

NOTHING NEW UNDER THE EARTH: THE GEOLOGY OF JULES VERNE'S *JOURNEY TO THE CENTRE OF THE EARTH*

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ABSTRACT

Voyage au centre de la Terre (1864, 1867: *Journey to the Centre of the Earth*) by Jules Verne (1828–1905) has been a bestseller in both French and English for well over a century. Literary scholars, however, have taken an almost exclusively intrinsic approach to studying the novel, without referring to its sources or writing. The source of the science has not been documented. Louis Figuier (1819–1894), a contemporary and compatriot of Verne, was a prolific writer on scientific and technological matters for the general public. His *La Terre avant le déluge* (1863: *The World before the Deluge*) sold an “unprecedented” 25,000 copies in four French editions in less than two years. Much of the scientific information in Verne’s novel was taken directly from this work. Verne incorporates scientific details and concepts treated by Figuier in *La Terre* in the *Journey* and describes and discusses them in nearly identical language. Exact numbers are duplicated and lengthy lists are reproduced in the same order. The borrowing is widespread and blatant. Verne, nonetheless, exhibits considerable skill in integrating the material borrowed from Figuier into the *Journey* and interpreting it in specifically literary terms.

INTRODUCTION

Amongst the works of Jules Verne (1828–1905), *Voyage au centre de la Terre* (*Journey to the Centre of the Earth*) is unique. It was the first unqualified critical success of Verne’s career—and the first work written under the supervision of his publisher and mentor Jules Hetzel (1814–1886). The style of the novel is more exuberant and colorful than in most of the sixty-four novels in the *Voyages Extraordinaires* that follow. As a result, *Journey to the Centre of the Earth* has been a consistent bestseller in both French and English for well over a century, and has recently entered the literary canon, with many studies of it being published over the last two decades. However, most literary scholars have taken an almost exclusively intrinsic approach to the novel, as if the text had magically sprung into being without discernible origins. The writer’s inspiration and sources have been largely ignored. Here we address the latter issue by identifying the major source of Verne’s scientific material and documenting the extent of his borrowing.

In the opening chapters of the novel, Professor Lidenbrock and his nephew Axel discover an ancient runic document that claims to indicate a route to the center of the Earth. They travel to Iceland, employ a local guide, and, following the document’s coded directions, enter a volcanic crater. The three descend through the sedimentary layers of the crust into its granite foundation. They become separated, but are re-united on the shore of an underground sea in an immense cavern hollowed in the granite. The travelers venture upon the sea in a crudely constructed raft built of logs from trees living in a subterranean forest. At sea they witness a battle between Jurassic “sea monsters” and disembark on an island with a breathtaking geyser. Later, their raft is hurled before a horrific

storm and the party is shipwrecked. Venturing inland the three explorers discover a vast repository of vertebrate remains, including the perfectly preserved mummy of an “incontestably Caucasian” human being. Professor Lidenbrock and Axel also see a herd of living mastodons and their attendant shepherd—a twelve-foot giant with a huge bough. The two flee for their lives. Later, after regaining their composure, the explorers set off an explosion to remove a boulder obstructing their downward journey. A gaping crevice opens, swallowing the waters of the underground sea and the raft on which the travellers are sheltering. After being carried deep toward the center of the Earth the three are returned to the surface in Italy by an accommodating volcanic eruption.

Scientific, ideological, and philosophical issues being debated in the mid-nineteenth century are closely integrated into the novel. The central question—one unanswered at the time—was the condition of the Earth’s interior. Was it molten or solid? Less central, but more controversial, was the nature of human prehistory. The discipline was just emerging at the time and the term itself was not yet in common usage¹—Verne uses “antédiluvien,” still partly biblical language. Contemporary debates over evolution and the nature and meaning of evolutionary progress also made their way into the novel. The depiction in *Journey* of long-extinct animals, a preserved modern man, and a human giant raised issues that were being contested by contemporary scientists. The progress of the discussions was being followed closely by the educated public, many of whom were of course reading Verne’s novels. The writer’s treatment of these contemporary scientific issues is given added force by the fact that Lidenbrock and Axel not only relate their experiences, but, as scientists, debate the competing theories and even refer to contemporary authorities.

Our starting point will be to examine Louis Figuier’s *La Terre avant le déluge* (1863).² From there, we will attempt to establish our central claim that a large part of the scientific information in Verne’s novel was taken directly from the 1863 work. This includes both the specific scientific details incorporated in the novel and the general worldviews espoused by the protagonists.

Verne occasionally mentions Figuier in his letters to the publisher Jules Hetzel, for instance on 4 November 1877; and his other works sometimes involve direct borrowing, for example in *Twenty Thousand Leagues under the Seas*.³ However, the authors of this article feel sceptical about the many loosely-written pieces where the observation of general similarities of approach between any two given authors has led to unwarranted assumptions, especially since it is hard to exclude a common source or the influence of the “conventional wisdom” of the time. Certainly, the basic thesis of Alcide d’Orbigny (1802–1857), that rock strata are ordered by their fossil content, thus dividing the past into visible stages, is the

¹ See A. Bowdoin Van Riper, *Men among the Mammoths: Victorian Science and the Discovery of Human Prehistory* (Chicago: University of Chicago Press, 1993).

² The borrowing from Figuier was unrecorded in the critical literature until the Presses Pocket edition of *Voyage au centre de la Terre* in 1991, where the ‘Dossier’ (436–459) quoted five extracts from *La Terre avant le déluge* (143–154, 300–303, 262–265, 284–285, and 72–73). Little attempt was made, however, to demonstrate the exact parallels, or to contextualize them. Similarly, William Butcher in the third and revised critical edition and translation of *Journey to the Centre of the Earth* (Oxford and New York: Oxford University Press, 1998), 226 and 229, shows that the battle between the two sea-monsters, the information about giants and the prehistoric vegetation are drawn from Figuier. But, apart from these pointers, no work has been carried out to date on this question of Figuier as the direct source of Verne’s masterpiece.

³ From Figuier’s *Les Merveilles de la science* (1869) and *Articulés, poissons, reptiles et zoophytes, mollusques* [s.d.].

metaphor that permeates the whole of *Journey to the Centre of the Earth*.⁴ And certainly, the influence of a wide range of other scientific writers is visible in Verne's novel: especially Elie de Beaumont (1798–1874) and Charles Sainte-Claire Deville (1814–1876) for volcanoes; Louis Agassiz (1807–1873) for the classification of fossil fish; and for prehistory *Paris avant les hommes* (1863) by Pierre Boitard (1789?–1859) and *Zoology . . . and Chief Forms of Fossil Remains* (1857, reissued 1866) by William Carpenter (1813–1885).⁵ In the present case, nevertheless, we believe that the evidence is conclusive that Verne borrowed directly and extensively from Figuier, for his geological and other information.⁶

Louis Figuier (1819–1894) was a brilliant and prolific writer on scientific and technological matters for the general public. Amongst his works were the 4,000-page *L'Année scientifique et industrielle* and *Les Merveilles de la science, ou Description populaire des inventions modernes*, plus volumes on electricity, canals, railways, alchemy, and life after death. Verne's second prose publication, "Un Voyage en ballon" (1851), was a direct transcription (unacknowledged) of Figuier's article "Les Aérostats et les aéronautes," published in the *Revue des deux mondes* in 1850. But *La Terre avant le déluge* was one of the writer's greatest successes: Figuier points out in the preface to the third edition that it had sold an unprecedented 18,000 copies in the first few months. One reason for the popularity was the brilliance and depth of the writing. As Henry W. Bristow (1817–1889) noted in his translation and adaptation, the author allowed himself many speculations and—in Bristow's narrowly Anglo-Saxon and empirical view—statements difficult to justify in purely scientific terms. However, the work is a wide-ranging, stimulating, and generally accurate account, in a fine style, of what were at the time controversial views on the history of the globe.

As for *Voyage au centre de la Terre*, we know little about its inception. Although a manuscript has recently emerged,⁷ there are no surviving proofs, and the only reference in the correspondence occurs on 12 August 1864.⁸ Since the novel is not mentioned in the contract with Hetzel of 1 January 1864, it was probably written between these two dates (the action of the novel itself runs up to March 1864). The first edition appeared on 25 November 1864, but this novel is unique amongst Verne's in that it underwent changes after this initial publication. Most of chapters 37–39 were added in the first large-octavo edition (1867). The 1864 edition features the fight between the ichthyosaur and the plesiosaurus but the fossil remains of human beings and the living giant herdsman, which go well beyond the limits of plausibility Verne normally allowed himself, appear first in the 1867 edition.

⁴ Alcide-Charles-Victor-Dessalines d'Orbigny (1802–1857) was a creationist geologist, renowned for his eight-volume *Paléontologie française* (1840–1854). He is cited in *Twenty Thousand Leagues* as having classified nine species of squid in the Pacific Ocean and in *The Children of Captain Grant* as having investigated the idea that giants lived in Patagonia. The generative metaphor is analysed in ch. 4 of William Butcher, *Verne's Journey to the Centre of the Self* (New York: St. Martin's Press, 1990).

⁵ However, Verne's English was non-existent, so his reading of Carpenter must have been in translation or summary form.

⁶ Nor are we claiming that Verne did not borrow from other texts of geological vulgarization, but simply that Figuier is the most blatant example.

⁷ Details are provided in Butcher, *Journey*, 1990, xxxi–xxxii and 231–232, and William Butcher, Long Lost Manuscript, *The Modern Language Review*, 1998, 93:961–971.

⁸ Olivier Dumas, Piero Gondolo della Riva, and Volker Dehs, eds., *Correspondance inédite de Jules Verne et Pierre-Jules Hetzel* (1863–1886), Volume 1 (Geneva: Slatkine, 1999), 30.

GEOLOGICAL INTERLUDES

The Transition Strata

Only a few days into the downward journey, Axel is convinced that the path the three men are following leads back up toward the surface. He tries to convince Professor Lidenbrock that the group is traversing Silurian strata from the Transition era, going up through the stratigraphic series:

I hadn't gone a hundred yards further before incontrovertible proof appeared in front of my eyes. It was to be expected, for during the Silurian Period there were more than 1,500 species of vegetables and animals in the seas . . . On the walls could be clearly seen the outlines of seaweeds and Lycopodia . . . I picked up a perfectly-preserved shell, one that had belonged to an animal more or less like the present-day woodlouse. Then I caught up with my uncle and said to him:

"See!"

"Well," he replied calmly, "it is the shell of a crustacean of the extinct order of trilobites. Nothing else."⁹

Compare this passage with Figuiet:

Most trilobites . . . were able to roll themselves into a ball, like our woodlouse, doubtless to escape the attack of an enemy . . . The seas were already abundantly inhabited at the end of the Upper Silurian period, for naturalists today know more than 1,500 species, animal and vegetable, belonging to the Silurian period.¹⁰

Clearly Verne is quite similar to Figuiet. In the next sentence, Figuiet writes: "Amongst the marine plants, a few species of algae, classified as belonging to the Fucoid genus, have been found in the rocks";¹¹ then, four pages later, again describing the Silurian: "We have seen . . . life opening up, and organization beginning with plants of a completely inferior order . . . algæ and kelps."¹² In the same way, Verne has Axel observing "the outlines of seaweeds and Lycopodia"¹³ in the Silurian strata. Figuiet characterizes the Silurian formations of

⁹ 'Je n'avais pas fait cent pas que des preuves incontestables s'offrirent à mes yeux. Cela devait être, car, à l'époque silurienne, les mers renfermaient plus de quinze cents espèces végétales ou animales . . . Sur les parois se voyaient distinctement des empreintes de fucus et de lycopodes . . . Je ramassai une coquille parfaitement conservée, qui avait appartenu à un animal à peu près semblable au cloporte actuel; puis, je rejoignis mon oncle et je lui dis:

"Voyez!"

"Eh bien, répondit-il tranquillement, c'est la coquille d'un crustacé de l'ordre disparu des trilobites. Pas autre chose." (ch. 19)

All English translations of *Voyage au centre de la Terre* are taken from Butcher, *Journey to the Centre of the Earth* (Oxford and New York: Oxford University Press, 1998), here on 98–99.

¹⁰ 'la plupart des trilobites . . . pouvaient se rouler en boule comme nos Cloportes sans doute pour se soustraire à l'attaque d'un ennemi . . . Les mers étaient déjà abondamment peuplées à la fin de la période silurienne supérieure, car les naturalistes connaissent aujourd'hui plus de 1500 espèces végétales et animales appartenant à l'ensemble de la période silurienne. (59)'

The translations of Figuiet have been done by the authors of this article. For the contemporary translation, vivid but unfaithful to modern eyes, see H. W. Bristow's edition of Louis Figuiet, *The World before the Deluge, Containing twenty-five ideal landscapes of the ancient world, designed by Riou, and two hundred and eight figures of animals, plants, and other fossil remains and restorations*, translated from the 4th French ed., rev. ed. by H. W. Bristow (London: Chapman and Hall, 1865), 448 p.

¹¹ 'Parmi les plantes marines, on a trouvé dans le terrain qui correspond à cette sous-période, quelques espèces d'algues que l'on rapporte au genre Fucoïdes.'

¹² 'Nous avons vu . . . la vie s'éclorre, et l'organisation débiter par des plantes d'un ordre tout à fait inférieur . . . des Algues et des Varechs'.

¹³ 'des empreintes de fucus et de lycopodes' (ch. 19).

Europe as “the most dislocated and disturbed.”¹⁴ He writes, “The beds, originally horizontal, are turned up, contorted, folded over, sometimes even vertical.”¹⁵ On passing into the Silurian strata, Axel correspondingly notes that the beds are “at an angle, often in fact vertical.”¹⁶

Professor Lidenbrock remains unswayed by the discovery of the trilobite and presses on in the same direction. To Axel, however, “the signs of the Transition Era became more and more obvious.” He mentions:

Devon, the county which gave its name to this sort of terrain . . . [the rocks] displayed the outlines of primitive animals. Since the day before, creation had made clear signs of progress. Instead of rudimentary trilobites, I spotted evidence of a more perfect order: amongst others, Ganoid fish.¹⁷

Figuier’s description of the Devonian begins:

. . . Devonian, so called because the rocks corresponding to that period appear very clearly and of great extent in Devon . . . [the strata exhibit] some species of animals and vegetables of much more complex organization than those that appeared on the globe in the primitive period . . . as our globe ages the organization [of creatures] becomes constantly more complicated.¹⁸

Ganoid fish, in particular the genus *Pterichthys*, are the first animals mentioned in Figuier’s survey of the Devonian fauna. The first fish caught by Hans during the sea voyage later in the journey will be of the genus *Pterichthys*.

The next day, still going up through the stratigraphic series, the three explorers leave the Devonian strata and ascend into the Coal Measures of the Carboniferous Period. Axel is able to “read” the history written in successive stages on the dark walls:

[In] the Carboniferous period . . . the Earth became covered in immense vegetation due to the tropical heat combined with a permanent humidity. An atmosphere of steam enveloped all parts of the globe, shielding it from the sun’s rays.

Hence the conclusion that the high temperatures could not have come from that new source of heat. Perhaps the sun was not ready to play its brilliant role. But in any case “climates” did not yet exist, and a torrid heat spread across the entire surface of the globe, the same at the poles as at the equator. Where did it come from? The interior of the globe.¹⁹

Figuier gives a similar accounting of conditions during the Carboniferous:

. . . the heat was the same in all latitudes . . . From the equatorial regions to . . . the icy Arctic Ocean . . . from Spitzbergen to the heart of Africa, the Carboniferous flora is always the same

¹⁴ ‘les plus disloquées et bouleversées’.

¹⁵ ‘Ses couches, originairement horizontales, sont relevées, contournées, plissées, quelquefois même verticales’ (65).

¹⁶ ‘inclinées et souvent disposées verticalement’ (ch. 19).

¹⁷ ‘. . . [le] Devonshire, qui donna son nom à ce genre de terrains. . . . [Les] marbres offraient des empreintes d’animaux primitives. Depuis la veille, la création avait fait un progrès évident. Au lieu de trilobites rudimentaires, j’apercevais des débris d’un ordre plus parfait: entre autres, des poissons Ganoïdes’ (ch. 20).

¹⁸ ‘. . . *devonienne*, parce que le terrain qui correspond à cette période apparaît très nettement et avec beaucoup d’étendue dans le Devonshire . . . [les couches exhibent] quelques espèces végétales et animales d’une organisation plus complexes que celles qui avaient apparu sur le globe primitif . . . à mesure que le notre globe vieillit, l’organisation se complique[r] sans cesse.’ (67).

¹⁹ ‘[Dans] la période houillère . . . la terre se recouvrit d’immenses végétations dues à la double action d’une chaleur tropicale et d’une humidité permanente. Une atmosphère de vapeurs enveloppait le globe de toutes parts, lui déroband encore les rayons du soleil.

De là cette conclusion que les hautes températures ne provenaient pas de ce foyer nouveau. Peut-être même l’astre du jour n’était-il pas prêt à jouer son rôle éclatant. Les “climats” n’existaient pas encore, et une chaleur torride se répandait à la surface entière du globe, égale à l’équateur et aux pôles. D’où venait-elle? de l’intérieur du globe.’ (ch. 20)

... When we find the same fossils in Greenland and on the equator ... we are forced to admit that at this period the temperature of the globe was the same everywhere. As a result, what we now call "climate" was unknown in geological times: there was only one climate over the whole globe.

Where, then, did this uniformity of temperature originate that surprises us today?

It came from the excessive heat of the globe. The Earth was still so hot in itself that its innate temperature dominated, rendering superfluous and imperceptible the heat that the central star sent it, in other words the sun.²⁰

Axel concludes his "geological considerations" of the Carboniferous with speculations on how coal is formed and comments on consumption of coal resources by the "industrialized nations":

Despite Professor Lidenbrock's theories, a violent fire smouldered in the bowels of the spheroid. Its effects were felt even in the outermost layers of the Earth's crust ...

There were few trees, only herbaceous plants, huge grassy areas, ferns, Lycopodia, sigillarias, Asterophyllites ...

It was this exuberant vegetation which produced the coal. The Earth's crust, still elastic, followed the movements of the liquid mass it encased. Hence a large amount of cracking and subsiding. The plants, dragged under water, gradually built up considerable piles of matter.

Next came the action of nature's chemistry: on the bottom of the seas, the vegetable masses became peat. Then, thanks to the effect of the gases, and in the heat from the fermentation, they underwent a complete mineralization.

In this way were formed the huge layers of coal.²¹

Similarly, Figuier concludes his lengthy treatment of the Carboniferous with a discussion of how coal is formed (pp. 96–114) and comments on the vast extent and global distribution of the world's coal resources (pp. 112–114), in particular:

During the Carboniferous period, the terrestrial crust, at that time hardly consolidated, merely formed a highly elastic envelope, because of its immense extent, resting on the interior fluid mass. This elastic crust was agitated by alternating movements ... It was probably through one of these collapses of the ground that the forests and vegetable masses ... found themselves submerged and that accumulated the grasses and shrubs ... which constitute coal.²²

²⁰ 'la chaleur était la même à toutes les latitudes. Depuis les régions équatoriales jusqu'à ... l'océan glacial arctique ... depuis le Spitzberg jusqu'au centre de l'Afrique, la flore houillée présente une complète identité. Quand on trouve les mêmes fossiles au Groenland et à l'équateur on est bien forcé de reconnaître qu'à cette époque la température du globe était la même partout. Ainsi, ce que nous nommons aujourd'hui le climat était inconnu pendant les temps géologiques: il n'y avait qu'un seul climat pour le globe entier.

D'où provenait cette uniformité de température qui a lieu de nous étonner aujourd'hui?

Elle tenait à l'excessive chaleur du globe. La terre était encore si chaude par elle-même, que sa température propre primait, rendait superflue et inappréciable la chaleur que lui envoyait l'astre central, c'est-à-dire le soleil.' (79–80).

²¹ 'En dépit des théories du professeur Lidenbrock, un feu violent couvait dans les entrailles du sphéroïde: son action se faisait sentir jusqu'aux dernières couches de l'écorce terrestre ...

Il y avait peu d'arbres, des plantes herbacées seulement, d'immenses gazons, des fougères, des lycopodes, des sigillaires, des asterophyllites ...

Or, c'est précisément à cette exubérante végétation que la houille doit son origine. L'écorce encore élastique du globe obéissait aux mouvements de la masse liquide qu'elle recouvrait. De là des fissures, des affaissements nombreux. Les plantes, entraînées sous les eaux, formèrent peu à peu des amas considérables.

Alors intervint l'action de la chimie naturelle; au fond des mers, les masses végétales se firent tourbe d'abord; puis, grâce à l'influence des gaz, et sous le feu de la fermentation, elles subirent une minéralisation complète.

Ainsi se formèrent ces immenses couches de charbon' (ch. 20).

²² 'pendant la période houillère, la croûte terrestre, alors à peine consolidée, ne formait qu'une enveloppe très-élastique, en raison de son immense étendue, et qui reposait sur la masse liquide intérieure. Cette croûte élastique était agitée par des mouvements alternatifs ... C'est peut-être par un de ces affaissements du sol que les forêts et les grandes masses végétales ... se trouvaient submergées et que les herbes et arbustes ... qui constituent la houille se sont accumulés.'

Axel makes one last scientific observation in the coal gallery. He detects “a very pronounced smell of hydrocarbon” indicating the presence “of the dangerous gas which miners call firedamp” in the gallery. Figuiet opines that coal is formed primarily from herbaceous plants, ferns, and aquatic vegetation, not trees. When submerged, these plants undergo chemical change and in becoming peat give off carburated hydrogen with which the coal is impregnated.

The Forest at Port Gräuben

After wandering lost for two days, Axel is re-united with his companions on the shore of a vast underground sea. Growing near the strand is a strange “tall, thick, dense forest of trees of medium height.” Professor Lidenbrock identifies it as a forest of mushrooms.

He was right . . . how big these plants grew in their preferred hot, humid environments . . . I knew that the *Lycopodon giganteum* reached eight or nine feet in circumference; but here [were] mushrooms 30 or 40 feet high . . . thousands of them . . .

But the vegetation . . . was not confined to mushrooms . . . they were the common shrubs of the Earth, here of phenomenal size, Lycopodia a hundred feet high, giant *Sigillarias*, tree-ferns as tall as pines from northern climes, Lepidodendrons with cylindrical forked stalks ending in long leaves bristling with coarse hairs like monstrous fleshy plants.

“Astonishing, magnificent, splendid!” cried my uncle. “Here we have the complete flora of . . . the Transition Era . . . these humble garden plants, which became trees in the first centuries of the Earth.”²³

Here is Figuiet’s description of the Devonian flora:

. . . the trees of the high forest are completely absent . . . Cryptogames, of which our present-day mushrooms can give some idea, surely formed the majority of this primitive vegetation . . . Lycopodia were the dominant herbaceous plants, through both the size of the individuals and the variety and number of their species.²⁴

The remaining part of Axel’s description is paralleled by Figuiet’s discussion of the flora of the Carboniferous Limestone and Coal Measures, for example, “immense *Sigillarias*” and “Lepidodendrons [with] bifurcating cylindrical stems.”²⁵ Verne’s description of “long leaves bristling with coarse hairs like monstrous fleshy plants” exactly corresponds to the illustrations of *L. sternbergi* and *L. elegans* in Figuiet.

The floor of the Transition forest is littered with the bones of much younger mammals. The three anachronistic mammals discovered by Axel are the mastodon, the dinothereum, and the megatherium. The first two of these animals are discussed at length and illustrated in Figuiet’s description of the Miocene fauna

²³ ‘Et il ne se trompait pas . . . Que l’on juge du développement acquis par ces plantes chères aux milieux chauds et humides . . .

Mais la végétation . . . ne s’en tenait pas à ces champignons . . . ; c’étaient les humbles arbustes de la terre, avec des dimensions phénoménales, des lycopes hauts de cent pieds, des sigillaires géantes, des fougères arborescentes, grandes comme les sapins des hautes latitudes, des lepidodendrons à tiges cylindriques bifurquées, terminées par de longues feuilles et hérissées de poids rudes comme de monstrueuses plantes grasses.

Etonnant, magnifique, splendide! s’écria mon oncle. Voilà toute la flore . . . de l’époque de transition . . . ces humbles plantes de nos jardins qui se faisaient arbres aux premiers siècles du globe!’ (ch. 30).

²⁴ ‘les arbres de haute futaie font complément défaut . . . Des cryptogames, dont nos Champignons actuels peuvent nous donner l’idée, devaient former la plus grande partie de cette végétation primitive (68) . . . Les Lycopes sont des végétaux herbacées . . . prédominant tant par la dimension des individus que par la variété et le nombre de leurs espèces.’ (71).

²⁵ ‘d’immenses Sigillaria’ (83); ‘Les Lepidodendrons [avec] des tiges cylindriques bifurquées’ (87).

of the Tertiary period. The megatherium of the Quaternary Period also receives several pages of coverage from Figuiet, together with two illustrations.

Axel's Waking Dream

On the second day aboard the raft on the Lidenbrock Sea, Axel has a "waking dream" in which the history of the Earth is re-played backward before his eyes at ever increasing speed until "centuries are flowing past like days." He is carried back to the beginning of the universe. The climax of Axel's vision is as follows:

. . . the vapour is covering up the entire Earth, which stage by stage becomes nothing but a gaseous mass, heated to red and white hot, as big as the sun and shining as bright!

In the centre of this nebula, 1.4 million times as big as the globe it will one day form, I am being carried off into planetary space!²⁶

Compare this with Figuiet's broad outline of history:

Our planet, then, should be imagined as . . . entirely gaseous matter. And if we consider that substances changed into gas occupy eighteen hundred times as much space as when solid, it can be deduced that this gaseous mass had to be as large as the sun, which is 1.4 million times as big as the present-day globe.²⁷

At this stage, then, we can already see that Verne's borrowing from Figuiet is consistent, right down to the figures and phraseology; but while borrowing the scientific terminology and many of the ideas, he generally contextualizes them by closely integrating them with, especially, Axel's concerns. The dramatic descriptions benefit greatly from Verne's mastery of the art of the novel. Nevertheless, the similarity between the texts is incontrovertible.

The Sea Battle

On the sixth day aboard the raft, the travellers witness a battle between two reptiles of the Secondary Period—an ichthyosaur and a plesiosaur. Like the blind men viewing the elephant, Axel sees only a small part of the ichthyosaur at any one time and declares it to be a porpoise, lizard, crocodile, and whale in turn (ch. 33). Figuiet describes his ichthyosaur as having "the head of a lizard, the teeth of a crocodile, the vertebrae of a fish . . . and the fins of a whale."²⁸

Verne penned "the bloody eye of the ichthyosaurus, as big as a man's head" and "Nature has given it an extremely powerful optical apparatus, able to resist the pressure of the water in the depths where it lives."²⁹ Figuiet wrote that the size of the ichthyosaur's eyes "frequently exceeds that of the human head" and

²⁶ 'Les vapeurs enveloppent la terre, qui peu à peu ne forme plus qu'une masse gazeuse, portée au rouge blanc, grosse comme le soleil et brillante comme lui!

Au centre de cette nébuleuse, quatorze cent mille fois plus considérable que ce globe qu'elle va former un jour, je suis entraîné dans les espaces planétaires!' (ch. 32)

²⁷ 'Il faut donc se représenter notre planète primitive comme . . . matière entièrement gazeuse. Et si l'on réfléchit que les substances portées à l'état de gaz occupent un volume dix-huit cents fois plus grand qu'à l'état solide, on en conclura que cette masse gazeuse devait être aussi grosse que le soleil, lequel est quatorze cent mille fois plus gros que la terre actuelle.'

²⁸ 'La tête d'un Léopard, les dents d'un Crocodile, les vertèbres d'un poisson . . . et les nageoires de la Baleine.' (159)

²⁹ 'l'oeil sanglant de l'ichthyosaurus, gros comme la tête d'un homme . . . La nature l'a doué d'un appareil d'optique d'une extrême puissance et capable de résister à la pression des couches d'eau dans les profondeurs qu'il habite.' (ch. 33)

that they have “the strength necessary to support the considerable pressure of the upper reaches [*sic*] of the sea.”³⁰

The other combatant in the sea battle, at first taken to be “a forty-foot turtle and a thirty-foot serpent” is soon recognized to be a “plesiosaurus, a serpent with a cylindrical trunk and a short tail, [that] has legs shaped into paddles.”³¹ Figuier describes the plesiosaurus as a combination of a turtle and a serpent, with a cylindrical trunk and large paddles (pp. 166–168; cf. pp. 199–201).

The ichthyosaur and the plesiosaur simultaneously repelled and fascinated nineteenth-century readers, who found the former particularly abhorrent because it was thought at the time to eat its own young.³² A battle between an ichthyosaur and a plesiosaur figures prominently in a drawing made in 1830 by Henry Thomas De la Beche (1796–1855) of life in the Liassic seas of ancient Dorset. A lithograph of this drawing made in the same year by George Scharf (1788–1860) was “the first true scene from deep time to [receive] even limited publication.”³³ Other illustrations of these two monsters of the Lias followed frequently in the succeeding years until the scene became, in Rudwick’s words, a “visual cliché.”

The third edition of Figuier’s *La Terre avant le déluge*, published in 1867, contained “twenty-five ideal views of landscapes of the ancient world”³⁴ drawn by Edouard Riou (1833–1900). One of these shows an ichthyosaurus emerging from the depths to confront a plesiosaur on the surface with its neck arched preparing to strike (Figure 130 in Figuier, 1864, reproduced here as Figure 1). The ichthyosaur is venting water from *two* blowholes in front of its eyes. Riou also provided 56 illustrations for *Journey to the Centre of the Earth* in 1864. One in chapter 33 shows a similar scene but with the two “monsters” locked in mortal combat and the ichthyosaur not venting from its blowholes. In the text Verne seems to be referring to the drawing made for Figuier when Axel and Professor Lidenbrock observe the (emphasis added) “*two* liquid columns” produced by the ichthyosaur.³⁵

Landfall and Beyond—The Plain of Bones

Exploring inland, after being shipwrecked, the travelers—in the section of the novel added in 1867—come across a vast repository of fossil bones covering “perhaps three square miles” and containing “the whole history of animal life” (ch. 37). In this mortuary Professor Lidenbrock finds first a skull and then a mummified human body (Figure 2), which he pronounces to be that of a man from the Quaternary Period. He follows his discovery with an amazing display of erudition, enumerating instances in which, by honest mistake or deliberate fraud, fossils have been presented to the gullible public as the remains of human or humanoid beings. He begins with cases in which the bones of Ice Age elephants

³⁰ ‘leur volume excédait souvent celui de la tête d’un homme’: ‘la force nécessaire pour supporter la pression considérable des hauts fonds [*sic*] des mers’ (160).

³¹ ‘une tortue large de quarante pieds et un serpent de trente pieds . . . un plesiosaurus, serpent à tronc cylindrique, à queue courte, qui a les pattes disposées en forme de rame’ (ch. 33).

³² This inference was based on splintered remains of smaller individuals found in coprolites (fossilized excrement) of larger ones and the presence of complete skeletons of small ichthyosaurs in the ‘stomach’ of adult ichthyosaurs. The latter are now thought to be in the birth canal rather than the digestive tract (Alfred S. Romer, *Vertebrate Paleontology* (Chicago: University of Chicago Press, 1966), 119).

³³ Martin J. S. Rudwick, *Scenes from Deep Time: Early Pictorial Representations of the Prehistoric World* (Chicago: University of Chicago Press, 1992), 47.

³⁴ ‘25 vues idéales de paysages de l’ancien monde.’

³⁵ De la Beche’s original drawing showed the two combatants, with an inconspicuous ichthyosaur in the background spouting from a single blowhole.

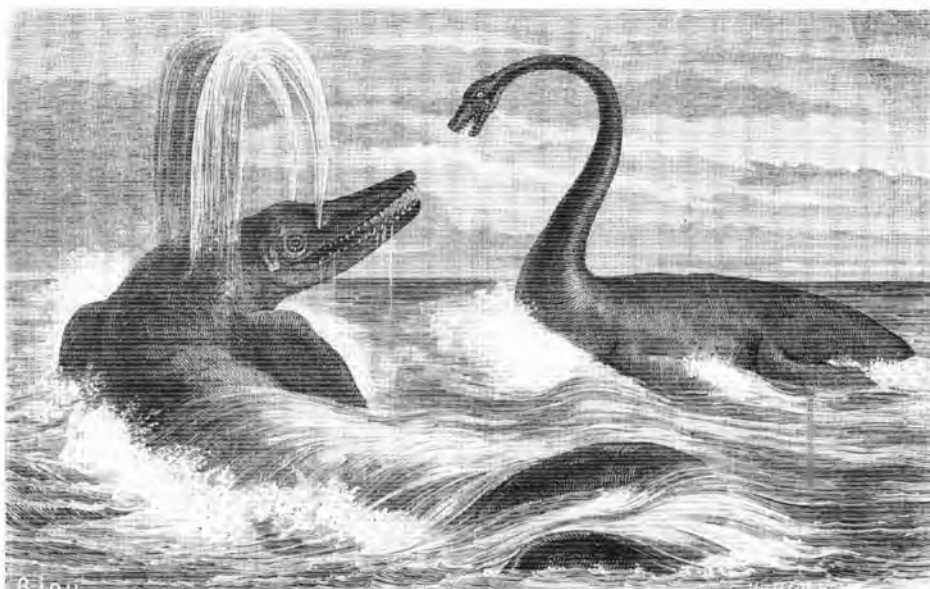


Figure 1. "Ichthyosaurus and plesiosaurus," by Edouard Riou, in the chapter "Jurassic Period" of Louis Figuier, *La Terre avant le déluge* (1863).

have been attributed to the heroes of myth or antiquity and concludes with Johann Scheuchzer's egregious identification of the skeleton of a giant salamander as a man who had witnessed the Flood:

I am not unacquainted with the story of Ajax's kneecap, with what was claimed to be Oreste's body as found by the Spartans, or with Asterius's ten-cubit-long body as described by Pausanias. I have read the reports on the Trápani skeleton discovered in the 14th century, which people wished to believe was Polyphemus's, as well as the accounts of the giant dug up in the 16th century near Palermo. You are as aware as I, gentlemen, of the analysis carried out at Lucerne in 1577 of the enormous bones claimed by the illustrious doctor Félix Plater to belong to a giant 19 feet tall. I have devoured Cassanion's treatises, and all the monographs, pamphlets, presentations and counter-presentations ever published on the skeleton of Teutobochus, King of the Cimbrians, who invaded Gaul and who was excavated from a sandpit in the Dauphiné in 1613. In the 18th century, I would have combated Peter Camper's affirmations regarding the existence of Scheuchzer's pre-Adamites!³⁶

In this passage Verne has brilliantly condensed two much lengthier passages in Figuier, including virtually all the proper names, such as "Pre-Adamites . . . Peter Camper . . . Scheuchzer . . . Asterius . . . Ajax . . . Trápani . . . Félix Plater . . . Lucerne . . . Teutobochus . . . Cassanion." Lidenbrock's recitation even follows the same order as the treatment of this topic given in *La Terre avant le*

³⁶ "Je connais l'histoire de la rotule d'Ajax, du prétendu corps d'Oreste retrouvé par les Spartiates, et du corps d'Asterius, long de dix coudées, dont parle Pausanias. J'ai lu les rapports sur le squelette de Trapani découvert au XIVe siècle, et dans lequel on voulait reconnaître Polyphème, et l'histoire du géant déterré pendant le XVIe siècle aux environs de Palermo. Vous n'ignorez pas plus que moi, messieurs, l'analyse faite auprès de Lucerne, en 1577, de ces grands ossements que le célèbre médecin Félix Plater déclarait appartenir à un géant de dix-neuf pieds! J'ai dévoré les traités de Cassanion, et tous ces mémoires, brochures, discours et contre-discours publiés à propos du squelette du roi des Cimbres, Teutobochus, l'envahisseur de la Gaule, exhumé d'une sablonnière du Dauphiné en 1613! Au XVIIIe siècle, j'aurais combattu avec Pierre Campet l'existence des préadamites de Scheuchzer!" (ch. 38).



Figure 2. "A perfectly recognisable human body," by Riou, in ch. 37 of Jules Verne's *Journey to the Centre of the Earth* (1864, 1867).

déluge (pp. 326–328 and 340–342), although Figuiet makes more explicit Peter Camper's role in the controversy over Scheuchzer's pre-Adamite witnesses of the Flood. At the same time, Verne entertains the reader by a variety of literary devices, such as employing Axel's point of view to mock Lidenbrock's over-academic style. In sum, this passage would on its own provide conclusive proof that Verne borrowed from Figuiet in writing the novel.

The Forest Giant

Further inland, the adventurers discover a forest, which displays "the vegetation of the Tertiary period in all its splendor." Axel sees "enormous shapes wandering around under the trees . . . gigantic animals, a whole herd of mastodons . . . fully alive and resembling [those] discovered in the bogs of Ohio in 1801." Professor Lidenbrock stays Axel's instinctive retreat and urges him forward. They see a man "shepherding" the mastodons, or rather a giant: ". . . more than twelve feet tall [with a] head as big as a buffalo's . . . half hidden in . . . his wild locks [like those] of the elephants of the first ages." This giant "from before the flood" carries an enormous bough as a shepherd's crook.

Figuiet provides an extended discussion of the American mastodon—five

pages of text and six illustrations. He reports that the first skeleton of the animal previously known only by its skull and teeth, called by Buffon (1707–1788) “the elephant of the Ohio,” was discovered on the banks of the Hudson in New York in 1801. Another skeleton was recovered from a marsh west of the river later that same year. Verne seems to have conflated the two items in writing “the bogs of the Ohio in 1801” (ch. 39). After recounting the several discoveries, Figuier tells of an Indian legend that these great animals lived in former times, conjointly with a race of men whose size was proportionate to their own!

Following his eventual return to the surface, Axel doubts the testimony of his senses, refusing to believe that humans—generations of them—lived beneath the surface. He prefers instead to believe that the creature was “some Protolithecus, some Mesolithecus like the one discovered by M. Lartet in the bone-laden bed of Sansan!”³⁷ Figuier has a similar paragraph describing the discovery of the man-sized Miocene ape *Dryopithecus* in the “bone-laden bed of Sansan”³⁸ by Édouard Lartet (1801–1871) and the *Mesolithecus* in Greece by Jean Albert Gaudry (1827–1908). Verne seems to have combined the two ideas.

The Forest Flora

The immense forest adjoining the plain of bones is quite different from the grove of mushrooms at Port Gräuben. Axel describes the Tertiary flora in all its splendor:

Great palm-trees of species no longer existing and superb palmaceae, pine, yews, cypress and thujas . . . The ground was carpeted with . . . moss and hepaticas . . . all intermixed and intertwined [with] trees from highly different countries on the surface of the globe, the oak growing beside the palm-tree, the Australian eucalyptus leaning on the Norwegian fir, the northern birch mingling its branches with the New Zealand kauri.³⁹

However, in this forest, the “flowers, so numerous in the Tertiary Age when they first appeared,” are without color or perfume, partly because of the absence of sunlight but also because Verne’s underground cavern, while of course being discovered in 1864, simultaneously partakes of the distant past.

Figuier provided a similar description of the forests of the Eocene in which “rose lofty palm trees, of species since disappeared, such as . . . palmacites . . . with many green trees . . . firs, pines, yews, and above all cypresses and thuyas.”⁴⁰ On the next page, he remarks that “hepaticas and mosses grow in humid places.”⁴¹ The flora also “included a great number of those plants today confined to Australia,” with the eucalyptus mentioned as an example and shown in an illustration. In the summary of the Tertiary preceding the section on the Eocene period, Figuier refers to the Tertiary as “the period of flowers” and describes the surface as “embellished by their variegated colors.”⁴² Figuier characterizes the Miocene flora of Europe as containing both forms analogous to those of our equatorial regions and genera suitable to temperate and even cold countries.

³⁷ ‘quelque protolithèque, de quelque mésolithèque semblable à celui que découvrit M. Lartet dans le gîte ossifère de Sansan!’ (ch. 39).

³⁸ ‘gîte ossifère de Sansan.’

³⁹ ‘De grands palmiers, d’espèces aujourd’hui disparues, de superbes palmacites, des pins, des ifs, des cyprès, des thuyas . . . Un tapis de mousses et d’hépatiques revêtait moelleusement le sol . . . confondus et entremêlés [avec] des arbres des contrées si différentes de la surface du globe, le chêne croissant près du palmier, l’eucalyptus australien s’appuyant au sapin de la Norvège, le bouleau du Nord confondant ses branches avec les branches du kauris zélandais.’ (ch. 39).

⁴⁰ ‘se dressaient de hauts Palmiers, d’espèces aujourd’hui disparues, comme les . . . Palmacites . . . beaucoup d’arbres verts . . . les Sapins, les Pins, les Ifs, et surtout des Cyprès, des Thuyas’ (266)

⁴¹ ‘Des Hépatiques et des Mousses croissent dans les lieux humides.’

⁴² ‘l’époque des fleurs . . . embellie par leur couleurs diaprées.’

At this stage, then, we have seen that there is a remarkable congruence between both the terminology and the objects described by Figuiet and Verne.

SHARED WORLD VIEW

Geology in the Mid-Nineteenth Century

Two opposing schools of geologic thought attracted adherents in the middle decades of the nineteenth century.⁴³ Directionalism and progressivism were the central tenets of a mature catastrophism articulated most authoritatively, in English at least, by Adam Sedgwick (1785–1873). Directionalism maintained that the intensity of certain geologic processes such as volcanism, earthquake activity, and mountain building had declined over time as the interior of the Earth cooled. Progressivism saw in the fossil record an increase in the level of organization or complexity of life over time, culminating in the appearance of mankind in the recent geologic past. The strict uniformitarianism of Charles Lyell (1797–1875) saw the Earth as a system in a state of dynamic equilibrium. Lyell and his disciples, Charles Darwin (1809–1882) among them, denied directionism in Earth's history and progressivism in the fossil record.

Mature catastrophism was not overtly scriptural like the catastrophism of the 1820s advocated by William Buckland (1784–1856) (who is cited in Verne's "Humbug: The American Way of Life," a spoof of Barnum-style geological hoaxes published in 1910, but probably written in the 1860s). But this movement was not anti-scriptural, and indeed was often seen as supporting revealed religion.⁴⁴ Directionalism and progressivism had strong teleological overtones. Both were widely perceived as the Creator's way of preparing a dwelling place for mankind through the operation of secondary causes (natural law) rather than by divine fiat. Figuiet advocated a directionalist view of Earth's history and progressivism in the organic realm. He thus fits squarely in the catastrophist camp. Moreover, like other members of this school, Figuiet openly proclaimed his strong religious beliefs in his text, interpreting earth history and the progress of life as the visible working of the will of the Creator.

Two quotations from the Preface reveal the important scientific and religious elements of Figuiet's worldview. First, belief in local or limited—as opposed to world-wide or global—catastrophes:

. . . our globe has undoubtedly been the theatre of frequent catastrophes: immense rents have torn its solid crust, eruptions . . . have issued from its chasms . . . [and] torn up and displaced the soil, drowning continents, excavating deep valleys and raising lofty mountains. But all these phenomena, in spite of their power and redoubtable intensity, could not extend to the entire globe . . . Their action was necessarily local.⁴⁵

Second, belief in progressivism, directionism, and the compatibility of geology and religion:

⁴³ Charles C. Gillespie, *Genesis and Geology: The Impact of Scientific Discoveries on Religious Beliefs in the Decades before Darwin* (New York: Harper & Row Publishers, 1951); Martin J. S. Rudwick, *The Meaning of Fossils: Episodes in the History of Paleontology* (Chicago: University of Chicago Press, 1976); Michael Ruse, *The Darwinian Revolution: Science Red in Tooth and Claw* (Chicago: University of Chicago Press, 1979); and Anthony Hallam, *Great Geological Controversies* (London: Oxford University Press, 1983).

⁴⁴ Ruse, *Revolution*, 1979, 67–70.

⁴⁵ 'Sans doute, notre globe a été le théâtre de fréquentes catastrophes: d'immenses déchirures ont ébranlé son écorce solide, et des éruptions se sont fait jour à travers ces abîmes: ces grands mouvements ont ébranlé le sol, noyé des continents, creusé des vallées profondes et fait surgir de hautes montagnes. Mais tous ces phénomènes, malgré leur puissance et leur redoutable intensité, ne pouvaient s'étendre au globe tout entier . . . Leur action était nécessairement locale.' (xiv)

Species have died out quite naturally, of old age . . . The sovereign Master who created the animal and plant species willed [it] . . . According to a plan emanating from his All-powerful wisdom . . . races have made way for other . . . more perfect ones. Geology and revelation are now agreed . . . Recent discoveries . . . have justified in this way the tale of the sacred historian. . . . Nothing shows with more certainty than the study of geology . . . the creative power of God . . . After sad chaos follows a still incandescent sphere, which is molded into regular forms, and cools down enough to allow access to organic life . . . Its burning surface . . . is covered . . . and decorated with shrubs and forests. The continents and seas take on their definite boundaries. The first beings . . . were succeeded by more and more perfect creatures, until God causes to emerge from his creative hand his last work, man, adorned with the supreme quality of intelligence, by which he rules the whole of nature and submits it to his laws.⁴⁶

However, in all of this, God acted through natural causes, not supernatural intervention. “It was not necessary . . . that the elements be overthrown” or that God call upon “the united fires of earth and the heavens.” All was accomplished “according to a plan emanating from the All-powerful and from His wisdom.” Read law for plan in this passage to understand Figuier’s scientific position. For Figuier regularity (law) results from the will of God. For example, rotating fluid bodies take a spherical form because “it is one of the laws of their being, emanating from the Creator.”

The worldview of the protagonists in *Journey to the Centre of the Earth* generally mirrors that of Figuier, albeit watered down or subject to irony.

Progressionism, Teleology, and Evolution

To Axel, the fossils contained in the sedimentary record reveal the path of progress upward from primitive animals to man. In the Devonian strata he notes:

. . . outlines of primitive animals. Since the day before, creation had made clear signs of progress. Instead of rudimentary trilobites, I spotted evidence of a more perfect order: amongst others, Ganoid fish . . . It became plain that we were moving back up the scale of animal life, of which man forms the peak.⁴⁷

Progressionists often held that for each level of organization the organisms created first were most advanced and that degeneration generally followed. One English-language embodiment of this belief was to be found in Hugh Miller’s *The Footprints of The Creator; or, The Asterolepis of Stromness*, published in 1847.⁴⁸ Its religious warrant was to be found in the doctrine of decline from original perfection associated with the Fall in Genesis. Axel thinks it likely that the Lidenbrock sea “contains only fossil species—in which both fish and reptiles alike are more

⁴⁶ ‘Les espèces organiques sont mortes tout naturellement, de leur belle mort . . . Le Maître souverain qui a créé les espèces animales et végétales [l]’a voulu . . . C’est d’après un plan émane de sa toute-puissance et de sa sagesse . . . les races ont fait place à d’autres . . . [plus] perfectionnées . . . accord important de la géologie et de la révélation . . . les découvertes récentes . . . ont . . . justifié de cette manière le récit de l’historien sacré.

. . . Rien n’est plus propre que l’étude de géologie à mettre en évidence . . . la puissance créatrice de Dieu . . . Au sinistre chaos succède un globe encore incandescent, qui se modèle en formes régulières, et se refroidit assez pour donner accès à la vie organique . . . Sa brûlante surface . . . se couvre . . . et se décore d’arbustes et de forêts; les continents et les mers prennent leurs limites définitives . . . Aux premiers êtres . . . succèdent des êtres de plus en plus achevés; jusqu’à ce que Dieu fasse sortir de ses mains créatrices, son dernier ouvrage, l’homme, orné de cet attribut suprême de l’intelligence, par lequel il domine toute la nature et la soumet à ses lois.’ (xv-xvi)

⁴⁷ ‘des empreintes d’animaux primitives. Depuis la veille, la création avait fait un progrès évident. Au lieu des trilobites rudimentaires, j’apercevais des débris d’un ordre plus parfait: entre autres, des poissons Ganoïdes . . . Il devenait évident que nous remontions l’échelle de la vie animale dont l’homme occupe le sommet.’ (ch. 20)

⁴⁸ Ruse, *Revolution*, 1979, 108–109; Gillespie, *Genesis and Geology*, 1959, 174–176.

perfect the further back they were created"; and that "present-day saurians, even the largest and most formidable crocodiles and alligators, are but feeble reductions of their fathers."⁴⁹

Mammals also show this degeneration. After crossing the sea, Axel finds remains of "gigantic glyptodonts of the Pliocene period, of which the modern tortoise is but a minute reduction."⁵⁰ The mummified man of the Quaternary found by Professor Lidenbrock is not a hulking, prognathous Neanderthal but "incontestably Caucasian"⁵¹ with a facial angle of nearly 90°. At the time Verne was writing, French anthropologist Paul Broca (1824–1880) was arguing that the higher races of mankind were orthognathous and more or less white-skinned, whereas the primitive or degenerate races were prognathous and dark-skinned.⁵²

In both his dream aboard the raft (ch. 32) and subsequent observation of the battle of the sea monsters (ch. 33), Axel gives the standard version of the succession of animal life of the progressionists, from "zoophytes of the Transition" to mammals and man. He leaves little doubt as to the end to which this progress is directed:

[The] whole fossil world relives in my imagination. I am going back to the biblical ages of the Creation, long before man was born, when the incomplete Earth was not yet ready for him.⁵³

Teleology is writ large and small in the novel: the Earth was made as a home for man and the mummified body found by the Professor was "preserved for exclusively anthropological purposes!" (ch. 38)

Verne was far from an advocate of evolution⁵⁴ and Axel's progressionism should not be taken as an endorsement of that doctrine. Lyell noted the "almost paradoxical" state of affairs in which most progressionists were "very vehement opponents of transmutation," that is, evolution, and most transmutationists were circumspect over progress in the fossil record.⁵⁵

Directionalism

Early in the narrative Professor Lidenbrock offers a directionalist argument to convince Axel of the feasibility of the journey. "Is it not true that the number of volcanoes has considerably decreased since the first days of the world? And indeed if there is heat in the centre, can one not deduce that it is also tending to diminish?"⁵⁶ During the journey Axel ascribes many phenomena to geological forces acting with greater intensity in the first ages of the Earth when the globe

⁴⁹ 'ne renferme que des espèces fossiles, dans lesquelles les poisons comme les reptiles sont d'autant plus parfaits que leur création est plus ancienne' (ch. 32) : 'Les sauriens actuels, alligators ou crocodile, les plus gros et les plus redoutables, ne sont que des réductions affaiblies de leurs pères des premiers âges' (ch. 33)

⁵⁰ '[des] gigantesques glyptodonts de la période pliocène dont la tortue moderne n'est plus qu'une petite réduction' (ch. 37).

⁵¹ 'incontestablement caucasique' (ch. 38).

⁵² Stephen Jay Gould, *The Mismeasure of Man* (New York: W. W. Norton and Company, 1981), 82–84. Orthognathous skulls have facial angles between 85°–93° and prognathous skulls, between 70°–80°.

⁵³ 'ce monde fossile renaît dans mon imagination. Je me reporte aux époques bibliques de la création, bien avant la naissance de l'homme, lorsque la terre incomplète ne pouvait lui suffire encore' (ch. 32).

⁵⁴ Butcher, *Journey*, 1991, xxi.

⁵⁵ Charles Lyell, *The Geological Evidences for the Antiquity of Man* (Philadelphia: George W. Childs, 1863), 405. Rudwick, *Fossils*, 1976, and Ruse, *Revolution*, 1979, explain this apparent paradox.

⁵⁶ 'N'est-il pas constant que le nombre des volcans a considérablement diminué depuis les premiers jours du monde? et, si chaleur centrale il y a, ne peut-on en conclure qu'elle tend à s'affaiblir?' (ch. 6)

possessed greater heat. The fissure in which the journey begins formed when “the Earth slowly cooled during the first days of the world, the decrease in volume produced disruptions, breakages, shrinkages, and cracks in the crust.”⁵⁷ The precious metals seen in the walls were deeply buried by “the upheavals of the first days.” Another shaft the trio follows “had clearly been produced during the contraction of the Earth’s very structure, at the period when it was cooling down” (ch. 24). The immense clumps of seaweed encountered on the voyage cause Axel to ask himself, “What must the Earth have looked like during the first centuries of its formation when, acted upon by heat and humidity, the vegetable kingdom was developing solitarily on its surface?”⁵⁸ To explain the remains of human beings in the underworld, Professor Lidenbrock hazards that even “in the Quaternary Period, considerable upheavals in the Earth’s crust still occurred. The lengthy cooling of the globe produced fissures, cracks, and faults.”⁵⁹ The fossils, it is implied, fell into these gaps; they were not contemporaneous with the Quaternary.

Directionalism was much in vogue in the middle decades of the nineteenth century. Earlier in the century, catastrophists had decoupled the past from the present, allowing for differences in kind, not just in intensity, between processes that operated in the remote geologic past and those operating in the modern era.⁶⁰ However, Figuier and the catastrophist geologists of mid-century embraced a directionalism which distanced the geologic past from the present by merely quantitative, not qualitative, means. In the Epilogue, to the question, “What are the causes of the present irregularities of the globe?” Figuier answers: “The primordial cause is, as we have said so often, the cooling of the Earth . . . [which has produced] the folds, furrows, and fractures leading to . . . the formation of the main mountains . . . which have caused new continents to be created while filling in the beds of former seas.”⁶¹ He concludes that these causes, although in a much weakened form, seem to continue in operation to the present day.

Design, Providence, and Law

The worldview of Sedgwick, and others like him, included a God who was visible in nature and active in human affairs.⁶² The eight Bridgewater Treatises published between 1833 and 1836 argued for a God manifest in creation by enumerating specific examples of good design revealed by contemporary science. By mid-century, however, many were willing to attribute the “designedness” of things to the operation of natural laws rather than separate acts of contrivance. In the widely read *Vestiges of the Natural History of Creation*, published anonymously in 1844, Robert Chambers stated this position clearly: “the whole creation

⁵⁷ ‘la terre se refroidit peu à peu aux premiers jours du monde, la diminution de son volume produisit dans l’écorce des dislocations, des ruptures, des retraits, des fendilles’ (ch. 22).

⁵⁸ ‘quel devait être l’aspect de la terre aux premiers siècles de sa formation, quand, sous l’action de la chaleur et de l’humidité, le règne végétal se développait seul à sa surface!’ (ch. 32).

⁵⁹ ‘à l’époque quaternaire, des troubles considérables se manifestaient encore dans l’écorce terrestre: le refroidissement continu du globe produisait des cassures, des fentes, des failles’ (ch. 38).

⁶⁰ Gillespie, *Genesis and Geology*, 1959.

⁶¹ ‘Quelles sont les causes qui ont produit les reliefs actuels du globe?’: ‘La cause primordiale c’est, comme nous l’avons dit si souvent, le refroidissement de la terre . . . les plis, les ridements et les fractures . . . ont provoqué la formation des principales montagnes . . . qui ont eu pour résultat de créer de nouveaux continents en comblant le bassin des mers anciennes.’ (477).

⁶² Ruse, *Revolution*, 1979.

. . . depended upon one law or decree of the Almighty . . . the idea of a separate exertion for each [example of design] must appear totally inadmissible."⁶³

Buckland's *Bridgewater Treatises* were in the older tradition of enumeration. First published in 1836, *Geology and Mineralogy* underwent nine subsequent editions by 1860.⁶⁴ The work was translated into French by francophone Louis Agassiz, often cited by Verne, and widely read by Continental scientists.⁶⁵ Figuiet may have been familiar with it. Illustrations from Buckland's work seem to be included in the 358 figures in *La Terre avant le déluge*,⁶⁶ although, as stated in the Preface (p. xii), Figuiet borrowed these from d'Orbigny's *Cours Élémentaire de Paléontologie et de Géologie Stratigraphique*, not directly from Buckland's original work.

Axel makes implicit allusions to a Divine Architect when viewing the columnar basalts in the fjord of Stapi (ch. 14) and perhaps when he describes the roof of the lava gallery as a "succession of arches" in the Gothic and Roman style (ch. 19). Professor Lidenbrock is more explicit. Describing the huge cavity that contains the Lidenbrock Sea he remarks, "the vault is solid; the Great Architect . . . built it of good firm stuff" (ch. 31).

Axel allows for personal providence in human affairs. God led him to the whispering gallery (ch. 28) and his fall into the grotto by the underground sea is "providential" (ch. 29). However, it does not follow from this that Verne was necessarily religious: Hetzel often strongly recommended that his author insert Christian comments, apparently for commercial reasons, since he himself was an atheist! Natural phenomena are explained in Verne's work by physical law—not by divine intervention. Axel and Lidenbrock are committed to law, as were Sedgwick and other catastrophist geologists.⁶⁷ "The astounding acoustic effect" by which he is able to communicate with his companions in the whispering gallery "could easily be explained by simple natural laws" (ch. 28) and the anomalous clouds over the subterranean sea are explained "by some physical law which was beyond me" (ch. 30). Professor Lidenbrock believes that the atmosphere will become denser, "following a law which has not been completely determined," as the party descends toward the center of the Earth. Concerning the baffling occurrence of "sedimentary soil" at Port Gräuben and the fossil vertebrates it contains, he claims that:

it can be explained geologically. At a certain period, the Earth consisted only of an elastic crust, subjected to alternate upward and downward movements, by virtue of the laws of gravity. These probably gave rise to landslides, and a section of the sedimentary terrains must have been carried down to the bottom of newly-opened chasms.⁶⁸

CONCLUSION

Verne was accused of plagiarism a number of times in his career, most notably for *Journey* but also for *Around the World* and other novels. He indignantly

⁶³ Robert Chambers, *Vestiges of the Natural History of Creation* (Churchill: London, 1844), 197. Reprinted in *Vestiges of the Natural History of Creation and Other Evolutionary Writings by Robert Chambers*, edited with a new introduction by James A. Secord (Chicago: University of Chicago Press, 1994).

⁶⁴ Gillespie, *Genesis and Geology*, 1959, 294.

⁶⁵ Rudwick, *Fossils*, 1976, 203.

⁶⁶ Rudwick, *Scenes*, 1992, 173.

⁶⁷ Ruse, *Revolution*, 1979, and Gillespie, *Genesis and Geology*, 1959.

⁶⁸ "ce fait peut s'expliquer géologiquement. A une certaine époque, la terre n'était formée que d'une écorce élastique, soumise à des mouvements alternatifs de hauts et de bas, en vertu des lois de l'attraction. Il est probable que des affaissements du sol se sont produits, et qu'une partie des terrains sédimentaires a été entraînée au fond des gouffres subitement ouverts." (ch. 30)

denied these accusations although paying compensation in one case. He was defended on one occasion by Henri Poincaré, future President of France. The irony, of course, is that in those two novels, the borrowing from other texts was systematic and obvious. Verne often named his sources within his text, although he rarely indicated the extent of the borrowing and diluted the acknowledgements by hiding them amongst scores of other names, as in *Twenty Thousand Leagues*. In the recently published correspondence with Hetzel,⁶⁹ he claims that he never “copies,” although admitting that Théophile Lavallée (1804–1866), from whose draft he is writing *Géographie de la France*, has purloined most of his material from Conrad Malte-Brun (1775–1826).⁷⁰ Verne says his solution here is simply to re-write the chapters to hide the borrowing. While both copyright laws and general attitudes to reuse of material were much more indulgent in the nineteenth century, it is surprising that Figuiet himself does not seem to have put on record the degree of Verne’s debt. For the conclusion stands out that, without *La Terre avant le déluge*, the *Journey* could hardly have been written. The parallelism is remarkable both in the scientific details presented and the general geologic and scientific attitudes espoused. The *pièce de conviction* is the multitude of figures, proper names, and scientific terms shared in the two works.

Verne, however, also demonstrates considerable literary skill. Having extracted significant information from Figuiet, he always takes care to transform it before integrating it into his story. Many devices are used—dialogue, the disciple-master relationship, the combination of telling and showing, the use of the perspective of the characters, even the ridiculing of learned scientific discourse. Stylistically, while Verne occasionally shows his penchant for the unadulterated list, he is normally careful to simplify without falsifying, to entertain at the same time as inform.

What is not clear is the precise sequence of events. Verne drew his inspiration and material from Figuiet for his 1864 edition; but the density of borrowing is greater in the parts added in the 1867 version. Why, then, did he wait three years before adding the three chapters? One answer may reside in the surge of interest in prehistory in France during the intervening period. The publisher Hetzel would surely have had his word to say in a major revision designed to cash in on fashionable debate. But in the absence of any documentation about the additions, answers will remain largely speculative.

In conclusion, many of the ideas in *Journey* which for generations have been assumed to be of Verne’s own invention, are not originally his, even if he invariably adds a creative gloss to them. So close are *Journey* and *La Terre* that we would claim that an analysis of one of the most famous novels of the nineteenth century without reference to the source of its scientific content may not be fruitful. The mature catastrophism developed by geologists in the 1840–1850s and popularized by Figuiet thus lives on through Verne.

REFERENCES

- Boitard, Pierre, *Paris avant les hommes: l’homme fossile, etc.: histoire naturelle du globe terrestre: illustrée d’après les dessins de l’auteur: ouvrage posthume publié par sa famille: suivi d’une nomenclature des règnes de la nature antédiluvien* (Paris: Passard, 1861), 494 p.
- Butcher, William, *Verne’s journey to the centre of the self: space and time in the voyages extraordinaires* (New York: St. Martin’s Press, 1991), xvii, 206 p.

⁶⁹ Dumas, et al., *Correspondance*, 1999, 47.

⁷⁰ Malte-Brun, Conrad, *Géographie universelle de Malte-Brun. Entièrement refondue et mise au courant de la science*, par Th. Lavallée, 6 vols. (Paris: Furne, 1855–1859). Lavallée also published *Les frontières de la France: ouvrage couronné par l’Académie française*, 2nd. ed. (Paris: Hetzel, 1864), and other historical and geographical works.

- Butcher, William. Long-Lost Manuscript. *The Modern Language Review*, October 1998, 93(4):961–971.
- Carpenter, William B., *Zoology; being a systematic account of the general structure, habits, instincts, and uses of the principal families of the animal kingdom: as well as of the chief forms of fossil remains*, 2 vols. (London, 1857, re-issued 1866).
- Chambers, Robert. *Vestiges of the Natural History of Creation and Other Evolutionary Writings*, ed. with a new introduction by James A. Secord (Chicago: University of Chicago Press, 1994), 254 p.
- Dumas, Olivier, Piero Gondolo della Riva, and Volker Dohs, eds., *Correspondance inédite de Jules Verne et Pierre-Jules Hetzel* (1863–1886), Volume 1 (Geneva: Slatkine, 1999).
- Figuier, Louis. *La Terre avant le Déluge: Ouvrage contenant 25 vues idéales de paysages de l'ancien monde, 325 autres figures dessinées par Riou*, 3rd ed. (Paris: Hachette et Cie., 1864), 484 p.
- Figuier, Louis. *The World before the Deluge. Containing twenty-five ideal landscapes of the ancient world, designed by Riou, and two hundred and eight figures of animals, plants, and other fossil remains and restorations*, translated from the 4th French ed., rev. ed. by H. W. Bristow (London: Chapman and Hall, 1865), 448 p.
- Gillespie, Charles C., *Genesis and Geology: The Impact of Scientific Discoveries upon Religious Beliefs in the Decades before Darwin* (New York: Harper and Row, 1959), 306 p.
- Gould, Stephen J., *The Mismeasure of Man* (New York: W. W. Norton and Company, 1981), 352 p.
- Hallam, A., *Great Geological Controversies* (New York: Oxford University Press, 1983), 182 p.
- Lyell, Charles, *The Geological Evidences of the Antiquity of Man with Remarks on Theories of the Origin of Species by Variation* (Philadelphia: George W. Childs, 1863), 518 p.
- Romer, Alfred S., *Vertebrate Paleontology* (Chicago: University of Chicago Press, 1966).
- Rudwick, Martin J. S., *The Meaning of Fossils: Episodes in the History of Paleontology*, 2nd ed. (Chicago: University of Chicago Press, 1976), 287 p.
- Rudwick, Martin J. S., *Scenes from Deep Time: Early Pictorial Representations of the Prehistoric World* (Chicago: University of Chicago Press, 1992), 280 p.
- Ruse, Michael, *The Darwinian Revolution: Science Red in Tooth and Claw* (Chicago: University of Chicago Press, 1979), 320 p.
- Van Riper, A. Bowdoin, *Men among the Mammoths: Victorian Science and the Discovery of Human Prehistory* (Chicago: University of Chicago Press, 1993).
- Verne, Jules, *Voyage au centre de la Terre* (Paris: Hetzel, 1864, revised 1867).
- Verne, Jules, *Journey to the Centre of the Earth*, ed. and transl. with introduction and notes by William Butcher, 3rd ed. (Oxford and New York: Oxford University Press, 1998), 234 p. First edition 1992.