

PROCEEDINGS OF THE

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10ÈME JOURNÉES DES ACTINIDES

MAY 27-28, 1980 - STOCKHOLM

Editors:

**BÖRJE JOHANSSON
ANDERS ROSENGREN**

Foreword

It is well known that during the "journées"-meetings scientists from different fields (such as solid state physicists, chemists, experimentalists as well as theoreticians) meet and discuss their most recent results, their common problems and exchange new ideas. To us these "journée"-meetings (as indeed actinide meetings in general) seem to belong to those very few international meetings, where physicists and chemists still come together and learn about each other's work.

The last few years the number of participants has been about 70-80 and it has been emphasized that the meetings should have an informal and relaxed character. France, Germany, Belgium and England have been the leading nations. However, more recently, also people from Poland, Italy and Sweden have participated and thus the "journées" have got a more complete European look.

This year the "journées" were for the first time organized outside Central Europe and we are very happy that this meeting took place here in Stockholm. This circumstance together with the fact that the present meeting was the 10th one were the reasons why we chose to invite some distinguished oversea actinide research workers. For the same reasons we also invited distinguished speakers from the Eastern part of Europe as well as from Denmark.

Since, after all, Stockholm is somewhat displaced relative to Central Europe we regard the number of participants, which was about 55, as most gratifying. The number of contributed papers was also very high, probably the highest ever for the Journées des Actinides. This meant, however, that the program became quite extensive, which unfortunately might have severely reduced the number of informal contacts/person/hour. However, the choice of conference hotel was made with the intention to keep the conferees together also after the sessions and further to try to keep the original idea about informality alive. In this spirit we also organized an excursion trip by a steam-ship in the Stockholm archipelago, where a visit was paid to the old quarry in Ytterby. Just

to remind you this was the place where many of the lanthanides were discovered and in fact Ytterby has given name to four elements in the Periodic Table.

In bringing together the present proceedings we have taken a most liberal point of view, trying not to force anybody to send in a contribution which he (or she) anyway will soon publish in some journal. Instead, in those cases (which naturally are dominating) we have just included the abstract. This might still give quite a good idea about the particular contribution.

We are most grateful for the financial support provided by the Swedish National Science Research Council and the Swedish National Defence Research Institute. A special expression of appreciation is due to Lisbeth Carlborg, FOA, for her constant and persistent help in the many administrative duties so necessary to the organization and conduct of the "Journées". Thanks are due to Birgitta Eriksson, of the Arrhenius Laboratory, for her guidance at the Ytterby quarry. Finally we would like to thank everybody for his (or her) contribution to the 10^{eme} Journées des Actinides and hope that all of you enjoyed the meeting as much as we did.

Stockholm 27 Oct. 1980



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10^{ème} JOURNEES DES ACTINIDES, May 27-28, 1980, STOCKHOLM
 (sponsored by the Swedish National Science Research Council
 and by the National Defence Research Institute)

PROGRAMME

Tuesday, May 27, 1980

BREAKFAST 0800 - 0845

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0950	15
<u>J.C. Spirlet</u> (Institute for Transuranium Elements, Karlsruhe), F. Leider and G. Pattyn-Fauville; "Preparation of Pure Actinide Metals and Compounds".	

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<u>A. Boeuf</u> (JRC Ispra, Grenoble), J.M. Fournier, L. Manes, J. Rebizant, F. Rustichelli and J.C. Spirlet; "Progress on Neutron Diffraction Study of NpO ₂ Single Crystals".	
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1105	F. Benetollo, <u>G. Bombieri</u> (C.N.R., Padova), G. De Paoli and P. Zanella; "Conformational Changes in Uranium (IV) Octahedral Complexes Induced by the Ligand Coordinated to the Central Atom. The Crystal and Molecular Structure of $UCl_4 \cdot 2DMPVA$ ".	37
1120	<u>F. Weigel</u> (University of München), G.D. Wittmann and R. Marquart; "On some Americium-Silicon and Curium Silicon Binary Compounds".	38
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1420	E. Dornberger, <u>B. Kanellakopoulos</u> (Heisse Chemie, Kernforschungszentrum Karlsruhe), R. Klenze and A.H. Stollenwerk; "Crystal Field Spectra and Magnetic Properties of Neptuniumtetracyclopentadienide, $(C_5H_5)_4Np$, and Triscyclopentadienylneptuniumchloride, $(C_5H_5)_3NpCl$ ".	58
1435	<u>A. Tabuteau</u> (Laboratoire Curie, Paris), J. Jové, M. Pagès, Lorenzelli, Pascard and J. Gal; "Observation of Magnetic Transition in $U_{1-x}Np_xO_2$ Solid Solution by Mössbauer Spectroscopy".	74

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1520	W.T. Carnall, <u>J. Mulak</u> (Institute for Low Temperature and Structure Research, Wroclaw), J.C. Sullivan, F. Wagner Jr., and D.W. Wester; "A new Compound of Neptunium /4+/ - Np/OH/2SO ₄ ".	86
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1550	E. Klähne, C. Giannotti, H. Marquet-Ellis, <u>G. Folcher</u> (CEA, CEN, Saclay), and R.D. Fischer; "Photo-Induced Homolysis of Triscyclopentadienyl Uranium ^{IV} Alkyl Complexes: A Case of Successful U ^{IV} →U ^{III} Reduction".	98
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- 0935 M.F. Le Cloarec, P. Delamoye, S. Hubert and R. de Kouchkovsky; 161
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- 0950 D. Damien (Fontenay-aux-Roses) and C.H. de Novion; 166
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1405 W.T. Carnall, B. Kanellakopoulos, (Heisse Chemie, Kernforschungs- 201
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COFFEE 1435 - 1450

Chairman: W. Müller

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1515 V. Dallacasa (Commission of the European Communities, JRC, Karlsruhe); 234
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EXCURSION BY BOAT TO RESARÖ

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The Ytterby quarry

The Ytterby quarry is situated on an island called Resarö in the Stockholm archipelago. The archipelago is one of the largest in Europe, consisting of about 10 000 islands within an area of 10 000 km². The Ytterby quarry was discovered in 1750 and was owned by the Rörstrand Company. It was mined for feldspar and quartz. These minerals were used as raw materials at the Rörstrand porcelain factory, which was situated on another island in the archipelago. The Baltic Sea facilitated transportation of the products. In 1930 the porcelain factory was moved to mainland Sweden and raw materials were then obtained from other parts of the mainland. At that time, quarrying at Ytterby ended and the quarry was filled with water. In 1940, Ytterby quarry was bought by the Board of National Economic Defence for use as an oil depository. The part of the quarry open to the public consists of a cavity 4 m deep and 120 m in circumference, and four gangues. These gangues contain waste material from the mine-working. The deepest part of the quarry is 120 m and there are several hundred meters of underground tunnels.

Lanthanoid chemistry grew from a discovery by Swedish Army Lieutenant Carl Axel Arrhenius. In 1787 he found an unusual black mineral in the Ytterby quarry. He called the mineral ytterbite. In 1794, Johan Gadolin, professor at the University of Åbo in Finland, separated from samples of this mineral a new and previously uncharacterized "earth". In 1797, Anders Gustaf Ekeberg renamed a mineral gadolinite, and the "earth" yttria.

At that time another heavy mineral, cerite, was found in Bastnäs, Sweden, by Axel Fredrik Cronstedt. From cerite a substance was isolated independently by Jöns Jacob Berzelius and Wilhelm Hisinger, in Sweden, and by a German researcher Martin Heinrich Klaproth. This substance was named ceria after the recently discovered planetoid Ceres.

Both ceria and yttria were at first believed to be simple compounds. No one could imagine that these substances contained several unknown elements. The complete characterization of the substances took more than 100 years.

In 1839, a Swedish chemist, Carl Gustaf Mosander discovered a new element hidden in ceria. He called the element lanthanum, from a Greek word meaning "to be hidden". Three years later he could tell that lanthanum had a "twin brother", which he called didymium (twin brother). These "twins" were not similar in colour, for while lanthanum compounds were colourless, salts of didymium were dark red. Mosander also examined yttria and found in this mineral three components. One of these the name yttrium. The other two were named terbia and erbia after the second syllable of Ytterby.

Scientists seem later to have mixed up these names, so that Mosander's terbia, which according to him had the stronger basic properties, is now called erbium, and vice versa. In the case of erbia and terbia much more work had to be done. In 1878 a Frenchman, de Marignac, isolated from "new erbia" a component which he called ytterbium. He also isolated gadolinium from "new terbia". With ytterbium the possibilities of naming elements after Ytterby were exhausted. Ytterby has given names to four different elements, a record number for one single place.

Later L.F. Nilson in Uppsala succeeded in identifying one more element from "new erbia". He called the element scandium as it occurs in minerals found only in Scandinavia.

P.T. Cleve, who also worked in Uppsala, continued the examination of "new erbia". Using spectroscopic methods, he showed that it contained three more components. One of these kept the name erbium. The second was named holmium, after Stockholm. The third element was called thulium, an ancient name for Scandinavia. Two years later, Lecoq de Boisbaudran announced that he had isolated an additional element from holmium. As this had not been easy, he called the element dysprosium, which means "difficult to get at". The last element to be isolated from yttria was found by the Frenchman Urbain in 1906. It was identified in what had been believed to be the one element ytterbium, but which actually after proved to contain two elements. The new element was named lutecium after

Lutetia, the ancient name for Paris.

Ceria suffered a similar fate. Five elements besides cerium and lanthanum were identified in this mineral. The Austrian Auer von Welsbach continued to examine didymium. He found that this twin in itself consisted of twins. The major component was called neodymium (new twin) and the other component, the salts of which were green, praseodymium (green twin). Gadolinium was first identified in yttria but in 1886, six years later, it was found in ceria as well, by de Boisbaudran. de Boisbaudran also discovered samarium in samples of didymium.

He could tell that this "samarium" probably consisted of two elements, but he was not able to give adequate proof of this. In 1901 another Frenchman, Urbain, identified this element and named it europium.

Little Ytterby quarry has given names to four elements: erbium, terbium, ytterbium and yttrium. Fifteen Swedish scientists have been instrumental in the discovery of twenty-seven elements. Jöns Jacob Berzelius is credited with being involved in the discovery of seven elements: silicon, selenium, thorium, zinc, calcium, barium and cerium. He discovered thorium when he examined a black mineral specimen from Norway. He named the element after an old Swedish god, Thor.