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NRDL MARSHALL ISLAND RESURVEY - 1956

RESULTS OF ANALYSES PERFORMED AT HASL

Laboratory Report 56-7

by

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During February of 1956 a survey team from the U. S. Naval Radiological Defense Laboratory collected samples of marine life, land plants, water and soil, and lagoon and ocean water on or near selected islands in the Marshall group. Some of the collected samples were sent to HASL for fission product analysis. In some cases portions of specimens were retained at NRDL for inter-laboratory cross-checking purposes. A complete listing of samples received including those selected for analysis is given in Table 1.

The marine, water, and urine samples were received in good condition but many of the vegetation specimens were in a severe state of decay upon arrival at HASL. Furthermore, some samples were received unsealed so that the contents had leaked out and were on the outside of their own and other containers. It was felt that this could be a source of cross contamination in addition to the loss of the leaking samples.(1) For this reason and because of limited time and manpower, only selected samples were subjected to analysis. However, all of the marine and vegetation samples received (with the exception of coconut shell) were wet-ashed using nitric acid, diluted to known volumes, and stored

in polyethylene containers. Concentrations are based on the weight of the material at the time it was received at HASL. Consequently, all radiochemical and analytical results are reported here in terms of d/m or grams, per gram of material as received at HASL. Dr. H. Weiss has stated via letter(2) that the wet weights of the plant specimens were not recorded at the time of collection. He has proposed that the results be expressed in terms of d/m/kg of material as received at NRDL.

For determination of total beta activity an aliquot of the solution of wet-ashed material was transferred to a glass planchet, evaporated and dried under an infra-red lamp. Counts were converted to disintegrations by applying a geometry factor based on K^{40} as a standard. A self-absorption correction was also applied in each case.* Under the wet ashing and plating conditions used at HASL possible loss of volatile fission products such as Ru^{106} - Rh^{106} is avoided.(3) For practical reasons, the coconut outer and inner shells were dry ashed at 500°C prior to dissolution.

* For the particular specimen type under consideration, several values of activity vs. dry weight of the plated aliquot were plotted and a smooth curve fitted for the points. Another curve (based on extrapolation to zero mass) of activity ratio (A/A_o) was drawn and used for determining the self-absorption correction. See Figures 2 through 8.

The procedure outlined in NYO-4617 was followed for the radiochemical analysis of Sr^{90}. The Cs^{137} analyses were performed by S. Tarras using a method which to date has not been documented. It involves the coprecipitation of cesium with ammonium alum to eliminate mixed fission products as well as potassium, then a final precipitation as the chloroplatinate. Radiochemical and gravimetric yields of 95% are attainable. The samples were analyzed for calcium by C. Baxter employing the oxalate-permanganate titration method(4).

As a check on radiochemical purity, beta absorption analyses were carried out by N. Hallden(5) on the Cs^{137} fractions of two pooled urine samples (specimens collected at Utirik and Likiep), one water sample (HASL #3457), and one soil (HASL #3462). In each case Cs^{137} was positively identified and there was no evidence of other interfering isotopes. The radioactive decay of the Y^{90} fractions of the urine samples was followed over a period of one hundred hours. Within statistical limits concurrence with the theoretical half-life was observed.

Analytical results are shown in Tables 2 through 6. The error term accompanying each absolute result represents one standard deviation due to the error in counting. The only available interlaboratory cross-check data are given in Table 7. These

results were obtained from Dr. S. Cohn by phone on April 24, 1956. A follow-up letter from Dr. Cohn[6] expressed his idea that the discrepancy in the beta count probably lies in the conversion from c/m to d/m. NRDL used Sr^{90} - Y^{90} as a standard in this case and for purposes of comparison, the HASL results were also standardized against Sr^{90} - Y^{90}. It is felt that the use of K^{40} as a standard allows the best approximation of the energy for mixed fission products among the available long-lived isotopes[7].

As an aid in evaluating these data, Figure 1 and Table 8 are included.

REFERENCES

1. Memorandum from Dr. J. H. Harley to Mr. M. Eisenbud, "Rongelap Resurvey Samples from NRDL", April 17, 1956.

2. Letter of May 9, 1956 from Dr. H. Weiss to Edward Hardy.

3. Memorandum from G. Hamada to Dr. J. H. Harley, "The Effect of the Wet Ashing Technique Used at HASL on Ruthenium Volatilization", March 29, 1956.

4. Private communication, Mr. I. B. Whitney.

5. "Analyzing Beta Absorption Graphically to Identify Emitters", J. H. Harley and N. Hallden, Nucleonics, 13, 1, January 55, pp 32-35.

6. Letter of May 2, 1956 from Dr. S. Cohn to Mr. I. B. Whitney.

7. HASL Laboratory Report 56-1, "Standardization and Operation of Fallout Counters", N. A. Hallden and J. H. Harley.

TABLE 1

NRDL MARSHALL ISLAND RESURVEY - 1956

Samples Received at HASL

(samples analyzed at HASL shown in parenthesis)

MARINE ORGANISMS - 65 (23), received 3/6/56

	Rongelap	Gejen	Eniaetok	Eniwetak	Sifo	Utirik	Likiep	Kabelle
Fish - 37 (13)								
Unicorn	1			1				
Mullet	1							
Surgeon	1 (1)	1 (1)		1 (1)		2 (2)		
Damsel	1 (1)			1 (1)		2 (2)	1 (1)	1 (1)
Sea Cucumber	1							
Bl. Tip Shark								1
Trigger								1
Siganus					1		1	1
Butterfly					1 (1)		1 (1)	1 (1)
Snapper		1		1	1			
Squirrel		1			1	1		
Parrot			1		1	1		
Angel			1		1			
Goat			1					
Sergeus					1			
Sea Bass							1	
Crab - 11	3	1	1		3	3		
Clam - 2	2							
Snail 9 (4)	2	4 (4)*				2		1
Coral 6 (6)	1 (1)	1 (1)	1 (1)			2 (2)	1 (1)	
LAND PLANTS - 77 (14), received 4/3/56								
Coconuts - 26 (5)	3 (3)	3	4	4	4	4 (1)*	4 (1)*	
Portulaca 6	1	1	1	1		1	1	
Pandanus - 18 (2)	3 (2)*	2	3	2	2	3	3	
Papaya - 9	3					3	3	
Arrowroot 14 (7)	2 (1)*	2 (1)*	2 (1)*	2 (1)*	2 (1)*	2 (1)*	2 (1)*	
Banana - 2							2	
Taro - 2							2	
SOIL - 21 (13), received 4/3/56	3	3 (2)*	3 (3)*	3 (2)*	3 (2)*	3 (2)*	3 (2)*	
LAND WATER - 7 (6), received 4/3/56								
Well - 4 (4)						2 (2)	2 (2)	
Cistern - 2 (1)	1 (1)					1 (1)*		
Lens - 1 (1)			1 (1)					
SEA WATER - 14 (14), received 4/3/56								
Ocean - 7 (7)	1 (1)*	1 (1)*	1 (1)*	1 (1)*	1 (1)*	1 (1)*	1 (1)*	
Lagoon - 7 (7)	1 (1)*	1 (1)*	1 (1)*	1 (1)*	1 (1)*	1 (1)*	1 (1)*	
URINE - 24 (24), received 3/29/56	5 (5) (Majuro)					10 (10)	9 (9)	

* Interlaboratory cross-check samples.

TABLE 7

NRDL MARSHALL ISLAND RESURVEY - 1956

INTERLABORATORY COMPARISON

(Snail Solutions Prepared at NRDL from Specimens Collected on Gejen Island)

HASL #	NRDL #	Type	Total β Activity (d/m/gram-wet) HASL*	HASL†	NRDL°	Total γ Activity (d/m/gram-wet) NRDL	Sr^{90} (d/m/gram-wet) HASL	NRDL
3326	1636	Spider	520± 10	570± 11	877	378	4.4±0.39	
3327	1637	Spider	2180± 29	2400± 32	2965	1605	1.3±0.34	
3328	1638	Scorpion	23310±290	25600±300	29700	9150	1.1±0.44	
3329	1639	Scorpion	9800±120	10800±125	11250	4640	1.5±0.58	

* Standardized against K^{40}

† Standardized against Sr^{90}- Y^{90}

o Standardized against Sr^{90}- Y^{90}

NOTE: Wet weights furnished by NRDL
NRDL results forwarded by phone to I. B. Whitney
from S. Cohn on April 24, 1956.

TABLE 8

NRDL MARSHALL ISLAND RESURVEY - 1956

TOTAL β ACTIVITY - d/m/gram*

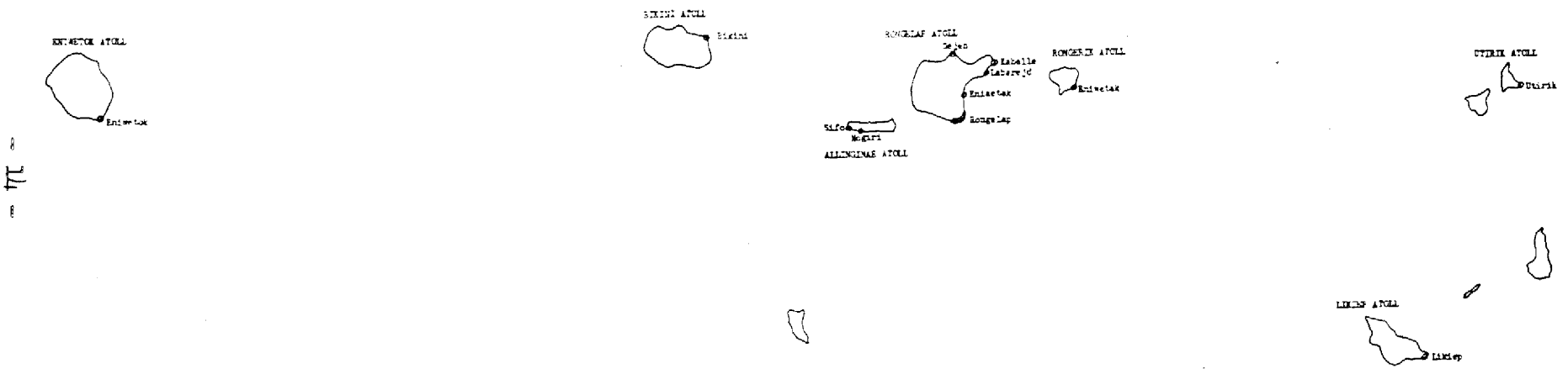
	Rongelap	Eniaetok	Kabelle	Gejen	Eniwetak	Sifo	Utirik	Likiep
FISH								
Surgeon	52				34		22; 18	
Damsel	37		120	230	20		14; 22	11
Butterfly						95		51
CORAL	35	200		310			≤18; 21	≤15
SNAILS								
Spider				520; 2200				
Scorpion				23,000; 9800				
LAND PLANTS								
Coconuts								
Outer Husk	71;66 } 26						} 51	} 10
Inner Shell	26;35 }							
Meat and Milk	98;87							
Milk	43							
Pandanus	42; 30							
Arrowroot	lost	180		300	67	59	26	7.3
SOIL		290; 65; ≤41		69,000; 120	3000; ≤61	620; ≤57	1600; ≤73	≤53; ≤65
LAND WATER**								
Well							≤20; ≤19; 28	≤20
Cistern	1500						43	
Lens		560						
SEA WATER**								
Ocean	49	≤23		≤18	25	≤19	≤21	45
Lagoon	≤26	≤20		≤21	≤19	≤20	≤19	≤20

* Weight of material as received at HASL

** Samples scavenged with $Fe(OH)_3$

FIGURE 1

LAYOUT SKETCH OF PORTION OF MARSHALL ISLAND AREA



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SELF-ABSORPTION CURVES

FIGURE

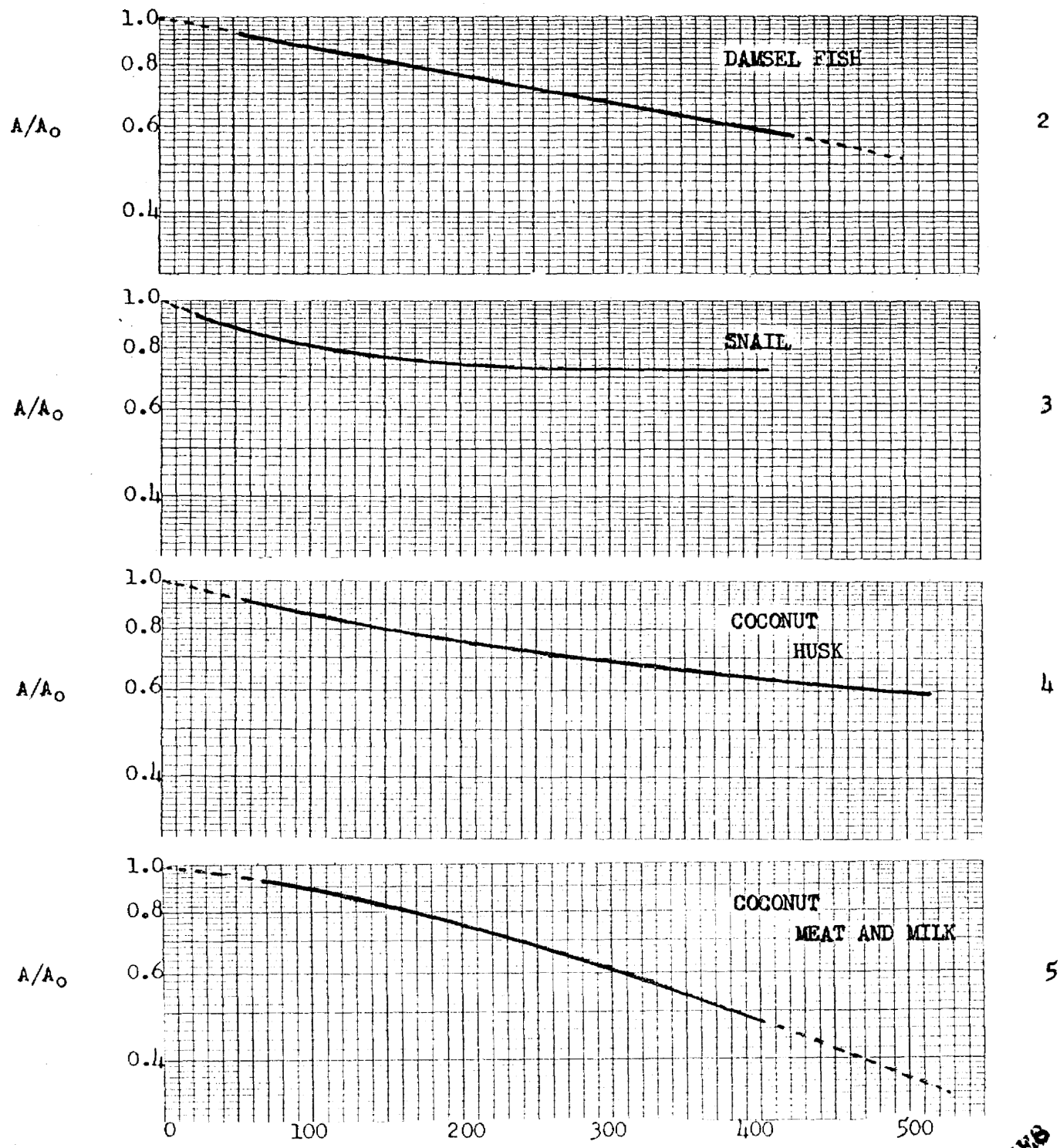

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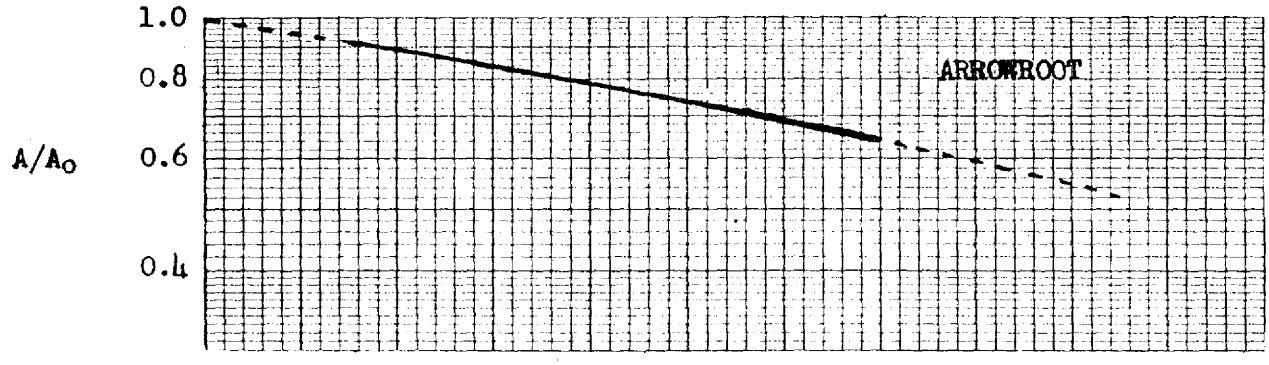
FIGURE



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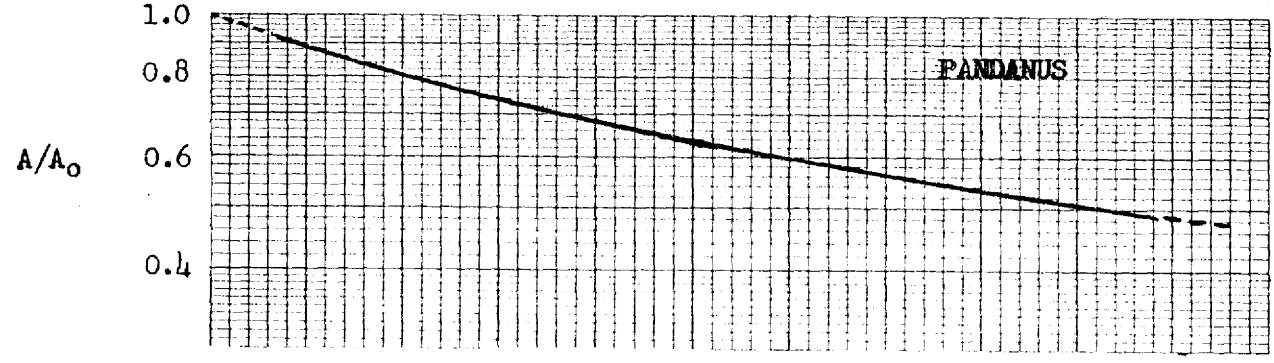

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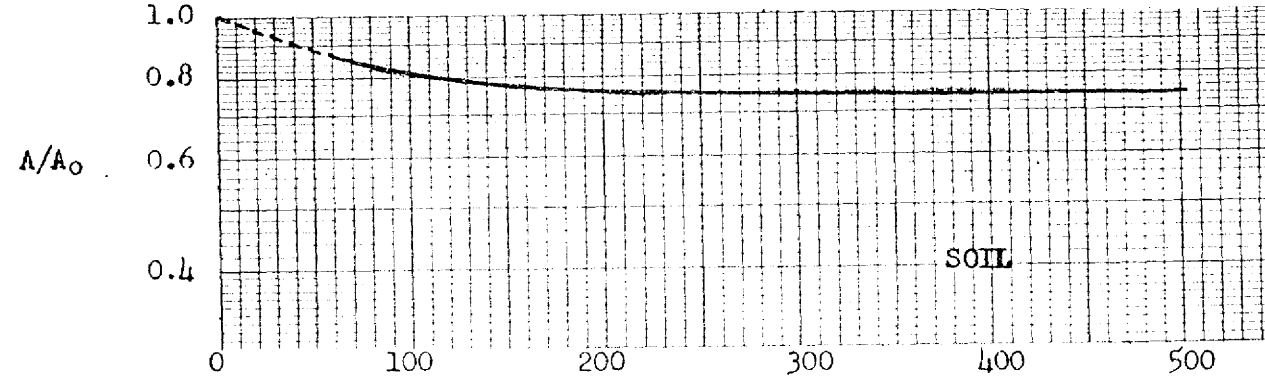

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Residue Weights in Milligrams