

"EVIDENCE FOR AN ELECTROLYTICALLY INDUCED SHIFT IN THE ABUNDANCE RATIO OF SR-88 TO SR-86"

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ABSTRACT

Compelling preliminary strong evidence is presented for an electrolytically induced shift in the ratio of Sr-88 to Sr-86. Since the natural abundance ratio of these two isotopes is constant, this shift would, if corroborated, constitute a unique signature of cold nuclear reactions.

INTRODUCTION

Since the natural abundance ratio of Sr-88 to Sr-86 is a constant, it is of some interest that compelling preliminary evidence [3,5,7,10] strongly suggests the achievement of electrolytically stimulated shifts in the ratio of these isotopes amounting to many standard deviations as determined from mass spectrometric analyses. Such shifts, if confirmed, constitute a unique "signature" of cold nuclear reactions in the condensed matter environment of the cathode. Mass spectrometric evidence (SIMS and ICPMS with the latter preceded by an ion-exchange column separation of strontium and rubidium) provide strong preliminary evidence for the electrolytically stimulated production of the strontium isotopes Sr-86 and Sr-88 resulting in a shift in the natural abundance ratio. The two electrolytic cells employed nickel mesh cathodes and light water based 0.57 M rubidium salt electrolytes. The fact that the SIMS analysis yielded a ratio of Sr-88 to Sr-86 approximately equal to the natural abundance ratio of Rb-87 to Rb-85 provides support also for the author's CAF Hypothesis [3] ("Cold Alkali Fusion"), which seeks to unify the heavy water [1] and light water [2] excess heat effects. The author's LANT Hypothesis [6] ("Lattice Assisted Nuclear Transmutation"), which is a generalization of CAF, also receives support from the calorimetric and mass spectrometric results.

CELL DESIGN and CALORIMETRY

Cell and calorimeter design for the two cells of interest have been previously presented in references [3, 7, and 10]. In addition, R. Eagleton [13], the author's research colleague, has submitted a detailed recitation of these for all the light water cells of our research collaboration. [See paper by R. Eagleton in this publication.] (These cells were constructed by Eagleton, but designed by the two of us with essential design features driven by considerations based upon the author's theoretical work. Essentially all of the data has been gathered by the author with Eagleton playing the key role in maintaining the equipment. Data analysis and theoretical work in understanding the data is carried out by the author with Eagleton playing an important part as a sounding board for the theoretical interpretations.) [See Eagleton's paper for description of the cells.]

SIMS Analysis (Post-run Cathode of Cell 53)

The post-run cathode material for cell 53 evidences strong signals at mass numbers 86 and 88 of the SIMS mass spectrograph (Fig.1) compared to that for the pre-run cathode material (Fig. 2). (Analyses of pre-run and post-run electrolyte samples via mass spectrometry for both cell 53 and 56 has limited strontium concentrations to less than approximately 5 ppb in the electrolyte samples of about 50 ml

volume.) Fig. 3 and Fig. 4 contain the mass spectrographs, respectively, for the following respective cases: Post-run cathode material (cell 53) 100-200 amu and pre-run cathode material (cell 53) 100-200 amu. Appendix S provides a table of data from the original lab report. See also reference [10]. The text of Appendix A can be obtained by writing to the author. (SIMS tests were performed by a well-known U.S. National Laboratory which prefers to remain anonymous at this time.)

A key fact from the author's CAF Hypothesis is the fact that the ratio of the line height for mass number 88 to that for 86 (Fig. 1) is approximately the same as that for the ratio of the rubidium signals for masses 87 and 85. According to CAF these rubidium isotopes are the parents of the strontium isotopes by way of the addition of a proton in a cold nuclear reaction which differs greatly from thermonuclear reactions. An alternative interpretation is that the signals at mass numbers 88 and 86 (Fig. 1) are actually associated with rubidium hydride, has been rejected for two reasons: (1) the mass signal for rubidium oxide, a much more stable compound than RbH, in the post-run spectrum (Fig. 3) is lower than that for the putative RbH. (2) The ICPMS mass spectrometric analysis has verified the production of a significant shift in the ratio of Sr-88 to Sr-86, as discussed in the following section.

ICPMS Analysis Following an Ion-Exchange Column Separation

The analysis of the pre- and post-run cathode materials for cell 53 and cell 56, the latter used rubidium hydroxide (0.57 M) instead of rubidium carbonate in the light water based electrolyte and generated about five times as much excess heat as cell 53 [3,7,10]. The analyses [3,7,10] consisted of ICPMS ("Inductively Coupled Plasma Mass Spectrometry) mass spectrometry preceded by an ion-exchange column separation of the divalent strontium from the monovalent rubidium. The analyses shows that this separation provided enough enrichment of the strontium relative to the rubidium to guarantee a meaningful ICPMS measurement of the ratio of Sr-88 to Sr-86.

The mass spectrograms of Fig. 1 and Fig. 2 were carried out by SIMS analysis, respectively, for the postrun cathode material and for the prerun cathode. (Earlier measurements established an upper limit on strontium in the post-run electrolyte (cell 53) of 5 ppb.) Note the following from Fig. 2 (Prerun):

Fig. 2 (Prerun): Mass 86: Signal height of 3.6 cm corresponds to 190 counts.

Nickel 58: 10.0 cm signal height: 1,250,000 counts.

Fig. 1 (Postrun): Note that signal height discrimination is greater than that for Fig. 2. (Fig. 2 had a 50 V offset, and Fig. 1 a 125 V offset. Thus, in comparing signal heights are corrected using the ratios of the Nickel signals from both (ratio = 40.3):

Mass 86: 3.25 signal height: 36 counts
Mass 88: 2.6 cm signal height: 16 counts

Corrected counts from Fig. 1 to compare with those in Fig.2:

Mass 86: 36 x 40.32 = 1,452 counts
Mass 88: 16 x 40.32 = 645

Ratio of Sr-86 to Sr-88: (Corrected for background in Fig.2): = (1,452-190)/(645-150) = 2.55. (1)

Note: the natural abundance ratio of Sr-86 to Sr-88 is approximately: = 0.12. (2)

Thus, we have an isotopic abundance ratio shift by a factor of 2.55/0.12 = 21. (3)

Note: the natural abundance ratio of Rb-85 and Rb-86 is about = 2.59. (4)

Nota Bene: The ratio in (1) so closely matches (4) which is strong support for Bush's hypothesis that

the strontium arises from the rubidium via the addition of a proton at the surface of the nickel.

Using the analytical data, for cell 53, the ratio of Sr-88 to Sr-86 is 3.504 ± 0.002 , which is lower than the ratio for the standard and the pre-run cathode materials by about 716 standard deviations. Similarly, for cell 56 the ratio of Sr-88 to Sr-86 for the post-run cathode material is approximately 2.731 ± 0.003 , which is about 826 standard deviations below the ratio for the pre-run cathode materials. Note that the fact that this ratio is lower than that for cell 53 is consistent with the fact that cell 56 gave much more excess heat than did 53 and the CAF Hypothesis according to which excess heat is associated with the amount of nuclear product. Therefore, there is compelling preliminary experimental support for electrolytically stimulated transmutation and the author's CAF Hypothesis [3,5,7,10]. **It is important to note that contamination of the cell by material containing strontium would not produce a spurious shift in the isotope ratio.** For that reason, this isotope shift result is much stronger evidence than an elemental shift such as the claimed production of calcium [3,4] in the case of a light water based potassium carbonate electrolyte for which the contamination issue is paramount because of the ubiquitous presence of calcium in the general environment. This shift in a ratio that is otherwise constant in nature, assuming that it can be corroborated, appears to be a unique signature of cold nuclear reactions [3,5,7,10].

The LANT ("Lattice Assisted Nuclear Transmutation") Hypothesis

The author's LANT Hypothesis [6] ("Lattice Assisted Nuclear Transmutation") is a generalization of the author's CAF Hypothesis. Applied to the isotopes of hydrogen, LANT essentially states that a hypothetical cold nuclear reaction made possible by the lattice structure of a metal (such as nickel or palladium) in which a proton, deuteron, or triton is added to another nucleus is possible if the sum of the rest-mass energies of the reactants is greater than that of the products. (Of course, in addition to mass-energy conservation, no Laws of Physics should be violated.) The difference (surplus) in rest-mass energy is assumed to show up initially as phonons and the kinetic energies of the products. Because the reactions are cold, it is a good approximation to ignore the kinetic energies of the reactants.) Due to various degradation processes, essentially all of the surplus energy would quickly degrade to what is referred to as "excess heat" in connection with the heavy water [1] and light water [2] excess heat effects.

According to the LANT model [6], the Sr atoms formed in the lattice would themselves become targets for the lattice assisted addition of a proton. The Table of Fig. 5 entitled "Isotope Production via Cold Nucleosynthesis: Rubidium Series" [6,7,10] contains isotopes for which evidence of production in connection with the operation of cell 53 is provided by a comparison of the post-run and pre-run SIMS spectrographs of Fig. 1 through Fig. 4. Note from the Table that the total excess heat theoretically produced in connection with the isotopes synthesized is $(3.8 \pm 0.4) \times 10^{19}$ MeV, whereas the actual excess heat determined for cell 53 via calorimetry was about $(4.0 \pm 0.8) \times 10^{19}$ MeV. This computation provides strong initial support for the LANT.

THE COULOMB BARRIER: Can there be Sufficient Tunneling for Genuine Cold Fusion?

It is the author's opinion that the cold nuclear reactions constitute genuine cold fusion in which the width of the Coulomb barrier is sufficiently narrowed due to shielding by electrons to stimulate sufficient quantum mechanical tunneling to achieve the fusion rates inferred from experimental excess powers. Of course, this begs the question of how the electrons are enabled to increase their proximity to the positively charged particles to achieve the shielding. Two proposals to explain this effect were previously suggested: (1) In an earlier paper [3] it was recalled that s-state electrons can exist for a small fraction of the time inside a proton (light water case) or a deuteron (heavy water case) during

which time there is a much-narrowed Coulomb barrier experienced by a second charged particle colliding with the combination. The difference between an ordinary deuterium or hydrogen gas (or mixture) sealed in a glass jar and a deuteron (proton) "gas" sealed in a solid (e.g. palladium or nickel) by an electric field, or gas pressurization, will simply be a consequence of the greater opportunities for electrons in the solid to achieve s-state status vis-a-vis the deuterons (protons). Thus, one might conceive of a situation in the solid where a single electron in a zero angular momentum state passes periodically through an entire line of deuterons (protons) charge-neutralizing each in turn as it passes through. (2) Electron collapse into a sufficiently reduced-radius orbit because of a limitation on the energy density of the zero point electromagnetic field achieved in the condensed matter environment. Thus, Puthoff [12], building upon the pioneering work of Boyer [11], has shown that the ground state of hydrogen is actually a dynamical state of equilibrium in which the accelerating electron absorbs as much energy from the background zero-point field as it radiates away. This mechanism provides the basis for the author's recent mode [8,9], the ECFM ("Electron Catalyzed Fusion Model"), to attempt to unify heavy- and light-water cold fusion. This is one of the first cold fusion models to consider the zero-point energy field, and the first to fit actual data on excess power versus loading.

CONCLUSIONS

Compelling mass-spectrometric evidence using SIMS and ICPMS (preceded by ion-exchange column separations of strontium and rubidium), although of a preliminary nature, in the form of a significant shift in the ratio of Sr-88 to Sr-86 relative to their natural abundance ratio supports the author's CAF and LANT hypotheses of cold nuclear reactions associated with a condensed matter environment. Additional work is under way to check these preliminary results.

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NOTE: A complete copy of the West Coast Analytical Service, Inc. report is available from the author.

LABORATORY REPORT

Table 1

<u>Date</u>	<u>Sample ID</u>	<u>Sr 86</u>	<u>Sr 88</u>	<u>Total Strontium</u>
4- 8-93	0.01ppm Sr Std	10.48	89.52	10ppb
4- 9-93	0.01ppm Sr Std	10.48	89.52	10ppb
4-13-93	0.01ppm Sr Std	10.56	89.44	10ppb
4-14-93	0.01ppm Sr Std	<u>10.53</u>	<u>89.47</u>	10ppb
		10.51±0.04	89.49±0.04	

<u>Date</u>	<u>Sample ID</u>	<u>Sr 86</u>	<u>Sr 88</u>	
4-13-93	100ppm Rb/0.01ppm Sr	10.47	89.53	10ppb
4-15-93	100ppm Rb/0.01ppm Sr	<u>10.55</u>	<u>89.45</u>	10ppb
		10.51±0.06	89.49±0.06	

<u>Date</u>	<u>Sample ID</u>	<u>Sr 86</u>	<u>Sr 88</u>	
4- 8-93	A#53	ND	ND	ND
4- 9-93	A#53	22.2	77.8	1400ppb
4-15-93	A#53	12.05	87.95	NC

<u>Date</u>	<u>Sample ID</u>	<u>Sr 86</u>	<u>Sr 88</u>	
4- 8-93	#56PR	22.3	77.7	NC
4- 9-93	#56PR	26.8	73.2	1500ppb

NC - not calculated

Figure 1. Cathode post-run mass spectrogram.

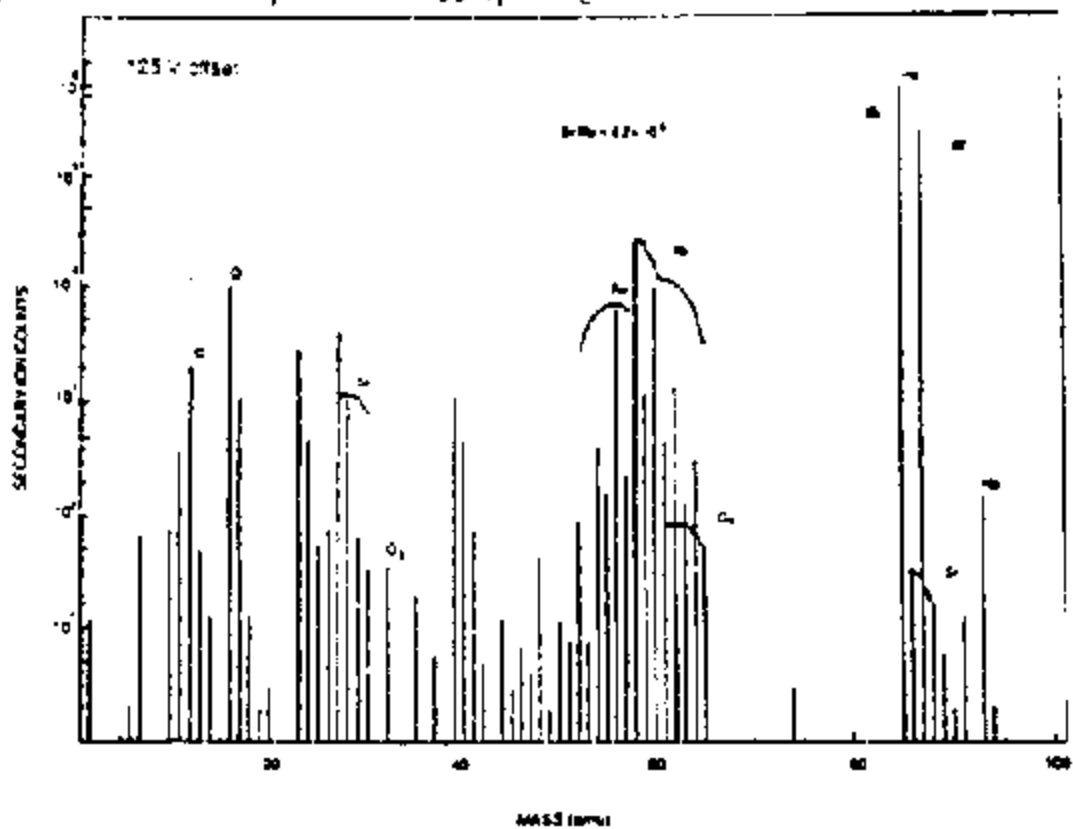


Figure 2. Cathode pre-run mass spectrogram.

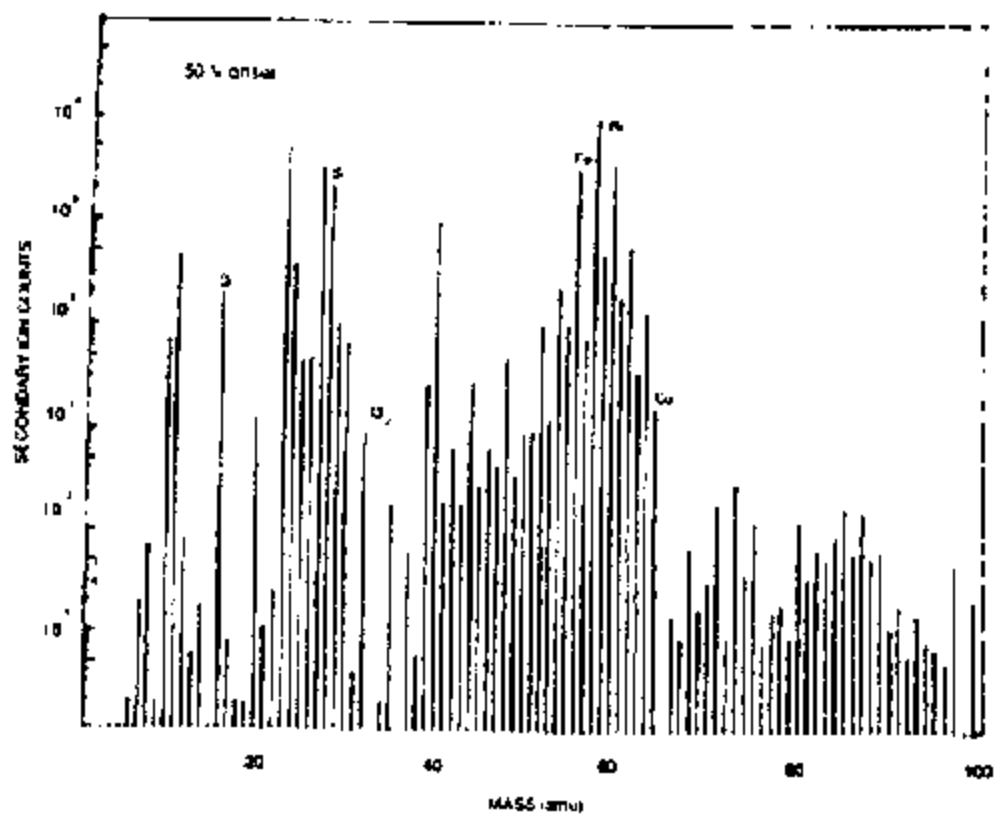


Figure 3. Cathode post-run mass spectrogram

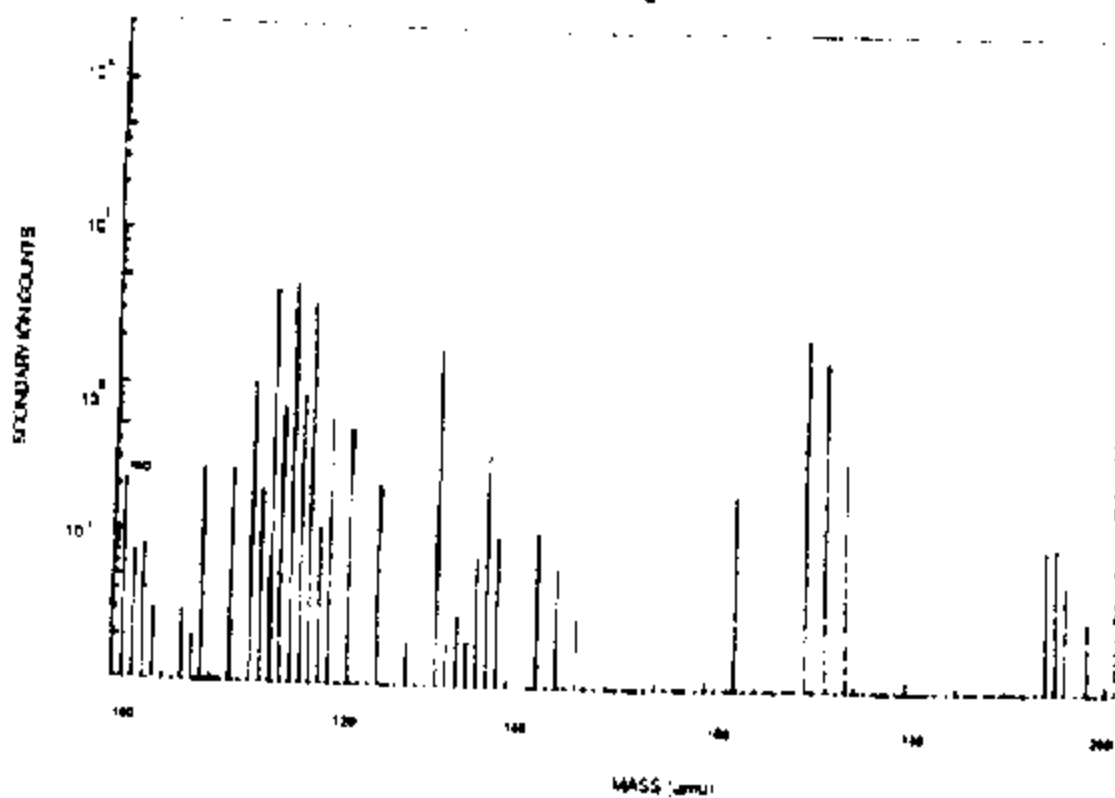


Figure 4. Cathode pre-run mass spectrogram

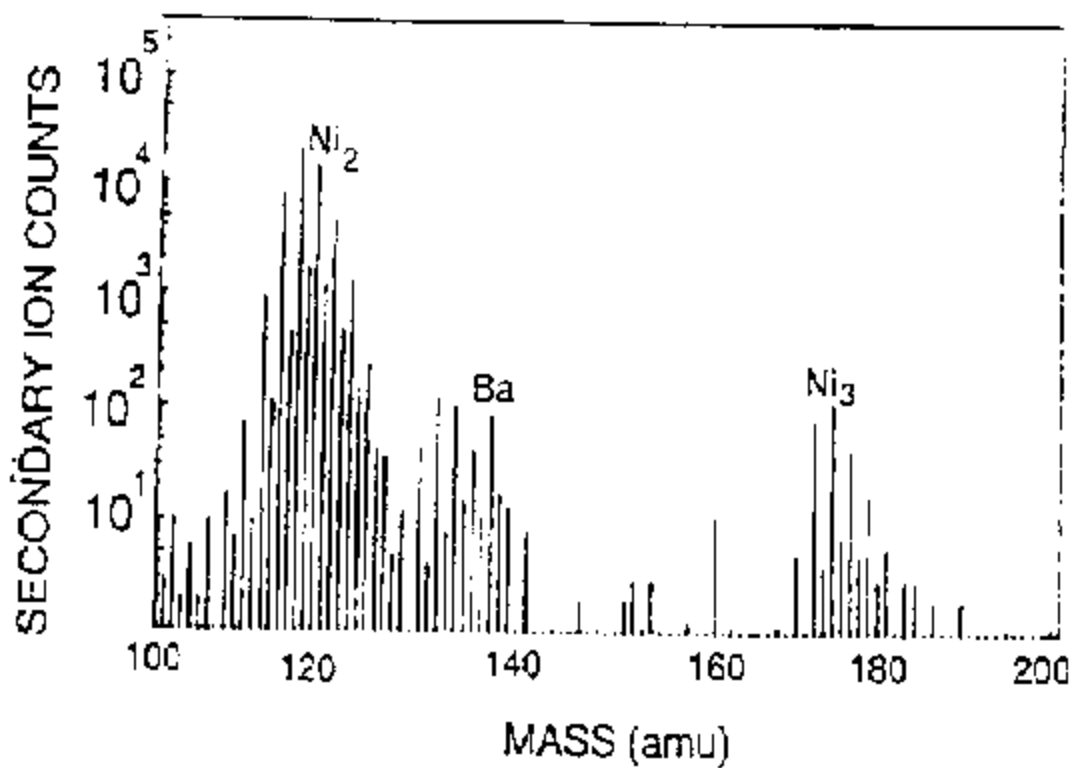


Figure 5

Lattice-Assisted Nucleosynthesis: Rubidium Series

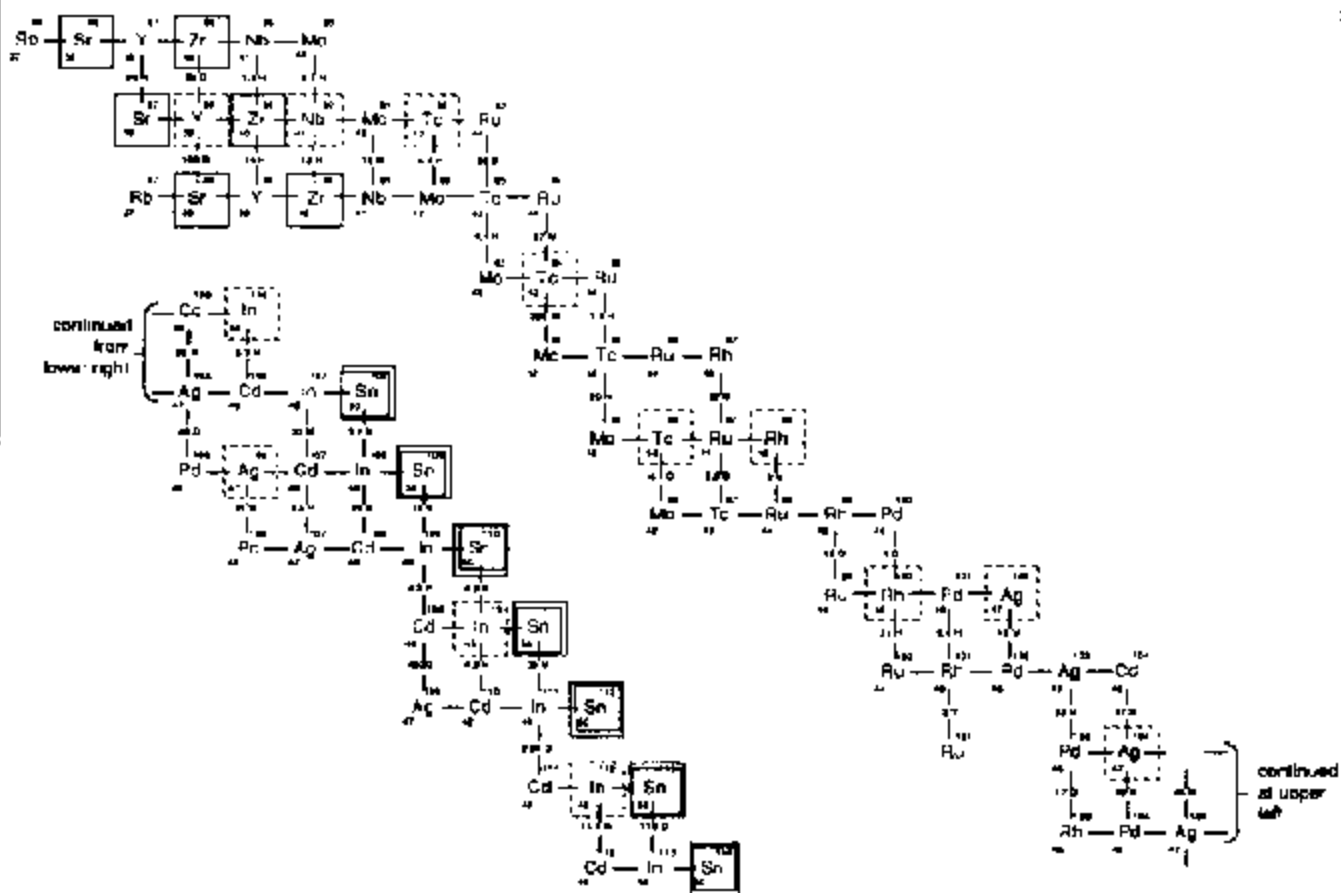


Figure 6

Isotope Production via Cold Nucleosynthesis: Rubidium Series
(Cell 53)

Mass Number (A)	Nuclides Synthesized	Net number of Nuclei Synthesized x 10 ¹⁶	Total Energy Released (MeV x 10 ¹⁷)
86	38Sr ⁸⁶	1.34	1.29
87	38Sr ⁸⁷	19.25	33.30
88	38Sr ⁸⁸ , 39Y ⁸⁸ (108D), 40Zr ⁸⁸ (88D)	0.52	0.55
89	39Y ⁸⁹	1.66	4.6
90	40Zr ⁹⁰	0.28	1.1
91	41Nb ⁹¹	3.00	12.1
92	42Mo ⁹²	(small)	(small)
93	42Mo ⁹³	27.03	148.10
94	42Mo ⁹⁴	0.23	1.43
95	42Mo ⁹⁵	(small)	(small)
96	44Ru ⁹⁶ , 43Tc ⁹⁶ (4.35D)	(small)	(small)
97	43Tc ⁹⁷ , 44Ru ⁹⁷ (2.9D)	(small)	(small)
98	44Ru ⁹⁸	(small)	(small)
99	44Ru ⁹⁹ , 45Rh ⁹⁹ (16.1D)	(small)	(small)
100	45Rh ¹⁰⁰ , 46Pd ¹⁰⁰ (4D)	0.30	3.90
101	44Ru ¹⁰¹ , 45Rh ¹⁰¹ (3v)	3.70	41.30
102	45Rh ¹⁰² , 46Pd ¹⁰²	1.21	14.50
103	45Rh ¹⁰³ , 46Pd ¹⁰³ (17D)	1.40	17.80
104	46Pd ¹⁰⁴	0.54	7.30
105	46Pd ¹⁰⁵ , 47Ag ¹⁰⁵ (40D)	(small)	(small)
106	46Pd ¹⁰⁶ , 48Cd ¹⁰⁶	(small)	(small)
107	47Ag ¹⁰⁷	0.54	7.30
108	48Cd ¹⁰⁸	0.23	3.90
109	47Ag ¹⁰⁹ , 48Cd ¹⁰⁹ (453D)	2.25	39.70
110	48Cd ¹¹⁰	(small)	(small)
111	48Cd ¹¹¹ , 49In ¹¹¹ (2.8D)	(small)	(small)
112	50Sn ¹¹²	2.25	44.60
Sums:		65.73 x 10 ¹⁶	384.17 x 10 ¹⁶ MeV

Estimating a ten percent error, then, the total energy to produce the above based upon the LANT Model is approximately $(3.8 \pm 0.4) \times 10^{19}$ MeV versus the total excess heat determined from calorimetry for Cell 53 of $(4.0 \pm 0.8) \times 10^{19}$ MeV.