## Title

CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS XXV. PREPARATION AND ISOLATION OF Au195,196,198,199 FROM PLATINUM



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September 19, 1951

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# CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS

## XXV. PREPARATION AND ISOLATION OF $Au^{195,196,198,199}$ FROM PLATINUM*

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September 19, 1951

Radioactive gold, produced by bombardment of platinum with 19-Mev deuterons, has been isolated without added isotopic carrier. Four known long-lived radioisotopes of gold(1) are produced by (d,n) and (d,2n) reactions with deuterons of this energy: 180-day $Au^{195}$, 5.6-day $Au^{196}$, 2.7-day $Au^{198}$, and 3.3-day $Au^{199}$. The shorter-lived activities ($Au^{193}$ and $Au^{194}$) were allowed to decay out prior to chemical separation. Other possible concurrent reactions include formation of radioisotopes of platinum by (d,p) reactions and radioisotopes of iridium by (n,p) reactions. The carrier-free radio-gold was separated from the target material and from possible radioisotopes of iridium by a solvent extraction method using ethyl ether.

Five 1 mil foils of C.P. platinum(2) were clamped to a water-cooled copper target plate and bombarded with 19-Mev deuterons for a total of 20 microampere hours at an average beam intensity of 10 microamperes, in the 60-inch cyclotron at Crocker Laboratory. The bombarded foils were dissolved in a minimum volume of aqua-regia. Twelve N HCl was added to destroy excess $HNO_3$, the solution was diluted to approximately 15 ml of 3 N HCl, and

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(1) G. T. Seaborg and I. Perlman, Rev. Mod. Phys. 20, 585 (1948)

(2) Spect. pure platinum - less than .01 per cent gold.

the radio-gold was extracted with ethyl ether which had previously been saturated with 3 N HCl. Four extractions with ethyl ether were needed to remove most of the radio-gold from the aqueous phase. The ether layer was washed with 6 N HCl and the activity was quantitatively retained in the organic layer. Fifty milligrams of NaCl were added to the ether phase and the mixture was evaporated to 1 ml on a steam bath. The carrier-free radio-gold plus the NaCl was diluted to 5 ml to give an isotonic saline solution for subsequent biological investigations.

The radio-gold was identified by half-life determinations, absorption measurements, and by a chemical separation procedure using carriers. The decay was followed for 60 days and showed an initial composite half period of approximately 3.5 days, presumably due to $Au^{198,199}$. Four days after chemical separation the decay curve showed mainly the 5.6-day period of $Au^{196}$ (3). After 15 days the curve began to lengthen perceptibly and 25 days after chemical separation the activity showed only the 180-day period, which was presumably $Au^{195}$ (3). Aluminum and lead absorption measurements 6 days after bombardment showed the approximately 0.43 Mev beta particle and the 0.37 Mev gamma ray previously reported(4) for $Au^{196}$. An aliquot of the solution was added to a solution containing carrier amounts of Ir, Pt, and Au. The radioactivity was quantitatively recovered in the Au fraction following chemical separation.

We wish to thank Professor G. T. Seaborg for helpful suggestions, the crew of the 60-inch cyclotron at Crocker Laboratory for bombardments, and Miss Margaret Gee for assistance in counting.

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(3) Nuclear Data, National Bureau of Standards Circular 499 (September, 1950)

(4) G. Wilkinson, Phys. Rev. 75, 1019 (1949)