

X  
Master

Deal

~~SECRET~~

Harley

NYO-4648

HASL

Declassified - See memo, Carroll to Rogers 2/21/58

UNITED STATES ATOMIC ENERGY COMMISSION

NEW YORK OPERATING OFFICE

HEALTH AND SAFETY LABORATORY  
ANALYTICAL BRANCH

STABLE STRONTIUM AND RADIUM SURVEY AT  
FIVE PASTURE SITES IN THE UNITED STATES

May 25, 1955

*Do not start*

LOAN COPY  
RETURN TO HASL

~~SECRET~~  
m. [redacted] cited  
[redacted]  
[redacted] may be  
person [redacted]

DO NOT  
PHOTO  
DUPLICATE

FILMED FOR MICROCARD TIS JUN 16 1959

~~SECRET~~

NYO 74924



## **DISCLAIMER**

**This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.**

---

## **DISCLAIMER**

**Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.**

UNCLASSIFIED

REPORT NO. NYO-4648

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

53572

STABLE STRONTIUM AND RADIUM SURVEY AT  
FIVE PASTURE SITES IN THE UNITED STATES

Analytical Branch  
Health and Safety Laboratories

Compiled by  
George A. Welford

Photostat Price \$ 3.30

Microfilm Price \$ 2.40

Available from the  
Office of Technical Services  
Department of Commerce  
Washington 25, D. C.

May 25, 1955

CLASSIFICATION CANCELLED  
DATE 1-30-56  
For The Atomic Energy Commission

*W. H. Cancele*  
Chief, Declassification Branch *Lu*

UNCLASSIFIED

CONTENTS

	<u>PAGE</u>
SUMMARY	
ABSTRACT	1
I. THE INFLUENCE OF IONIC CALCIUM ON THE UPTAKE OF STABLE STRONTIUM AND RADIUM	2
GRAPH 1	3
GRAPH 2	4
II. RELATIONSHIP BETWEEN RADIOSTRONTIUM AND STABLE STRONTIUM IN BONE	5
GRAPH 3	6
III. COMPARISON OF LEACHING AGENTS (0.1N HCl, 6N HCl, 1M NH <sub>4</sub> Ac) AND A COMPLETE SOLUTION METHOD FOR RECOVERY OF STRONTIUM FROM SOIL	7
IV. Sr <sup>90</sup> , RADIUM, AND STABLE STRONTIUM CONTENT OF LIVESTOCK BONE ASH DURING 1953	8



ABSTRACT

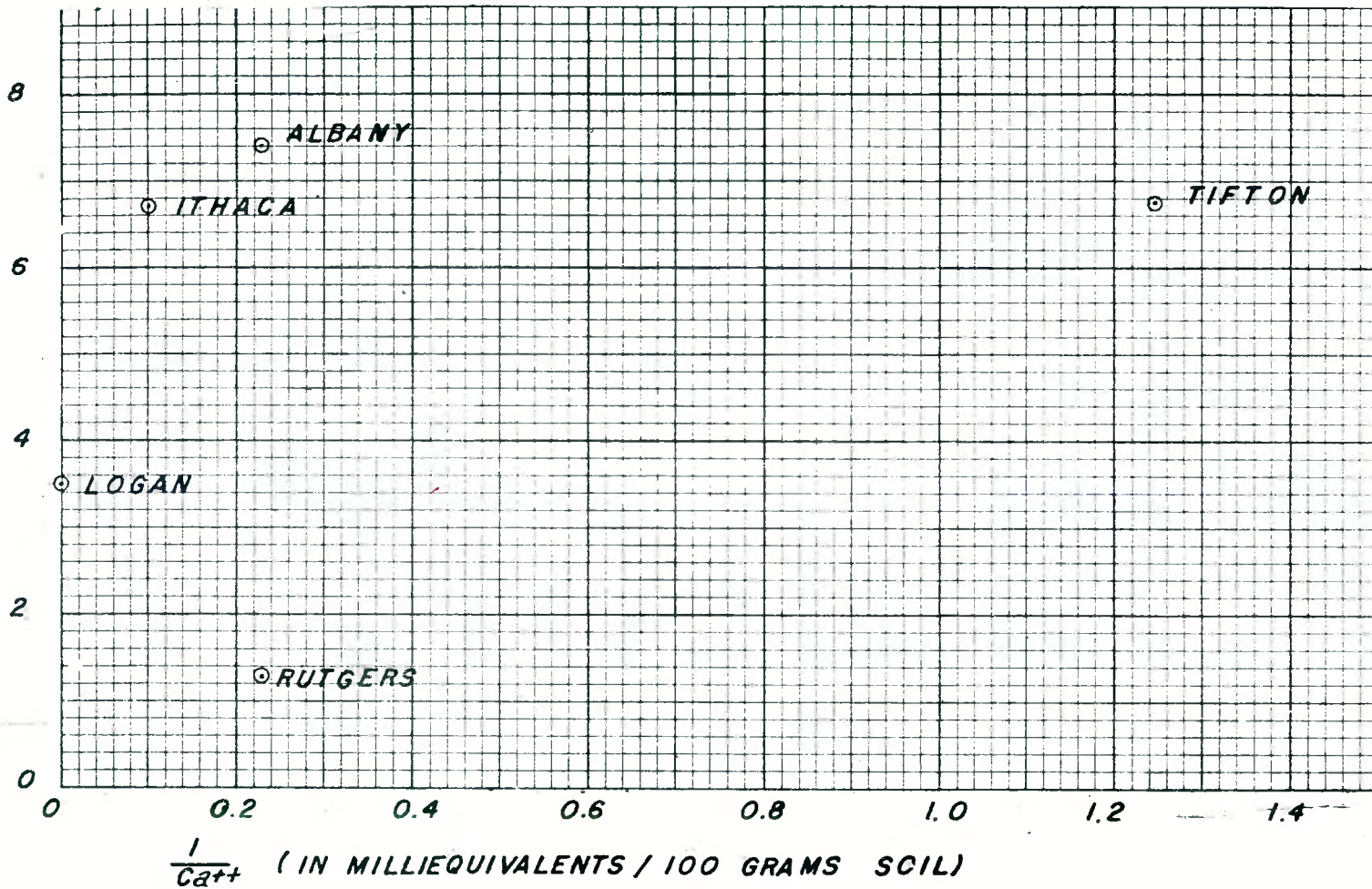
In the early fall of 1953, HASL set up a long range program to study the factors involved in the biological uptake of radiostrontium at five pasture sites within the United States. The initial results on radiostrontium and radium uptake were reported in NYO-4571. Subsequent to NYO-4571, the analytical work on stable strontium and radium was completed. This report covers the 1953 survey of stable strontium and radium content of soil and bone at the five pasture sites. This study was limited to soil and bone, as vegetation in the 1953 survey was not available at all of the sites. A re-survey of the five pasture sites, with an addition of Raleigh, North Carolina for an intermediate available calcium level, was completed in the fall of 1954.  $Sr^{90}$  and  $Sr^{89}$  uptake studies are reported in NYO-4649. Stable strontium and radium values will be published for the 1954 survey when the analytical work is completed.

A comparison of three leaching agents, (0.1 N HCl, 6 N HCl, and 1 M  $NH_4Ac$ ) with a complete solution method for the recovery of stable strontium at each site is reported. This comparison is being studied on soils with varying calcium content for recoveries of radiostrontium.

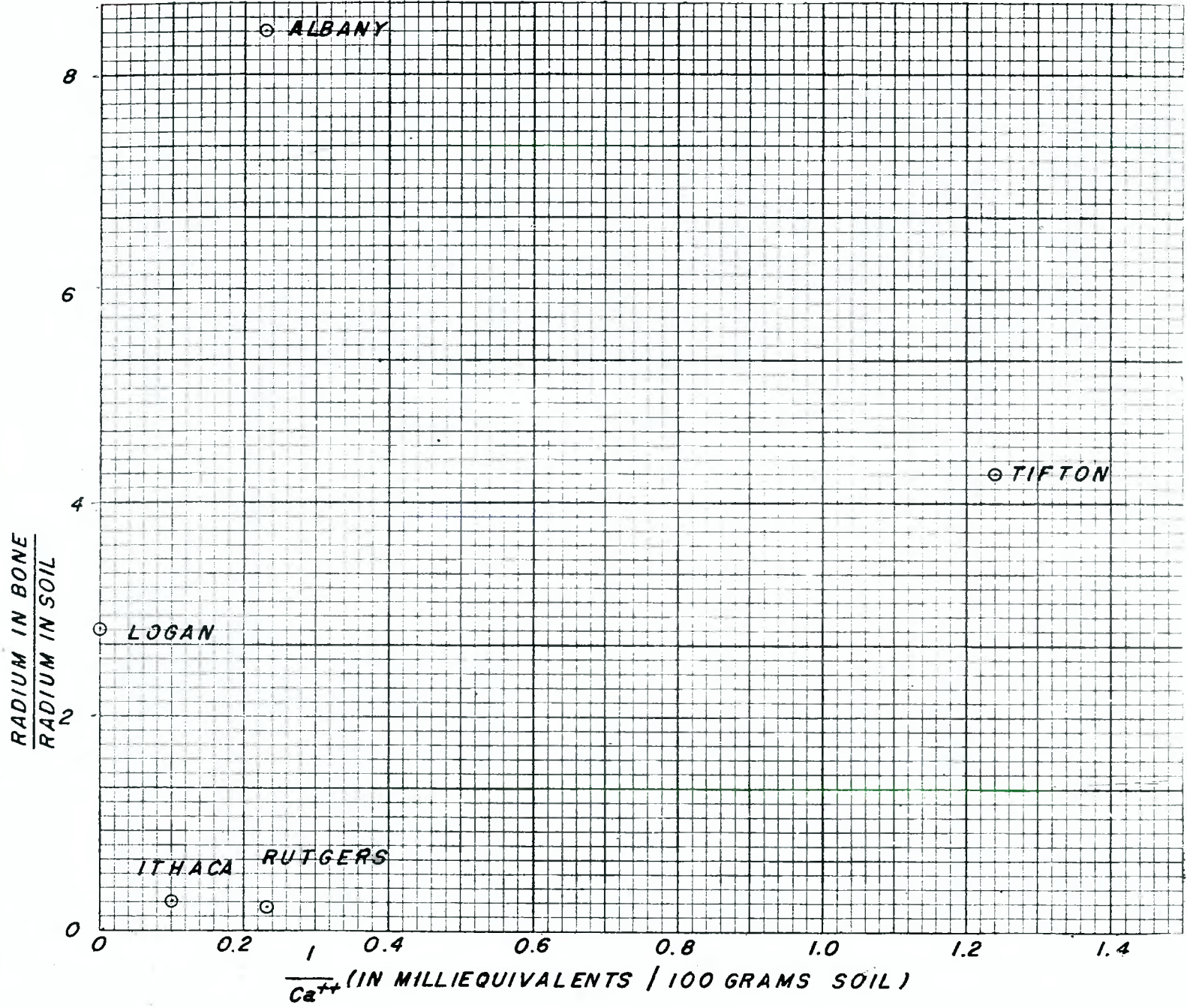
I. THE INFLUENCE OF IONIC CALCIUM ON THE UPTAKE OF STABLE STRONTIUM AND RADIUM

In the survey of the five <sup>pasture</sup>~~pastoral~~ sites for 1953 and 1954 and work done at Beltsville Experiment Station, a relationship was established between the uptake of radiostrontium and the exchangeable calcium in the soil. Since there should be no discrimination of plant and animal bone to different strontium isotopes, this same relationship should hold for stable strontium and exchangeable calcium in the soil. Graph 1 shows the results obtained when exchangeable calcium in the soil is plotted against stable strontium uptake. Graph 2 shows the results obtained when exchangeable calcium in the soil is plotted against radium uptake. These results compare favorably with the uptake of radiostrontium reported in NYO-4571.

NORMAL STRONTIUM IN BONE  
NORMAL STRONTIUM IN SOIL



GRAPH 1



GRAPH 2

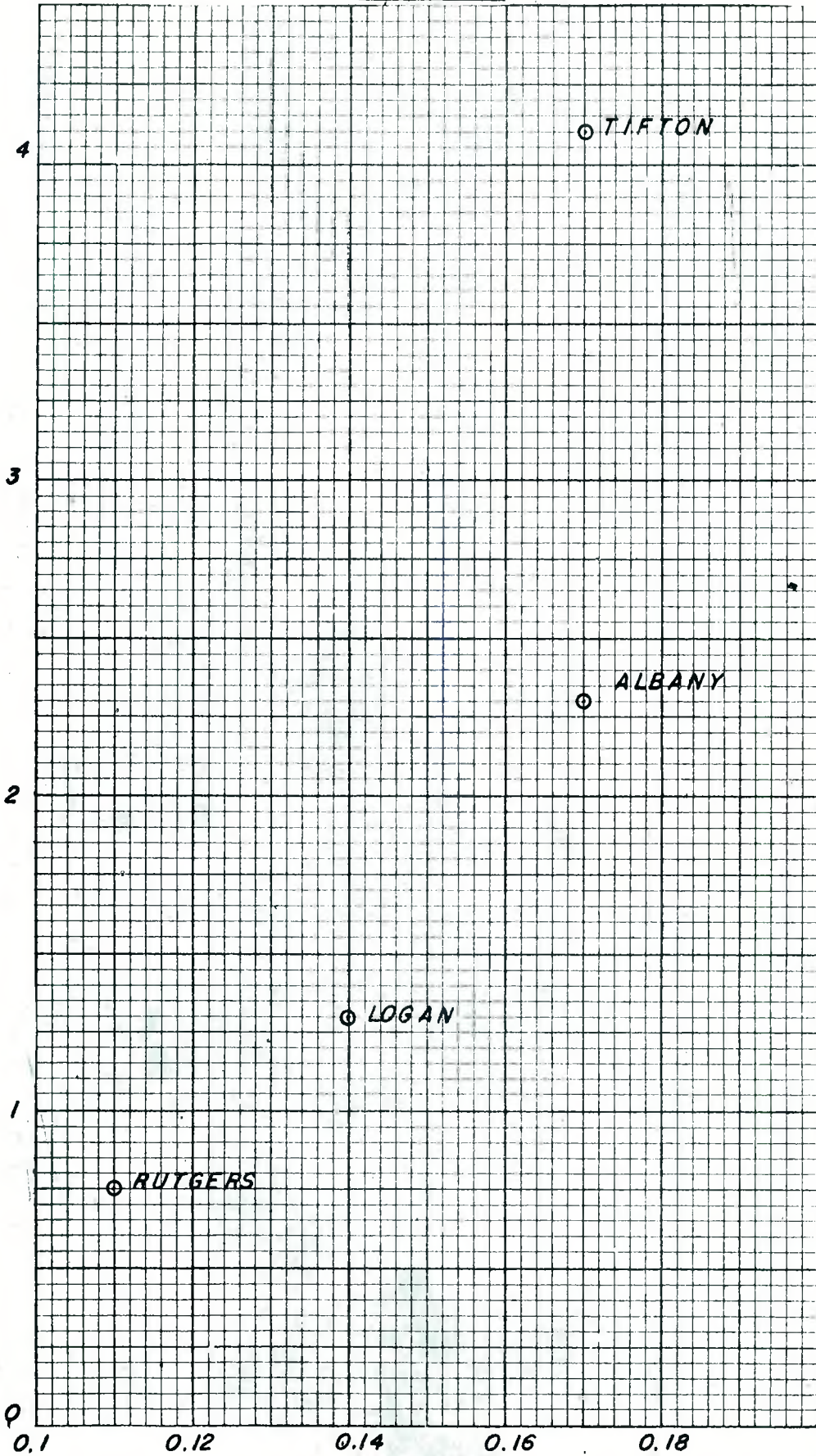
II. RELATIONSHIP BETWEEN RADIOSTRONTIUM AND STABLE STRONTIUM  
IN BONE

The uptake of stable strontium and radiostrontium increases at the pasture sites according to the amount of available calcium in the soil. NYO-4571 reports this relationship for radiostrontium and Graph 1 of this report shows the stable strontium relationship.

Graph 3 shows an apparent relationship between radiostrontium and stable strontium in the bones of livestock which grazed at each of the pasture sites. This relationship verifies the dependence of strontium uptake upon the available calcium in the soil. Strontium, radio or stable, will be found in the bones of livestock in increasing quantities where available calcium in the soil is low.

GRAPH 3

RADIOSTRONTIUM IN BONE (D/M/GM. ASH) EXTRAPOLATED TO 1/1/54



NORMAL STRONTIUM IN BONE (MG/GM)

~~SECRET~~  
**Table 13 a**

**III. COMPARISON OF LEACHING AGENTS AND A COMPLETE SOLUTION Fusion METHOD FOR RECOVERY OF STRONTIUM FROM SOIL**

(Samples Collected 1954)

Table A gives the values obtained from the use of 0.1N HCl, 6N HCl, 1 molar ammonium acetate, and a complete solution method for the recovery of stable strontium from soil. The highest values were obtained with the complete solution method. The higher the exchangeable calcium, the greater the difference between the values obtained from the ammonium acetate leach and the complete solution values.

*BB*  
*[Handwritten signature]*

**TABLE A**

<u>Location</u>	<u>0.1N HCl</u> <u>mg/gm</u>	<u>6N HCl</u> <u>mg/gm</u>	<u>1M NH<sub>4</sub>Ac</u> <u>mg/gm</u>	<u>Complete</u> <u>Solution</u> <u>mg/gm</u>	<u>Available</u> <u>Ca (meq/100gm)</u>
Rutgers	.050	.082	.052	.076	5.4
Albany	.021	.023	.013	.043	4.3
Logan I	.036	.040	.014	.037	Calcareous
Logan II	.037	.047	.022	.038	Calcareous
Tifton	.022	.025	.023	.030	0.6
Ithaca	.027	.027	.018	.042	9.9

~~SECRET~~

IV.  $\text{Sr}^{90}$ , RADIUM, AND STABLE STRONTIUM CONTENT OF LIVESTOCK BONE ASH DURING 1953

Table B gives the results of  $\text{Sr}^{90}$ , radium, and stable strontium concentrations found in livestock bones in 1953. All livestock from each site was approximately one year old at the time of slaughtering and had grazed in pastures at each site during the summer and early fall of 1953.

TABLE B

<u>Location</u>	<u><math>\text{Sr}^{90}</math> d/m/gm</u>	<u>Ra d/m/gm</u>	<u>Stable Strontium mg/gm</u>
Rutgers	1.0	.099	0.11
Albany	2.9	3.7	0.17
Logan I	1.0	2.7	0.14
Logan II	0.5	—	—
Tifton	3.0	<u>3.4</u>	0.17
Ithaca	0.9	.048	0.18



SUMMARY

- I. Present studies indicate a possible relationship between exchangeable calcium in the soil and the uptake of radium and stable strontium in livestock. This corresponds to the apparent relationship shown in NYO-4571 for radiostrontium and exchangeable calcium. Further studies are in progress on samples obtained in 1954.
  
- II. Where there is an increase of stable strontium in bone, there is an increase in radiostrontium.
  
- III. A study of techniques for recovering soil strontium was made. The two hydrochloric acid leaches of the soil show comparable amounts of stable strontium, while the ammonium acetate leach was lower. The complete solution technique recovered larger amounts of stable strontium at each site than the ammonium acetate leach technique.