, in the desert of Atacama. 7. Arseniate of nickel, a little hydrated, mixed with a silico aluminate of nickel from the same locality as the preceeding one. 8. Fragment of an aërolite which fell in 1857, in the environs of Hevedia at Costa-Rica.

These specimens were accompanied by a full mineralogical notice of each, and a letter addressed to M. Elie de Beaumont, by M. Domeyko, announcing that he has sent two cases of fossil-bones, found in the same locality he had explored the preceeding year at Taguatagua. He also gave a description of a recent valley containing bones of Pachyderms, situated at the foot of the Andes, and presenting the same features as the great formation two or three hundred leagues on the other side of the range. This circumstance will, perhaps, throw some light on the true epoch of the relationship of this district to the last changes of the Andes M. Domeyko also sends a note on the valley of the ancient lake of Taguatagua on which new light has been thrown by the study of the region above mentioned.

On Density and Hardness considered as distinctive characters of Metalloides and Metals.

M. Marcel de Serres has communicated an important paper to the French Academy on the above subject. "The classes, orders, and families, which have been established in the classification of simple bodies, considered in regard to their hardness and density, appear to be founded on sundry rules, which the comparison of these properties has furnished.

"The metalloides are divided naturally into gases, liquids, and solids, the latter into soft (apalides) and hard (schlerides).

"The soft metalloides, with one exception (phosphorus), are denser than the hard ones: it is principally by the degree of hardness that the two orders may be distinguished."

M. Serres then proceeds to inquire whether the difference between the density and hardness of the metals is as decided as in the case of the metalloides. For this purpose he divides the metals into—1. Heteropsides, which are the lightest bodies among the metallic substances, being in some cases less dense than water. 2. Allopsides, which comprise the hardest bodies in nature, often the schleride metalloides, indicated by the No. 10, in the scale of Mohs. 3. Autopsides, which are again divided into perfect metals and common metals.

From the tables we learn that among the metalloides phosphorus is the least, and tellurium the most dense; and that phosphorus, again, is the softest and diamond the hardest.

Among the metals stilbite is the least, and iridium the most dense; while asbestos is the softest, and emerald the hardest.

On the Extinct Genus Thecodontosaurus.

M. P. Gervais has communicated a notice of the first discovery of the remains of this animal in France. M. Dumortici, of Lyons, who forwarded the specimens to him, found them at Chappon (Ain). M. Gervais refers to the characters of the genus, as stated by Messrs. Riley and Stutchbury in their memoir on the *Th. antiquus* of the

Bristol dolomite (Trans. Geol, Soc. of London, 2nd series, vol. 5, p. 359); and concludes that the animal found at Chappon belongs to the same species, or, at all events, the same genus.

Mineralogy,—Analysis of the "Glossecolite Shepard," by M. F. Pisani.

This substance, which resembles the "Halloysite" in its formation and properties, was found at Dade in the province of Georgia: M. des Cloiseaux, the discoverer, gives the following description of it.

"The glossecolite shepard is compact, and breaks with a conchoidal fracture; it is dull looking, but with rubbing it becomes bright; it is white and sharp to the taste; it does not soften in water, but becomes transparent on the edge and opaline, throwing off bubbles of air, and giving out a strong clayey smell. Soft and very fragile, water is disengaged in the "matras," and the mineral becomes a bluish grey. It is infusible with the blowpipe, and gives a beautiful blue with nitric of cobalt: sulphuric acid attacks it, heat being applied.

"The glossecolite shepard is composed of—

Silica	40·4
Aluminum	37·8
Magnesium	0·5
Water	21·8
	100·5

Some New Geological and Mineralogical Discoveries in the Five Principal Volcanic Departments of France.

M. Bertrand de Lom, in a memoir under this title read before the French Academy gives some interesting details tending to show the great richness of these districts in gems and crystals, especially corundum and crysolite, twelve thousand specimens of the former having been found by him previously to his last exploration, which we may remark, has occupied him six years.

Geological Results of a Voyage of Discovery along the Coasts of the Red Sea.

M. Courbon, surgeon on board a French frigate which has been surveying the coasts of the Red Sea by order of the Emperor, has sent in a very valuable report of the natural history part of the expedition, the geological portion of which, illustrated by numerous sections and five large maps made from notes taken on the spot, will form a very valuable addition to our knowledge of the strata of the districts bordering thereon.

The localities which appear to have been more particularly studied are the bay of Adulis and island of Dissée, Edd and Haycok, Perim

https://doi.org/10.1017/S1359465600004445 Published online by Cambridge University Press

and Doomairah. The island of Dissée, formed of a great number of gentle prominences, composed of nearly vertical beds of gneiss, mica-schists and other like rocks, sometimes impregnated with granite, is highly interesting; and M. Courbon's description of it and the neighbouring shore will well repay perusal.

M. Courbon thus describes Perim :—

"Perim is the result of a volcanic eruption below water. The lavas and other erupted matter have first of all raised the coral bed, which formed the bottom of the sea, leaving in its substance some of their remains, and have then forced a passage to appear above the sea-level. This volcano, of which the vast crater corresponded to the whole bay of Perim, has been some time in activity; and has covered the island with mud, cinders, scoriæ. puzzuoloni and, lastly, with the trachytic rocks, which now cover its surface.

"The volcanic action then ceased, and the calcareous sandstones formed: at length a gentle upheaval elevated them, in their turn, above the water; and the island has since that time presented the same appearance that it now does."

The facts collected by M. Courbon, taken in conjunction with those of his predecessors, prove that the Red Sea, which forms one of the most marked localities on the surface of the globe, and of which the eastern side in particular is aligned with a wonderful precision on the great primitive circle of Thuringerwald, which passes Aden, bears traces throughout all its length of eruptive phenomena of immense extent, and of an age certainly not very remote from the present epoch.

On the Age of Fossil Bones, as determined by their composition.

M. Delesse has furnished a paper on this subject, from which we extract the following remarks :—

"When animals are buried their fleshy parts soon decay, whilst the hard part, which forms the skeleton, resists decomposition. Nevertheless, the latter undergoes some alterations that are easily discoverable in comparing the same parts of the skeleton of fossil, with living animals. If one considers particularly the bones, their alterations are shown by the changes in their density and their chemical composition. First of all, it is very easy to prove that in fossil bones their density always augments with age. This augmentation is very sensible, not only in the bones belonging to different geologic epochs, but also those of the present time. In the bones of a man, more particularly, it rises sometimes thirty-four per cent. It is generally higher in the tusks of elephants and mastodons than in their bones. This arises from the destruction of the organic matter or bony substance, and also from the introduction of new mineral substances.

"When fossil bones are impregnated with oxyde of iron, or pyrites, their density rises very rapidly, and is only limited by the density of those minerals. It is difficult to compare the carbonate of lime in a normal and fossil bone; for it varies not only in each bone, but also in each animal

In consequence of the destruction of the bony substance, the carbonate of lime ought to augment in a fossil bone, but this does not always take place. In certain fossil human skulls it falls more than three per cent. although it is at least double in a normal skull: the quantity of carbonate of lime diminishes, therefore, occasionally, in fossil bones, more particularly in the first period of their decomposition, that is, when the bony substance is being destroyed.

But most frequently the carbonate of lime augments in the fossils prior to our epoch. One can easily prove this in those which are cellular, because their cavities are filled with it in a crystallized form. It also increases in the most compact bones, even the teeth and tusks. As the carbonate of lime is found in most rocks and waters of infiltration, it is easy to understand why its quantity increases in fossil bones. The phosphate of lime sometimes diminishes considerably, as low as twenty-five in one hundred, as M. Fremy has proved; sometimes, on the contrary, it rises as high as eighty in one hundred, although on the average it is little over sixty in the normal state. The bony substance is present in fossils, and the azote they contain enables us to arrive at the proportion. Nevertheless, but little remains in the bones found in formations older than the tertiary. The bones which belong to the recent formations, or to the diluvium, contain, on the contrary, a good proportion.

The quantity of azote in a fossil bone depends on complex causes. Firstly, it varies with the bone and the animal. Nevertheless, when one compares the bones of mammals, birds, and reptiles, the difference in the proportion of bony substance does not exceed many hundredth parts, consequently the difference of proportion of azote is reduced to some thousandth parts.

When the bones are fossilized, the azote depends on their exposure to the atmosphere before they were covered up; for the atmosphere destroys organic matter pretty rapidly. It depends also upon the dampness or dryness of the beds in which they lie, and upon the salt or fresh-water which they imbibe. The mineralogical composition of the rock in which they are found must again be considered, because it tends to vary the substances contained in the water of infiltration.

Lastly, the azote in a fossil bone varies with the age. To be convinced of this fact it will be enough to test it in bones belonging to different epochs, and especially in human bones. Although a normal bone contains about fifty-four thousandths of azote, there are but 32·3 in a human bone more than a century old; 22·9 in one of the time of Julius Cæsar; 18·5 in a human skull found by Sir C. Lyell in the Denise beds; 16·5 in a human jaw-bone, which has been forwarded to me by M. de Vibraye, as coming from the grotto of Arcy, and 13·6 in a human cubitus discovered by M. Lartet, at Aurignac.

The human remains last mentioned have been the subjects of much geological discussion; they are regarded as very ancient, and, as we have seen, contain but little azote. Nevertheless, in other human bones which have undergone changes, either by exposure to air or by fossilization, the proportion of azote is still less. A human skull, of which the exact age is unknown to me, and which was found in a marine conglomerate of Brazil, has but 1·6 thousandth of azote.

When bones have been buried under the same condition the quantity of azote becomes better comparable; and then it varies, especially in relation to their age.

According to the observations of M. Lartet, the human bone of Aurignac, above mentioned, was associated with extinct species of animals, especially of the reindeer and rhinoceros. It therefore became of interest to discover the quantity of azote in the bones of those animals.

I have obtained 14·8 for the reindeer, and 14·5 for the rhinoceros of Aurignac. That is to say, nearly the same proportion as for the human cubitus found in the same deposit. Hence, analysis seems to indicate that these extinct animals were contemporaneous with man.

In the grotto of Arcy, M. de Vibraye says there are three deposits of bones, which are very distinct. The upper and most recent one contains unmistakeable traces of the habitation of man, and of animals still represented in the vicinity. In a human bone which came thence, I found still twenty-four thousandths of azote. The middle deposit contains bones of extinct species, particularly the reindeer, in which there is 14·3 of azote: these last are enveloped in a red clay, with a great number of celts and of flint implements. The lower deposit contains bones of *Ursus spelæus*, which contain no more than 10·4 of azote.

It is therefore very evident that the azote varies in the bones from these deposits according to their age; and that it successively diminishes as the age itself increases.

The caverns and osseous breccias contain bones of the hyena, stag, ox, horse, and rhinoceros, which have an equal, or nearly equal, proportion of azote to those of certain human bones of great antiquity.

Analysis proves, consequently, that these animals, belonging to extinct species, have lived on our earth at an epoch not far removed from our own.

To sum up: a fossil bone is subject to very complex alterations. The porosity and density augment; its bony substance is destroyed; and the proportion of calcareous salts is more or less modified, or altogether destroyed. In the first phase of decomposition, a bone retains a great part of its osseine, effervesces slowly in acid, and loses a little of its carbonate of lime. In the last phase the bony substance has almost altogether disappeared: it is sharp to the taste, and effervesces violently in acid. At this period its carbonate of lime tends generally to augment more rapidly than the phosphate. Sometimes it still undergoes other metamorphoses, which completely alter its chemical composition, although its form remains unchanged.

The testing of azote, then, contained in a fossil bone, permits us to control and verify the assertions of archæology and geology. It can even afford us, within certain limits, indications of its age; and furnishes us with another means of determining relative age in the different epochs of our globe.