

Interview with Professor Usón Celebration of Inorganic Lives

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Professor Rafael Usón.

Luis A. Oro: Professor Usón, let me begin by asking you to describe your childhood.

Rafael Usón: I was the eldest child in an extended merchant family. My parents went to work with all of the adults at six in the morning, came home for lunch at

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half past one, left again at four and did not return home until dinner time. My childhood was very noisy as I had eight brothers and cousins. The absence of a quiet room in which I could study and do my homework meant that I had to learn to concentrate and shield myself from the surrounding noise. This ability to collect my thoughts and work under almost any circumstances has served me well in later years.

L.A.O.: How did you become interested in science?

R.U.: I have always been a voracious reader; but early on I became most interested in scientific topics. At the age of 12, I was introduced to chemistry at school and I installed my first laboratory at home. I did experiments that were described in books on recreational chemistry and was very pleased when they worked. It was then that I decided to become a chemist.

L.A.O.: When you went to University did you decide to go directly into chemistry?

R.U.: Yes, that is correct. I went to University in 1942 at the age of 16. The School of Science at the University of Zaragoza was very demanding but also pleasant. We had very good and dedicated Professors who gave us an excellent background in theoretical chemistry. However, the practical side suffered from a lack of adequate funding. In addition, as a consequence of the Spanish civil war (1936–1939) as well as the second world war (1939–1945) we were isolated from the scientific world and contemporary books and journals were very difficult to obtain.

L.A.O.: After graduating in chemistry from the University of Zaragoza in 1947 you decided to do doctoral studies, which was not a very common thing to do in those days. What were the conditions in the laboratory given the scientific isolation of Spain during that difficult period?

R.U.: In order to become a University Professor, as I really wanted to be, it was absolutely necessary to first obtain a doctoral degree. We had very scarce and primitive equipment but through much personal effort in the laboratory and some three hours of study each day I was able to get my Ph.D. degree in 1950 and, at the same time, improve on my basic knowledge and nurse my ambition for the future.

L.A.O.: You spent two years in Munich as a postdoctoral fellow. What made you decide to go to Germany?

R.U.: I was familiar with Professor Egon Wiberg's book '*Lehrbuch der Anorganischen Chemie*' and became interested in his research on hydrides. I was awarded a fellowship by the C.S.I.C. (Consejo Superior de Investigaciones Científicas, the Spanish Research Council) and went to Munich for two years. They were

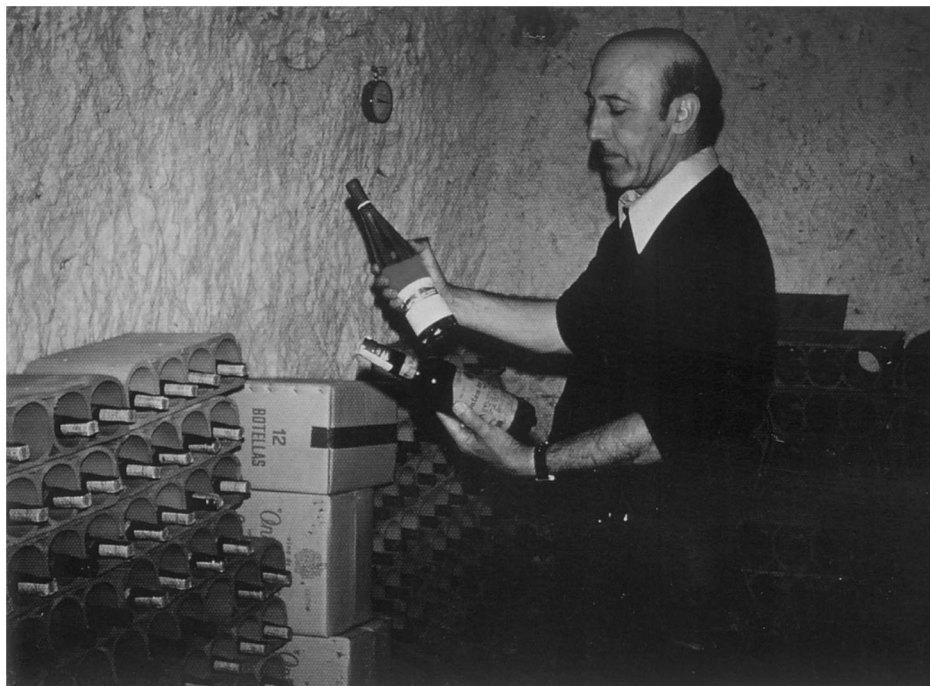


Usón receiving the most important Spanish science prize from the King and queen of Spain.

two very happy years both scientifically and personally, although the stipend was tight and I lost 10 kilos during my first five months in Munich. When Professor Wiberg discovered the reason he gave me a supplemental monthly amount. The second year my fellowship was doubled and my financial problems disappeared.

L.A.O.: In Munich you worked on aluminium and boron hydrides. You published several papers in *Zeit. Anorg. Chem.* and *Zeit. Naturforsch.* in the period 1951–1956 with Wiberg and several young German scientists such as M. Schmidt, H. Nöth and H. Graf. What are your memories of that time? Did you develop any special friendships during that period?

R.U.: I should like to add the names of Richard Bauer, Hans-Hermann Hüdepohl and Walter Henle who helped me overcome my experimental shortcomings early on. Max Schmidt and Heinrich Nöth obtained chairs in Inorganic Chemistry (Max first in Marburg, then Würzburg; Heinrich in Munich), the others went to industry. Kurt Mödritzer, a student at the time, did his advanced laboratory work under my guidance and later went to work for Monsanto (USA). He is the editor of *Synthesis and Reactivity in Inorganic and Metal-organic Chemistry* and we



Usón in his cellar showing his expertise on wines.

remain good friends. Hubert Schmidbaur, now Professor of Inorganic Chemistry at the Technical University of Munich, was then a first-year student and finally completed his doctorate with Professor Schmidt in Marburg.

Although we worked enthusiastically we also took the time to relax and enjoyed celebrating Fasching (Carnival) and Oktoberfest, drinking the special beers which were offered on those occasions. We also visited the Badische Weinstube, located near our laboratory. Max Schmidt invited me to his family home in Vöhringen an der Iller (near Ulm) and I had the memorable opportunity to meet his family, his younger brother and sister, to play chess with his father, and to fish for brown trout and grayling in the Iller, a beautiful tributary to the Danube.

L.A.O.: I understand that you also met your wife Sonja Finkenzeller in Munich.

R.U.: Yes, I was very fortunate. She was studying Chemistry and I loved her at first sight and was lucky to be soon corresponded. Our marriage has been and is wonderful and we have had the additional pleasure to be able to discuss scientific matters with good understanding on her part.



Usón relaxing with his dog.

L.A.O.: Then you returned to Zaragoza. How did you manage to pursue your chemistry research until you were awarded the chair of Inorganic Chemistry at the University of Oviedo (1960)? What was the access to University Chairs like in those days?

R.U.: In 1953 I became an Assistant Professor of Inorganic Chemistry and after 1954 I was also a ‘Colaborador’ and later ‘Investigador’ of the C.S.I.C. At the time there were only 12 Universities in Spain with a single Chair of Inorganic Chemistry in each. When one of them became vacant either through retirement or through the death of the incumbent, a successor was appointed through a lengthy set of tests of all the candidates which took place in Madrid in front of a panel of jurors which evaluated every single performance and took a final vote. With bad luck, one had to wait several years until a new vacancy led to a new set of tests.

L.A.O.: What were your main research interests during your stay at Oviedo?

R.U.: The conditions I encountered at Oviedo were totally inadequate. I spent much of my time teaching undergraduates but managed to begin research on non-aqueous solvents, which did not require expensive facilities and allowed me to improve on the teaching of my Ph.D. students.

L.A.O.: Presumably you were working very hard in those days in order to get things done. Did you have much time at all to spend outside the lab?

R.U.: Since the beginning of my doctoral research I had been working some fourteen hours a day, six days a week. Therefore, I was not afraid of working hard. A few hours with friends and with my family and — in Oviedo — some trout and sea-trout and occasionally salmon fishing were enough to reduce the mental stress.

L.A.O.: In 1967 you returned to Zaragoza as Professor and Head of the Department of Inorganic Chemistry, you became the keystone of the development of organometallic chemistry in Spain. How did this occur?

R.U.: It happened somewhat accidentally. The absence of Dr Pascual Royo, who moved to a Chair at the newly created University of Badajoz, forced me to give more attention to the research of several Ph.D. students who had been working on the synthesis of organometallic complexes using LiC_6F_5 and $\text{TlBr}(\text{C}_6\text{F}_5)_2$ under the direct supervision of Dr Royo.

Our first papers in international journals appeared in 1971. Since then, we have published more than 600 papers in leading international journals.

L.A.O.: You spent some time at high-level administrative positions at the University of Zaragoza. Could you tell us something about those activities?



Usón with Gordon Stone and their spouses travelling to the Spanish Pyrenees.

R.U.: I dedicated my attention to those administrative duties for some four hours daily without allowing them to disturb my teaching and research. I strived to show that a good University must be dedicated to research.

L.A.O.: Today you are best known for your impressive work on pentahalophenyl complexes of precious metals. What do you consider to be your most important contributions in this area?

R.U.: I am most pleased with the following three results: (i) the recognition that the presence of the common ancillary ligands (phosphines, arsines) prevented further substitution and, as a consequence, the successful synthesis of homoleptic anionic complexes $[\text{MR}_4]^{n-}$ ($\text{M} = \text{Au}$, $n = 1$; $\text{M} = \text{Pd}$, Pt , $n = 2$); (ii) the use of these anionic complexes as donor ligands to form heteronuclear complexes with unbridged metal–metal bonds; and (iii) the synthesis of the first examples of $\text{Pd}(\text{IV})$, $\text{Pt}(\text{III})$ and $\text{Tl}(\text{II})$ complexes.

L.A.O.: Many of your research students and collaborators followed postdoctoral studies abroad and some 25 of them presently hold academic positions in Inorganic Chemistry.

R.U.: Back in Zaragoza, a number of highly motivated students came to work with me after 1970. In addition, scholarships and research grants became more



Usón and Al Cotton at Usón's home.

numerous and generous than in previous years. Many of these students pursued postdoctoral research abroad with Professors Nyholm (London), Stone (Bristol), Lewis (Cambridge), Cotton (Texas) and Maitlis (Sheffield) among others. In addition, we began our collaborations with crystallography experts such as Professors Sheldrick (Göttingen), Jones (first at Göttingen, later at Braunschweig) and Tiripicchio (Parma). The expansion of Spanish universities provided many of them with academic positions and the increase in the available research funding, especially after 1980, made it possible for them to become active participants in the opening of new areas of research in organometallic and coordination chemistry.

L.A.O.: What were the main factors that allowed the remarkable development of organometallic chemistry and science in general in Spain?

R.U.: Progress came by in steps: first, an increase in the number of available scholarships allowed many gifted and highly motivated students to pursue their doctorates. Next, a number of them were able to obtain postdoctoral fellowships that allowed them to further their studies with one- or two-year visits to the very best foreign research centers. Finally, the introduction and funding of new permanent positions at a level below that of full-Professor (two such levels were available for some years, now merged into the position of ‘Professor Titular’) as well as the increase in the number of universities meant that it was no longer necessary to wait many years for one of just a few openings which allowed for a previously non-existent mobility. For instance, several of my former collaborators at the University of Zaragoza obtained such positions and eventually rose to Full Professors at various universities such as Professors Pascual Royo (Badajoz, Murcia and presently Alcala de Henares), Victor Riera (Barcelona, Zaragoza, Valladolid and presently Oviedo), Luis Oro (Madrid, Zaragoza, Santander and now at Zaragoza), Juan Fornies (La Laguna and now at Zaragoza), and others, thereby rapidly expanding the groups working on Organometallic and Coordination Chemistry as well as allowing the development of different approaches to these topics. Other groups emerged independently such as those of Professor Joaquim Sales (Barcelona) and, a few years later, the excellent group headed by Professor Ernesto Carmona who had spent several years in London working with Professor Geoffrey Wilkinson as a postdoctoral research fellow before returning to the University of Sevilla.

L.A.O.: How do you see the future of Chemistry research in Spain?

R.U.: The impressive development that came about during the period of 1985–1995 should be consolidated. A variety of indicators show the excellent state of Spanish Chemistry at the present time such as, for instance, the quantity of articles that have been published in a number of the leading international journals which command the highest impact factors. But to remain competitive, the most urgent

need is an increase of the relative funding to the levels that are the norm in the European Community which are twice the Spanish funding level.

L.A.O.: Professor Usón, I thank you very much for sharing your memories and insights with us.