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UNIVERSITY OF CALIFORNIA

Radiation Laboratory

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Note on the Ion Exchange Separation of

Europium, Gadolinium, and Terbium

G. H. Higgins and K. Street, Jr.

April 24, 1950

Berkeley, California

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## Note on the Ion Exchange Separation of Europium, Gadolinium, and Terbium

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University of California, Berkeley, California  
April 24, 1950

In connection with the general problem of comparing the behavior of the actinide elements with their rare earth homologues, it was desirable to know the relative rates of elution of the rare earth triad europium, gadolinium, and terbium on eluting with citrate solutions from Dowex-50 cation resin. Ketelle and Boyd<sup>1</sup>

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<sup>1</sup> B. H. Ketelle and G. E. Boyd, J. Am. Chem. Soc. 69, 2800 (1947)

in Fig. 6c show an elution (run at 100°C) of the heavy rare earth elements from Dowex-50 cation resin using 5% ammonium citrate solution of pH 3.25. In their experiment the activity peak that eluted in about 0.7 the time required to elute their europium peak is labelled Gd thus implying a large separation between europium and gadolinium. B. B. Cunningham and H. G. Hicks<sup>2</sup> ran europium and gadolinium under

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<sup>2</sup> B. B. Cunningham and H. G. Hicks, unpublished work.

somewhat different conditions (room temperature and pH 3.05 citrate) and found practically no separation of europium and gadolinium. In addition, J. O. Rasmussen<sup>3</sup>

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<sup>3</sup> J. O. Rasmussen, unpublished work.

ran europium, gadolinium, and terbium under still different conditions (75°C and pH 3.2 citrate) and again found essentially no separation of europium and gadolinium. In addition, he found that terbium was eluted well ahead of europium and gadolinium. It thus appeared that there was a real discrepancy between this later work and that of Ketelle and Boyd.

In order to check this point a run was made under conditions very close to those used by Ketelle and Boyd. Fig. 1 shows the results of an elution of yttrium,

Fig. 1-- Elution of Y, Tb, Gd, and Eu with  
pH 3.25 ammonium citrate at 97°C.

terbium, gadolinium, and europium made at 97°C. using 5% ammonium citrate solution of pH 3.25. Tracer  $Y^{91}$ ,  $Gd^{154}$ , and  $Eu^{152-154}$  were used and in addition approximately 200 ug. amounts of stable terbium, gadolinium, and europium were added to make spectrographic identification of the peaks possible. The column used was 20 cm. long and 5 mm. in diameter and a flow rate of 0.3 ml/cm<sup>2</sup>/min. was maintained. The Eu and Gd activities appear as a single broad peak, however spectrographic analyses make possible the construction of the dashed curves for Eu, Gd, and Tb. It is evident on comparing this elution with Fig. 6c of Ref. 1 that the activity labelled Gd by Ketelle and Boyd is very likely a terbium activity and that any gadolinium activities they may have had are under the front of the europium peak.

It should be noted that the very small separation of gadolinium from europium and the much greater separation of terbium from gadolinium agrees very well with the expected effect of the half-filled 4f electron configuration as was first pointed out by Boyd.<sup>1</sup>

This work was performed under the auspices of the U. S. Atomic Energy Commission.

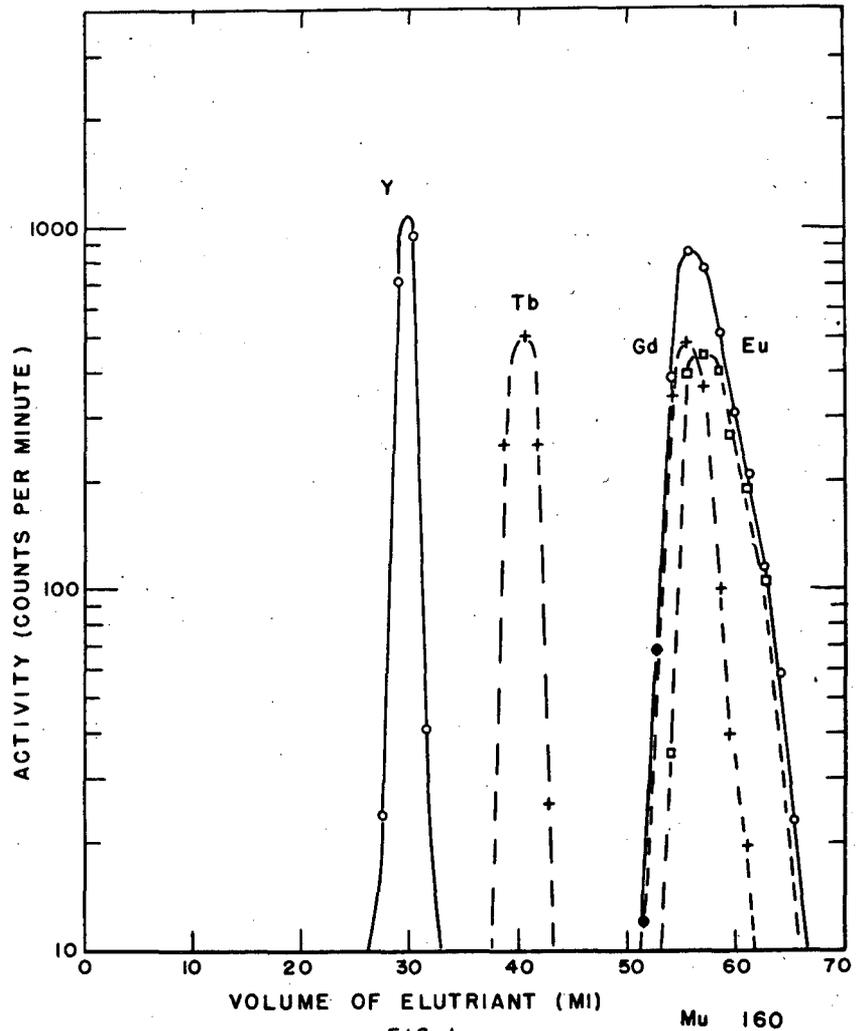


FIG. 1

Mu 160