

## **A LIFE FRESCO: ENZO FERRONI (1921–2007)**

**Enzo Ferroni, chemist:** born Florence 25 March 1921; Professor, Physical Chemistry, University of Florence 1965–96 (Emeritus), Rector 1976–79; President, Italian Centre for Colloids and Surfaces (CSGI) 1993–2006; President (twice), Italian Society of Physical Chemistry.

Walther Hermann Nernst, the great German scientist, Nobel laureate in Chemistry, father of the third principle of thermodynamics, had a Florentine disciple, Giorgio Piccardi, later professor of Physical Chemistry at the University of Florence.

Piccardi studied fluctuating phenomena before Ilya Prigogine and his best scholar and scientific successor was Enzo Ferroni who, when Piccardi retired, held the chair of Physical Chemistry at the University of Florence. Ferroni was also director of the Department of Chemistry and full professor of Physical Chemistry at the University of Cagliari (Sardinia).

One of the authors of this article (E.T.) had the honor to be a student of Giorgio Piccardi, Enzo Ferroni and Ilya Prigogine.

Enzo Ferroni died in a Florentine hospital on the 9 April 2007 at the age of eighty-six, after several years of failing health and much pain.

Ferroni was born in Florence on 25 March 1921 and was educated at the Royal University of Florence where he took his 'Dottore' degree in Chemistry 'Magna cum Laude' (full marks and honours). There, soon after World War II, he reorganized the laboratories and served as teacher and instructor. Yet Ferroni was either an unsalaried or an unassuming man. He knew his subject well and knew how to pass on his knowledge to others; his practical classes were a model and his technique impeccable.

When he was still a student at the University of Florence, he had his first meeting with the renewed chemist Richard Willstätter (1872–1942). The Jewish Nobel Prize winner (1915) had been forced to flee Germany in 1939 and was staying temporarily in Italy before settling in Switzerland. The elderly chemist – who was in an extremely poor financial condition, having lost all but a meagre part of his belongings – left a deep impression on the young Ferroni. He once remarked that he learned much more by speaking with him only few times than in a whole university course.

Here, he also met Professor Giorgio Piccardi (1895–1972) and their friendship was kindled by the deep and warm interest in Florence and its artistic treasures. Soon after World War II, he visited Belgium and thereafter returned for a long stay. In Brussels, he met Ilya Prigogine (1917–2003) with whom he began to share a deep interest in the study of the thermodynamics of surface phenomena.

For a great part of his professional life, Ferroni was physical-chemistry master at the University of Cagliari (1961–65) and later in Florence (1965–91). In 1967 he was elected 'Preside' (Head) of the Faculty of Science and in 1976 'Magnifico Rettore' (Rector) of the University of Florence. Five years after his retirement he was made Emeritus professor.

On Friday, 4 November 1966, Ferroni's scientific interests changed drastically; after a month of heavy rain, the Arno River had overflowed its banks, flooding the city of Florence and causing incalculable damage to life, property and cultural patrimony. Now known as 'l'Alluvione', the Florence Flood revolutionized the field of art restoration as no other single event: a great part of this 'revolution' was carried on by Ferroni, who devoted his genius and strength to the restoration of paintings. Ferroni set up and tested innovative technologies in the field of cultural heritage conservation.



From left to right: Paola Berchieri-Ferroni and Enzo Ferroni, mid-1990s.

On 10 November 2006, during the symposium ‘Conservation Legacies of l’Alluvione’ held in Florence at the Villa La Pietra, University of New York, to commemorate the 40th anniversary of the flood, his name echoed many times, e.g. his method for consolidation of wall paintings based on barium sulphate. On that occasion, it was said that without his indomitable work nearly half the frescos that we can now admire in museums (Cimabue’s, Beato Angelico’s and many others), which in 1966 were covered by mud, polluted water and oil, would have been lost forever.

Ferroni’s enthusiastic interest in chemistry and arts, and his skill and resource as an experimenter were an inspiration to his pupils. His influence was more potent because he was not only a good chemist but also a man of broad culture and wide interests. For his merits in 1967, he received the golden medal from the Secretary of the ‘Pubblica Istruzione’ of the Italian Republic followed a year later by a similar acknowledgement from the Minister of the National Education of France, Alain Peyrefitte (1925–99), of the fourth ministry of Georges Pompidou (1911–74). He received the golden medal from both the Italian Society of Physical Chemistry and the Italian Society of Environmental Chemistry and Cultural Heritage. He was a member of numerous Italian and foreign academies and chemical societies, including the Société Chimique Française, the Academy of the Georgofili and the New York Academy of Science. He also served as president of the Accademia delle Arti del Disegno, founded by Cosimo I de’ Medici – duke of Tuscany – on 13 January 1563.

As Luigi Dei and John Meurig Thomas wrote in *The Independent*:

the present intense activity in conserving the medieval paintings on the walls of Santa Croce Basilica in Florence (La Leggenda della Vera Croce by the 14th-century painter Agnolo Gaddi), and indeed the restoration work of murals in churches across Italy and throughout the world, relies heavily on the ingenious innovations of Enzo Ferroni and his colleagues in the Department of Chemistry at the University of Florence.

Wall paintings degrade as a result of the slow transformation of the binder calcium carbonate, derived from the carbonatation of the calcium hydroxide (slaked lime) used by the artist, into the hydrated sulphate of calcium (known as selenite), by the action of polluting sulphur dioxide and oxygen. This process, known as sulphatisation, results, inter alia, in the loss of colours and of the cohesion of the paint layers to the underlying substratum with the consequential formation of ‘blisters’.

This is the damage that could be seen on the face of St Dominic in Fra Angelico's St Dominic in Adoration of the Crucifix in the cloister of San Marco, Florence, before the convent's 15th-century frescoes were restored in the late 1960s and 1970s using methods pioneered by Ferroni.

Ferroni, a surface and colloid scientist, showed how such paintings could be restored by a carefully planned chemical protocol. This protocol entails the removal of the patina of selenite by administering, first, a poultice of ammonium carbonate and then a treatment with barium hydroxide to consolidate the painting. The process was explained in a classic paper in 1977, published in 'Scritti di storia dell' arte in onore di Ugo Procacci' ('Writings in honour of Ugo Procacci'), and co-written with his colleague Dino Dini, one of the leading fresco conservators in the world.

Ferroni knew that the burgeoning fields of materials science and technology would inevitably play a critical role in the conservation arena. His co-operation with the Nobel laureate Giulio Natta convinced him that this branch of science would be a fundamental reference point for future conservators.

Ferroni was not only a leading colloid chemist and a pioneer of science applied to cultural heritage conservation, he was also a man with a unitary vision of culture. He gave lectures on colloids and surfaces, on chemistry applied to the conservation of frescoes, on Leonardo da Vinci's drawings and on the technical story of the caravels in which Christopher Columbus set out to discover the New World. He continued to lecture in physical chemistry at Florence during his three years as Rector: for him the university's primary function was teaching. 'Students are my employers', he would say.

During most of his professional life, Ferroni was physical-chemist at the University of Florence. It was, in fact, in the temporary laboratory in the playground of the 'Istituto di Chimica' (Chemical Institute) at its original site in via Gino Capponi in Florence that Ferroni carried out his early work on the surface tension of flowing liquids with his mentor Professor Giorgio Piccardi. Subsequently, his interests turned to epitaxy, but within a few years he resumed research on colloidal solutions and critical micellar concentration.

In 1961 he was given the title of full professor in Chemistry by the University of Cagliari, but long before – when he was still working in Florence – he had had a group of about a dozen research students under him for a number of years.

He was responsible for many different research programs and he could easily turn his interests from one to another branch of chemistry. In the early 1960s with his pupil and later close friend – E.T., one of the authors of the present article – Ferroni studied the formation of complexes from manganese (II) and dithionite ions in aqueous solution, by improving the paramagnetic resonance technique.

A less well-known aspect of Ferroni's scientific activity concerns his work on the aqueous stable suspensions of powdered coal. These suspensions were manufactured in water by grinding coal to obtain a bimodal particle size distribution which was subsequently dispersed in water and polyelectrolytes such as Kelzan and Taxad. Ferroni successfully employed such suspensions in industry. In fact, he had previously noticed that they could be transferred by pipelines or used directly for firing by furnaces.

To mention his scientific work alone would be to tell only half the story, for Ferroni was a man of letters as well as a man of science, a scholar and an historian. Among his scientific writings were many chapters of the monographs: 'Enciclopedia della Chimica' (Encyclopaedia of Chemistry) in 1972 and 'Storia dell' Ateneo Fiorentino' (History of the University of Florence) in 1986.

He survived his beloved wife Paola – married in 1946 – by approximately one year; this sudden event made his health decline rapidly. The couple had neither children nor close relatives, but the commemoration ceremony and funeral were equally attended by a multitude of former students and colleagues. His passing is mourned here and abroad, and those of us who received from him our first introduction to chemistry may indeed count ourselves fortunate.

Many of his students are now professors in Italian and foreign universities.

From the human point of view, Enzo Ferroni was a great man: he served his pupils and the society.

He loved to speak as a novelist: science in his mouth was a tale. Once he said to his pupils what Plutarch wrote about Archimedes in *Parallel Lives*: ‘Archimedes is known for useful discoveries: his famous principle based on the concept of density led to imprisonment of merchants doping gold with other metals; he used solar energy to burn the sails of Roman ships. When asked to write these useful things or to invent others, he replied that he only concerned himself with “fine and beautiful” things.’ Enzo Ferroni dedicated most of his life to fine and beautiful things.

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