

UCRL-1141

~~CONFIDENTIAL~~

UNIVERSITY OF CALIFORNIA - BERKELEY

TWO-WEEK LOAN COPY

*This is a Library Circulating Copy
which may be borrowed for two weeks.
For a personal retention copy, call
Tech. Info. Division, Ext. 5545*

RADIATION LABORATORY

~~CONFIDENTIAL~~

UCRL-1141

No Standard Distribution

UNIVERSITY OF CALIFORNIA

Radiation Laboratory

Contract No. W-7405-eng-48

DECLASSIFIED

THE U²²⁷ COLLATERAL SERIES

W. W. Meinke, A. Ghiorso, and G. T. Seaborg

February 21, 1951

CAUTION

This document contains information affecting the National Defense of the United States. Its transmission or the disclosure of its contents in any manner to an unauthorized person is prohibited and may result in severe criminal penalties under applicable Federal laws.

Berkeley, California

~~CONFIDENTIAL~~

UCRL-1141

Declassification Procedure Distribution

-2-

<u>Distribution: Series A</u>		<u>Copy Numbers</u>
Declassification Officer	DECLASSIFIED	1-6
Publication Officer		7
Patent Department		8-9
Area Manager		10
Information Division		11
	Total	<u>11</u>

Information Division
Radiation Laboratory
Univ. of California
Berkeley, California

THE U²²⁷ COLLATERAL SERIES

W. W. Meinke,* A. Ghiorso,** and G. T. Seaborg**
Department of Chemistry and Radiation Laboratory
University of California, Berkeley, California

February 21, 1951

ABSTRACT

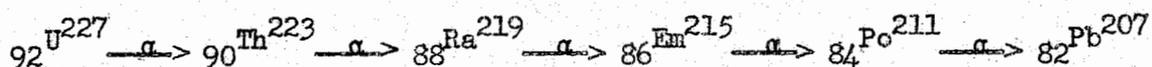
Continuation of our investigations of the type which led to the observation and characterization of five artificial radioactive chains collateral to the natural radioactive families^{1,2,3} has led to the partial identification of one additional chain, collateral to the actinium ($4n \pm 3$) family.

Thorium nitrate was irradiated for one minute with 175-mev helium ions in the "jiffy probe" of the 184-inch Berkeley cyclotron. At the end of bombardment the target container was ejected from the probe by compressed air and blown into a pneumatic tube which carried the target some 100 yards to the Chemistry Building. Chemical separation was begun on the target 18 seconds after shutdown and counting of the separated sample was begun 1.4 minutes after shutdown. The chemical procedure consisted of solution of the thorium nitrate target in slightly acidic saturated ammonium nitrate solution. The tracer uranium was then extracted into diethyl ether and an aliquot of this ether solution ignited on a platinum plate to give a nearly weightless sample. The decay and energy of the alpha particles in the resulting samples were measured with an alpha particle pulse-analyser⁴ equipped with a fast sample-changing mechanism.

*Present address: Department of Chemistry, University of Michigan, Ann Arbor, Michigan.

**Present address: Department of Chemistry and Radiation Laboratory, University of California, Berkeley, California.

The 9.3 minute U^{228} and 58 minute U^{229} collateral series predominated in these uranium samples. Several of the more satisfactory runs, however, showed a third series decaying with the 1.4 minute half-life of the parent. Although the mass type has not yet been definitely identified through known daughters, general considerations with regard to the method of formation and half-life of the parent substance, and the energies of all the members of the series suggests a collateral branch of the $(4n + 3)$ family:



The measured alpha particle energies of the individual members of the U^{227} series, assigned according to alpha decay systematics in this region,⁵ are shown in the accompanying table. Alpha energy and half-life values predicted³ from these systematics are also given in the table. The values given for Po^{211} are the accepted values from the literature.^{6,7}

Isotope	Type of radiation	Half-life	Energy of radiation (mev)	
			Observed	Predicted
U^{227}	α	1.4 ± 0.15 min 0.3	7.0 ± 0.1	7.0 - 7.2
Th^{223}	α	($\sim 10^{-1}$ sec, predicted)	7.5 ± 0.1	7.5 - 7.7
Ra^{219}	α	($\sim 10^{-3}$ sec, predicted)	7.8 ± 0.1	7.9 - 8.1
Em^{215}	α	($\sim 10^{-6}$ sec, predicted)	8.6 ± 0.15	8.6 - 8.8
Po^{211}	α	0.52 sec	7.434	
Pb^{207}	Stable			

REFERENCES

1. Ghiorso, Meinke, and Seaborg, Phys. Rev. 74, 695 (1948).
2. Meinke, Ghiorso, and Seaborg, Phys. Rev. 75, 314 (1949).
3. Meinke, Ghiorso, and Seaborg, Phys. Rev. (March, 1951).
4. See, e.g., Ghiorso, Jaffey, Robinson, and Weissbourd, NNES PPR 14B, Paper 16.8 (1949).
5. Perlman, Ghiorso, and Seaborg, Phys. Rev. 77, 26 (1950) and unpublished revisions bringing curves up to date.
6. Leininger, Segrè, and Spiess, Bull. Am. Phys. Soc. 26, No. 1, 47 (1951).
7. G. T. Seaborg and I. Perlman, Rev. Mod. Phys. 20, 585 (1948).