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SCIENTIFIC INSTRUMENTS, LABORATORIES
AND THE 19TH CENTURY GREEK STATE

Introduction

In the part of the European periphery constituted by the post-Byzantine Greek world, the history of modern scientific instruments begins at the end of the 18th century. Until then, Greek scholars had almost no contact with experiment and observation.

The only known scientific instruments collection of the post-Byzantine period before the end of the 18th century, is this of Chrysanthos Notaras (c. 1663-1731), Patriarch of Jerusalem from 1707 until his death. In 1684, Notaras wrote a treatise on the astrolabe and the astrolabe-quadrant, based on Ottoman and Arabian sources and he constructed as well these instruments. Note that the astrolabe-quadrant, called also Profatius' astrolabe, was very common among the Ottoman Turks, because easier to construct. Notaras constructed also instruments for surveying, which are described and illustrated in his book *Eisagogi eis ta geografika kai sfairika* (Introduction to geography and the sphere) printed in Paris in 1716. We have testimonies that Notaras' instruments were kept at Jerusalem's Patriarchate until the 1930ies, but unfortunately we have not for the moment succeeded to find them.

At the end of the 18th century, scientific instruments were considered as a vehicle of the new experimental philosophy which begun to be widely taught in the Greek Colleges of the Ottoman Empire and of the Greek Diaspora. At that epoch, due to the generosity of sponsors (mainly Greek merchants), these Colleges begun to be furnished in instruments for the teaching of experimental physics and chemistry. These instruments were purchased mainly in Paris and Vienna, as testified by the correspondence between the professors of these schools and the Greeks of Diaspora who bought and sent the instruments.

The Greek Colleges of the Ottoman Empire were familiar with experimental physics at the beginning of the 19th century. We have testimonies of the existence of School laboratories in the Greek Colleges of Constantinople, Smyrna and Kydonies in Asia Minor, Bucharest and Jassy in Romania, Odessa in Russia, the island of Chio, Ampelakia and Milies in Thessaly, Jannina in Epirus,

Astros in Peloponesus. Using science for political purposes, that means to prove the superiority of the Enlightened Europe on the Ottoman Empire, some scholars of these schools often organized public demonstration experiments; in Smyrna for example, those were organised each Saturday. These small school laboratories were even noticed by European travellers, as Pouqueville who wrote in his *Histoire de la Régénération de la Grèce*, printed in 1825, that, as far as it concerns the Kaplaneion College in Jannina, it owned “some globes...and some chemical instruments”, but “the college and the laboratory of physics were destroyed”. As for the Chios’ College, Levi Parsons and Pliny Fisk, noticed during their visit in 1820 that it had a good chemical laboratory

Note that from the above-mentioned Colleges, those of Jannina, Chio, Astros and Milies are located in the contemporary Greek State.

As among these Colleges, only the school of Astros did belonged to the new and small Greek State founded during 1828 and 1832, it would not be excessive to affirm that almost no scientific instruments existed inside the boundaries of this State. If one excepts instruments for co-ordinates determination at sea, like sextants or octants, the only ones known is a refractive telescope of the 18th century, imported and used by the scholar Theophyllos Kaΐris, which is today preserved at the library-museum of the island of Andros and some demonstration instruments for experimental physics which belonged to the school of Astros, not preserved today.

The foundation of the independent Greek State was based on the model of the European Nation-State of the 19th century. Scientific and technical education was among the main symbols of this model. A Nation-State of the 19th century had to have at least four institutions to prove its participation to the scientific and technological ideological model: a University, a School of Engineers, a Military School and an Observatory. And this system should be based on a centrally organised secondary level education, which should furnish an important cursus of Physics and Mathematics. Following the ideology of the Greek revolution, all these institutions were to be founded as soon as possible in the independent Greek State.

Science and technology of the 19th century had their symbols. Those were the scientific instruments, and after the second half of the century the great scientific laboratories. The courses of experimental physics in the secondary level education were generalised during the century. Already, during the 18th century these symbols were presented to the public by demonstration experiments. During the 19th century this presentation will reach much more people by the illustrated articles of the press. To own scientific instruments became a *sine qua non* condition for a State to be considered as Modern. One should not forget this context when trying to understand why the small and poor new Greek State will spend a lot of money to furnish the new institutions with instruments which were scarcely used or even not used at all.

The Observatory of Athens: the sponsors and the State

Since the foundation of the Observatory of Paris and of Greenwich Observatory at the 17th century, those institutions became main State symbols determining time and measures and giving the needing scientific prestige to their States. The ideological foundations of those institutions during the 19th century are well presented in the statutes of the Poulkovo Observatory founded in 1833: "a) to furnish observations such precise and perfect as possible aiming to the perfection of Astronomy as science; b) to furnish observations indispensable to geographic and scientific enterprises; c) to co-operate to the perfection of practical astronomy in its applications to geography and navigation and to offer the possibility to training into the geographical determination of the lands."

In 1840, the rich Greek of Diaspora, George Sinas, who was also Consul of Greece in Vienna, discussed with his friend Prokesh-Osten, Ambassador of Austria in Athens, about what could he offer to contribute to the development of the newly founded Athens' University. Prokesh-Osten, who during 1837 had at his service as translator the physicist and astronomer George Vouris, proposed to Sinas to contribute to the foundation of an Observatory. At the mind of the Austrian ambassador, this institution would mainly be useful to the Greek navigation. In fact, the only co-ordinates which will be determined by the institution will be that of its own place; the survey of the Greek lands and coasts will be for long enterprised by English or French officers. On another hand, the Observatory will play an important role in two other fields not mentioned by Prokesh-Osten, those of meteorology and seismology.

For such an important State affair as the foundation of an Observatory, the King of Greece would not be absent. Othon gave to Sinas the higher State decoration and he was personally involved in the foundation. He asked the Architect and town-planner of Athens Eduart Schaubert to furnish the plans of the building; as for the place, Lycabettus, the higher hill of the town, was proposed.

The difficulties of the land and the non approval of the first draft of the building modified these first plans. A more soft hill, that of the nymphs and a new style for the building were chosen. Both had also a clear ideological meaning.

The hill of the nymphs was the place were the first Athenian astronomer, Meto, observed during the antiquity. As for the building, the first draft proposed by Schaubert was of a Middle-Age style recalling the German romanticism; the approved second draft was made by Schaubert's collaborator, Theophil Hansen and was of a pure neo-classical style. One can admire today the symmetry of this beautiful building, recently restored, constructed with materials recalling Ancient Athens: stone from the hill of the nymphs, cyan marble from Hymettus, white marble from Penteli. The symbols are those of Ancient Greece; Ancient Greek astronomers are painted and around the vault the twelve Gods of Olympus.

The case of the Observatory of Athens is that of a main State institution depending almost entirely on private funds. Except the salary of its first director, George Vouris, paid by the State, as he was also a professor of the Athens' University, all other expenses were covered by Sinas family. By George Sinas at first, and after his death in 1853 by his son Simon Sinas and after the death of this later in 1876, by his wife Ifigenia. The family Sinas paid also the salary of the third and the most important, during the 19th century, director, the German Julius Schmidt.

George Vouris who travelled in Vienna for that purpose ordered the first instruments of the Observatory during 1845. From then on and until 1852, Vouris made several visits to Europe to order more instruments and make contacts, all expenses covered by George Sinas. After that date, there will not be some important new order until the last decade of the 19th century. These first instruments will be restored in 1861 at the request of Julius Schmidt and as usually Sinas family covered the expenses of that restoration.

If one considers the instruments installed during the first years of the foundation of the Observatory, one could conclude that this small Institution was pretty well furnished for the standards of that time: A Plossl equatorial refractor of 6.2 inches aperture, a Starke meridian circle of 3.7 inches aperture, two clocks, Berthoud and Kessel, a Kessel chronometer, five small telescopes for comet hunting, two barometers Kapeller and a series of other meteorological instruments.

This first period of the Athens Observatory, that of an important State institution founded and entertained by a private person ended at 1890, during the effort for modernisation of Greece made by Tricoupis Government.

During this first period, a single man, its Director and sole astronomer, ran the Observatory. This institution contributed to the prestige of the small capital of a small State, was a part of the symbols of modernity of that State, but was not really integrated into the educational and scientific structures of that State. Schmidt scarcely participated to the Greek scientific community. He did not really trained other astronomers neither founded a team. This is why, after his death in 1884, the observatory did almost not fonctionned under the rule of his assistant Demetrius Kokkides. Schmidts's main achievement, the map of the moon, one of the best made before the satellite era, was made by him alone. Nevertheless, with the instruments he possessed, he made the first complete series of meteorological observations in Greece and also for the first time he centralised and organised the seismological observations.

The second period of the Observatory is that of its direct dependence from the State, and corresponds to the Tricoupis' modernisation period. During that period, a new effort has been made to order scientific instruments to cover the gap between the non-existent Greek university laboratories and those which flourished in West Europe. In that modernisation effort, a private State

institution had not more its place. By special decree a new director was named in 1890 at the Observatory, Demetrius Eginitis, who came from the Observatory of Paris. Real State services of Meteorology and Geology were then organised and a State policy to cover the lack of funds was pronounced. After the bankrupt of Greece in 1893, a National Committee was founded in 1896 under the direction of Prince George, to provide funds for the renewal of the instruments of the Observatory. The Committee obtained 250,000 Drs from Greeks of the Diaspora as D. Dorides, A. Syngros, M. Koryalenios, P. Stephanovik, E. Zarifis, K. Mavromikhalis, A. Skouze, N. Chrysovelonis. With this money, Eginitis expanded the Observatory and acquired in 1896 the great transit circle of Gautier, 15 cm aperture and 2 m focal length (named after Andreas Syngros), and in 1900 the big equatorial Gautier of 40cm aperture (named after Dimitrios Dorides). C. Ionides gave his private telescope, an equatorial reflector Browning of 20 cm aperture.

The history of the modern Greek State is may be the history of its sponsors and this is quite clear as far as it concerns the scientific instruments. The history of the donations can be traced until today as the instruments and the buildings keep the names of the donators: Syngros meridian, Dorides equatorial, and simply Sinas to indicate the ancient building of the Observatory.

Second level education: many instruments for a few professors

Inside the boundaries of the actual Greek State, the only known instruments coming from school laboratories before the foundation of the Greek State, are kept in the small collection of the Library-Museum of the village of Milies, in Thessaly. These are some simple school demonstration instruments. The scholar Anthimos Gazis sent them from Vienna at the beginning of the 19th century.

The other known instrument of the beginning of the 19th century, is a refracting telescope, which belonged to Theophilos Kaïris, probably bought in Paris during his stay there in 1810. Theophilos Kaïris (1784-1853) has been professor at the Colleges of Kydonies and Smyrne in Asia Minor before the Greek Revolution of 1821. After that Revolution, he founded a School at the island of Andros in 1836. The instrument is kept in the Kaïris Library-Museum.

As mentioned above, at the foundation of the Greek state, educational institutions, which followed the image of those of Western Europe, were created, and first of all primary and secondary schools. Education and science became then a State affair, as well as the acquisition of scientific instruments for educational purposes.

Soon after king Otton's arrival, a decree proclaimed the foundation of the first secondary level school, that of Nauplion, where courses began in March 1834.

Among the lessons were included physics and chemistry. From 1833, a similar school existed here in Hermoupolis and in 1835 more than 10 secondary level schools were functioning in the new State. The 1837 programme includes the course of physics from the 3rd class of the Gymnasium and that of Chemistry from the 4th. As far as it concerns scientific instruments, they were officially introduced in the secondary level education by the programme of 1836; a decree of the year 1855, included in the programme two hours of experimental physics in the 2nd and 3rd classes of the Gymnasium. From then on, the State will import from Western Europe scientific instruments to furnish the school laboratories. For example, in 1860, at the Gymnasium of Nauplion there existed six glass-cases in which the instruments were kept. Many of these are preserved till today as a magnificent Ramsden apparatus, some electrical machines, a microscope, instruments for hydrostatics, hydrodynamics, aerostatics, aerodynamics etc.

The main problem concerning the teaching of experimental physics in the Gymnasiums, was not the acquisition of the scientific instruments. These were furnished by the State although its great financial difficulties, or by private donations. To have a laboratory in the Gymnasium was for each Greek town a sign of modernity, so an effort was also made in a local level. The real problem consisted in the lack of teachers capable to present experiments to their pupils.

For the Gymnasium of Plaka for example, we know from the Archives that scientific instruments were sent in 1857, and that the professor of physics George Paulides was asked by letter from the Ministry to begin the teaching of experimental physics. In that letter, the Ministry expressed the vow that the professor would be prepared enough for that course. But, almost twenty years later, in 1874, the minister of Cult and Public Education will note, in a letter addressed at all the Greek schools, that the course of experimental physics was in reality never taught until then in the Gymnasiums. The Minister expressed the opinion that this situation was due to the lack of a suitable schoolbook and that this book was at least printed and was to be sent to the Gymnasiums.

We assist here at a non-correspondence between the technical capacities and the human or organisational capacities. The Greek Gymnasiums had to follow the West European example, they had to have a school laboratory and a course of experimental physics and chemistry. The State and the donators followed that ideal and they furnished the schools with the suitable apparatus. But at the same time the State did not trained the school professors to teach that course and not even considered seriously that problem before 1874. And even after that date, the training will be highly theoretical, based more on school manuals than on real laboratory training in Athen's University.

The origin of the school instruments of the 19th century varies, being essentially French. Note that one of our main difficulties to study the history of these instruments is to find their constructors, as very often there are not mentioned.

As we approach to the end of the 19th century, the schools collections multiply. During those times, the Greek State expanded to Thessaly and new Gymnasiums were founded. Nevertheless, the preserved instruments are few. Unfortunately, most of them were destroyed when the schools did receive new ones, mainly during the 1920ies and 1930ies. During those years many school instruments were ordered to a single constructor, Max Kohl, an enterprise founded in 1876. We find Max Kohl's scientific instruments in the Greek collections from the end of the 19th century. Note that some of the instruments constructed at the end of the 19th century came in the Greek Gymnasiums later than that date. Indeed, they were received after the World War I, when Germany gave to Greece scientific instruments in order to repair the War damages.

With the new expansion of the Greek State to Macedonia during the 1910's, more Gymnasiums were founded. In their collections we still find 19th century instruments, probably given by Greeks of Diaspora or due to German donations after the World War I.

We wish also to mention a private school collection of the late 19th century, the small one of Hill's Girls' school, an institution founded in 1838. The collection has been constituted at the end of the century, as Physics were not taught to Girls before the 1870ies.

An interested small collection is that belonging originally to the Merchant School of Volos, in Thessaly. Among these instruments, there are some interesting small demonstration machines for hydrodynamics. The collection is preserved at the National Archives of the town of Volos.

The scientific laboratories: for education purposes only

The laboratories of the Physics and Chemistry department of the University of Athens, which was included at those times in the Faculty of Philosophy (the Faculty of Science was founded in 1904), began to be furnished with instruments from the 1850'ies. In fact, the physics laboratory was seriously organised only after 1890, during the period of Greek State modernisation. At those years, Timoleon Argyropoulos, who had studied in Paris, founded the first important university physics laboratory. Concerning the chemistry laboratory, this began to be organised after 1866 by Anastasios Christomanos (1841-1906), who previously had worked in German chemical laboratories.

The collection of 19th century scientific instruments of the Athens' University is very rich. Note that it would be interested to follow the origin of the scientific instruments of these laboratories, which testifies the bounds of the Greek professors with the country of their studies but also the technological influence of West European countries on Greece. Until the French - German war of 1870,

the origin was mainly French; after that date German instruments began gradually to be imported and from the beginning of the 20th century Swiss instruments too.

The existence of the 19th century collection of Athens' University is not only due to the laboratories founded by Argyropoulos and Christomanos. As mentioned before, after the World War I, Germany gave to Greece a lot of scientific instruments, mainly from German universities. Many of these instruments date from the end of the 19th century. Strange enough, due to this event, we can reconstruct the history of German universities' laboratories at the end of the 19th century by studying the Greek collections!

Another university laboratory collection of the end of the 19th century is that of the National Technical University of Athens. After the reform made by Demetrius Scalistiris at 1864 aiming to the transformation of this former school of crafts and arts to an engineering university, scientific laboratories began to be founded. The tradition of that institution was mainly French during the 19th century. Scalistiris, as many other directors and professors of the Technical University, has been foreign pupil of the French Ecole Polytechnique. As a consequence, most of the 19th century instruments of the National Technical University's collection are from France.

By the end of the 19th century, the rising of Greek industry and mining led to new technological needs. Some private laboratories for measures, tests and chemical experiments were then created. Unfortunately, the state of research is too poor to present even an overview on the history of the private Greek laboratories of the end of the 19th century.

In the small and young Greek State, very few people composed the scientific community. When the numbers are modest, the institutions depend much more on personnel contributions. The functioning of the Observatory of Athens, for example, depended only on the skill of its director, that is why we had periods of intense activity followed by periods of total stagnation. We could make the same remark as far as it concerns the Physics and Chemistry Laboratories. The creation of these Laboratories at the second half of the 19th century has not been followed by the creation of real research teams. They have been used as teaching Laboratories even by the most active professors, as Argyropoulos and Christomanos. It will not be excessive to affirm that research was introduced to Greek Universities a whole century later, during the 1970ies.

Our policy for the preservation and the study of the instruments

Till recently, only instruments dated before the Greek revolution were considered by the State as national heritage, and so were carefully preserved and exposed in Museums (like this of Milies). Gradually, the interest have expanded

to the first instruments of the Observatory of Athens and of the Athens' university, but the main corpus of the instruments of the 19th and of the beginning of the 20th century has been neglected. Only some personal initiatives have contributed to the preservation of a number of these instruments.

To contribute to the preservation and show off the scientific instruments located in Greece, the National Hellenic Research Foundation has created the Hellenic Archives of Scientific Instruments. These archives concern the scientific instruments of the Greek collections of the post-Byzantine period, until 1950. The aim of these Archives is to construct a virtual Museum in multimedia, giving information on the instruments, on the institutions where these instruments belonged and on the men involved with the history of these instruments in Greece. For each instrument we give the following information:

Pictures of the instrument, its Title, its Dimensions, its construction Materials, its Constructor and the Date of construction, a Technical description, a description of its Functioning, the History of the instrument, its Origin, its today's Location, and eventually some remarks on its condition. Our policy is to give the more possible links to the user: from the instrument to the institutions, the constructors, the scientists, etc and *vice versa*.

Note that we will also try to constitute files for the instruments which have not been preserved, but for which we have some information and eventually pictures.

The internet site of our Archives, which has been inaugurated in January 1999, is: <http://www.eie.gr/hasi>.

Our virtual Museum has been supported by the Programme Archives de la Creation, of the Centre National des Recherches Scientifiques in France. We wish here to thank Michel Blay who was at the origin of this Programme, as well as Costin Mioreanu who continued to coordinate it.

Our next step will be to create a permanent exhibition in the Hermoupolis Museum of Technology, which is being created by the National Hellenic Research Foundation in the island of Syros. In this Museum, we aim to organize a summer school and a permanent training for those interested to the history and the preservation of scientific instruments.

The Hellenic Archives of Scientific Instruments of the National Hellenic Research Foundation, will also organize in 2002 in Athens, the 21th International Scientific Instrument Symposium.