

CHEMICAL HERITAGE FOUNDATION

ALFRED O. C. NIER

Transcript of Interviews
Conducted by

Michael A. Grayson and Thomas Krick

at

University of Minnesota
Minneapolis, Minnesota

on

7, 8, 9, and 10 April 1989

(With Subsequent Corrections and Additions)

ACKNOWLEDGMENT

This oral history is one in a series initiated by the Chemical Heritage Foundation on behalf of the American Society for Mass Spectrometry. The series documents the personal perspectives of individuals related to the advancement of mass spectrometric instrumentation, and records the human dimensions of the growth of mass spectrometry in academic, industrial, and governmental laboratories during the twentieth century.

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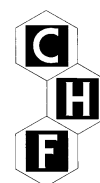
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ALFRED O. C. NIER

1911 Born in St. Paul, Minnesota on 28 May

Education

1931 B.S.E.E., Electrical Engineering, University of Minnesota
1933 M.S.E.E., Physics (under Henry Hartig), University of Minnesota,
1936 Ph.D., Physics (under John Tate), University of Minnesota

Professional Experience

1936-1938 Harvard University, Cambridge, Massachusetts
Postdoctoral Fellow under Kenneth T. Bainbridge

University of Minnesota, Physics Department
1938-1940 Assistant Professor of Physics
1940-1944 Associate Professor of Physics
1944-1966 Professor of Physics
1953-1965 Chair
1966-1980 Regents Professor of Physics
1980-1994 Regents Professor of Physics, Emeritus

1943-1945 Kellex Corporation, New York
Scientist

Selected Honors

1950 Elected to National Academy of Sciences
1953 Elected to American Philosophical Society
1956 Arthur L. Day Medal, Geological Society of America
1959 Elected as Foreign Scientific Member of the Max-Planck Institute for
Chemistry
1960 Pittsburgh Spectroscopy Award
1965-1966 National Lecturer, Sigma Xi
1971 Atomic Energy Commission Award for Contributions to Development
and Use of Atomic Energy
1977 NASA Medal for Exceptional Scientific Achievement
1980 Elected to American Academy of Arts and Sciences
1980 Elected to Royal Swedish Academy of Science

- 1980 Honorary Doctor of Science, University of Minnesota
- 1981 Distinguished Service Award, University of Minnesota Chapter, Sigma
Xi
- 1982 Elected to Minnesota Inventors Hall of Fame
- 1984 Victor Goldschmidt Medal of the Geochemistry Society
- 1985 Field and Franklin Award for Outstanding Achievement in Mass
Spectrometry, American Chemical Society
- 1985 Thomson Medal, International Mass Spectrometry Conference, Swansea,
Wales
- 1992 William Bowie Medal of the American Geophysical Union

ABSTRACT

Alfred O. C. Nier was born in Minnesota in 1911 to parents who had emigrated from Germany. After a brief dispute over his name, Nier was baptized Alfred instead of Hans, since his mother believed Hans sounded too German. However, his two middle initials proved problematic during World War II when the government was researching publications by Alfred O. Nier and Alfred O. C. Nier for security clearances. Consequently, the majority of Nier's publications are without his second middle initial.

Having been interested in radios during high school, Nier decided to study electrical engineering when he enrolled at the University of Minnesota in 1927. When he graduated in 1931 he pursued engineering jobs; however, few firms were hiring due to the Depression. Luckily, during his undergraduate career Nier had been involved in physics research with his mechanics professor Henry A. Erikson. This physics experience led him to a research position and teaching assistantship with University of Minnesota professor Henry Hartig. Nier earned a master's degree in electrical engineering, though most of his research experience was in physics; he began his doctoral research at a time when quantum mechanics and x-rays were burgeoning fields of study. After much deliberation Nier chose to work with John Tate, head of the physics department and editor of the *Physical Review*. Subsequently, Tate assigned Nier to work on mass spectrometry. In the mid-1930s Nier built his first mass spectrometer and quickly obtained the first spectrum of benzene, though he never published it. Instead his first publication was in *Review of Scientific Instruments* in 1935 on feedback control for magnets.

Nier spent the majority of his doctoral research obtaining a precise understanding of how mass spectrometers worked and how he could improve the instruments to enhance his isotopic abundance studies. It was in the area of isotopic abundance where Nier encountered his scientific hurdle: a nuclear physics controversy over the mass abundance of potassium-40.

After completing his Ph.D. in 1936, Nier was awarded a National Research Council Fellowship. He elected to work with Kenneth T. Bainbridge at Harvard University. After working for General Electric over the summer, Nier began his work on 180° mass spectrometers in the fall. Fortunately, Bainbridge, who had excellent funding despite the Depression, had been able to build a large electromagnet over the summer. By December Nier completed a mercury spectrum and, through stabilizing the power supply and maximizing the accelerating potential, was on his way to establishing more precise isotopic abundances than the ones F. W. Aston produced in 1915. While at Harvard, Nier was introduced to geochronology and geochemistry through studying the atomic weight of common lead and uranium-lead.

Nier returned to the University of Minnesota after completing his postdoctoral research in 1938 instead of staying on as an instructor at Harvard or becoming a researcher at Westinghouse. Despite teaching a heavy course load Nier was able to begin building a magnet for his mass spectrometer and a thermal diffusion column to provide carbon-13 for stable isotope tracer studies. However, he had a diverse range of projects to complete on his 180° mass spectrometer with the help of students and his machinist R. B. Thorness.

In the fall of 1939 Nier became involved in work related to uranium-235 and UF_6/UBr_4 (Nier refers to UF_6 in the interview but references UBr_4 in some publications). Nier, with E.T. Booth, J.R. Dunning, and A.V. Grosse, demonstrated conclusively via mass spectrometry that uranium-235 was the isotope that underwent slow neutron fission. As his research group at Minnesota was the only one capable of analyzing uranium he was ordered to begin separating

uranium-235 on his 180° mass spectrometer. After Pearl Harbor and the official entry of the United States into World War II, Nier and his research team worked under the command of Harold C. Urey as part of the Manhattan Project. Nier's mass spectrometry expertise would prove invaluable to the war effort; Nier initially built four instruments for isotope analyses and ten instruments specifically for hydrogen-deuterium analyses. Nier taught many how to use and build these machines and allowed General Electric to produce his mass spectrometers. One such instrument that GE built was the Nier designed leak detector for the K-25 diffusion plant in Oak Ridge, Tennessee. Nier worked with the Kellogg Corporation to support gaseous diffusion processes to make line recorders, which were mass spectrometers monitoring the process stream.

After World War II, Nier returned to the University of Minnesota where he remained as a professor. Nier's post-war mass spectrometry research touched on many areas including electrical detection, atmospheric studies and mass spectrometers for rockets, geochemistry, and precise masses. Nier participated in the upper atmosphere Aerobee flights throughout the 1960s, the Viking Project in the 1970s, and the Pioneer Venus project. During this atmospheric work Nier became friends and a collaborator with Klaus Biemann.

Throughout his oral history Nier discusses his many publications, the instrument details of many mass spectrometers, his awards, and his interesting career. Nier explained that his short attention span and unique education in physics and electrical engineering allowed him to capitalize on the new field of mass spectrometry when the country needed his expertise most.

INTERVIEWER

Michael A. Grayson retired from the Mass Spectrometry Research Resource at Washington University in St Louis in 2006. He received his B.S. degree in physics from St. Louis University in 1963 and his M.S. in physics from the University of Missouri at Rolla in 1965. He is the author of over forty-five papers in the scientific literature dealing with mass spectrometry. Before joining the Research Resource, he was a staff scientist at McDonnell Douglas Research Laboratory. While completing his undergraduate and graduate education, he worked at Monsanto Company in St. Louis, where he learned the art and science of mass spectrometry under O. P. Tanner. Grayson is a member of the American Society for Mass Spectrometry [ASMS], and currently is the Archivist for that Society. He has served many different positions within ASMS. He has served on the Board of Trustees of CHF and is currently a member of CHF's Heritage Council. He continues to pursue his interest in the history of mass spectrometry by recording oral histories, assisting in the collection of papers, researching the early history of the field, and preparing posters recounting historic developments in the field.

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