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► **To cite this version:**

Claudine Cohen. “How nationality influences Opinion”: Darwinism and palaeontology in France (1859–1914). *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences*, 2017, 66, pp.8-17. 10.1016/j.shpsc.2017.10.003 . hal-04486507

HAL Id: hal-04486507

<https://hal.science/hal-04486507>

Submitted on 1 Mar 2024

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**“HOW NATIONALITY INFLUENCES OPINION” :
DARWINISM AND PALAEOLOGY IN FRANCE
(1859-1914)**

Abstract :

This paper discusses the “non-reception” of Darwin’s works and concepts in French palaeontology and palaeoanthropology between 1859 and 1914. Indeed, this integration was difficult, biased and belated, for ideological, intellectual and epistemological reasons : - Clémence Royer’s biased 1862 translation of Darwin’s *Origin of Species* pulled its ideas toward “social darwinism”, making them less attractive to the natural sciences. - French nationalism and the authority of religion, which imposed Cuvier’s thinking until late into the century - the dominance of Lamarckian and neo-Lamarckian transformism in France, both in biology and in paleontology, which proposed the notion of orthogenetic laws and environmental determinations, and refused darwinian evolutionary mechanisms - obstacles inherent to the application of Darwin’s concepts to palaeontology, namely the impossibility to identify evolutionary mechanisms through the fossil record, which was stressed by Darwin himself and underlined in turn by 19th century French palaeontologists.

However, as I argue, in the course of the examined period, French palaeontology grew from refusal to a better understanding and evaluation of Darwin’s thinking. The quest for intermediary forms, the construction of branching evolutionary trees and the attempts to reconstruct human biological and cultural evolution were important efforts toward an integration of some aspects of Darwinian views and practices into French palaeontology and plaeoanthropology. The 1947 Paris conference which brought together American Neo-darwinists and French paleontologists made Darwinian concepts better understood and triggered a revival of French palaeontology from the 1960s.

Bullets :

This paper:

- analyzes different aspects of 19th century French anti-Darwinism, their causes and effects.
- describes the emergence of *transformist* views in French late 19th-Century palaeontology
- Examines the specificity of French Neo-Lamarckian thought
- studies the reference to Darwin's thought in 19th century French palaeontological works (Gaudry, Saporta, Deperet, F. Bernard)
- studies evolutionary concepts involved in the approach to Human evolution in Palaeoanthropology at the turn of the 20th century

Keywords :

Félix Bernard, Jacques Boucher de Perthes, Marcellin Boule, Georges Cuvier, Cuvierism, Charles Darwin, French Anti-Darwinism, Evolutionary laws, Albert Gaudry, Etienne Geoffroy Saint-Hilaire, Human evolution, Jean-Baptiste Lamarck, Lamarckism, Neo-Lamarckism, Missing links, XIXth Century Palaeontology, Palaeoanthropology, Phylogenetic trees, Edouard de Saporta.

Acknowledgements :

I am grateful to Armand de Ricqlès, Jean Gayon, Laurent Loison, Michel Veuille, Pascal Tassy, for our exchanges over the years on different aspects of the reflection presented here. I thank also my colleagues and students of the Laboratory Biogéoscience of Dijon, for our discussions on these questions. Finally, I owe many thanks to Marco Tamborini and David Sepkoski for inviting me to write this paper and for their patience during its preparation.

“Le Darwinisme est en mauvaise odeur au Jardin des Plantes”¹ wrote palaeontologist Vladimir Kovalevsky (1842-1883) to Charles Darwin on August 19th, 1871 [DCP, 1871], as he reported about his work at the Paris Muséum of Natural History, where he had come to study fossils under Albert Gaudry’s guidance [Kovalevsky, 1873]. “The French are dead against You and I must really mitigate my Darwinism not to irritate them,” he added. Indeed, it was not comfortable to be a Darwinian palaeontologist in France in those years. Albert Gaudry had been barred for more than a decade from the chair of Vertebrate paleontology at the Museum of Natural History because of his support to Darwin’s thinking. And Darwin’s own application to the French Academy of Sciences as a corresponding member was rejected six times before he was eventually elected at the botany section, in 1878.

French anti-Darwinism has been underlined and commented on at length, starting with Darwin himself : “Judging from the rapid spread in all parts of Europe, excepting France, of the belief in the common descent of allied species, I must think that this belief will before long become universal. How strange it is that the country which gave birth to Buffon, the elder Geoffroy & especially to Lamarck sh^d now cling so pertinaciously to the belief that species are immutable creations” he wrote to Gaudry in 1868 [DCP²-LETT-5794]. A long tradition of scholarship has insisted on the difficult, or even non-reception of Darwin’s thinking in 19th and part of 20th Century French natural sciences – Yvette Conry’s study *L’introduction du Darwinisme en France* stated that “French 19th Century palaeontology

¹ “Darwinism is extremely unpopular in the botanic garden”. (The Muséum d’histoire naturelle was in the botanic garden in Paris)

² DCP is for *Darwin Correspondence Project*

missed Darwinism³” [Conry, 1974, 227], Peter Bowler devoted a whole chapter to “French anti-Darwinism” in his study of *The Eclipse of Darwinism*, concluding that “Darwinism was never eclipsed in France because there was nothing to eclipse in the first place” [Bowler, 1986, 117], and in Tom Glick’s *Comparative Reception of Darwinism*, Robert Stebbins [Stebbins, 1988, 122] similarly insisted on the fact that “there was no Darwinian revolution in France”, because “the evolutionary plot had already been explored, and driven off the stage in the dramatic encounter of 1830 and subsequent developments”. However, more recent works brought criticisms to these judgments, stressing the importance of Darwin’s work for the acceptance of transformism in France [Grimoult 2000], or providing a more complex and subtle vision, owing both to a finer examination of several French palaeontologists’ scientific works and to a reassessment of what can be defined as “Darwinism” and its uses in palaeontology during the 19th Century (Tassy, 2006).

The particular choices and attitudes of French palaeontologists between 1859 and 1914 reveal in fact a varied and complex situation. While some of them held on to Cuvierian fixism until the end of the century and even beyond, others endorsed transformism under the name of Lamarckism or Neo-lamarckism and ignored Darwin’s works and concepts. But there were also readings of Darwin’s works among palaeontologists and anthropologists, sometimes flawed with errors or misunderstandings, and some of which led to integrating his ideas and methods into their research. In addition, paleoanthropology emerged and flourished in France as a new field in its own right, allowing the possibility to discuss the application of evolutionary concepts to human evolution.

As I will argue, in the course of the examined period, French palaeontology grew from blunt refusal to a better understanding and evaluation of Darwin’s thinking. The quest for intermediary forms, the construction of branching evolutionary trees and the attempts to

³ All translations from the French in this text are mine.

reconstruct human biological and cultural evolution were important landmarks toward a real, if limited, integration of some aspects of the Darwinian vision and methods into French palaeontology.

***I –Nationalism claims and religious frameworks
The persistence of Cuvier’s authority***

“Darwin was the continuator of a grand tradition; he applied his genius to demonstrating a theory that Diderot had presented and announced, and that Lamarck and Geoffroy had developed scientifically. Darwin knew how to make the marvelous discoveries of the savant [Cuvier], who with most ferocity and authority rejected the transformism of Lamarck and of Geoffroy Saint-Hilaire, serve his own argument. In creating palaeontology, Cuvier, the champion of species immutability, furnished valuable arguments to the transformist, Darwin”.

This extract from Darwin’s obituary published in 1882 in the *Bulletin de la Société d’Anthropologie de Paris* is a perfect characterization of Darwin’s reception in French palaeontology. Through its homage to the great British scientist, it strongly insists on what Darwin owed to French naturalists: not only Lamarck and Geoffroy, but even Cuvier who, although being the strongest opponent to transformism, still provided in his palaeontological works arguments in support to Darwin’s transformist doctrine. By claiming Darwin’s unavowed heritage, it is clear that the author of his obituary pays indirect homage to the prestigious French school of the natural sciences which flourished during the first third of the century.

France was the cradle of vertebrate paleontology [Rudwick, 1978, 1995] and the place of the invention of its name [Ducrotay de Blainville, 1822]. At the turn of the 19th century Cuvier (1769-1832) laid the bases for its foundation, through the definition of its practical methods and theoretical principles [Cohen 2004; 2011] and the publication of his seminal

works [Cuvier 1812; 1825]. Cuvier imposed a fixist and catastrophist framework to French paleontological research [Laurent, 1987], strongly refusing evolutionary interpretations of the succession of forms in the fossil record, and explaining discontinuities between them by immense catastrophes which periodically marked the history of life and destroyed successive faunas and floras. According to Cuvier, the paleontologist's aim was to identify and reconstruct anatomically extinct beings and to establish their relative antiquity relying on their stratigraphic succession.

Cuvier's intellectual influence extended well beyond his death in 1832, both in the French sciences and in French scientific culture [Cohen, 2002]. His scientific authority persisted through the end of the century, and his catastrophism prevailed in France even long after Lyell had strongly asserted actualism as a conceptual foundation for scientific geology in England. The idea of the fixity of species and fauna, of the short duration of Earth history, and the hypotheses of a succession of geological catastrophes, the last of which he identified as the biblical Deluge [Cuvier, 1825], constructed a temporal and conceptual framework which remained acceptable by religion. This certainly was a serious obstacle to the acceptance of Darwinian materialism and evolutionary mechanisms in France while Cuvierism still reigned during the second half of the 19th Century.

Cuvier's disciples, who had by then become academic authorities, continued to argue against transformism until late in the century [Conry, 1974, 195-199]. Biological fixism and geological catastrophism long characterized the "official" geology and palaeontology which prevailed in major teaching and academic institutions, and remained the conceptual framework for a number of major scientific elaborations, such as Elie de Beaumont's (1798-1874) theory of mountain formation [Elie de Beaumont 1852], Louis Agassiz' (1807-1873) glacial theory [1840] and classification of species [1869], Alcide d'Orbigny's (1802-1857) paleontological stratigraphy [1849], and even, to some extent, Jacques Boucher de Perthes'

(1788-1868) recognition of human antiquity [1857, 1864, Cohen & Hublin, 2017]. For many French geologists and paleontologists, the refusal of Darwin's thinking primarily followed their overall rejection of transformism.

Among the reasons for this rejection, xenophobia and nationalism certainly played their parts. French natural sciences had been flourishing and brilliant during the first decades of the century, with the internationally renowned figures of Cuvier (1769-1832), Geoffroy Saint-Hilaire (1772-1844) and Lamarck (1744-1829). During the last decades of the century, French natural history scientific institutions were in decline [Limoges, 1980]. In the 1870's, as the Second Empire collapsed, and after the terrible defeat of Sedan and the episode of the Paris Commune, the themes of "decadence" were pervasive in French society. French science tried to argue for its specificity and grandeur against German and English scientific research, and remained committed to its masters of the previous decades. Foreign scientists were considered with suspicion : Darwin was ignored by many French naturalists several decades after the publication of his *Origin of Species*, or viewed as no more than Lamarck's epigone.

Another major reason for the misreading of Darwin's work was the circumstance of its first translation in 1862⁴. The French title given by Clemence Royer (1830-1902) to Darwin's book was *De l'origine des espèces ou des lois du progrès des êtres organisés* [*On the origin of species, or the laws of progress of organized beings*]. In this rendition and the accompanying 52 page preface, Darwin's text was skewed to insist upon social "progress" and the necessity of finding its "laws". "Natural selection" was translated as "*élection*

⁴ Getting his work translated into French was a difficult task for Darwin, and the choice of Royer came after several failures. On 30 mars 1860 he wrote to Quatrefages (DCP-LETT-5794) « The Gentleman who wished to translate my "Origin of Species" has failed in getting a publisher:—Bailliere, Masson & Hachette all rejected it with contempt. It was foolish & presumptuous in me, hoping to appear in a French dress (...). It is a great loss—I must console myself with the German Edition which Prof. Bronn is bringing out". After the publication of Royer's work he expressed his disapproval and opposed a second edition.

naturelle”, which distorted Darwin’s concept to give it an almost metaphysical meaning. Royer’s translation and its preface, which were oriented towards a claim for social progress, contributed in making Darwin’s work a basis for "social Darwinism", a political ideology which was in fact fueled by Spencer’s philosophy rather than by Darwin’s [Becquemont, 2004]. Facing this ideology which strongly advocated for elitism, social selection, and racism, Darwinism could hardly appear in France as a sound foundation for research in the natural sciences, and this was another cause for its rejection [Bernardini, 2013]. Darwin’s *Origin of species* was twice retranslated in the following years, by J.-J. Moulinié on the 5th and 6th editions [Darwin, 1873] and then by Barbier on the 6th [Darwin, 1882] but readers of *The Origin* in Royer’s translation rarely took the effort of rereading it in a better version [Tassy, 2006].

Other difficulties were inherent to Darwin’s thinking and its relationship to palaeontology. Darwin himself presented palaeontology as a body of evidence, but also recognized that due to the “poverty of our geological collections”, the incompleteness of the "book of nature", and the evolutionary process itself, intermediary forms are difficult to recognize, and lines of descent are not easy to reconstruct [[1859], 1872, chapters 10 and 11]. While he urged palaeontologists to go to the field in search of the “missing links” of life history, Darwin also cited other, perhaps more reliable proofs for evolution, such as morphology or embryology [ibid., chap. 14]. The reason why Darwin never rallied the complete allegiance of French naturalists can be found in philosophical stances – on the one hand, the importance of religious beliefs and the refusal of the materialism implied by Darwinian thought, and on the other, a rationalist resistance to its conceptual difficulties : how can one find in fossils evidence for the evolutionary processes cited by Darwin, variation and natural selection? How can the destructive power of natural selection be invoked to explain the creative processes of adaptation and evolution? Should not one call for some

creative power of nature, some "vital impetus", some transcendent law of change? These were the questions addressed by both biologists and paleontologists in France at the turn of the 20th century.

***The “reconstruction” of Lamarckism
in the second part of the 19th century***

In the 1830's, transformism had been strongly dismissed by Cuvier, who ridiculed Lamarck's work even in his obituary [Cuvier, 1832] and spectacularly refuted Etienne Geoffroy Saint Hilaire's "Unity of Composition" in a famous 1830 public debate at the Academy of Science in 1830 [Appel 1987].

Both Lamarck and Geoffroy Saint Hilaire were interested in paleontology. Geoffroy described new fossil species of Crocodiles in Normandy, and concluded from his study the existence of "intermediary forms" and of an evolutionary link between saurians and mammals [Geoffroy, 1831]. Lamarck's classification of invertebrate fossils [Lamarck, 1801; Laurent, 1987, 29 sq] shed light on the existence of "analogous" species between the present and the deep past. He underlined the variations of fossil organisms through time, he argued that Humans were responsible for the extinction of fossil species, and suggested that Man might be descended from apes [Lamarck, 1809, Laurent, 1987].

Both naturalists had disciples during their lifetimes. In the 1820's, Etienne Serres (1786-1868), a physician, comparative anatomist and a disciple of Geoffroy, who held the chair of comparative anatomy from 1850 at the Paris Museum, produced a theory which attempted to provide a "pattern of unification" in the organic world through comparative embryology [Serres 1827; Gould, 1977, 47-51]. In his later study of South American fossils [Serres 1857;], Serres affirmed that he believed in "an affiliation between the forms of lost animal species and of those which survived destruction" although he still maintained the idea of creation and called for the Cuvierian "revolutions" then advocated by Elie de Beaumont to

explain the extinction of South American great mammals in his study of *Glyptodon ornatus* [Serres, 1866, 209]. Geoffroy's own son, zoologist Isidore Geoffroy Saint Hilaire, played an important role during the second part of the century in the dissemination of his father's ideas and of transformist views.

Other naturalists, such as Frederic Gérard (1766-1857) and Belgian palaeontologist Jean-Baptiste D'Omalius d'Halloy (1783-1875), were early followers of Lamarck's transformism. Goulven Laurent [1987, 407-415] cites, in addition, a number of geologists and paleontologists who showed interest in Lamarck's ideas during the first half of the century. However, these naturalists were marginal and their importance in the emergence of transformist ideas in the second part of the 19th century remains contentious : while Pietro Corsi [Corsi, 1988; <http://www.lamarck.cnrs.fr>] insists on the importance of the (even limited) acceptance of transformism from 1825 to the constitution of a "pro-evolutionary culture" in France, Cedric Grimoult [2000, p. 37 sq] argues instead that the "victory of evolutionism", is due to the dissemination of Darwin's works and ideas after 1859.

By the mid-19th century, alternative concepts to Cuvier's fixism emerged, and a number of French naturalists called on the doctrines of Lamarck and Geoffroy Saint Hilaire as a foundation of their claims [Laurent, 1987]. Long after their deaths, both were proclaimed as heroes and pioneers of a new thinking in Biology [Laurent, 1987, Richard 1997]. Among Cuvierian paleontologists who adopted transformist ideas, Paul Gervais (1816-1879), who succeeded Serres as a professor of comparative anatomy at the Paris Museum, and who was originally a creationist, admitted by the end of his life that "within a same genus, species seem to be the modifications of one another, and the different genera of each family were originated from a same common ancestor, from which they were descended by diversification ". [Gervais, 1878, 256]. As he concluded: "Lamarck's theories, if improved, applied with more wisdom, and sometimes rectified [...] will certainly open new horizons in

science "[ibid.: 314]. A similar reflection on transformism dwells in the works of Swiss palaeontologist François Jules Pictet (1809-1872) who wrote in 1844 "All observations and research of some value agree to proclaim the permanence of species," [Pictet, 1844 I, 84] but who later admitted actualism, while remaining reticent toward Darwin's thought [Pictet, 1864, p. 252].

Following the prestigious works of Pasteur (1822-1895) and Claude Bernard (1813-1878), experimental biology became prominent in France in the last decades of the century, and Lamarck's name and doctrine became a major reference for biologists such as Yves Delage (1854-1920), Felix le Dantec (1819-1917), Edmond Perrier (1844-1921) and Alfred Giard (1846-1908), the latter of whom was eventually named Professor at the Chair of the "Evolution of Organized Beings", created at the Sorbonne by the (then socialist) Municipality of Paris in 1888 [Donnat, 1888]. These biologists laid the basis for a French "neo-Lamarckism" which, contrary to the American doctrine of the same name, was secular, agnostic, positivist, and lay almost entirely in the field of experimental biology. This French Neo-Lamarckian school has been described as quite diverse [J. Roger, 1982; Bowler 1986 110], but a certain unity can be found in its support for Lamarck's concepts such as the inheritance of acquired characters, the adaptive value of effort and habit, the influence of the environment, and the search for transcendental "laws" of evolution, based on morphological and embryological considerations [Perrier, 1884; 1888 ; Loison, 2012]. These scientists did not accept natural selection as a sound evolutionary concept, and considered most of Darwin's work as a mere extension of Lamarck's *Philosophie zoologique*. Convergences were all the more strongly emphasized as Darwin had minimized his French predecessor's intellectual heritage, while he shared with him many ideas, including the notions of inheritance of acquired characters and of life's progress through change.

After the publication in French of August Weismann's *Essais sur l'hérédité et la sélection naturelle* [Weismann, 1892], scientific discussions over the question of "the inheritance of acquired characters" were carried on in France from the point of view of neo-Lamarckian biology. After 1900, most French biologists remained reluctant to accept the new science of genetics [Bowler, 1986, 116-117]. Biologist and zoologist Lucien Cuenot (1866-1951) was a remarkable exception: as early as 1894, he accepted Neo-Darwinian concepts and supported the notion of natural selection [Cuenot, 1911]. He also conducted experimental research in genetics, a rare endeavor at that time -- it took many more decades before most French scientists started to recognize the importance of this new field in biology. But Cuenot lived and worked in Nancy, and was isolated from mainstream Parisian institutions. After the first World War, having no material means to pursue his experimental research in genetics, he started working on evolutionary theory, but his evolutionary views had little impact, if any, on French palaeontology. Finally, his theoretical positions were not without hesitations and by the end of his life, he supported finalism, thus introducing modifications to his acceptance of Darwinian concepts [Cuenot, 1941].

By the turn of the century, a "Neo-Lamarckian" climate pervaded French palaeontological thinking as well as the elaborations of experimental biologists of the time, although connections between the two domains remained quite loose and did not imply real collaborations. Most French paleontologists who developed evolutionary views attempted to define "laws" of phylogenetic transformation transcendent to the fossil record, such as Haeckel's law of recapitulation, laws of size increase or reduction, laws of growth and senescence, and other orthogenetic evolutionary trends (*orthogenesis* referring to "regularly directed evolution" [Bowler, 1986, 116], that is the orientations of fossil lines toward a specific path, or toward the achievement of an ideal morphological type). These views were triggered by the desire to make of paleontology a "real", inductive science, whose nomothetic

structure would be similar to physics. In contrast, in Darwin's "view of life", the history of living beings through deep time, cannot be reduced to transcendental "laws" or linear schemes, because it relies on contingent processes and events. This point, which is today considered central to Darwin's evolutionary thinking, was a source of ambiguities and discussions throughout this period, as illustrated in particular in Albert Gaudry's works.

Between Darwinism and Neo-Lamarckism
Albert Gaudry's Philosophie paléontologique

In his 1882 obituary for Darwin, Albert Gaudry wrote that he had read the *Origin* "with a passionate admiration [...], slowly tasting it, as one drinks with small strokes a delicious liqueur [...]. I found there a multitude of observations and thoughts which were in tune with the connections I had been able to perceive in the ages of the past " [Gaudry, 1888: 32]. Gaudry (1827-1908) was overtly an admirer of Darwin, whose work he read as early as 1862 in Clémence Royer's translation. His recently discovered annotated copy of Darwin's *Origin of species* reveals his enthusiastic reading, but also his eagerness to find in it support to his own religious beliefs [Tassy, 2006].

Gaudry became a leading figure of French evolutionary paleontology by the end of the 19th century, but his admiration for Darwin initially led to institutional setbacks⁵. Gaudry was Cuvierian palaeontologist Alcide d'Orbigny's brother-in-law and had been appointed as an *Aide-naturaliste* at the Paris Muséum in 1853. By the 1860s he had become an accomplished vertebrate palaeontologist, but he was then isolated at the Sorbonne and at the Muséum d'histoire naturelle because of his transformist views. He had to wait long years before he was named a Professor at the Sorbonne (1868) despite unfavorable reports addressed to him by Minister of education Victor Duruy. He was eventually elected as a professor of Vertebrate paleontology at the Paris Museum to succeed Edouard Lartet in 1872:

⁵ Darwin himself warned him : « Your belief will, I suppose at present, lower you in the estimation of your countrymen" (Letter to Gaudry January 21st 1869, *Darwin Correspondence Project*, "Letter no. 5794," accessed on 26 August 2017)

these appointments, which gave him a central place in French science and eventually great scientific authority, meant the introduction of transformism into an institution where Cuvier's dogmas had long reigned.

Gaudry was one of the first who built "trees" inspired by Darwin's abstract scheme of phylogenetic evolution through geological time [Darwin [1859], 1872, chapter IV]. The possibility of placing "intermediary" species between previously distinct genera was made possible by the multiplication of field work and a better knowledge of the fossil record. In 1867 Gaudry published the results of digs he had conducted in Greece since 1855 on the Miocene formations of Pikermi: he claimed to have discovered among this Tertiary fauna previously unknown types which were the true intermediaries between Vertebrate genera or even families. He illustrated his *Animaux fossiles de l'Attique* [*Fossil Animals of Attica*] [Gaudry, 1867] with phylogenetic schemes representing the evolution of several families of terrestrial vertebrates: Hyenae, Proboscids, Horses, Rhinoceros, and Suiforms. These genealogical trees - among the first of their kind - synthesized his own practices of research with the knowledge of the time in vertebrate palaeontology.

Les Animaux fossiles du Mont Lubéron [Gaudry, 1878] accounted for new palaeontological excavations and finds from a site in South-Eastern France of the same geological age as Pikermi. Here, Gaudry stressed the existence of a variability within fossil species which, he claimed, made him able even to distinguish "races". The results of his field research were presented in a synthetic work in three volumes, *Les Enchaînements du monde animal* [1878-1890], in which Gaudry applied his transformist vision to the history of animals through the Primary, Secondary and Tertiary eras. He later developed his evolutionary philosophy at length in an elegant work entitled -- paraphrasing the title of Lamarck's great work -- *Essai de Philosophie paléontologique* [Gaudry, 1896].

(place here the plate)

Gaudry's evolutionary tree of Proboscids, published in his *Animaux fossiles de l'Attique* in 1867, was one of the first phylogenetic trees ever published according to Darwin's principles.

In fact, Gaudry's evolutionary philosophy, as presented in the inaugural lesson of his Paleontology course at the Paris Museum in 1873, was quite different from Darwin's views. "Alongside the differences in species of consecutive epochs, many features of resemblance seem to reveal kinship: paleontology now starts seeing great chains of beings that swing through geological ages and connect creatures of the ancient times to those of the present. Many rings of these chains are lost forever to us, many have been found or will be found, and we will seek them with ardor. For a plan dominates the history of nature, and I trust that the study of palaeontological sequences will help us understand this yet mysterious plan", [Gaudry, 1873]. Gaudry takes up the metaphor of the "missing links" instead of Darwin's own metaphor of erased "pages" in a "book" : he is far here from Darwin's view of a contingent history of the living world⁶, and overtly maintains religious beliefs along with his scientific ideas. His quest for "intermediary forms" is associated with the traditional representation of the hierarchical "chain of beings", and with an idyllic vision of the world, in which all living forms are organized and connected in a perfect harmony. His thinking reflects a vision of evolution determined by a divine "plan", conceived as a necessary progress culminating in humans. Each geological era witnesses a certain type of perfection. In the Secondary era, at the end of the Jurassic and in the early Cretaceous, Dinosaurs, "the most gigantic of all continental quadrupeds", represented "the reign of brutal force". By the end of the Tertiary, the great mammals achieved yet another kind of perfection of a higher level: "The real apogee of the animal world [...] appears by the end of Tertiary times, during the Miocene and

⁶ Epistolary exchanges show that both Darwin and Gaudry were aware of their intellectual dissent : see Gaudry's letter to Darwin of May 22nd, 1867 (DCP-LETT-5546), in which Gaudry pays homage to the British scientist, while he also stresses his divergence with Darwin's materialism. And whereas Darwin congratulated Gaudry for having "intended to examine the relationships between extinct animals from the point of view of their genealogy" [Darwin, letter to Gaudry, Jan 21st, 1868, DCP LETT 5794], he stressed elsewhere the differences between his own argument and the French palaeontologist's views (see letter to Armand de Quatrefages 28 May 1870 DCP, LETT 7204,].

Pliocene, that is, immediately before the advent of Man. " In his eyes Tertiary Elephants were "the most beautiful, the most active, the most intelligent" and one could say the most "human" of all quadrupeds. The following epoch would culminate in the appearance of *Homo sapiens*.

To Gaudry, the evolution of the living world is not ruled by destruction and violence. To explain extinction, he discarded both Cuvier's catastrophism and Darwin's natural selection, to propose a peaceful and poetic vision of nature. The "kings of nature" at each age were herbivores, not carnivores, who would have precipitated destructions. The extinction of these gigantic animals can only be explained as a consequence of their "tendencies", as they had no predators. Gaudry's transformism in fact presents a mystical vision of the harmony of nature and of its laws: "the geological world never was a place of carnage, but a majestic and quiet theater "[Gaudry, 1896, 29]. "The Dinosaurs' terrible fights have been greatly exaggerated", he wrote, arguing that in the late-Miocene world, if "ferocious beasts" did kill herbivores threatened by starvation, it was only to shorten their sufferings, and that "except for their love battles", animals had "hardly any quarrel. " We are far here from natural selection. Gaudry's views recall in fact, in many respects, the "theology of evolution" then advocated by American Neo-Lamarckians[Cope, 1887]: his positions regarding the "laws of evolution" and the role of God in nature echo those of paleontologists such as Cope, Hyatt, and Henry Fairfield Osborn, with whom he cultivated intellectual and personal ties [Osborn, 1902].

However, through his claim for the necessity to uncover "intermediary forms " in the history of life and to build phylogenetic trees, and in his dissemination of transformism to the wider public through the creation and organization of the Gallery of Palaeontology at the Paris Museum, Gaudry's actions were essential to the establishment of evolutionary paleontology in Cuvier's country. He brought transformism, and some important aspects of Darwin's thought, out of marginality into mainstream palaeontology. As Pascal Tassy has

remarked [Tassy, 2006], building tree-like phylogenies is an essentially Darwinian practice, and in this respect Gaudry was a Darwinian, despite his refusal of natural selection. Most importantly, he also gave personal support to the recognition of "Fossil Man" [Gaudry 1859 ; Cohen & Hublin 2017], thus overcoming again Cuvierians' hostility on this issue.

Gaudry enjoyed international scientific reputation. His works were translated into several languages, including English, German, and Serbian, and he maintained scientific relationships with major scientists around the world. Darwin held him in high esteem, and described him as “[one] of the best paleontologists in Europe”⁷, although he was conscious that Gaudry’s evolutionary views were different from his own in many respects. Gaudry’s correspondence with Darwin between 1866 and 1878, with Othniel Marsh, Edward Drinker Cope, Henry Woodward and Boyd Dawkins⁸, shows him exchanging ideas, books, and specimens with these great scientists. The numerous fossils specimens or moulds which were received from around the world and exhibited in the Galerie de Paleontologie since its foundation in 1898 materialized these international links and exchanges.

By the end of his life, Gaudry's scientific works and teachings were strongly influential in France. He was the master for a long posterity of transformist paleontologists and palaeoanthropologists. As we will see below, his views on evolution shaped (although in diverse ways) the ideas of a number of French palaeontologists and palaeoanthropologists, such as Gaston de Saporta, Charles Depéret, Marcellin Boule and Pierre Teilhard de Chardin.

After Gaudry :

Darwinism and anti-darwinism in fin-de-siècle French Palaeontology

"An energetic, skillful and profound thinker succeeded in condensing, in a book which is now famous, aspirations that were hitherto wavering, and to establish the bases of a

⁷ Letter from Darwin to George Bentham 1st may 1868, DCP-LETT-6154

⁸ Signed books and letters from these different scientists can be found among Gaudry’s paper ket at the Bibliothèque du Laboratoire de paleontology, in the Paris Museum Natural History.

powerful synthesis, as illustrated by the word *Darwinism*, now often applied to transformist ideas in general : but it would be more accurate to restrict this word to the series of bold and ingenious hypotheses of which the English naturalist has been so prodigal ." Thus Gaston de Saporta (1823-1895) paid homage to Darwin [Saporta, 1869]. A palaeobotanist, a friend and disciple of Gaudry, and a correspondent of Darwin [Conry, 1972], Saporta who worked as an independent naturalist in Aix en Provence and participated in research and editorial projects at the Paris Museum, made a Darwinian profession of faith: "As disciples of Darwin, we obey his impulse by applying to the vegetable kingdom a method of investigation whose fundamental rules he formulated with a sure hand" [Saporta, 1881, I, . XI]. In his successive works, *Plantes jurassiques [Jurassic plants]* [1872-1891], *La flore fossile du Portugal [the fossil flora of Portugal]* [1894] *Le Monde des plantes avant l'apparition de l'Homme [the world of plants before the appearance of man]*, and *L'évolution du règne végétal [The evolution of the vegetable kingdom]* [1881], Saporta conceived of the succession of fossil plants on a geological scale as a continuous series. However, the evolution he described was mainly progressive, guided by laws determining evolutionary change based on the model of ontogenetic development. The influence of the environment, climate, and acclimatization also played an essential role in Saporta's evolutionary doctrine, which has been characterized as a "misunderstanding" of Darwin, [Conry, 1974: 109-163] because of his ignorance of Darwinian mechanisms. However, his 1869 paper on *Darwin and the transformist school* commented on Darwin's notions of descent, variation, and artificial selection used as a model for natural selection, insisting on the fact that "the action of Man on animals and plants is nothing but a rational imitation of the unconscious processes of nature" (Saporta, 1869 : 17, Tassy, 2006). Saporta understood Darwinian concepts very well, although he did not fully apply them to his scientific practice.

Other palaeontologists who had been trained with Gaudry were more critical of the Darwinian doctrine. Charles Depéret (1854-1929), who became a professor of palaeontology at the University of Lyon in 1886, insisted on the conceptual difficulties lying in the construction of tree-like phylogenies advocated by Darwin and after him by Gaudry. In his *Transformations du monde animal [Transformations of the animal world]* [Deperet, 1908] he rejected Gaudry's ambition to put into light "intermediary forms" between fossil genera : these supposed phylogenies were based on illusory resemblances, factitious and paradoxical approximations. In Deperet's view, "it is not sufficient to argue, as has been done since Darwin, for the lack of paleontological documents. Transitions between genera do not, and cannot exist : facts demonstrate that they are branches which had a separate evolution and an independent history".

According to Depéret, the history of these "branches" is determined by evolutionary "laws" which govern gradual transformations, such as the tendency in size increase or reduction he had contributed to establish ["Cope-Depéret's law"], or the law of "irreversibility" set out by Belgian paleontologist Louis Dollo (1857-1931), according to which a character once lost in phylogenetic evolution cannot be retrieved: "specialized" forms can only evolve into more specialized forms [Gould, 1970]. "Branches" which have reached a certain specialization in their structure, can either get more and more specialized, or die out. In Deperet's views, evolution is thus conceived as an orthogenetic drive without branching, governed by transcendent "laws". The characters shared by species belonging to these different lines of descent can only be independent acquisitions, or "parallelisms". "Primitive", non-specialized forms alone can generate new lines of descent. The strict application of this principle results in the virtual impossibility of representing evolution as a phylogenetic tree, but only as a *table* with parallel lines of descent whose origins are lost in the unknown: a paradoxical representation of evolution which multiplies parallelisms and forbids conceiving

of possible filiations. The parallel-branching pattern advocated by Depéret and his description of orthogenetic "laws" of palaeontological evolution materializes Neo-Lamarckian rather than Darwinian concepts.

***Toward a reconciliation ?
Félix Bernard's attempt for a synthesis***

In the last years of the 19th century, Félix Bernard (1863-1898), a young and bright invertebrate paleontologist, worked as an assistant at the Paris Museum of Natural History where he was Gaudry's colleague, and where had been trained by Ernest Munier-Chalmas (1843-1903), an unconventional but sharp geologist and invertebrate palaeontologist. In 1895, at 35 years of age, Bernard published an 1100 page volume entitled *Eléments de Paléontologie*, which summarized with intelligence and lucidity the transformist debates of the time, and presented a comparative approach to neo-Lamarckian and Neo-Darwinian concepts and methods, and their applications to palaeontological research.

His work was written as a textbook for students and amateurs – remarkably, soon after its French publication, a hundred page extract was translated into English and published in the United States under the title *Principles of Palaeontology* [Bernard, 1897]---. This bulky, but very readable treatise offers an insightful attempt to recapitulate the different orientations of transformism and their impacts upon the paleontology of the time. Moving past the xenophobia of the former generation, it presents a theoretical assessment of evolutionary palaeontology fed with German, English, American and French sources [Bernard, 1895,V]. The first chapter presents the different transformist conceptions which animated paleontology in his time, testifying to a careful reading of Darwin's works and attempting to figure out applications of his theses to paleontological methods and reflection.

Bernard praises Darwin's genius, but he also recalls "how his predecessors had opened the way for him.", emphasizing the merits of Geoffroy and of Lamarck, the latter

being "unjustly neglected by Darwin who only includes him in his preface along with obscure predecessors." He stresses, moreover, that "today a great part of the transformist school more appropriately pays to the illustrious scientist [Lamarck] his due tribute" [Ibid., 10]. Among Darwin's contributions to evolutionary thought, Felix Bernard analyses the notion of natural selection. "This principle," he explains, "is the foundation of the entire transformist doctrine, whose various propositions receive daily demonstrations in palaeontology": however, he stresses, "palaeontology cannot provide any direct argument in support of the principle of selection"[p. 15]. Another major contribution of Darwin is his reflection on intermediary forms. Darwin pointed out the lack of palaeontological evidence for evolution due both to the rarity of fossils and the relative scarcity of transitional forms. Bernard notes that "the principle of natural selection presupposes that intermediary forms cannot last long ... It is therefore natural that we do not meet, in the present, the forms of passage between the different species, except in the case of the appearance of new forms, whose evolution is not yet complete". This also explains why palaeontology does not easily provide these types of passage, "neither in the form of local varieties nor in the form of mutations." [Ibid., 16] This leads him to envision the notion of evolutionary "saltations", referred here to Cope and Ed. von Hartmann. "It is indisputable that the rate of evolution in the same group presents extreme variations," as a result of tensions between "progressive forces" and "conservative forces" during the evolutionary process [Ibid., 18-19]⁹.

Félix Bernard presents with remarkable insight Darwinian evolutionism and its contributions to paleontological research, in particular for the establishment of phylogenies. "As a transformist, I am convinced that the ideal classification for each group is a genealogical tree", Bernard wrote. However, he stressed that "methods used in the

⁹ This analysis of evolutionary "saltations" bears close resemblance with Eldredge's and Gould's arguments in support of their notion of "punctuated equilibria" [Eldredge and Gould, 1972]. Stephen Jay Gould knew well Bernard's *Elements de paléontologie* through its American short version, which he republished in 1980, and may have found an inspiration in it.

establishment of a phylogeny are not all provided by paleontological data: embryology and comparative anatomy also play important parts" [*ibid.* VI-VII].

Bernard strongly criticizes the "metaphysical obscurities" of the "theology of evolution" advocated by American neo-Lamarckians such as Cope and Hyatt [*ibid.*, 22], as well as the hypothesis of an obscure "vital force" determining growth and decrease in size during the evolution of species, which was supported by some French biologists. However, he supports the neo-Lamarckian attempt to define evolutionary "laws" : laws of acceleration and retardation of development, "law of progress", according to which living beings have "[improved] themselves since the first periods when we found them in the fossil state "[*ibid.*, p. 34]. He also admits the direct or indirect influence of the environment on variations. However, "whether the variations which are transmitted are acquired by exercise and obsolescence, or whether they are spontaneous variations of the germinal plasma accumulated by natural selection remains to be determined. In order to solve this question, it is necessary to appeal less to paleontology than to biological experiments" [*Ibid.* 22]. He strongly insists on the necessary relationships between paleontology and the biological sciences : a sound disciple of French neo-Lamarckian biologists, he urges them to better understand evolutionary processes such as variation and mechanisms of inheritance.

Bernard's reflection reveals that in France by the end of the century, Darwin's evolutionary thought could be well understood and recognized in its conceptual foundations, and that some of its aspects were significantly applied to the methods and practices of paleontology, while at the same time major difficulties remained in the elucidation of the mechanisms he described.

Felix Bernard died only one year after the publication of his treatise, in 1896. His untimely death did not allow him to achieve the bright career he might have had, in a time when major scientific changes were about to bring novel elements to answer his queries, with

the birth of genetics opening new ways in experimental biology for the explanation of Darwinian evolutionary mechanisms – but, as has been stressed above, most French scientists remained long reluctant to adopt the new concepts of genetics.

Decline and rebirth of French 20th century Palaeontology

Palaeontologist and evolutionary biologist Henry Tintant [1992] pointed out the flaws in the status and practices of paleontology in France during the first half of the 20th century : its remoteness from biological inquiries and its enslavement to geology in the wake of a long Cuvierian tradition. Lacking financial means and support for research and publications, paleontology was almost totally reduced to a futile set of practices, a "pastime for old ladies", with little relevance to the life sciences. The study of fossils remained descriptive and stratigraphic, and had no real interest in the establishment of phylogenies or the understanding of evolutionary processes. Refusing Darwinian mechanisms or even ignoring questions about them, palaeontologists mainly sought to identify "orthogenetic" laws within a Neolamarckian scope – their interest in evolution being often colored with religious concerns.

One had to wait till the middle of the century and a conference organized at the Sorbonne in 1947 by palaeontologist Jean Piveteau (1899-1991) on *Paléontologie et transformisme* [Piveteau, 1950] to see the introduction of Neo-Darwinian concepts trigger a revival of evolutionary palaeontology in France. This conference, whose aim was to “confront the view points of Paleontologists and Geneticists on transformist theories”, was attended by prominent French scientists such as Camille Arambourg (1885-1969), Lucien Cuénot, Pierre-Paul Grassé (1895-1995), Pierre Teilhard de Chardin, and, on the foreign side, by the champions of the Neo-Darwinian Synthesis, George Gaylord Simpson, Alfred Romer, J.B.S. Haldane, E.A.Stensiö, and D.M.S.Watson. One major point discussed during the conference

was orthogenesis, by then a dominant concept and even a field of research in its own right in French paleontology. Criticisms of this notion were addressed by Simpson and Romer. If French scientists such as Cuenot and Teilhard de Chardin went on to support finalism and orthogenesis, a new generation [Devillers, 1991] would soon take up conceptual innovations proposed by the American school. This encounter with neo-Darwinism was the departure point for a renaissance in French evolutionary palaeontology during the following years. This was reflected in particular in the originality and dynamism of the " Paris School " of palaeontology [De Ricqlès, 1991] which saw from the 1960s a renewal made of intellectual pluralism and methodological innovation.

The rise of French palaeoanthropology

Thinking about human evolution

Early debates and discoveries leading to the recognition of Human antiquity had taken place mainly in France between 1820 and 1850. Prehistoric archeology and palaeoanthropology were "officially" founded in 1859 with the recognition of Jacques Boucher de Perthes' claims for the contemporaneousness of humans and extinct animals, demonstrated through paleontological, archeological and geological evidence from the deposits of the Somme River Lower Valley, in Northern France [Cohen & Hublin, 2017]. However, no connection was made then between Darwin's thinking and paleoanthropology, and Boucher de Perthes, who was hailed as the founder of a new discipline, still called for the "Antediluvial Man" [Boucher de Perthes, 1849, 1857, 1864]. By the same time, similar research had been carried out at Brixham Cave in England [Van Riper, 1994] and British scientists -- Hugh Falconer, Joseph Prestwich, John Evans, Charles Lyell -- traveled to Northern France to examine the Somme River deposits near Amiens and Abbeville and to recognize the truth of Boucher de Perthes' claims. Lyell's synthesis recapitulated evidences for human antiquity, and admitted, at least in part, Darwin's evolutionary concepts and the

idea of human evolution [Lyell, 1863; Cohen, 1996]. Ever since the 1860s and well into the 20th century, the development of palaeoanthropology and prehistoric archeology was strong in France with internationally visible works, exceptional sites, leading researchers, prestigious institutions, and well distributed scientific journals. The new science fascinated the public, its discoveries were popularized through a number of books and artistic representations in sculpture, painting, poetry, and novels, thus becoming fully part of French scientific culture (Cohen, 1999; Cohen & Hublin, 2017).

Palaeoanthropological studies of the second half of the 19th century led to the establishment of a chronological framework of the prehistoric descent of Man that drew a parallel between his anatomical and cultural evolution. After the publication of the *Origin of Species* in 1859, and of *The Descent of Man* in 1871 [translated into French in 1872], physician Paul Broca (1824-1880), illustrious anatomist and founder of the French Société d'anthropologie de Paris in 1859, discussed Darwin's works. His comments, though critical, recognized the importance of the great British naturalist and of the innovations he brought to evolutionary thinking [Conry, 1974, 51-67]. At the same time, the idea (attributed to Darwin) that "Man comes from the Apes" made its way in popular imagination [Cohen, 1999] but it was not unanimously accepted in French scientific circles during the last decades of the 19th century. A number of French anthropologists, among which Armand de Quatrefages (1810-1892), who was a professor of anthropology at the Paris Museum and exchanged with Darwin a long and important correspondence¹⁰, continued to support creationist concepts and the fixity of species. Others, like Gabriel de Mortillet (1821-1898), Abel Hovelacque (1863-

¹⁰ Although they did not share views on life history and human evolution, Darwin held Quatrefages in high intellectual esteem. See for example Darwin's letter of May 28th, 1870 (DCP-LETT-7204), in which he commented on Quatrefages' book *Charles Darwin et ses précurseurs Français* (1870) : « It is impossible that any account of my views could be fairer, or as far as space permitted fuller, than that which you have given. The way in which you repeatedly mention my name is most gratifying to me. When I finished the second part, I thought that you had stated the case so favourably that you would make more converts on my side than on your own side. On reading the subsequent parts I had to change my sanguine view. In these latter parts many of your strictures are severe enough, but all are given with perfect courtesy & fairness”.

1896), and Leonce Manouvrier (1850-1927), who adhered to left wing materialism, were eager to support transformist ideas.

Mortillet, a member of the Société d'Anthropologie de Paris who specialized in palaeoanthropology and prehistoric archaeology, was a militant atheist and socialist. His transformism mostly followed Etienne Geoffroy Saint Hilaire's and he conceived of human evolution as a linear progress. In 1867, he proposed to classify the ages of humanity according to the few human fossils then known and the stone tools typical of each period. From 1869, he was in charge of classifying Boucher de Perthes's stone tools for the Musée des Antiquités nationales of Saint Germain en Laye newly founded by Napoleon III [Cohen and Hublin, 2017] ; as a result, he drew the scheme of a gradual evolution attempting to match the successive types of industry with the different prehistoric human types then known: for the most ancient, "Acheulean" cultures were represented by the "Moulin Quignon type" (represented by a jaw bone later recognized as a fake); Middle Palaeolithic Mousterian industries were attributed to Neanderthals ; while Upper Palaeolithic Solutrean and Magdalenian industries belonged to *Homo sapiens sapiens*, represented by the famous Cro-Magnon Man discovered in 1868 in the Vézère valley and studied by Louis Lartet.

The search for a "missing link" between apes and humans aroused much discussion and speculation. According to their transformist convictions, Gabriel de Mortillet and Abel Hovelacque hypothesized the figure of an *Anthropopithecus* somewhat inspired by the *Pithecanthropus* proposed by German biologist Ernst Haeckel, which embodied the notion of a "Tertiary man", an evolutionary link between Apes and Humans [Mortillet 1896, Hovelacque 1878] . They believed that his traces could be found in allegedly very primitive chipped flint tools, the so-called "eoliths" unearthed by Abbé Bourgeois (1819-1878) in the Oligocene levels of Thenay [Loir-et-Cher] [Bourgeois, 1867]. After years of intense debates, the Thénay eoliths eventually proved to be naturally cut and burned stones. However, more

"Tertiary eoliths" found in Portugal or England continued to fuel scientific discussions over the origin of Man in Europe until the first decades of the 20th century.

Speculation would soon be tempered by more sound field discoveries. In 1891, the Dutch military physician Eugène Dubois, inspired by Haeckel's ideas and his own geological studies, exhumed a skullcap, a few teeth, and several femurs from the Lower Palaeolithic layers of Trinil, Java. *Pithecanthropus erectus*, "the Ape-Man that stands", had a low skull, a small brain [900 to 1000 cm³], and a perfectly bipedal gait [Theunissen, 1987]. As soon as it was known in Europe, this discovery became the source of heated arguments. Was the fossil skeleton that of a man, or of an ape? In France, at the Paris Société d'Anthropologie where Dubois gave a presentation in the framework of a "Transformist conference" in 1896, Darwinian anthropologist Léonce Manouvrier supported, like Dubois, the intermediary position of the fossil. However, it soon appeared that *Pithecanthropus*' characters were far from being "intermediary". In many respects (the perfect bipedal gait, associated with the low skull), *Pithecanthropus erectus* did not fit with the anatomical model then made up by French scientists. These debates were essential to subsequent important changes in the vision of Human evolution in France.

The turn of the century saw the linear scale of human evolution shattered. Marcellin Boule (1861-1942), a former student of Albert Gaudry, who was an eminent professor of paleoanthropology at the Paris Museum of Natural History and the director of the Institut de Paléontologie Humaine founded in Paris in 1910, opposed Mortillet's linear scheme and proposed a tree-like image to represent human evolution. Taking up Darwin's metaphor, he compared "each group of similar creatures... to a tree or a bush with different degrees of density, each branch of which is either a genus, or a species, or a race" [Boule, 1913, 249-50]. In his vision of human evolution, the lower and middle Paleolithic Human fossils were side branches, doomed to extinction : *Pithecanthropus* did not stand in human ancestry, because

of his weak brain development. Similarly, Neanderthals were backward beings whose technical skills were debatable. The conclusions Boule drew from his 1911-13 study of la Chapelle-aux-Saints Neandertal remains [Boule, *Ibid.*] insisted on the primitivity of this form : "It is therefore probable - Boule concludes - that *Homo Neanderthalensis* possessed only a rudimentary intelligence, certainly superior to that of great Apes, but probably lower than any current human race. He probably did not have a rudiment of articulated language" (...) "The probable absence of any trace of aesthetic or moral concerns agrees well with the brutal aspect of this vigorous body and heavy and bony head, with the robust jaws, proving the predominance of purely vegetative or bestial over cerebral functions" (Boule, *Ibid.*). Neanderthals became extinct and the more evolved *Homo sapiens sapiens* was responsible for their slaughtering. Despite a Darwinian framework, Boule thought of *Homo sapiens* as a single vertically ascending branch whose evolution, considered in finalist terms, had very ancient root in "European pre-*sapiens*", a hypothetical lower palaeolithic Hominid which already had large brains. Boule's ideas had a large international influence, notably in England upon the works of palaeoanthropologist Arthur Keith. Piltdown Man, discovered in Sussex [England] and unanimously celebrated as *Eoanthropus dawsoni*, "the Dawn Man " in 1912, would give support to his vision – but its recognition as a fake in 1953 lead to the fall of the fiction of "European pre-*sapiens*" which had been imposed for decades in French and English paleoanthropology.

Orthogenetic and teleological views of human evolution continued to pervade French paleoanthropology until late into the 20th century [Cohen 2008]. Jesuit father Pierre Teilhard de Chardin (1881-1955), who was trained as a geologist and a vertebrate palaeontologist by Marcellin Boule at the Paris Museum of Natural History, later developed a metaphysics of human evolution which was in part inspired by Henri Bergson and Edouard Le Roy's philosophy, and which also recalled Gaudry's evolutionary concepts. Until the mid-20th

century, particularly through the influence of Teilhard, abbé Breuil, and other ecclesiastics who became prominent in the field, religious thinking exerted an undeniable influence on French palaeoanthropology and prehistoric archaeology. Thus the French school of paleoanthropology was long marked by a distinctive character which persisted late into the 20th century, until the 1960s when the emergence of structuralist studies and the internationalization of research opened the possibility to think about human evolution within a renewed evolutionary framework.

CONCLUSION

“It is curious how nationality influences opinion,” wrote Darwin to anthropologist Armand de Quatrefages on May 28th, 1870, “a week hardly passes without my hearing of some naturalist in Germany who supports my views, & often puts an exaggerated value on my works; whilst in France I have not heard of a single zoologist except M. Gaudry (and he only partially) who supports my views. But I must have a good many readers, as my books are translated, & I must hope, notwithstanding your strictures, that I may influence some embryo naturalists in France”, (DCP-LETT-7204).

Between 1859 and 1914, French palaeontology mostly developed within Cuvierian, Lamarckian or Neo-Lamarckian frameworks, rather than against a Darwinian background. I have shown that these particular scientific choices stemmed from several causes: on the one hand, from a nationalist or even xenophobic attachment to the French natural sciences’ “Golden Age” and to the great masters of the 19th century; on another hand from an ideological context, supporting either religious beliefs or, alternatively, positivist rationalism – both positions being (or seeming to be) then impossible to reconcile with Darwinian theoretical frameworks. Epistemological difficulties, relating to the impossibility to identify "Darwinian" processes – such as variation and natural selection - in the fossil record, played an important role in the difficulty of this integration.

However, fulfilling Darwin's hopes, beginning in the 1870s his views and methods did make their way to a new generation of French paleontologists. At first mistranslated, misread, and rejected, his *Origin of Species* became better known in France and as we have seen several fundamental aspects of his scientific thinking were integrated into palaeontological practice, reflection and research.

It would be thus inadequate to proclaim the general failure or weakness of French paleontology for the reason that it was not Darwinian. During the considered period, French palaeontology and palaeoanthropology did yield great works and prestigious personalities such as Albert Gaudry, Gaston de Saporta, Charles Deperet, Marcellin Boule and others, who brought new elements from the field, provided scientific syntheses that made an impression in their time, and were internationally known and respected. None of them ignored Darwin, although their relationship to Darwinism was complex. French scientists were not isolated -- connections existed between them and foreign scientists through voyages, correspondence, exchanges of books and of specimens.

However, French paleontology long kept its own, national character before it started, decades later, to become fully internationalized. In many respects, the French school of palaeontology during this period can be characterized in its methods by its strong connection with geology, stratigraphy, and comparative anatomy rather than with experimental biology and genetics. The specific character of French paleontology also relies, in part, on the particular nature of its sites. French palaeontology was strong on Tertiary and Quaternary studies, from Cuvier's Gypsum of Montmartre to Gaudry's Mont Lubéron, Lartet and Filhol's sites of Sansan and Durfort, and to the rich prehistoric sites of the Vezère and Dordogne Valleys. The French had no impressive dinosaurs such as those found in the American deserts, but a wealth of Quaternary sites yielding mammoths and remains of early humans and

their cultures, which explains the rich development of French palaeoanthropology and prehistoric archaeology and their strong appeal to the public.

Indeed, as Darwin put it, “nationality influences opinion”. French Palaeontology between 1859 and 1914 embodied a particular scientific “style”¹¹ in its own right, which for the best and for the worst persisted in its scientific institutions, in its forms of reasoning, its methods, its theoretical and ideological frameworks as well as in the modes of its popular dissemination.

¹¹ This concept of scientific « style » might be loosely referred to Alistair Crombie, *Styles of Scientific thinking in the European Tradition: The History of Argument and Explanation especially in the Mathematical and Biomedical Sciences and Arts*. 3 vol, London: Gerald Duckworth & Company. 1994

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