Albert Ghiorso 1915-2010

BERKELEY, CA. – Albert Ghiorso, lifelong nuclear researcher at the Lawrence Berkeley Laboratory, the co-discoverer of twelve chemical elements, more than anyone else in history, and a prolific inventor of nuclear technology, died December 26, 2010, at the age of 95. Ghiorso's discoveries include the following elements:

Atomic number	Name	Year
95	Americium	1945
96	Curium	1944
97	Berkelium	1949
98	Californium	1950
99	Einsteinium	1952
100	Fermium	1953
101	Mendelevium	1955
102	Nobelium	1958
103	Lawrencium	1961
104	Rutherfordium	1969
105	Dubnium	1970
106	Seaborgium	1974

Over a period of more than 50 years, Ghiorso led the development of major new techniques in nuclear science, enabling the discovery about 30 new isotopes of 12 new elements. This work was central to proving the correctness of Seaborg's theoretical revision of the periodic chart and its extension to higher atomic numbers, which in turn directly and significantly impacted all of nuclear chemistry, physics, weapons, research, medical treatment of cancer, and consumer products.

Albert Ghiorso was born in 1915 in Vallejo, California, of Italian and Spanish ancestry. As a child, he developed a fascination with airplanes, machines, and radio. As a teenager, he built short-wave radios that out-performed military equipment. After obtaining his B.S. degree in engineering from the University of California in 1937, he built specialized radio gear, and through that work came into contact with the Radiation Laboratory on the Berkeley campus. This led to his employment designing and building the world's first commercial Geiger counters to detect nuclear radiation.

By 1942 the Manhattan Project was underway to develop the atomic bomb. Berkeley chemist Glenn Seaborg was asked to study the chemistry of Plutonium, and he invited Ghiorso to join his group in Chicago. During the years 1942-46, Ghiorso invented critical techniques for identifying characteristic nuclear radiation, in particular the 48-channel pulse-height analyzer that made it possible to identify the energies of decay products (e.g., alpha particles) and thereby identify the nuclei that produced them. Using this instrument, Ghiorso was able to identify two new elements (95, Americium and 96, Curium). His work was also essential in clarifying the chemistry of Plutonium, used in making the first atomic bombs.

Of even more significance was the proposed revision of the periodic chart of the elements by Seaborg in 1944. Within five years, Ghiorso and his collaborators had produced and identified elements 97 (Berkelium) and 98 (Californium), validating Seaborg's hypothesis and providing direction for further extensions of the periodic chart to higher atomic number. The 1951 Nobel Prize for Chemistry recognized the significance of that work.

During 1952-53, Ghiorso and co-workers at Berkeley and a group at Argonne National Laboratory collaborated on an examination of the radioactivity of atmospheric dust collected from the first thermonuclear explosion (the "Mike" event). That work resulted in the discovery of two additional elements, 99 (Einsteinium) and 100 (Fermium). The fact that Ghiorso is the first author of the publication is indicative of his primary role in those discoveries.

In the mid-1950s, Ghiorso and colleagues used the Berkeley cyclotron to produce 17 atoms of element 101 (Mendelevium). This was the first time an element was identified atom-by-atom, using a revolutionary technique (recoil) conceived by Ghiorso.

After the discovery of element 101, it became clear that to extend the periodic chart any further, a new accelerator would be needed, and the Berkeley Heavy Ion Accelerator (HILAC) was built, with Ghiorso in charge. That machine was used for the discovery of elements 102-106, each identified by only a few atoms. For each element, significant new techniques had to be invented and developed to cope with the very low production and detection rates. For element 102 (Nobelium), Ghiorso invented a double-recoil technique. For element 103 (Lawrencium), he introduced solid-state alpha-particle detectors, which had higher energy resolution than gas proportional counters. For element 104 (Rutherfordium), a fast rotating wheel was introduced to transport the short-lived products to the radiation detectors. For element 105 (Hahnium/Dubnium), the group added electronic time-correlation techniques. For element 106 (Seaborgium), Ghiorso's group had to develop significantly increased production and detection efficiencies, requiring target cooling, sample sequencing, and sophisticated data analysis.

Ghiorso's contributions to nuclear science are extensive and influential. He and collaborators published more than 100 articles in the *Physical Review* and *Physics Letters* alone, in addition to numerous papers in chemistry journals and review articles. These papers are in the broad categories of new elements, new isotopes, nuclear decay, nuclear systematics, and transuranic chemistry. In almost all the element discovery publications, Ghiorso is the first author, appropriate to his primary role in the research.

The techniques invented and used by Ghiorso's teams were adopted and extended in numerous laboratories worldwide. The Berkeley work directly influenced similar work at the GSI laboratory in Darmstadt, Germany, where elements 107-112 were discovered, and the Joint Institute for Nuclear Research (Dubna, Russia), where elements 113-118 were discovered.

During the course of searching for heavier elements, Ghiorso conceived several breakthrough accelerators, including the Bevalac, which was used for medical therapy for hundreds of cancer patients, and the Omnitron, which provided an innovative design for a universal accelerator for nuclear chemistry. Ghiorso invented many sophisticated instruments and techniques, such as the gas-filled recoil spectrometer, used to isolate atoms of new elements, and extremely fast chemical separation techniques essential for identifying the very short-lived very heavy elements.

It would be difficult to overstate the importance of the work of Albert Ghiorso to nuclear science. In both scientific conceptual thought and potential practical applications, the extension of the periodic chart beyond uranium is comparable in importance to major scientific advances such as the elaboration of the electromagnetic spectrum, the invention of semiconductor electronics and lasers, and the understanding of the fundamental role of DNA in biology and medicine.

Ghiorso received a variety of awards, including the Lifetime Achievement Award of the Radiochemistry Society, the G. D .Searle and Co. Award, and an honorary doctorate from Gustavus Adolphus College. He was a fellow of the American Academy of Arts and Sciences and the American Physical Society. He is listed in the Guiness Book of World Records for "Most Elements Discovered."

Ghiorso enjoyed opera, art collecting, and rare bird watching with his wife. Characteristically, he invented a special flash for his camera, with which he was able to photograph extremely rare birds. He supported and donated to many organizations involved with environmental protection. He was very active in educational outreach, including appearances on science-related television programs, meeting with students in classrooms, enabling visits to the laboratory at the Berkeley, and writing popular reviews of the search for new elements. He is famous among his colleagues for his endless stream of creative "doodles," which define an art form suggestive of fractals. A full-length biography of Ghiorso is being written by Dr. Robert Schmieder, former postdoctoral researcher at the HILAC. For more information, see the link listed below.

Albert Ghiorso died of heart failure while recovering from a minor fall at his home near the U.C. Berkeley campus, where he had lived for 60 years, almost all of it with his late wife Wilma (Belt) Ghiorso. He is survived by a son, William Belt Ghiorso, an engineer at the Berkeley Lab, and a daughter, Kristine Pixton, a professional artist and software designer in Vestal, New York.

A memorial service is planned for Saturday, Jan. 15, 2011, 10:30 AM, at the Berkeley City Club, Berkeley California.

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