Teilhard de Chardin's Contributions to Mammal Phylogenesis

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A proposal of a research project about the contribution of Pierre Teilhard de Chardin to Mammal evolution is reported. The project is divided in three different steps. The first regards his contribution to early Mammals carried out just before and just after the first world war. The principal result was the description of the species *Teilhardina belgica*; now the genus *Teilhardina* is considered very near to the origin of the Euprimates and Tarsidae common phyletic tree. Then a revision of the Chinese period will be made when he described the main Mammals group using the new method of Geobiology. Finally his last period when as an expert of the Wenner-Gren Foundation travelled in Africa and proposed the scale phyletic tree; he investigated the different moments of the out of Africa migrations and finally described the steps of human evolution with the term bushy, today widely accepted.
Key words: Teilhard de Chardin, evolution, Mammals, Homo

Introduction: The three periods

In recent papers and books we investigated Teilhard de Chardin contributions to a general theory of evolution. His main idea is that evolution shows a general *moving towards* both of matter towards complexity and life and of life towards complexity and cerebralization.[1]

This is the complexity consciousness law used to explain the reasons of the *moving towards*. These results were made possible thanks to a new approach to the science of biological evolution: biology was defined as the

1 Cf. GALLENI, L.: Scienza e Teologia nella prospettiva del terzo millennio. In: *Revista Portuguesa de Filosofia*, 61, 2005, pp. 159–184.

science of living complexity and the whole Biosphere as the final complex system to be studied for a fully comprehension of evolutionary mechanisms.[2]

Teilhard de Chardin proposed a research program looking not related to the search of gene evolution in population, but of the fossil evolution inside a system larger than population.[3] From this project started the proposal of the study of evolution at a continental level and every group of evolving Mammals (the main field of investigation of Teilhard de Chardin as a palaeontologist) was interpreted as a whole and as a unity of evolution. This point of view is present in his first papers on Mammals and was derived from his discussion during the first world war with the geologist Jean Boussac. Both asked for a wider approach to palaeontology and geology and for the perspective to study the evolution at a global level involving the whole Biosphere. Jean Boussac died during the first world war and Teilhard de Chardin worked consequently to realise this common project. The systemic approach related to the study of evolution was then used by Teilhard as the tool in order to apply the techniques of complexity to the evolution of living systems and it was partially used in his first period, that of the doctoral thesis but it was fully realized during the Chinese period.[4]

With this method, evolution was evidenced not only as a simple dispersion of lines casually diverging from one spot, but on the contrary, was characterized by parallelism and canalizations.

Parallelisms and canalizations were the peculiar results of life evolution when population studies were integrated thanks to a larger scale approach: the continental one. Finally there was the proposal of a new branch of science, the Geobiology, the science studying the general laws of evolution at the Biosphere level.

These theoretical results were made possible by Teilhard de Chardin decennial works on palaeontology and palaeoanthropology.[5] Its consequences on environmental ethics were reported by Galleni and Scalfari.[6]

2 Cf. GALLENI, L.: Relationships between Scientific Analysis and the World View of Pierre Teilhard de Chardin. In: *Zygon*, 27, 1992, pp. 152–166.

3 Cf. GALLENI, L.: How Does the Teilhardian Vision of Evolution Compare with Contemporary Theories? In: *Zygon*, 30, 1995, pp. 25–45.

4 Cf. GALLENI, L.: Scienza e Teologia nella prospettiva del terzo millennio. In: *Revista Portuguesa de Filosofia*, 61, 2005, pp. 159–184.

5 Cf. GALLENI, L.: *Darwin, Teilhard de Chardin e gli altri ... le tre teorie dell'evoluzione*. Pisa : Felici, 2012; GALLENI, L.: Teilhard de Chardin : New Tools for an Evolutive Theory of the Biosphere. In: DELIO, I. (ed).: *From Teilhard to Omega*. New York : Orbis Books, 2014, pp. 221–237.

6 Cf. GALLENI, L., SCALFARI, F.: Teilhard de Chardin's Engagement with the Relationship between Science and Theology in Light of Discussions about Environmental Ethics. In: *Ecotheology*, 10.2, 2005, pp. 196–214.

A recent project on the evolution and phylogenesis of Primates[7] allowed a revision of Teilhard papers on the topics on Mammalian evolution previously summarized by Osborne[8] and Piveteau[9].

We divide Teilhard papers on Mammals evolution in three different periods.

The first is related to his doctoral thesis on France Mammal paleo fauna and on that of Belgium.

The second one belongs to the Chinese period when he worked describing Chinese paleo fauna of Mammals using continental evolution and the geobiological method and he looked also to the evolution of man. As a matter of fact he was a member of the team working on the so called Bejing man. His task in the team was the reconstruction of the paleohabitat and the statement that the Bejing man was able to realize and use stone tools. It was the first recognition that a fossil man not referred to *Homo sapiens* or his subspecies *Homo sapiens neanderthalensis* was able to develop and use tools.

The third and last period was that related to his American period and to his investigations on the origin of man, thanks to his travelling in South Africa as an expert of the Wenner-Gren Foundation, a foundation funding the field excavations of fossil hominids.

First period: the evolution of Mammals from France and Belgium

His first period is mainly related to works of his doctoral thesis and to the early evolution of Mammals.

The paper on Carnivorous evolution, where fossils of different forms and species are related thank to the evolution of teeth are considered the startpoint. This text was published in 1915, one century ago and it was an introduction to his PhD thesis.[10]

De Bonis[11] analysed this paper related on the Mammals of a peculiar site, the Quercy phosporites, and described the problematic related to investigation of this fossil material. There was a difficulty to get the material from

7 Cf. GALLENI, L., SCALFARI, F.: Teilhard de Chardin and Primates Evolution. In: VERACINI, C., CASANOVA, C., CONTRERAS, J., SCALFARI, F. (eds.): *History of Primatology: Yesterday and Today : The Western-Mediterranean Tradition*. (in press)

8 Cf. OSBORN, H. F.: Explorations, Researches and Publications of Pierre Teilhard de Chardin, 1911, 1931. In: *American Museum Novitates*, 485, 1931, pp. 1–13 (1618–1630). Here and in the rest of the text, the pages in brackets are those reported in SCHMITZ-MOORMANN, N., SCHMITZ-MOORMANN, K.: *Pierre Teilhard de Chardin : L'œuvre scientifique*. Olten; Freiburg im Breisgau : Walter-Verlag, 1971.

9 Cf. PIVETEAU, J.: *Le Père Teilhard de Chardin savant*. Paris : Fayard, 1964.

10 Cf. TEILHARD DE CHARDIN, P.: Les carnassiers des phosphorites du Quercy. In: *Annales de Palèontologie*, 1914–1915, t. IX, pp.103–191 (pp. 89–197).

11 Cf. DE BONIS, L.: The Meat Eaters of the Phosphorites from Quercy : Evolution and Phylogeny from P. Teilhard de Chardin. In: *Annales de Palèontologie*, 92, 2006, pp. 205–215.

museal collections, when often the exact site of discovering and information about dating were not fully reported. De Bonis, first of all, presents the papers published by Filhol and Scholsser: the references of Teilhard work. The paper is an useful summary of Teilhard discovery and a source for references. Moreover is underlined that he used teeth morphology more than cranial morphology as a tool for species description and confrontation with other materials. The reason was that most of the material examined by the American school were based on teeth and teeth morphology.[12] Teilhard was strongly interested in confrontation between his material and that of American fauna, a project carried on also during his Chinese period.[13] As a matter of fact, one of his main interests will be, along all his scientific researches, the confrontation between the patterns of different continental evolution inside a group in order to look for canalisations and parallelisms.

Anyway the use of teeth morphology was a lucky intuition and we will see it more carefully in the paper on Primates. He distinguished very well the differences between convergence and parallelism and he was aware that in teeth morphology, often, convergence phenomena were present. Anyway he did a carefully description of species inside the different group and of the relationships among groups. His work was mainly focused on the evolution of meat eaters and the description of the evolution of their teeth. The accuracy of teeth investigations made this paper a start point of the following papers on carnivorous evolution, mostly prepared by Crusafont-Pairò and Truyols--Santonja[14] using the tool of masterometry[15].

Crusafont and Truyols followed the suggestions of Simpson[16] to use measurements for a quantitative approach in palaeontology, and they used as a start point the accuracy in describing teeth morphology and evolution of the older carnivorous reported in the paper of Teilhard de Chardin (1915). Moreover in Crusafont and Truyols, the evolution of carnivorous teeth was followed for long times and large spaces and the carnivorous where considered as a whole unity moving towards the hypo carnivorous and the hyper carnivorous. They applied Teilhard de Chardin's geobiological method using teeth measurements.

The paper was the best result of the so called school of Sabadell, or the Latin school of evolution where Catalan, Spanish, Portuguese, Italian and French scientists meet regularly – among them also J. Piveteau from France and Piero Leonardi from Italy – and where Teilhard de Chardin was called

12 Cf. PIVETEAU, J.: *Le Père Teilhard de Chardin savant*. Paris : Fayard, 1964.

13 Cf. TEILHARD DE CHARDIN, P., STIRTON, R. A.: A Correlation of Some Pliocene Mammalian Assemblages in North America and Asia with the Discussion of the Mio-Pliocene Boundary. In: *Publ. Univ. Calif. Bull. Dept. Geol. Soc*., 13, 1934, pp. 277–290 (2120 – 2133).

14 Cf. CRUSAFONT-PAIRÒ, M., TRUYOLS-SANTONJA, J.: A Biometric Study of the Evolution of Fissiped Carnivores. In: *Evolution*, 10, 1956, pp. 314–332.

15 Cf. GALLENI, L.: Teilhard de Chardin and the Latin School of Evolution : Complexity, Moving towards and Equilibriums of Nature. In: *Pensamiento*, 67 (254) 2011, pp. 689–708.

16 Cf. SIMPSON, G. G.: *Tempo and Mode in Evolution*. New York : Columbia University Press, 1944.

querido amigo y excellente maestro (estimated friend and excellent mentor). The results summarized below are reported from Galleni.[17]

The application of Geobiological method to teeth evolution was made as follows: the Catalan authors measured the evolution of those teeth related to the different feeding habits of hypo carnivorous: the Ursidae whith a more varied diet and the hyper carnivorous such as the Felidae. The measurement were obtained from the angles made by different parts of teeth which were strongly dissimilar among the two extreme groups of Carnivorous. The basal group was that of *Cynodictis* and measurement were based on the paper of Teilhard de Chardin.

The results showed the correctness of Teilhard's statements. As a matter of fact, results are of interest because they were a demonstration of the application of Geobiological method: following for long times and wider spaces the distortion introduced by local effects such as natural selection, migration, genetic drift were limited and the true general mechanism of evolution put into evidence.

The teeth used for the measurements were M^1 (the lower carnassial) and P^4 (the upper carnassial) taken as the most specialised teeth in the two different lines of evolution. Of course all the other groups of carnivorous were described and general results were reported in appropriated graphs. The means of the different angles were calculated during evolution in time and the result was that, in spite of Carnivorous differentiation and the specialisation of hypo and iper Carnivorous, the mean remained quite constant in time for both the series of measurements. There was some kind of equilibrium maintenance conditioning the evolution of the group taken as a whole and this peculiarity was put into evidence thanks to the application of Geobiological methods and using as a start point the data of Teilhard de Chardin's 1915 paper.

Moreover the Geobiological methods were enriched by a peculiar genetic approach: that of Alberto Carlo Blanc[18] based on the parallelisms and canalisation described by N. Vavilov studing the origin of cultivated plants. Crusafont-Pairò and Truyols-Santonja integrated in this way the genetic aspects of Teilhard de Chardin geobiological theory.

In the presentation of a small book of Teilhard de Chardin published in Italian in 1947[19], Blanc[20] stated that Teilhard was completely not interested in genetics. Anyway parallelisms must have a genetics bases and Blanc found this basis in the theory of the origin of cultivated plants developed by Vavi-

17 Cf. GALLENI, L.: Teilhard de Chardin and the Latin School of Evolution : Complexity, Moving towards and Equilibriums of Nature. In: *Pensamiento*, 67 (254) 2011, pp. 689–708.

18 Cf. BLANC, A. C.: Cosmolisi : Interpretazione genetico storica delle entità e degli aggruppamenti biologici ed etnologici. In: *Riv. Antropologia*, 34, 1942, pp. 179–290.

19 TEILHARD DE CHARDIN, P.: *L'Avvenire dell'Uomo*. Roma : Partenia, 1947.

20 Cf. BLANC, A. C.: Prefazione. In: TEILHARD DE CHARDIN, P.: *L'Avvenire dell'Uomo*. Roma : Partenia, 1947.

lov[21]. The start point of every new group was an area were the original high genetically variable populations were found. Then selection, both artificial or natural, directed and canalised the previous rough material which conditioned the following evolution: the main results were parallelisms and canalisations. The same results observed by the palaeontologist Teilhard de Chardin were described by the genetic Vavilov and reported to a more general vision of evolution by Blanc.

Teilhard de Chardin's papers on Primates are of interest (Galleni and Scalfari in press[22]) mainly for the discussion about the position of Plesiadapidae, considered by Teilhard de Chardin, as they are today, more a sister group in respect to Primates than a first step in Primates evolution. Moreover there was the discovery and description of *Omomys belgica*. The species were posed in a new genus: *Teilhardina* by Simpson[23] and today after the discovery of representative of the genus both in Asia (see f.i. *Teilhardina asiatica* and in North America, and *Teilhardina magnoliana* it is considered by Beard[24] as a candidate to the basic form at the very beginning of the evolution of Tarsidae and of the other Euprimates.

The Chinese period and the application of Geobiological methods

The novelty of the Chinese period is characterized by the diffuse use of the Geobiological methods to describe and interpret the evolution of the main Mammals group presented in the Chinese subcontinent. Teilhard de Chardin realised that his experience in China allowed him to analyse evolution of groups at a continental levels and, as we have just remembered, to study the general lines of evolution. He is now considered the founder of the modern palaeontology of Chinese subcontinent because of his accurate description of the main Mammal groups. Moreover he used his new tools: a group was followed for long time and in large spaces looking also to the general transformation of the areal: the continental evolution. With this method Teilhard was able to demonstrate that evolution was not only a matter of a continuous dispersion of lines, but on the contrary was characterized by parallelisms and

21 Cf. VAVILOV, N. I.: Studies on the Origin of Cultivated Plants. In: *Bull. Appl. Botany and Plant Breeding*, 16 (2), pp. 1–248.

22 Cf. GALLENI, L., SCALFARI, F.: Teilhard de Chardin and Primates Evolution. In: VERACINI, C., CASANOVA, C., CONTRERAS, J., SCALFARI, F. (eds.): *History of Primatology: Yesterday and Today : The Western-Mediterranean Tradition*. (in press)

23 Cf. SIMPSON, G. G.: Studies on the Earliest Primates. In: *Bulletin of the American Museum of Natural History*, 77, 1940, pp.185–212.

24 Cf. BEARD, K. C.: The Oldest North American Primate and Mammalian Biogeography during the Paleocene Eocene Thermal Maximum. In: *PNAS*, 105 (10), 2008, pp. 3815–3818.

moving towards.[25] In this way he links his theory to that of Mivart[26] and Vavilov[27] quite probably without an exact knowledge of these authors. The impact of Chinese palaeontology and his way of travelling and of investigating were briefly reported by Galleni.[28] Most of his contributions were published by the Geological Survey of China (Teilhard de Chardin was one of the advisers) and then in the publications of the Institute de Géo-Biologie and finally in *Geobiologia*, the journal of the institute. They were collected and reprinted in Schmitz Moormann N. et K.[29] Geobiology represents the tool to integrate continental evolution with ecological changes and a way to open to a theory of the Biosphere. Writing about his first encounter with Teilhard, de Terra[30] stated that he was not exactly interested in ecological variations. The development of Geobiology as a matter of fact is a demonstration that during his Chinese period Teilhard de Chardin made also this integration.

Among the groups analysed we remember the Proboscidians (2565 – 2652), the Camelidae, Giraffidae and Cervidae (2653 – 2729), the Rodents (3635 – 3745). We have described many times the paper on the Rodents because, in the opinion of Teilhard de Chardin the evolution of the mole rats of the Chinese Pliocene and Pleistocene was an example of the results obtained using the geobiological method; followed for a long time and large spaces they showed a parallel evolution. The basal group was divided in there different branches and each branch developed independently the same characteristics: an increase in size, inception of the continuous growth of the molars and finally a fusion of cervical vertebrae. To be noted that the parallelal increase in body size had as a consequences also an increase in the dimension of brain: i. e. a moving towards cerebralization.

It was the experimental demonstration that evolution was mainly a moving towards characterized by parallelisms (3635 – 3746). Finally the Felidae (4095 – 4158) and the Mustelidae (4159 – 4222): as regards the Felidae of peculiar interests are the findings related to the genus *Machairodus*: the genus is divided into two main branches and these branches independently developed similar characters after their division: again an example of parallelism. The Mustelidae are an example of the Geobiological method because, side by side with the evolution of fossil forms, described by the palaeontologist Teilhard de Chardin, there is also the biogeographic distribution written by Pierre Leroy. The relationship traced with the fauna of Quercy (p.: 4169 and

25 Cf. GALLENI, L.: How Does the Teilhardian Vision of Evolution Compare with Contemporary Theories? In: *Zygon*, 30, 1995, pp. 25– 45.

26 Cf. MIVART, S. G. J.: *On the Genesis of Species*. London : Macmillan, 1871.

27 Cf. VAVILOV, N. I.: The Law of Homologous Series in Variations. In: *Journal of Genetic*, 12, 1922, pp. 47–89.

28 Cf. GALLENI, L.: La scienza e il dialogo tra culture : Pierre Teilhard de Chardin e i gesuiti naturalisti in Cina. In: CONTOS, L., KIELAK, D., PLAŠIENKOVÁ, Z. (eds.): *Wiaria I kultura miejscem dialogu*. Warszawa : Rhetos, 2013, pp. 49–69.

29 Cf. SCHMITZ-MOORMANN, N., SCHMITZ-MOORMANN, K.: *Pierre Teilhard de Chardin : L´œuvre scientifique*. Olten; Freiburg im Breisgau : Walter-Verlag, 1971.

30 Cf. DE TERRA, H.: *Memoires of Teilhard de Chardin*. London : Collins, 1964.

p.: 4219) is of interest. See Galleni[31] for a general discussion inside the theory of Teilhard de Chardin.

Third period: the evolution of *Hominidae*

Of course it is not completely correct to limit Teilhard de Chardin's interest in the evolution of the human phyletic tree only to the American period.

This period is of interest because it is not yet fully investigated, but as a general summary on Teilhard and human evolution, we could start from his short description of the events of the so called Piltdown man, a clamorous fraud in human palaeontology. Teilhard, still a student in the Jesuits school in Hastings, discovered a teeth. Of course he was not yet a trained palaeontologist, but he was asked of a description of the fossil and of a comment and he did it in a paper published on the *Revue des Questions Scientifiques*.[32] His conclusions (made when he was a student of Boule, so those of his professor) were that there was no proof that the mandible, clearly an ape mandible, and the skull, clearly human, belong to the same specimen: so no description of a new species or genus of human phyletic tree was possible until the proofs of the connections were not found! This opinion was at least proved correct when the fraud was discovered but the fact that Teilhard anticipated it many, many years before suggested to some authors that he was able to give the correct explication of the fossils because he was involved in the fraud, and this revision took place during his American period.[33]

Of course this accusation was without any scientific basis at all.[34]

During his Chinese period he presented many contributions on Early Men and their culture.

We wish only to remember here that he stated the cultural qualities of the so called Bejing man: he was *faber* and able to made stone obiect. He discovered for the first time a culture outside the *Homo sapiens*, *Homo neanderthalenis* group. A mental Rubicon was passed. The events are very well known anyway (Galleni, 2013a). Moreover we will not make any revision of the many contributions on the cultures of fossil men, because they are outside the field of interest of this paper.

31 Cf. GALLENI, L.: How Does the Teilhardian Vision of Evolution Compare with Contemporary Theories? In: *Zygon*, 30, 1995, pp. 25– 45.

32 Cf. TEILHARD DE CHARDIN, P.: Le cas de l'homme de Piltdown. In: *Revue des Questions Scientifiques*, 27, 1920, pp. 149–155.

33 Cf. TEILHARD DE CHARDIN, P.: 1953a. Correspondence between Dr. K.P. Oakley and P. Teilhard de Chardin, Regarding the Piltdown Hoax. inedita (4561–4567).

34 Cf. MANTOVANI, F.: *Il falso "Uomo di Piltdown" e l'accusa a Teilhard de Chardin*. http://www.biosferanoosfera.it/uploads/files/e62eaaf4167e1a20e43cbda1f4437e86f5128e43.pdf

Still to be carefully investigated is the period that Teilhard spent in New York as a consultor of the Wenner-Gren Foundation.

As a referent for funding he spent some times in South Africa in the sites of the discovering of *Australopitecidae*. They are the last years of confrontation with the evolution of man started in China with the *Synanthropus*. So far the problem is the place of the cradle of humankind: Africa or Asia and the position of the new discovery of Africa.

We will take into consideration (Galleni and Scalfari, in preparation) the confrontation about his idea on evolution of man and the present day discussion. Teilhard developed a scale phyletic tree where evolution took place along a very thin peduncle and then the different branches expanded as the scales of a pine cone.[35] Then he proposed the possibility of a very early first Out of Africa creating an early Indo Malaysian center of humanization from which derived the Pithecanthropians and finally particularly relevant is his proposal of a bushy evolution.

The early Out of Africa is reported in his travel notes during his stay in Africa and this notes have still to be fully investigated. They are printed in *fac-simile* in N. and K. Schmitz Moorman (pp.: 4486–4457).

Finally the proposals of human bushy evolution

By confronting the monophyletistis, who described a linear evolution from which *Homo* and its species will emerge as some well-defined and restricted branch of the higher primates, and the possibilities proposed by polyphiletist who considered the human species a mixture of different groups, he proposed as a third possibility, that of a surface of evolution characterized by bushy structure.[36] The bushy structure is today considered as the new interpretation of human evolution.

Actually, Teilhard de Chardin stated:

> "Today we are beginning to understand that between these two conflicting theories, on one hand, a narrow linear monophyletism and, on the other hand, a confusing polyphyletism, *through convergency* there is room for a third and much more satisfactory hypothesis, well supported experimentally by modern genetics, for a speciation which

35 Cf. TEILHARD DE CHARDIN, P.: *On the Zoological Position and the Evolutionary Significance of Australopithecines*, s. 2, 14, 1952, pp. 208–210 (4433–4435); TEILHARD DE CHARDIN, P.: The Antiquity and World Expansion of Human Culture. In: THOMAS jr, W. L.: *Man's Role in Changing the Face of the Earth*. Chicago : Chicago University Press, 1956, pp. 103–122 (pp. 4580–4589).

36 Cf. TEILHARD DE CHARDIN, P.: The Idea of Fossil Man. In: *Anthropology Today*. Chicago : Chicago University Press, 1953, pp. 93–100 (4478–4485).

> acts simultaneously on a large population of closely related individuals spread over a limited but sufficiently broad 'surface of evolution'. (...) For it (and as soon as) such a wide and complex cross section is assumed to exist at the base on any major animal phylum, and especially at the basis of human stem, then it becomes quite easy to understand the 'bushy' structure, more and more in evidence in the composition of humanity as observed in its fossil stages."[37]

The confrontation between the scale phyletic tree and the present day bushy description will be carried out. Moreover the different moments of the Out of Africa expansion could be usefully revised: for instance he is forerunner of the possibilities of the presence of form of *Homo erectus* beyond the Wallace line and this prevision was confirmed by the discovery of the *Homo florensis*.[38]

So far in the papers published during his American stay, Teilhard proposed the bushy evolution of Hominians and pre-hominians, a wide discussion about Australopithecinae and posed the question of how many events of moving from Africa characterized human expansion. These ideas will be usefully confronted with the present days updates about human evolution.

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37 TEILHARD DE CHARDIN, P.: The Idea of Fossil Man. In: *Anthropology Today*. Chicago : Chicago University Press, 1953, p. 97.

38 Cf. GALLENI, L.: Rileggere e rispiegare Teilhard de Chardin. In: *P. Teilhard de Chardin, Le singolarità della specie umana*. Milano : Jaca Book, 2013, pp. 83–117.

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