

## Spectroscopy in Greece. The early Days.

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During the second half of the nineteenth century the independent Greek state was making its first, uncertain steps towards a better and more promising future.

Greeks after their heroic struggle against the Ottoman Empire had now a new challenge; to form a well-organized state following the prototypes of the already developed nations of Central Europe.

It is beyond any doubt that this task was not set with rose petals. A number of social, political and economical factors made the road to the top of hill rather rough.

In this blur and rather insecure environment it was a surprise to see that a handful of people made serious attempts to work with devotion and passion for the development of sciences like physics, mathematics, biology and chemistry.

If one would like to give a synoptic but picturesque description of these attempts no other icon would be more suitable than that of a wild but untrained man who was trying to clamber to the top of a coconut tree. He might fall down several times, his body covered with scratches, but finally he would reach the top.

That was the situation for the first scientist in 19<sup>th</sup> century Greece. They worked hard but they made some unavoidable mistakes. Most of them had made serious undergraduate studies in good universities of France and Germany, United Kingdom not being yet a popular choice for this kind of studies as it is nowadays among the Greek youth.

The obvious reason for that is that in both countries there was already a network of Greek communities compiled by tradesmen and scholars, established since the Greek territory was occupied by the Ottoman Empire.

Furthermore the first King of Greece, King Otto was of German origin, and the whole educational system was an exact copy, theoretically of course, of the German one.

Consequently, among the first priorities of the King and his government was to establish a University, the first University of Greece, now known as the National University of Athens, in 1837.

Physics and Chemistry departments were not recognized as independent but were part of School of Philosophy until the first decade of the twentieth century.

After a number of professors with rather minor impact Timoleon Argyropoulos and Anastasios Christomanos, the first as professor of physics and the second as professor of Chemistry marked a new era in the status of these sciences, not only within the borders of the academia, but also within the wider Greek society of that period.

Anastasios Christomanos was born in Vienna. His family was one of the wealthiest Greek families at that time and his father had no objection that his son would study Chemistry in the University of Vienna at first and then at the Universities of Giessen, Berlin Karlsruhe and Heidelberg.

In Karlsruhe Christomanos had as tutor Prof. Welzien, one of the most prominent industrial chemists. Furthermore he had the privilege to attend the famous Karlsruhe Conference at which the modern chemistry had been born by great fathers like Kekule, Dumas, Wurtz, Hofmann, Liebig, Saintclair-Deville, Bethelot, Canizzaro, Roscoe and Bunsen.

Probably this was the place he had the chance to make his first acquaintance with Bunsen, and soon after he moved to Heidelberg

having, besides Bunsen, as teachers some of the most well-known scientists like Carius, Erlenmeyer, Kirchoff and Blum.

Though Christomanos was a young man who did not deny the joys of life he was also a hard worker and a very good student, so that Bunsen chose him as his assistant in the place of W. Rose, who had been elected Professor of Chemistry in Strasburg. From this position Christomanos participated actively in the first researches on spectroscopy leading by Bunsen and Kirchoff. No one can deny that spectroscopy and its applications opened new horizons not only to Chemistry and Physics, but also to other relevant sciences like Medicine, Biology, Mineralogy and Astronomy.

According to the data available, Christomanos had been sent by Bunsen to collect samples of water from the Nauheim and Duerkheim springs, samples where Caesium and Rubidium had been discovered.

Christomanos participated also in the experiments with which Bunsen alongside with the English chemist Roscoe measured the intensity of the light from red to violet and even to ultraviolet using hydrogen and chloride on silver salts.

When Christomanos got his doctorate diploma he came in Greece where he had an envied career as professor in the University of Athens. Additionally the Greek governments used him in several cases due to his expertise in chemistry and particularly in spectroscopy.

This was the period during which he had the chance to enrich the collection of the chemical instruments in the Chemical Laboratory of the University and bought among others several spectroscopes. One of them was a very nice Glatton spectroscope, a glucose meter made by Soleil, another spectroscope with 60° flint and others.

Using extensively instruments as such and applying the techniques he has learnt by Bunsen Christomanos analyzed the minerals of the Lavrion

area in Attica, which had been considered of high value for the development of the Greek economy, as at that place there were mines of lead and silver since the antiquity.

In January 1866 Christomanos participated in a committee of experts composed by important Greek scientists like Panayotis Vuyukas, Leonidas Palaskas, Hercules Mitsopoulos founder of the modern mineralogy in Greece and Julius Smith, director of the Athens Observatory for the study of the Santorini's volcanic phenomena.

Christomanos collected gases in situ, under unfavorable conditions, as the volcano at that time was active, and using spectroscopy found their compounds.

Spectroscopy was used by Christomanos to analyze the main hot springs of Greece like those of Methana, Loutraki, Killini and Aedipsos.

These analyses were of particular importance as during the course of the second half of the nineteenth century a particular kind of tourism had been developed and the Greek state thought that this was a valuable source of money for covering part of its needs.

More than two thousand samples of drinking water had been analyzed as well in Athens and other big cities as the development of a central network had been started for the putting water in every house.

The good work done by Christomanos had as result that, relevant analyses to be attributed to him in Cyprus and Naples, Italy.

Nevertheless, spectroscopy at that early days seem to remain a technique used just by one or two people.

It became wider known only during the first decades of the twentieth century when there was also a description of the method and the relevant applications in university textbooks. It is worth to be mentioned though that usually spectroscopy is referred to in books of Physics and there are but very abstract notions of it in the books of Chemistry and Mineralogy.

The main significance of the spectroscopic analysis is considered the fact that by using it one can identify elements in very small quantities like a millionth of a milligram.

Due to this fact it became possible that helium to be discovered by Ramsay, Thallium by Crookes and Indium by Reich and Richter.

In 1913 Vassileios Aiginitis, professor of Advanced Physics in the University of Athens presented in his book some colored images of several spectra and describes the way a spectrometer is working. Furthermore the basic principle expressed by Kirchoff on absorption spectra is given. Aiginitis mentions that following this principle scientists found that on the Sun exist many elements that there are also on Earth like Hydrogen, Calcium, Nickel, Zinc and others. The ultra red radiation and its properties is also examined and he points out that in this case it is used a crystal of NaCl which do not absorb this kind of radiation.

This short presentation gave an idea about what is considered the early days of spectroscopy in Greece. Though one may think that the spectrum giving the quantity of the use of spectroscopy in Greece is rather black if we watch the picture carefully we may see a thin red line, meaning that though physics and chemistry were making their first steps in Greece even in this innovative field of spectroscopy Greece has something to present.