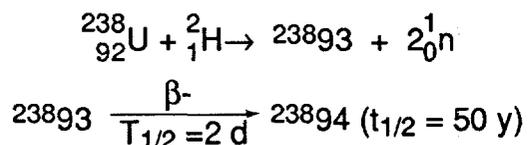


number designating the bombardment and a second designating the chemical fraction within that bombardment. Thus, this first bombardment is designated 93-1; the chemical fractions separated are designated 93-1-1, 93-1-2, and so forth. Today the purified element 93 fraction upon which the decay and radiation measurements are being made is being designated 93-1-3."

When I learned that McMillan had gone, I wrote to him asking whether it might not be a good idea if we carried on the work he had started, especially the deuteron bombardment of uranium. He readily assented.

Our first deuteron bombardment of uranium was conducted on December 14, 1940. What we bombarded was a form of uranium oxide,  $U_3O_8$ , which was literally plastered onto a copper backing plate. From this bombarded material Wahl isolated a chemical fraction of element 93. The radioactivity of this fraction was measured and studied. We observed that it had different characteristics than the radiation from a sample of pure 93-239. The beta-particles, which in this case were due to a mixture of 93-239 and the new isotope of element 93 with mass number 238 (93-238), had a somewhat higher energy than the radiation from pure 93-239 and there was more gamma radiation. But the composite half-life was about the same, namely, 2 days. However, the sample also differed in another very important way from a sample of pure 93-239. Into this sample there grew an alpha-particle-emitting radioactivity. A proportional counter was used to count the alpha-particles to the exclusion of the beta-particles. This work led us to the conclusion that we had a daughter of the new isotope 93-238--a daughter with a half-life of about 50 years and with the atomic number 94. This is much shorter-lived than the now known half-life of 94-239, which is about 24,000 years. The shorter half-life means a higher intensity of alpha-particle emission, which explains why it was so much easier to identify what proved to be the isotope of element 94 with the mass number 238 (94-238). The reactions are:



On January 28, 1941, we sent a short note to Washington describing our initial studies on element 94; this communication also served for later publication in The Physical Review under the names of Seaborg, McMillan, Kennedy, and Wahl(Z). We did not consider, however, that we had sufficient proof at that time to say we had discovered a new element and felt that we had to have chemical proof to be positive. So, during the rest of January, and into February, we attempted to identify this alpha activity chemically.

Our attempts proved unsuccessful for some time. We did not find it possible to oxidize the isotope responsible for this alpha radioactivity. I recall that we then asked