TABLE I. Parameters for resonances in Mo^{95}.

Resonance energy (eV)	Absolute intensity (photons per capture)		k_{M1} (MeV^{-3})	$g\Gamma_n^0$ (10^{-3} eV)
	E_γ=8.38 MeV	E_γ=9.15 MeV	E_γ=8.38 MeV	
45	0.006±0.001	0.0000±0.0005	0.08×10^{-1}	13.1 ±0.8[a]
107	0.018±0.004	0.039 ±0.008	...	0.010±0.006[b]
160	0.013±0.003	0.000 ±0.001	0.18×10^{-1}	0.55 ±0.10[a]
215	0.049±0.010	0.000 ±0.002	0.69×10^{-1}	0.08 ±0.04[b]

[a] Brookhaven National Laboratory Report BNL-325 (U. S. Government Printing Office, Washington, D. C., 1955).
[b] J. P. Marion (private communication). These values were calculated by assuming s-wave capture.

strong ground-state transition in the capture spectrum indicates capture forming a 1^- compound state. The presence of a strong 8.38-MeV line in the spectrum of the 215-eV resonance suggests that it may also be a p-wave resonance.

Table I contains a quantitative comparison of the absolute intensities of the 8.38- and 9.16-MeV lines corresponding to the resonances shown in Fig. 3 and also to the resonance at 160 eV. In addition, it shows the reduced width[12] k_{M1} for the 8.38-MeV line which was calculated by assuming $M1$ radiation. The resonance at 215 eV has an intensity of 0.05 photon per capture, which gives a reduced width of 0.069 MeV^{-3}, which is twice the largest value tabulated by Bartholomew[9] for nuclei with $A>75$. In the light of the possibility of fluctuations, only a probable assignment of negative parity can be made for this case; but the small value of $g\Gamma_n^0$ for the resonance is consistent with this conclusion.

These results indicate that capture spectra offer a promising means of identifying a large group of p-wave resonances, but it should be kept in mind that in this experiment no 4^- states formed in p-wave capture will be isolated by the methods outlined since spin considerations do not permit primary transitions to the region of interest. Nevertheless, in the light of the present interest in p-wave capture, a high-resolution measurement of the parameters of the resonances at 107 and 215 eV will be of considerable value in increasing our understanding of the importance of the parity of the compound state in neutron capture.

[12] The reduced width for $M1$ radiation is defined here as $k_{M1}=a\Gamma_\gamma/DE_\gamma^3$, where Γ_γ is the total radiation width of the resonance, a is the intensity of the transition, D is the spacing of states of the same spin and parity as the initial state, and E_γ is the γ-ray energy. This quantity, which is assumed to be independent of E_γ, facilitates comparison of the intensities of transitions in neighboring nuclei (see reference 9).

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A New Isotope, Pt^{201}

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A new Pt isotope was found by irradiation of mercury compounds with neutrons in the PRNC nuclear reactor. The Pt activities were separated from the mixture by precipitations as the K_2PtCl_6. In this fraction, a 2.3±0.2 min activity could be attributed to Pt^{201}, produced by $Hg^{204}(n,\alpha)Pt^{201}$. The Pt^{201} decays to the well-known Au^{201}. The genetic relationship was established by chemical separations of the daughter nuclide. The Au^{201} was identified by its half-life and its gamma-ray energy. Further, the growth of the gamma ray of 0.55 MeV, corresponding to Au^{201}, was measured in the isolated Pt fraction, with a 4-in.×4-in. NaI(Tl) scintillator coupled to a 512-channel pulse-height analyzer. The values of Butement and Shillito for Au^{201} were confirmed.

INTRODUCTION

WHEN mercury is bombarded with neutrons, the formation of various isotopes of Pt can be expected; among them, the isotope with mass number 201 formed by the reaction $Hg^{204}(n,\alpha)Pt^{201}$.

To this isotope, Cameron[1] has assigned a β-disintegration energy of ~1.7 MeV. Using a method published by Moszkowski,[2] the half-life has been estimated to be within the interval: 20 sec$\leqslant T_{1/2}\leqslant$20 min.

* Operated by the University of Puerto Rico for the Atomic Energy Commission.

[1] A. G. Cameron, Chalk River Laboratory Report CRP-690, 1957 (unpublished).
[2] S. A. Moszkowski, Phys. Rev. 82, 35 (1951).

In order that this reaction be energetically possible, the neutron energy should be of the order of 1 MeV.[1] This process can be achieved by using the fission neutrons of a nuclear reactor.

Mercury compounds were irradiated with neutrons and after radiochemical separations a fraction of Pt with the half-life of 2.3±0.2 min was isolated. From the genetic relationship with Au^{201}, the mass number 201 was assigned to the Pt isotope.

EXPERIMENTAL

The irradiations were performed in the PRNC nuclear reactor, at a power level of 1 MW, and flux of $10^{12}n/cm^2$ sec; the irradiation periods varied from 30 sec to 3 min.

Depending upon the chemical method to be used for the separation of the Pt fraction, spectroscopically pure HgO or $Hg(NO_3)_2 \cdot H_2O$ was employed. The amounts used varied from 0.4 to 0.55 g.

After the irradiation of HgO, the sample was dissolved in 6*M* HCl and the Pt was precipitated as K_2PtCl_6 or $(NH_4)_2PtCl_6$. The sample was prepared and counted with a GM counter having a 1.2-mg/cm² mica window. The time between the end of the irradiation and counting varied from 2.3 to 3.5 min.

After the irradiation of $Hg(NO_3)_2 \cdot H_2O$ the sample was dissolved in 3*M* HNO_3, and a gold-mercury fraction was removed by the method of Noyes and Bray.[3] Platinum was then precipitated as K_2PtCl_6 and counted. Again, the time between the end of irradiation and counting fluctuated between 3.6 and 4.2 min.

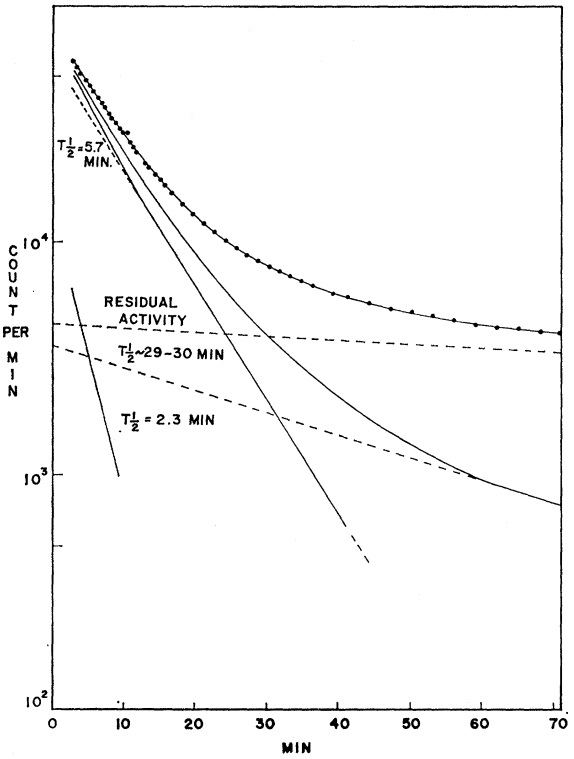

FIG. 1. Beta decay curve obtained with K_2PtCl_6 from the irradiation of HgO.

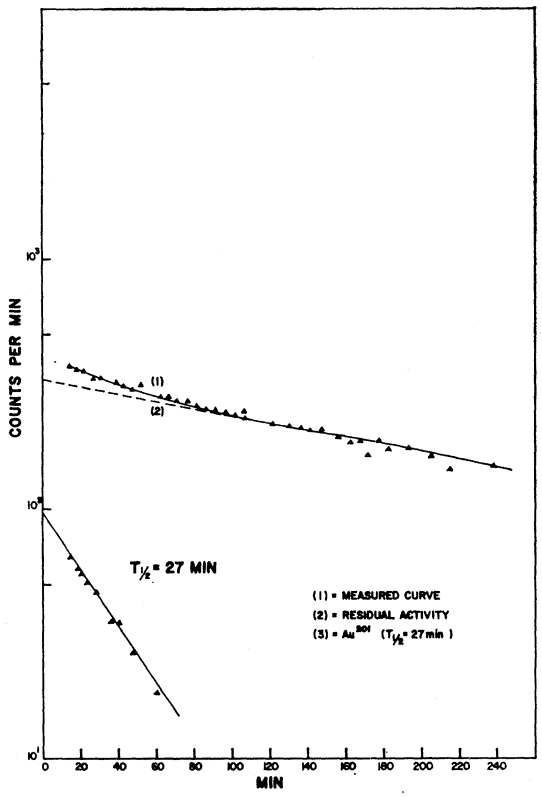

FIG. 2. Beta decay curve of the Au fraction obtained from the Pt isolated fraction.

Figure 1 shows a typical decay curve obtained with K_2PtCl_6 from the irradiation of HgO. The analysis of the curve shows the presence of nuclei with half-lives 2.3±0.2 min, 5.7±0.4 min, ~30 min, and also a residual decay activity. The 2.3-min half-life may be attributed to the Pt^{201} isotope; Hg^{205} accounts for the 5.7-min half-life,[4] while the ~30-min activity is probably due to a mixture of Au^{201} and Pt^{199} of half-lives[5,6] 26 and 31 min, respectively.

It must also be noted that when the sample was counted within 2.5 min after irradiation, a half-life of less than 20 sec could be observed which could[7] correspond to Pt^{199m}.

As it is possible to assign the mass number for the Pt isotope by the identification of the daughter nuclei, a Au fraction was isolated from the Pt fraction after a sufficient decay time.

[3] A. Noyes and W. Bray, *Qualitative Analysis for the Rare Elements* (The Mcmillan Company, New York, 1952), pp. 114–116.
[4] A. Lyon, Phys. Rev. **82**, 276 (1951).
[5] C. A. Butement and R. Shillito, Proc. Phys. Soc. (London) **A65**, 945 (1952).
[6] M. McMillan, M. Kamen, and S. Raben, Phys. Rev. **52**, 375 (1937).
[7] M. Wahlgren and W. Meinke, Phys. Rev. **115**, 191 (1959).

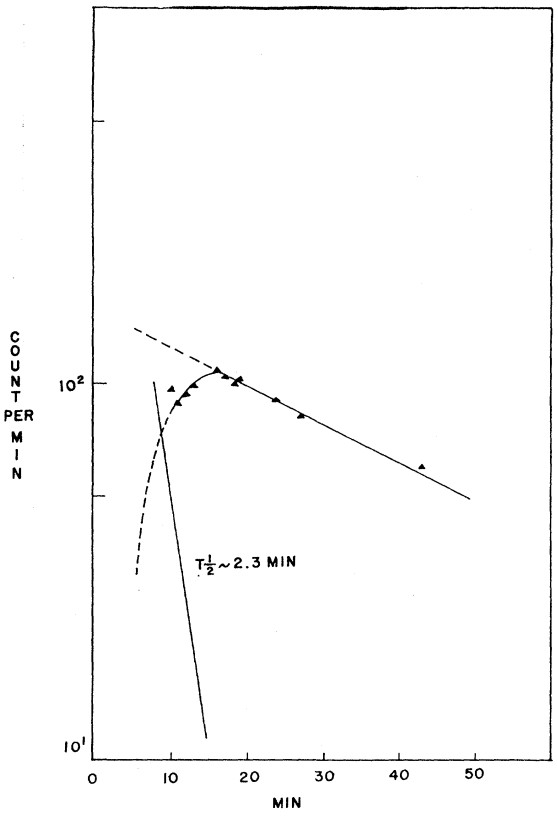

FIG. 3. Growth of the 0.55-MeV gamma ray corresponding to Au^{201}, in the Pt isolated fraction.

The separation was performed by solvent extraction of Au, with ethyl acetate, from the isolated platinum. The Au was obtained by precipitation with $SnCl_2$. A 27±2-min β activity was measured using a gas flow counter as shown in Fig. 2. This value is in good agreement with the half-life assigned for Au^{201} by Butement *et al.*[6]

Since Au^{201} emits gamma rays of 0.55 MeV,[6] another gold sample was prepared following the same procedure mentioned above. The gamma decay of this sample was observed in a single channel spectrometer with the base level voltage at an energy of 0.55 MeV. The half-life of the measured Au activity was between 27 to 28 min.

Knowing these results it could be expected that the 27-min Au^{201} activity was produced from the decay of the 2.3-min Pt activity mentioned before.

To confirm the existence of the above genetic relationship a HgO sample was irradiated, a fraction of Pt was purified, and gamma spectra were obtained using a 512-channel analyzer with a 4-in.×4-in. NaI(Tl) scintillator.

By analyzing the spectra, the growth of the photoelectric peak of 0.55 MeV, corresponding to Au^{201}, was observed at different time intervals and this activity was plotted. From the growth and decay curve shown in Fig. 3, it follows that Au^{201} is a daughter of Pt^{201} with a 2.3-min activity. The gamma spectra also showed[8] the formation of a well-known isotope Pt^{199} by (n,α) reaction with the fast neutrons on Hg.

For further confirmation of the above results, Au^{201} was separated from an isolated Pt sample obtained from the irradiation of $Hg(NO_3)_2\cdot H_2O$. These separations were carried out at identical successive intervals, and the separated fractions analyzed in the 512-channel analyzer. Again the 0.55-MeV peak was used, and the final genetic relationship was thus established.

CONCLUSIONS

1. The analysis of Fig. 1 shows the existence of a 2.3±0.2 min activity which may correspond to one of the Pt isotopes.

2. By (n,α) reaction with mercury, the formation of the following Pt isotopes can be expected: Pt^{195}, Pt^{196}, Pt^{197}, Pt^{199}, and Pt^{201}. The first two are known to be β stable; the Pt^{197} is a well-known nuclide, whose characteristics do not agree with these data; the Pt^{199} is a well-known nuclide and its presence was seen in the pulse-height spectra. Consequently the 2.3±0.2-min activity must be attributed to Pt^{201}.

3. The growth in the 512-channel analyzer of the gamma ray of 0.55 MeV, corresponding to the Au^{201} in the isolated fraction of the Pt, indicates that the Au^{201} grows from a parent, i.e., Pt^{201}, of a half-life of 2.3 min.

4. The separations of the several samples of Au^{201}, at identical intervals from the Pt fraction, established the $Pt^{201} \xrightarrow{\beta^-} Au^{201}$ genetic relationship.

5. The formation of Pt^{199} confirms the existence of (n,α) reaction on Hg.

From all these facts, it follows that the observed half-life of 2.3±0.2 min is due to the disintegration of a new isotope: Pt^{201}.

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[8] O. Minoru, Nucleonics Data Sheet No. 43; Nucleonics **19**, No. 9, 79 (1961).