

The University of Florence Vertebrate Palaeontology legacy

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ABSTRACT - The current Thematic Issue of the *Bollettino della Società Paleontologica Italiana* is dedicated to Augusto Azzaroli (1923-2015) and Danilo Torre (1929-2014), two eminent scientists, both active at the University of Florence, and among the most influential figures in Italian (and European) Palaeontology of the 20th Century. This Thematic Issue is an occasion to celebrate their scientific legacy and the tradition of vertebrate palaeontology at the University of Florence. This contribution also succinctly outlines the recent history of the Palaeontology Chair at the University of Florence.

INTRODUCTION

Florence is the ideal place for studying and carrying out research on late Neogene and Quaternary mammals. Since the Renaissance, the well-preserved fossil mammals discovered in Tuscany and housed in Florentine collections have been the subject of extensive study by numerous researchers. In particular, the 19th Century witnessed an impressive burst of interest in palaeontology in Florence. This period began with the appointment of Filippo Nesti (1780-1849) as curator of the palaeontological collections of the Imperial Regio Museo di Fisica e Storia Naturale (Imperial Royal Museum of Physics and Natural History) in 1807, and continued with the appointment of Igino Cocchi (1827-1913) as director of the Regio Istituto di Studi Superiori pratici e di perfezionamento (Royal Institute of Practical and Advanced Studies) and his dedication to the establishment of the Central Italian Palaeontological Collection and a central palaeontological library in Florence (Cioppi & Dominici, 2010; Dominici & Cioppi, 2018). The result was a consolidation of the city's position as a hub for palaeontological research.

In the last quarter of the 19th Century, Palaeontology at the Florence Regio Istituto di Studi Superiori pratici e di perfezionamento experienced an enormous growth thanks to the activity of renowned scientists, such as Antonio Stoppani (1824-1891), Cesare D'Ancona (1832-1908), Charles Immanuel Forsyth Major (1843-1923), Giuseppe Ristori (1856-1905), Domenico Del Campana (1875-1956), Alessandro Martelli (1876-1934), and Giuseppe Stefanini (1882-1938) (Cioppi & Dominici, 2010). From the viewpoint of the discipline history within the academy, one notable point is that when the University of Florence was founded through the transformation of the Regio Istituto di Studi Superiori pratici e di perfezionamento in 1924 (Cardini, 2004), Palaeontology was a discipline for which there was no specific Chair. The organisation of

the Faculty of Sciences at that time included only generic courses in Natural Sciences, with more specialised courses in Geological Sciences and Biological Sciences yet to be established. In the study plans of the time, Palaeontology was considered optional (a science ancillary to Geology), and it was typically taught by assignment, most often by the professor of Geology or his assistant. This situation was justified by the state of development of the geological sciences in those years, as Geology was largely focused on descriptive studies of stratigraphic and regional nature. Indeed, the work of the eminent geologists in Italian universities at that time largely included palaeontological studies mostly with a predominantly stratigraphic intent, although other studies with a more systematic-phylogenetic focus were conducted by scientists such as (among many others) Giovanni Capellini (1833-1889; rector of the University of Bologna and one of the founders of the Società Geologica Italiana), Carlo De Stefani (1851-1924; a graduate in law who developed an interest in geology which became so prevalent that it led to him getting the Chair in Geology and the direction of the Museo di Geologia e Paleontologia of the Florence Regio Istituto di Studi Superiori pratici e di perfezionamento), Alessandro Portis (1853-1931; geologist and palaeontologist at the universities of Turin and Rome, who studied Plio-Pleistocene vertebrates of several regions in Italy), Giorgio Dal Piaz (1872-1962; a geologist and palaeontologist in Padua, and one of the fathers of modern Geology in Italy), Giotto Dainelli (1878-1968; a geologist, geographer and explorer who studied, in person, the fossils collected during his travels in Africa and Asia and who named around thirty new fossil species) and Giuseppe Stefanini (1882-1938; a geologist at the University of Pisa and a world-famous specialist on Tertiary echinoids). All of them were prominent personalities in the scientific community belonging to the Società Geologica Italiana, founded in 1881 (Argentieri et al., 2024).

THE FIRST ITALIAN CHAIR IN PALAEONTOLOGY

The first Italian Chair in Palaeontology was established at the University of Florence in 1935 and was assigned to the talented young scientist Giovanni Merla (1906-1984). Merla graduated in Natural Sciences in Pisa in 1927, under the guidance of the geologist Mario Canavari (1855-1928), and soon thereafter became an assistant to Giorgio Dal Piaz in Padua (from 1928 to 1930), and then to Giuseppe Stefanini in Pisa (who had succeeded Mario Canavari) until 1932. Between 1932 and 1935, he moved to the Geological Survey in Rome. When Merla obtained a passing grade in a national competition for a teaching qualification in Geology, contacts were initiated to secure his appointment at the University of Florence.

The appointment of Merla to the University of Florence was not an ordinary matter. University institutes of experimental sciences at that time were based, and remained so for many years, on a single Chair. Merla had obtained the required qualification in Geology, but the Chair in that discipline in Florence was held by Giotto Dainelli (Fig. 1). Dainelli started his academic career in 1914 in Pisa, where he held the Chair of Geography until 1921, when he was called to the University of Naples. In 1924, upon the death of De Stefani, Dainelli was appointed as Chair of Geology in Florence, where he remained until 1948. Dainelli's genius and inspiration for the formation and dissemination of Geology are demonstrated by his desire, prompted by his brief stay in Naples in the early 1920s, for an iconic object for Geology: a partial marble pillar from the Pozzuoli Temple of Serapis (traditionally referred to as a Temple because of the discovery of a statue of the Egyptian god Serapis, the area was actually the public market, in latin name *Macellum*). The column is still located today in the atrium of the Dipartimento di Scienze della Terra of the University of Florence, at the base of the staircase leading to the first floor (Fig. 2b). It is not an incidental placement. Just as the frontispiece of the first volume of Charles Lyell's *Principles of Geology* (1830), showing the "Present state of the Temple of Serapis at Pozzuoli" (Fig. 2a), introduces the reader to the understanding of modern Geology, so the column at the base of the stairs introduces students and guests of the Dipartimento di Scienze della Terra of the University of Florence to the first-floor corridor, which is graced by the portraits of those early geologists of the late 19th and early 20th Centuries who brought prestige to Geology and Palaeontology in Florence.

Returning to the appointment of Giovanni Merla, it was Dainelli himself who proposed the call of the young professor, who had already established himself in the field of research and appeared full of promise. Such was the faculty's determination to have the best personalities among its professors that they accepted the suggestion and circumvented the formal difficulty by establishing a specific Chair of Palaeontology, the first in Italy, for Merla (Fig. 3). Thus, the University of Florence also became a rare example of an experimental institute with multiple chairs (Azzaroli, 1988). As soon as the Geology Chair became vacant in 1948, Giovanni Merla opted for the latter discipline, because it was most congenial to him. As a result, the Palaeontology Chair in Florence



Fig. 1 - Giotto Dainelli: a photo portrait taken in the first decades of the 1900s (photo courtesy of the Moggi Cecchi family archive).

remained vacant until 1961, when Augusto Azzaroli was appointed to it.

A point worth noting here is that one of the medals awarded annually by the Società Paleontologica Italiana is named in honour of the memory of Giovanni Merla. The prize is intended to recognise the work of young scholars in the field of palaeontology and is awarded to a young palaeontologist who has made a significant contribution to the discipline through his or her research (<https://www.paleoitalia.it/premi/medaglie-spi/>).

AUGUSTO AZZAROLI

Augusto Azzaroli (Fig. 4) graduated in Natural Sciences in 1945 from the University of Florence and was soon appointed assistant professor of Geology at the same university. His research interests in the early years of his university career (1950-1960) mostly focused on marine faunas of the Eocene, Oligocene and Miocene of northern Somaliland and the geological survey and mapping of the Northern Apennines. Also, he contributed to the reconstruction of geological events in the Italian Peninsula during the early Tertiary and the Miocene. His interest in aspects of stratigraphy drove him to prepare the Italian Code of Stratigraphic Nomenclature (co-authored with Maria Bianca Cita and Raimondo Selli in 1969). In 1960, when he returned to the University of Florence as a full professor after the experience of beginning a course of Geology and Palaeontology at the University



Fig. 2 - (color online) a) Frontispiece of the “ninth and entirely revised edition” (1853) of Lyell’s *Principles of Geology*, with a “View of the Temple of Serapis at Pozzuoli in 1836” (available at the Biblioteca Geomineralogica of the University of Florence). b) Marble pillar from the Pozzuoli Temple of Serapis in the atrium of the Dipartimento di Scienze della Terra of the University of Florence. Using the same words of Lyell describing the Pozzuoli Temple, the column is “pierced by a species of marine perforating bivalve, *Lithodomus*” (photo L. Rook).

of Khartoum in Sudan (1958-1959) and his appointment as Geology Chair at the University of Bari (1959-1960), his research shifted to vertebrate palaeontology, with a particular emphasis on Pliocene and Pleistocene mammals (Rook, 2015a).

Azzaroli dedicated himself to a continuous systematic study of the fossil mammalian faunas collected through the centuries and housed in the Museo di Geologia e Paleontologia in Florence. Actually, the critical revision of the fauna from the fluvio-lacustrine deposits of the Upper Valdarno Basin was promoted by Giovanni Merla (as director of the Istituto di Geologia at the University of Florence, to which the museum’s geological and palaeontological collections were annexed) along with a series of contributions published in the journal *Palaeontographia Italica* in the late 1940s and early 1950s (Azzaroli, 1947, 1951, 1954; Merla, 1949).

In these early years, Azzaroli met Alberto M. Simonetta (1930-2021), one of the most important exponents of Italian Zoology of the last Century (Ceccolini, 2022). Azzaroli and Simonetta were more than colleagues, and, as good friends (Fig. 5), they shared research travels in different countries of the world. The most notable of these

was the May-July 1977 expedition in Afghanistan (Degli Oddi, 2010; Puccetti Azzaroli, 2016). Simonetta was deeply interested in arthropods, including their origins and the interpretation of their phylogenetic relationships,



Fig. 3 - Giovanni Merla in his studio in Padua at the end of the 1920s (photo courtesy of the Merla family archive to Ernesto Abbate).



Fig. 4 - Augusto Azzaroli in September 1965 at the brick factory So.La.Va (Matassino, Upper Valdarno), surveying the palaeontological excavation of a *Mammuthus meridionalis* (Nesti, 1825) partial skeleton (photo from the archive of the Palaeontological Laboratory of the University of Florence).

devoting an important part of his early research years to palaeontology. In the 1960s, Simonetta carried out significant research and brought the attention of the scientific community to the almost forgotten middle Cambrian Burgess Shale fossils, discovered in 1909 by Charles D. Walcott (1850-1927), by publishing several notes on Burgess Shale arthropods (among others, Simonetta, 1962, 1970). Although Simonetta's various reconstruction hypotheses of the appearance of these animals were later reinterpreted, his pioneering revision studies of this fauna paved the way for the subsequent research summarised by Stephen Jay Gould (1941-2002) in *The Wonderful Life* (1989), which contributed to make the Burgess fauna one among the most famous Fossil-Lagerstätten.

In the late 1960s and 1970s, Azzaroli conducted increasingly detailed taxonomic and stratigraphic studies to determine the succession of the Pliocene and Pleistocene faunas. His work identified the Faunal Units representing the basis for the biochronological definition of the Villafranchian Land Mammal Age (Azzaroli, 1970, 1977; Azzaroli et al., 1982, 1988; Rook & Martínez-Navarro, 2010). Among the several field campaigns that were conducted in those years, one worth mentioning



Fig. 5 - Alberto Mario Simonetta (right) and Augusto Azzaroli (left) during a family excursion in the Tuscan countryside in the early 1960s (photo courtesy of the Azzaroli family archive).

is the research project in the area of Villafranca d'Asti (Piedmont), in collaboration with Donald E. Savage (1917-1999) from the University of California, Berkeley (Figs 6-7).

Azzaroli also paid great attention to the Florence Museo di Geologia e Paleontologia. Under his direction (from 1976 to 1994), he planned and realised a major renovation and modernisation of the museum (Fig. 8). Under Azzaroli's guidance, research on vertebrate palaeontology in Florence received a new impetus, and the collections became a reference point for young Italian and foreign researchers who were trained in the study of these specimens.

DANILO TORRE AND THE AZZAROLI SCHOOL

One of the first students to be tutored within the Augusto Azzaroli Florentine palaeontological school was Danilo Torre (Fig. 9). Graduating in 1954, Torre was one of the most renowned vertebrate palaeontologists in Europe during the final decades of the 1900s (Rook, 2015b). Along with Claudio De Giuli (1938-1988) and Giovanni Ficcarelli (1937-2024) (Fig. 10), this group of scholars attests to the robustness of the Florentine school of palaeontology that matured under the guidance of Augusto Azzaroli and served as a reference for the vertebrate palaeontologists generation that expanded in Italian universities in the 1970s (Kotsakis, 2025).

The research activities developed by Azzaroli and Torre in the last decades of the 20th Century were particularly



Fig. 6 - Sample packing during Villafranca d'Asti field work in the late 1960s. Annalisa Berzi (left), with Maria Luisa Azzaroli (middle) and Donald E. Savage (right). The photo also portrays Savage's Land Rover four-wheel-drive car. At the end of the "Villafranchian" project, Savage left his Land Rover in Florence and the vehicle remained in use by the Museum for over 20 years (photo courtesy of the Azzaroli family archive).

intense, with special emphasis on Pliocene and Pleistocene mammals. Both had been leading Florentine vertebrate palaeontology in the recovery of the internationally



Fig. 7 - Donald E. Savage (left) with Augusto Azzaroli (right) in the hall of the Muséum d'Histoire naturelle de Lyon (nowadays, Musée de Confluences) in the early 1970s. The *Mammuthus meridionalis* skeleton on the right side of the photo is the famous "mammoth de Choulans", a specimen recovered in 1859 whose peculiar history has been reported by Camaret et al. (2011) (photo courtesy of the Azzaroli family archive).

recognised tradition inherited from the palaeontologists of the previous Century (e.g., Filippo Nesti, Igino Cocchi, Charles Immanuel Forsyth Major, Domenico Del Campana, and others). Concerning the systematics and stratigraphic distribution of several mammal groups, both scholars made substantial contributions to a wide range



Fig. 8 - Augusto Azzaroli in the mid-1980s planning the renovation of the Florence Museo di Geologia e Paleontologia exhibit with Maria Cristina Andreani (photo from the Palaeontological Laboratory of the University of Florence archive).



Fig. 9 - (color online) Danilo Torre (left) receiving an honour from the hands of prof. Augusto Marinelli, the Rector of the University of Florence for three terms, from 2000 to 2009 (photo courtesy of the Torre family archive).



Fig. 10 - Claudio De Giuli (left) and Giovanni Ficarelli (middle) during the 1969 survey in the Sokoto region (north-eastern Nigeria). The fieldwork on Cretaceous marine deposits cropping out in the area led the team coordinated by Augusto Azzaroli to the recovery and description of a new mosasaur genus: *Goronyosaurus nigeriensis* (Swinton, 1930) (Azzaroli et al., 1972, 1973, 1975) (photo courtesy of the Ficarelli family archive).

of taxa, including primates, carnivorans, proboscideans, perissodactyls, artiodactyls and some micromammals (Rook, 2015a, b).

Several contributions included in this Thematic Issue highlight the significance of Azzaroli's legacy in the study of primates (Zoboli et al., 2025), proboscideans (Ferretti et al., 2025; Ros-Montoya et al., 2025), horses (Cirilli & Bernor, 2025), rhinos (Pandolfi et al., 2025) and deer (Croitor, 2025), as well as the ones by Torre on canids (Bartolini-Lucenti et al., 2025), hyaenids (Loddi et al., 2025; Martínez-Navarro et al., 2025), felids (Madurell-Malapeira, 2025) and other carnivores (Faggi, 2025; Werdelin & Fourvel, 2025).

Aside from their interest in systematics and taxonomy of fossil mammals, both Azzaroli and Torre were much interested in general aspects of the discipline, such as stratigraphy, evolutionary patterns, palaeobiogeography and other main themes. These more general topics have several contributions dedicated to them in the present Thematic Issue: Ghinassi et al. (2025) provide an update on the Upper Valdarno Basin as a pivotal vertebrate-bearing succession in the Pliocene and Pleistocene of Europe, starting with the fundamental paper by Azzaroli & Lazzeri (1977). Bertini et al. (2025) focus their contribution on the topic of the land-sea correlations during the Pliocene and Pleistocene, an issue that had been of interest to Torre and that was extensively treated in De Giuli et al. (1983, 1988) and Torre (1987). Evolution in insular conditions had been a topic of much interest in the earlier papers by Azzaroli (1952, 1961, 1978), and later on by the entire Florence vertebrate palaeontology research group, with a burst of scientific production in the 1980s, when a great effort was oriented towards the study of Neogene vertebrates in the Gargano area (De Giuli & Torre, 1984; De Giuli et al., 1986, 1987). Two contributions (Savorelli et al., 2025; van der Geer et al., 2025) explore this topic with papers on endemism and mammalian evolution under insular conditions. Raia et al. (2025) highlight the trends that today, thanks to technological and mathematical innovations, are driving the discipline towards the so-called computational palaeontology, a contribution that takes inspiration from Torre's pioneering interest in statistical analysis and multidimensional methods applied to palaeontology (Micheli & Torre, 1965; Torre, 1965). Finally, Bellucci et al. (2025) celebrate the richness of the Pliocene and Pleistocene mammal collections in the Museo di Geologia e Paleontologia of the University of Florence, which was directed by Azzaroli from 1976 until 1994, and by Torre from 1994 until 2003.

CLOSING REMARKS

The last decades of the 20th Century witnessed a strong development of vertebrate palaeontology at the University of Florence, thanks to the inputs of Augusto Azzaroli and his first successor Danilo Torre. In an exceptional case for an Italian university, there were three full professors of Palaeontology at the University of Florence up until the early 1990s (Augusto Azzaroli, Danilo Torre, and Giovanni Ficarelli), a golden age which today remains merely a pleasant memory due to the structural difficulties occurring in Italian universities. These systemic problems

are basically the same as those that Giotto Dainelli outlined in a brilliant paper about 80 years ago (Dainelli, 1943).

Palaeontology in Florence still attracts students to undergraduate and graduate courses in both Earth Sciences and Natural Sciences. The fascinating balance between the availability of historical collections, along with the development of new analytical and computational approaches, represents a new phase in the development of palaeontology and provides us with a way to honour and valorise the memory of the "giants" on whose shoulders today's research seeks to advance the discipline.

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We dedicate this short contribution to the late Giovanni Ficarelli, who was supposed to prepare a foreword for this Thematic Issue. Sadly, he left us too early. He passed away in April 2024, when the concept of this dedicated collection of papers was still in its initial stages.

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