ON THE DISCOVERY OF COSMIC RAY INTERACTIONS IN METEORITES: THE HELIUM STORY. H. Wänke, Max-Planck-Institut f. Chemie, P.O.B. 3060, D-55020 Mainz, Germany

Around 1930, F. A. Paneth and his coworkers in Königsberg (at that time Germany) had developed techniques for the microanalysis of helium. They were able to measure helium down to 10^{-8} ccSTP with high precision. Paneth was especially interested to use helium for age determination with the uranium/thorium-helium method. Soon it turned out that this method was not reliable for rocks as helium was partially lost by diffusion after crystallization of the rocks. Paneth correctly assumed that diffusion loss of helium would not occur in iron meteorites. In the thirties Paneth's group carried out many helium determinations of iron meteorites. The high precision of their data can be seen by comparing with analyses made several decades later.

However, in order to obtain ages U and Th analyses were necessary. For U there existed a very powerful technique developed by F. Hernegger, using UV-fluorescence, which allowed determinations of 10^{-9} g U with good accuracy. For Th alpha counting had to be used. It took years to obtain what was thought to be reliable values of U and Th in iron meteorites.

The calculated U, Th-He-ages caused great excitement as they ranged from about one million to 8,000 million years, exceeding the age of the universe, which at that time was thought to be about 6,000 million years old.

In 1947, C. A. Bauer had noticed that the highest helium concentrations measured by Paneth's group were found in meteorites of small mass. Bauer suggested that helium could be produced by the interaction of cosmic ray particles with the meteorite matter. He also pointed out that larger meteorites should show a depth effect and aside helium-4, helium-3 should be produced, too. Paneth who in the meantime has moved to Great Britain found no noticeable difference between surface and interior samples of Treysa meteorite (recovered mass 63 kg). Later on, Paneth's group found the depth effect in meteorite Carbo (recovered mass 450 kg).

Paneth contacted A. O. Nier, the world expert in isotope analysis and offered him to provide about 10^{-4} ccSTP He for isotope analysis. Nier, who had just determined the $^3He/^4He$ ratio in the Earth's atmosphere to 10^{-7}, thought of a ratio in this range and gave a negative answer.

Paneth finally heard of a young man in Oxford, who had just built a mass-spectrometer for rare gas analyses. His name was K. I. Mayne. He agreed to analyse $^3He/^4He$ in the He samples supplied by Paneth and found ^3He abundances up to 31.5 %. The corresponding paper by F. A. Paneth, P. Reasbeck and K. I. Mayne in Geochim. Cosmochim. Acta,Vol. 2, 300-303, 1952 marks the discovery of the first cosmic ray produced nuclei in meteorites. Later on, it was found that practically all the helium (helium-3 and helium-4) in iron meteorites was due to cosmic ray interaction and that all the U and Th figures produced by Paneth's group were several orders of magnitude too high and obviously due to contamination, mainly from the glass ware used for the chemical separations.