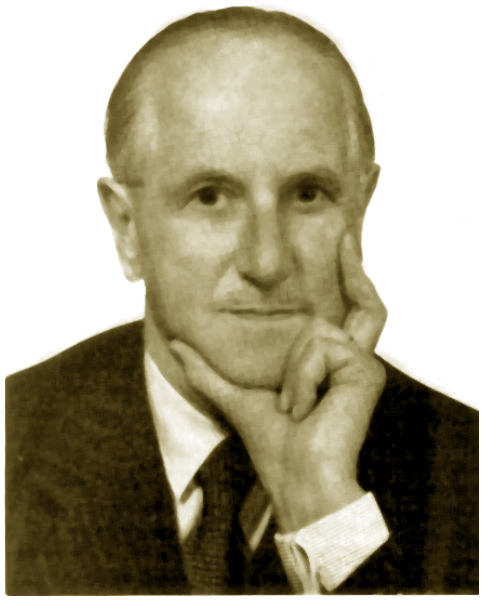

Friedrich Adolf Paneth (1887–1958)

by Silke Merchel

Friedrich Adolf Paneth is well known for his achievements in inorganic and analytical chemistry. He is one of the pioneers of radiochemistry and the founder of a new discipline, cosmochemistry.

Through the world

F.A. Paneth was born on the 31st of August 1887 in Vienna as the second son of Sophie Schwab and Joseph Paneth. His father, a private lecturer in physiology at the University of Vienna (the famous histological *Paneth cells* were named after him) died of tuberculosis, as Friedrich was only three years old.

After studying at the universities of Vienna, Munich and Glasgow, F. A. Paneth received his Ph.D. in 1910 at the Institut für Radiumforschung in Vienna. Only two years later, he became an assistant and received his venia legendi (habiliation) in 1913. Later on (1915) he worked as a private lecturer and held lectures at Prague (1918), Hamburg (1918) and Berlin (1922), before he finally became professor and director of the Chemical Laboratories at Königsberg University in 1929. There, he started to work on gaseous hydrides and his never-ending scientific love: meteorites.

Although he was a Protestant, himself, his parents had been Jews. This and the fact that he was not fond of Hitler's politics, made him leave Germany as one of the first scientists in 1933. He worked for some years at the Imperial College of Science and Technology in London and as a lecturer in atomic chemistry at the University of London. In the year 1939 he became professor and director of the Chemical Institutes of the University of Durham. He held this position for 15 years. He created the Londonderry Laboratory for Radiochemistry. Within this time he officiated two years as head of the chemistry division of the Joint British-Canadian Atomic Energy Team in Montreal (1943-1945), where he recruited young chemists like Geoffrey Wilkinson and Bertrand Goldschmidt for the nuclear energy project.

In summer 1953 he returned to Germany as director of the Chemistry Department of the Max-Planck-Institute for Chemistry Mainz. One of the later directors, Heinrich Wänke, followed him directly as an assistant. Only about five years later, F. A. Paneth died unexpectedly on the 17th of September 1958 at the age of 72 caused by an insidious and incurable illness.

Merits

F.A. Paneth was not only a man who was interested in pure experimental science; he also loved to draw the secrets from ancient scientist's works. He published over 50 papers regarding the history of science and philosophy of chemistry, *e. g.* about Paracelsus, Thomas Wright, Immanuel Kant, Faraday, Johann Wolfgang von Goethe, Albert der Große, Lothar Meyer, Albertus Magnus, Johan Gadolin, Marie Sklodowska-Curie or Frederick Soddy.

Additionally, he wrote numerous book reviews and meeting reports. His work on isotopes made him think - and of course publish numerous articles - about the concept of chemical elements including the meaning of the periodic table. In this context, it seems to be proven by personal scientific correspondence that F. A. Paneth suggested to Dirk Coster and Georg v. Hevesy to search for hafnium in natural zircon, which led to the element's official discovery in 1923.

All of his papers (about 300) are written excellently. F. A. Paneth was also famous for his brilliant talks. He dictated his last original paper (*Hat Chladni das Pallas-Eisen in Petersburg gesehen?*) to his daughter Eva Paneth only a few days before his death. This paper and a nearly complete list of his publications can be found in the Österreichische Chemiker-Zeitung (Heft 21/22, 1958). The same journal had honoured him a year before on the occasion of his 70th birthday. His son, Heinrich Rudolph Paneth, who renamed himself to Henry Post, followed his father's scientific work by translating some of his German-written papers into English and by publishing his own papers on general topics like "the periodic system and the reduction of chemistry to physics".

F. A. Paneth was one of the founders and original editors of *Geochimica et Cosmochimica Acta* which was founded in 1950. He was member of the editorial board and frequent author of GCA until his death. F. A. Paneth is honorary member of the Austrian Chemical Society (1950). He joined the Editorial Board of The International Journal of Applied Radiation and Isotopes from 1956-58. He was awarded with the Carl Baron Auer von Welsbach Medal of the Austrian Chemical Society and the Liebig-Denkmünze der GDCh (German Chemical Society) in 1957.

He was on of the 18 elitist nuclear scientists who signed the "Göttinger Manifest" on the 12th of April 1957. Among these were four noble price winners, namely Max Born, Otto Hahn, Werner Heisenberg and Max von Laue. By this declaration addressed to the members of the German government they communicated their deepest concern about the plans of The German Army of acquiring atomic weapons.

During his time at Königsberg, F. A. Paneth became fascinated by amber. His collection of amber specimens, donated 1986 by his daughter Eva to the University of Durham's Department of Geology, where it nowadays can be seen. He, of course, assembled his own collection of meteorites and literature about meteorites. Today, the F. A. Paneth collection is included in the meteorite collection of the MPI Mainz. It contains also five specimens named "Paneth's Iron", which is an observed fall of an iron meteorite from 1873 (IIIE, total mass of at least 150 kg, unknown location, main masses at London, Vienna, and Mainz). The F. A. Paneth Meteorite Trust, administered by the Royal Astronomical Society, was set up in 1960 to "encourage and further research concerned with meteorites".

The cream of the crop

It would be a very long list just to name all his scientific achievements; therefore, here only a selection of respected non-meteoritics work is given:

Interestingly, Paneth' most famous work is based on a failure. In Great Britain, Georg v. Hevesy, inspired by a suggestion of Ernest Rutherford, and Paneth in Vienna, inspired by Stefan Meyer, both unsuccessfully tried to separate radium D from lead. From this point and after meeting in Vienna, they cooperated and developed the technique of isotopic labelling and radioactive tracers. They used *e. g.* radium D as a tracer to determine the solubility of lead salts. Further on, Paneth used these techniques to investigate the unstable hydrides of lead and bismuth. Hevesy received the Nobel Prize in Chemistry for his work on radioactive indicators.

Although fusion was not known these days, he predicted together with Kurt Peters that the sun produced its energy this way. They even reported the transformation of hydrogen into helium by spontaneous nuclear catalysis at room temperature and normal pressure. The so-called *cold fusion* was "rediscovered" more than 60 years later by Stanley Pons and Martin Fleischmann. However, shortly after their announcements both teams had to declare their results to be false. The amount of helium, Paneth and Peters had measured, was due to contamination from air.

Together with W. Hofeditz he reinvigorated free radical chemistry by discovering the existence of methyl and ethyl free radicals in a flow system in the gas phase.

He fulfilled the alchemist's dream: The first chemical evidence of artificial transmutation could be proven by Paneth and his associate Paul L. Günther. They used the radiation from thorium to bombard *e. g.* paraffin resulting in the production of helium. In contrast to earlier works on transmutation, where all products were detected physically, in this work, the amount of helium was large enough to be detected chemically (1933).

By developing the methods of fraction desorption, Paneth was able to measure amounts of helium and neon as low as 10^{-10} cm^3. This led to the disproof of the general view that the composition of air varies with height. Paneth and co-workers proofed by helium-nitrogen data the total mixing of the stratosphere, and later on even to a height of 85 km.

For his life-lasting scientific real love, cosmochemistry, the situation is about the same. The most famous topics are:

- Paneth measured traces of helium (originating from uranium decay) in rocks to set ages of (extra-)terrestrial materials, which was an important step towards determining the age of the solar system. Unfortunately, this project was hindered by inaccurate methods for measuring uranium and thorium concentrations, which are also needed.
- Paneth and his co-workers in Durham could experimentally prove the theory of C. A. Bauer that cosmic rays induce spallation reactions leading (not only) to helium. They measured the first helium depth profile in a meteorite. Later on, they additionally affirmed the cosmogenic origin of most of the helium by mass spectrometry and, therefore, excluded the possibility of helium age determination for iron meteorites. They also identified neon as a product of nuclear reactions in space.
- For stony meteorites (with higher uranium and potassium contents compared to irons), Paneth and co-workers determined ages by the uranium-helium- and the potassium-argon-method, respectively.

- Paneth also discussed in several papers the possibilities of the origin of meteorites, the frequency of meteorite falls, and the age of the universe.

References and further reading

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