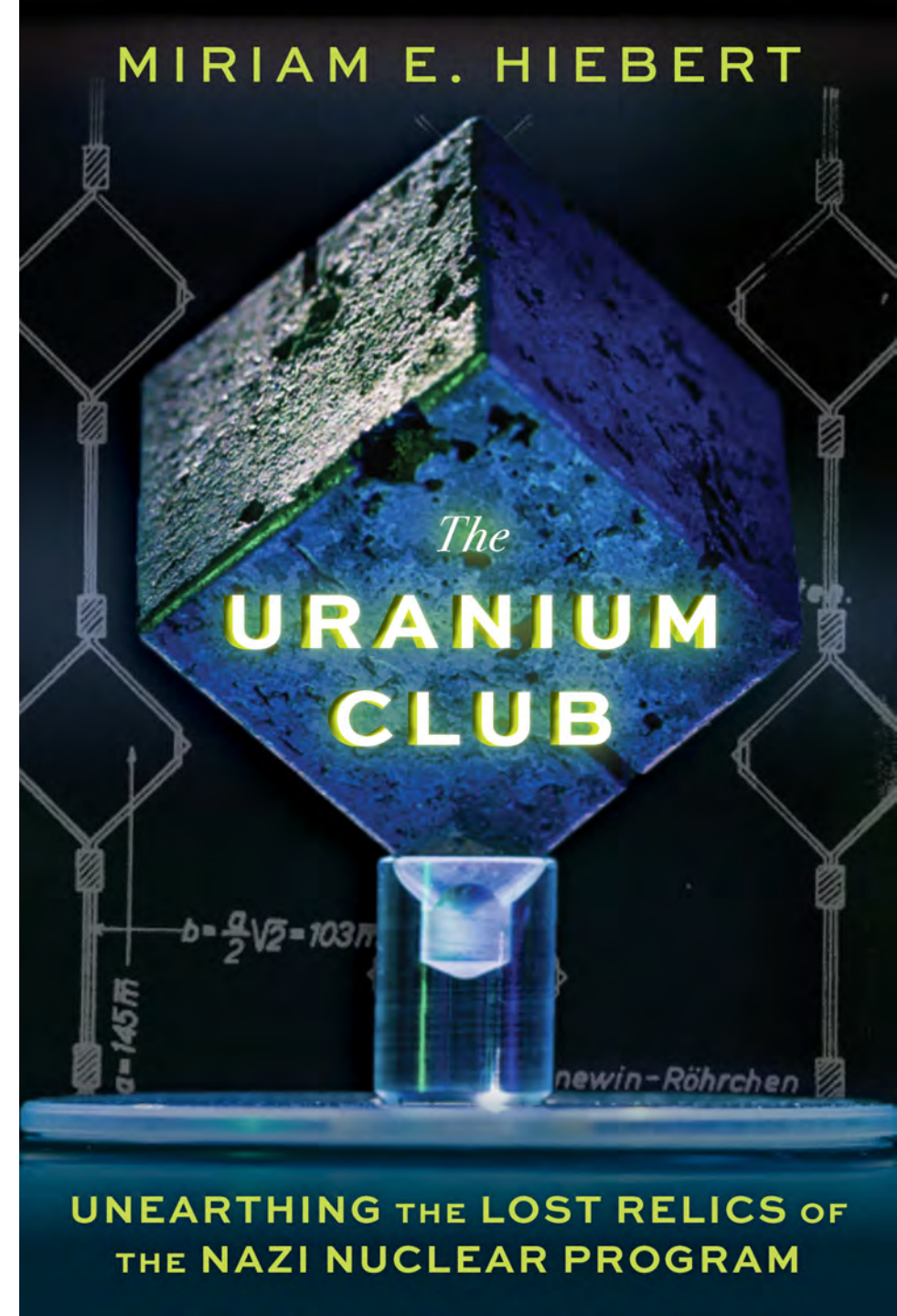
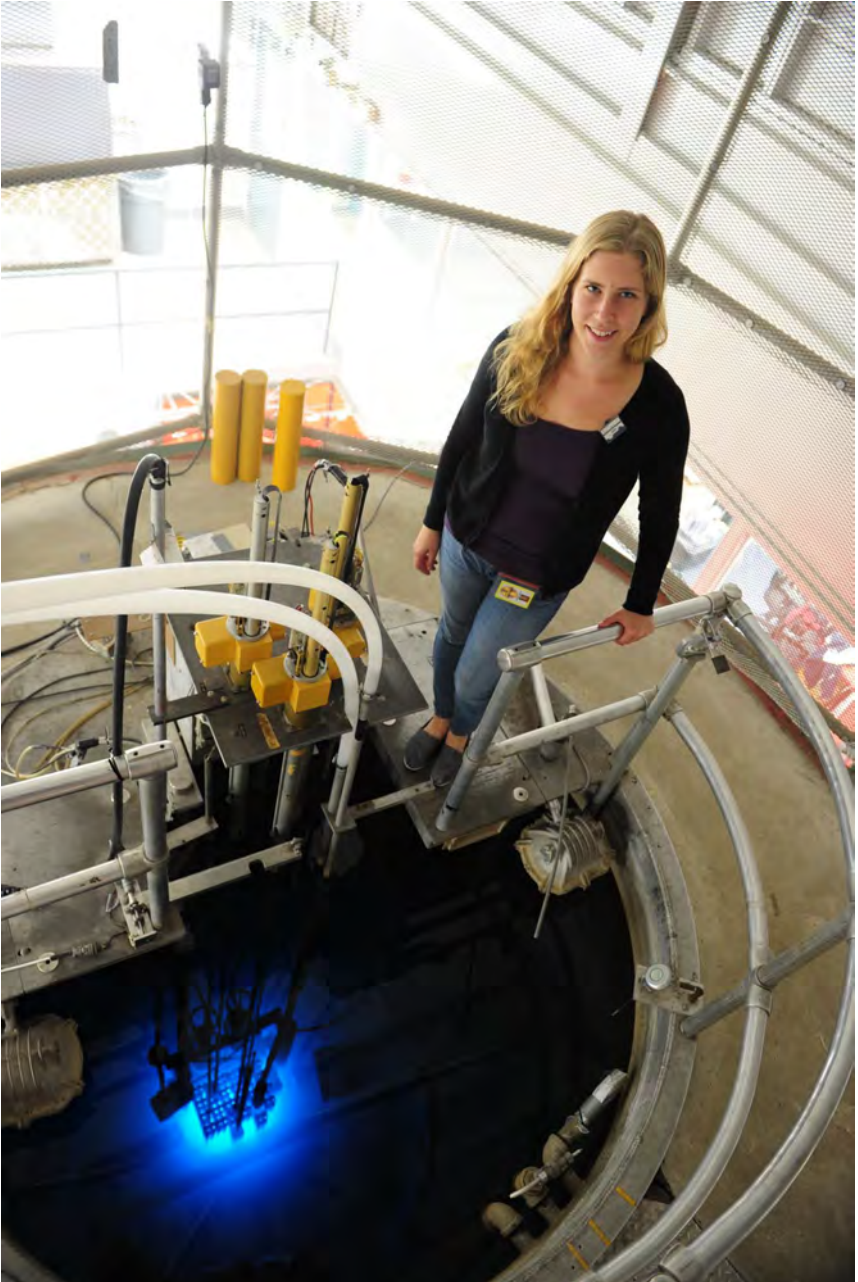


The Uranium Club

Miriam E. Hiebert Ph.D.
APS Senior Physicists Group
College Park, Maryland
October 18th 2023

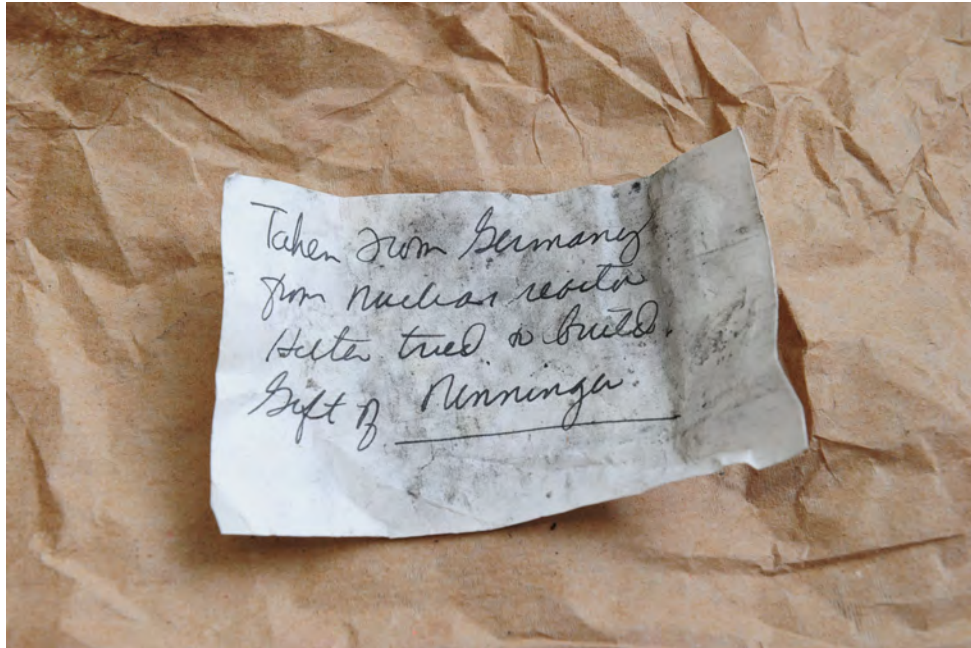


Maryland University Training Reactor

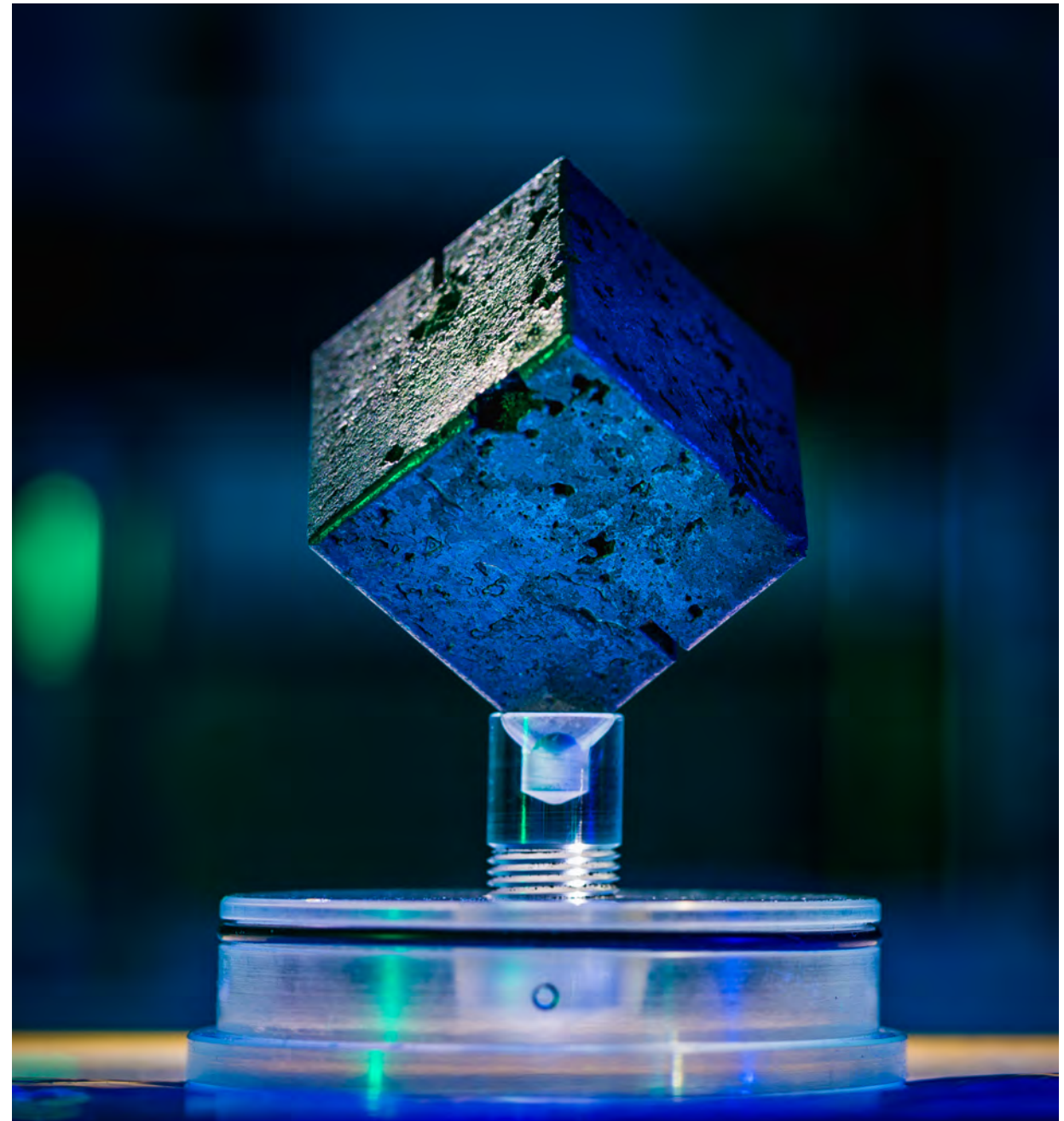


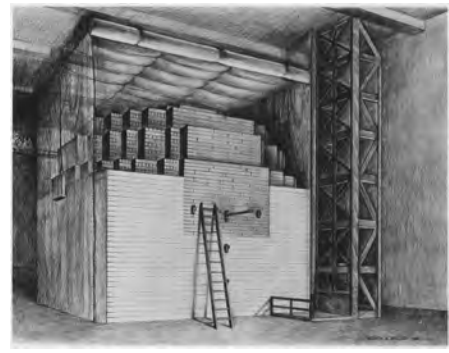
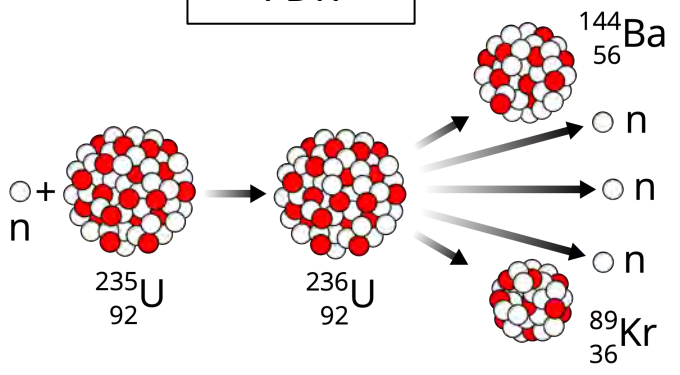
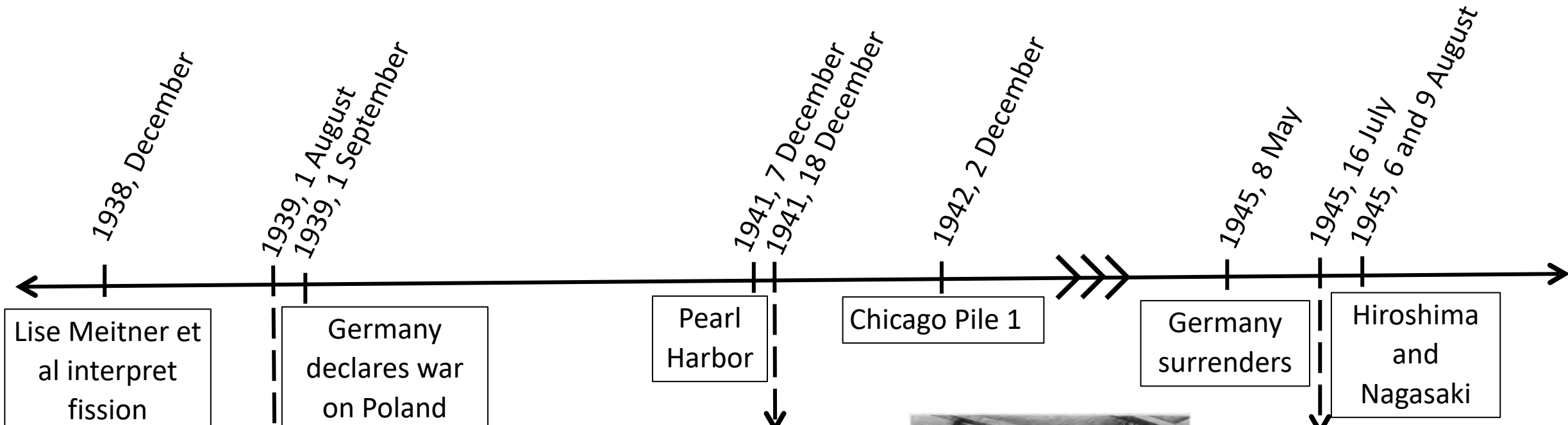
The Cube

Received by Tim Koeth as a gift in August of 2012



“Taken from Germany from nuclear reactor Hitler tried to build. Gift of Ninninger.”





Taken from
Germany...

The Manhattan Project

- The U.S. effort to build the first nuclear weapon
 - Project cost \$2 billion dollars and employed 600,000 people
- Motivated by the assumption that Germany would be well on the way to making their own nuclear weapon
- As Germany began to fall – no nuclear weapon had appeared
- New Goals:
 - Nuclear information/materials
 - Prevent USSR access



General Leslie R. Groves

The Alsos Mission

Top Secret military intelligence mission tasked with acquiring information about the German scientific progress in all fields, with particular focus on the progress of the nuclear program.



Intelligence Lead:
Col. John Lansdale



Military Lead:
Col. Boris T. Pash



Scientific Lead:
Samuel Goudsmit



The Lawyer: John Lansdale Jr.

- Volunteered for service in the Military Intelligence Division
 - First Lieutenant under General Strong, Deputy Chief of Staff for Intelligence (G-2)
- Originally tasked with processing reports of Nazi and Soviet threats to military assets
 - The Berkeley Incident
- Selected to lead Manhattan Project Security by Groves



Lt. John Lansdale Jr.
Intelligence Chief – Alsos Mission

The Solider: Boris Pash

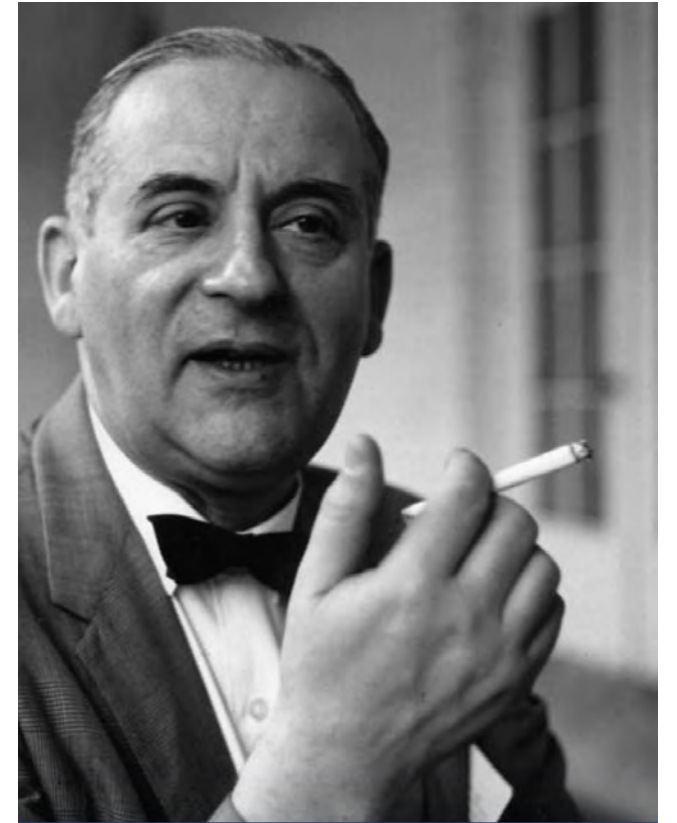
- Born in San Francisco – raised in Russia
- Fought against the Communists during the Russian Revolution
 - Moved back to U.S. when Bolsheviks took over
- Enlisted in the Army in 1940
 - Posted to Western Defense Command (San Francisco)
 - Investigations into USSR espionage
 - Oppenheimer recordings
- Chosen to head Alsos Missions in Italy and Germany



Col. Boris Pash
Military Chief – Alsos Mission

The Scientist: Samuel Goudsmit

- Born in The Hague (Jewish)
- Electron spin with George Uhlenbeck (1925)
- Fluent in Dutch, German, English
- Intimately connected with most of the European physics community
 - Particularly Bohr and Heisenberg
- Not involved in the Manhattan Project
 - Was working on radar development at MIT



Dr. Samuel Goudsmit
Scientific Chief – Alsos Mission

Goudsmit

Heisenberg Fermi



University of Michigan, 1939

- Neutral Nations
 - Allied Territory
 - Axis Powers
 - Axis Territory
- 1942





April 27, 1945



What Happened Next?

- *“Skillful questioning of the German scientists by Goudsmit and his associates finally disclosed the hiding place of the heavy water and uranium and, on April 26, the heavy water was removed from the cellar of an old mill near Haigerloch and sent back to Paris. **About one and a half tons of the small metallic uranium cubes were dug up from a plowed field just outside of the town. These, too, were quickly dispatched to Paris. Both [heavy] water and uranium were then shipped to the US, to be disposed of by the Combined Development Trust. (CDT).**”* (Now It Can Be Told, page 242)

SECRET

HEADQUARTERS
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY
ALSOS MISSION
APO 887

DECLASSIFIED

Authority *NND 933079*

MEMORANDUM

21 May 1945

TO: Major R. R. Furman

FROM: S. A. Goudsmit

SUBJECT: Activity of Material

With the help of a Geiger Counter borrowed from CWS, a rough measurement was made of the material stored at a depot in Paris. The material was packed in wooden boxes of about one inch thickness.

The radiation in the neighborhood of the boxes was about 1/25 of an R-unit per 24 hours. The way the boxes are stacked up, this radiation is the same irrespective of the distance from the boxes but decreases rapidly beyond the distance of several yards. This activity is well below the limit of safety by a factor of about 100.

In spite of the crudeness of the measurements and the inaccuracy of the instrument used, it is felt that the material does not offer any danger from radiation at all even when handled continuously over a long period.

The measurement is not accurate enough to determine whether the material required any special activity as a result of the experiments to which it was exposed, but we know that the type of experiments done makes any appreciable additional activity very unlikely.

S. A. GOUDSMIT
Scientific Chief

NO DEPT. OF ENERGY CLASSIFIED
INFORMATION (NO RD/FRD/~~SECRET~~)
COORDINATE WITH: DoD
BEFORE DECLASSIFICATION/RELEASE
AUTHORITY: DOE-DFG
BY E. A. BARNER, DATE:

E. A. Barner 3/27/86
H. L. Hooper 4/1/86

SUBJECT: Activity of Material

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S. A. GOUDSMIT
Scientific Chief

The Reactor
Hitler Tried to
Build...

The Kaiser Wilhelm Institute

- Founded in 1911 to promote the natural sciences in Germany
- Sub-divided into 29 “Institutes”
 - KWI for Physics – founded in 1917
 - KWI for Chemistry – founded in 1911
- But also: KWI for Leather Research, KWI for Cell Physiology, KWI for Vine Breeding...
- KWI for Anthropology, Human Heredity and Eugenics – founded in 1926
 - Human experimentation on concentration camp prisoners



Werner Heisenberg

- Ph.D. in physics from University of Munich 1923
- 1924-1925 worked with Niels Bohr in Copenhagen
 - Quantum Mechanics
 - 1932: Nobel Prize
- Germany's "Golden Boy" of physics
 - "the most dangerous possible German in the field because of his brain power"
- James Chadwick
- American friends begged him to move to the U.S.
 - "Germany needs me"
- THEORETICIAN



Kurt Diebner

- Ph.D. in physics from Martin Luther University (Halle) in 1932
- Began working/consulting for government (Nazi) labs
 - Advisor on nuclear physics to the Reich Ministry of Defense and the Army Ordnance Office
- Was *not* viewed as part of the academic science community.
- **“Second – rater”**
- EXPERIMENTALIST

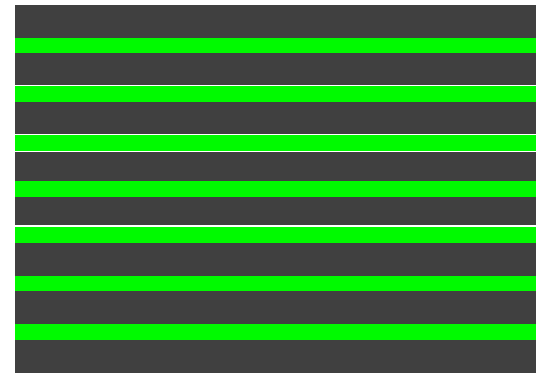


The German Uranium Club

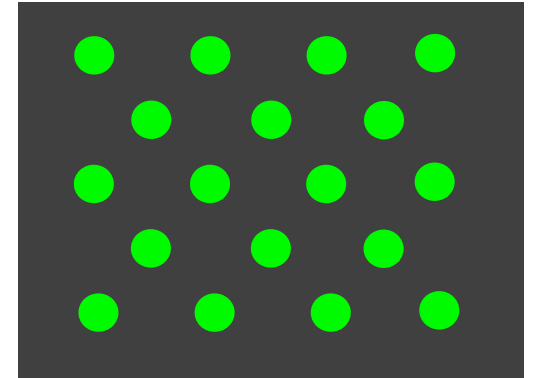
- Also began with a letter...
 - Dated April 24, 1939 from Harteck and Groth to Eric Schumann (head of weapons research - German Army Weapons Bureau)
 - Discussed possible new explosive technology.
 - Schumann is skeptical – but brings it to Kurt Diebner
- Diebner immediately establishes a research effort – **The Uranium Club**
 - Issued military orders to nuclear scientists to attend planning sessions in Berlin
 - Weapons Bureau takes over KWIP and appoints Diebner as Director

Early Experiments

- Focused on technical problems while they waited for U supplies:
 - Moderator material
 - Exclude graphite → heavy water
 - Geometry and size of a reactor
 - Layers vs Lattice



Layers
(Heisenberg)



Lattice
(Diebner)

- Two main reactor-oriented groups:
 - **L-series:** Heisenberg at Leipzig University
 - **B-series:** Diebner at KWIP in Berlin
 - The scientists working at KWIP (Wirtz and von Weizsacker) regarded Diebner as a “second rater” – consulted with Heisenberg

Relocation and Final Experiments

- In 1943, Diebner was replaced by Heisenberg as head of the KWIP
 - Moved to Gottow and began constructing lattice experiments (**G-series**)
 - Immediately achieves higher neutron multiplication
- End of 1944 – Heisenberg had his plates cut into cubes...
 - Begins construction of BVII as a lattice
- Allied bombing of Berlin increases
 - All research is ordered to leave Berlin area



The “Lab” in Haigerloch

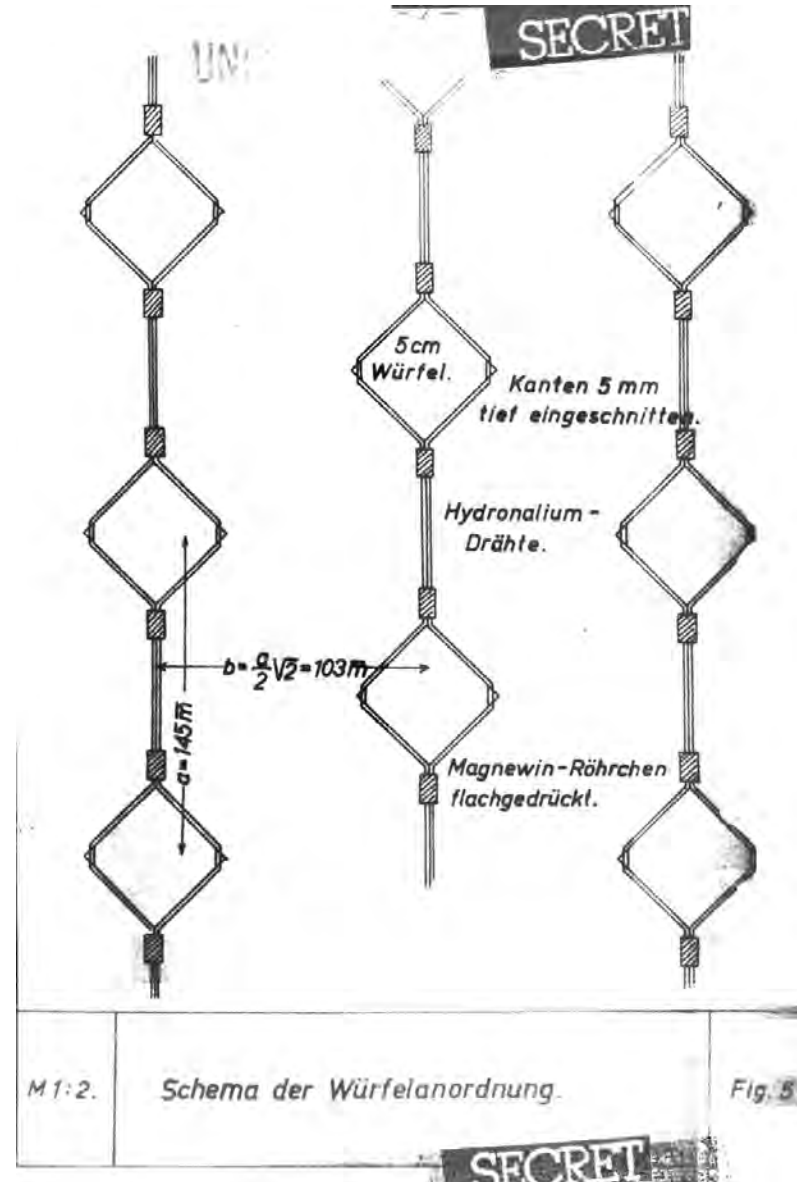


April 27, 1945



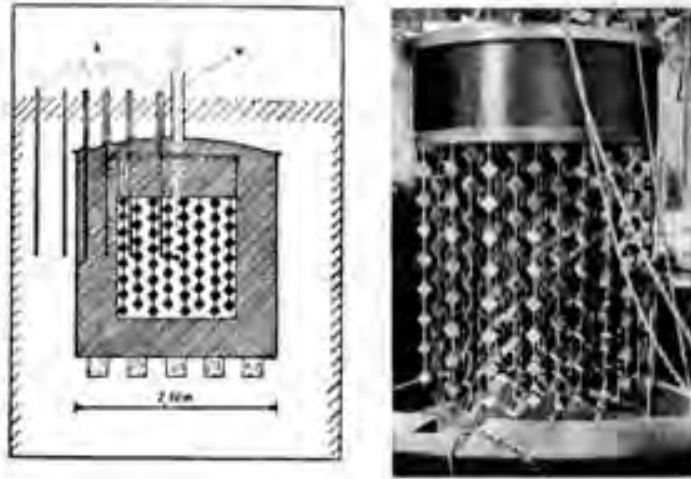
June 5, 2022

The Last Experiment: BVIII



How close did the Germans get?

A 2009 MCNP5 study of the B-VIII reactor by Grasso, Oppici, Rocchi, and Sumini.



Model	Graphite purity	Graphite density (g/cm ³)
A	Pure graphite	2.2
B	Graphite with 1 ppm Boron	1.8
C	Natural graphite	1.8

Table 4. The results of the MCNP simulations for the effective neutron-multiplication constants k_{eff} , their standard deviations (SD), their corresponding neutron-multiplication factors M , the neutron mean-free-paths (mfp) in centimeters over the entire reactor, and the average prompt neutron lifetimes (l) in seconds for Models A, B, and C.

Model	k_{eff}	SD	M	mfp (cm)	l (s)
A	0.89454	0.00013	9.482	2.28	5.6530×10^{-4}
B	0.86831	0.00013	7.593	2.28	4.8395×10^{-4}
C	0.85748	0.00013	7.016	2.28	4.1184×10^{-4}

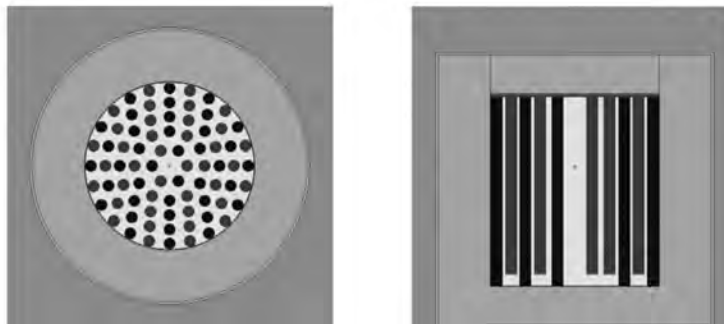


Fig. 5. Horizontal (*left*) and vertical (*right*) cross sections at the central plane of the B-VIII reactor, as simulated by the MCNP code for Model C and as rendered by VISED software.

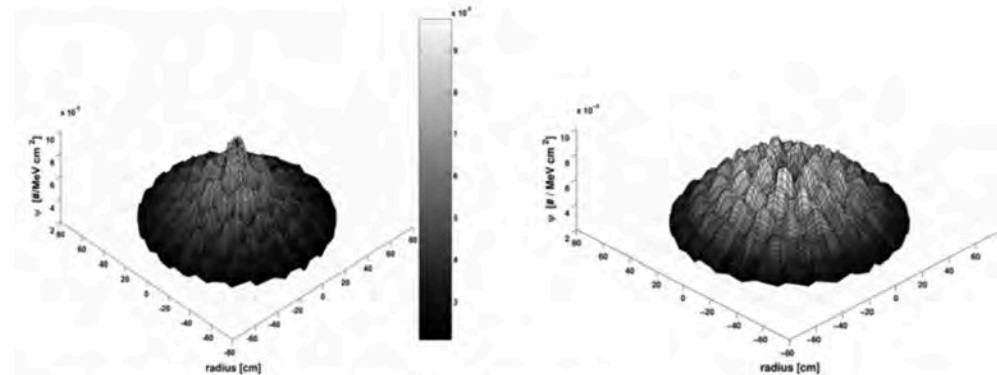


Fig. 7. The radial spatial profile of the neutron-flux distribution Φ versus neutron energy E at a horizontal central plane in the B-VIII reactor for thermal neutrons of energies up to 0.625 eV (*left*) and for fast neutrons of energies above 0.625 eV (*right*), as obtained with the MESHTAL feature of the MCNP5 code.

→ Needed ~ 50% (300) more U cubes

The Farm Hall Recordings: Aug 6th, 1945



The “Guests:” Otto Hahn, Max von Laue, Walther Gerlach, Werner Heisenberg, Paul Harteck, Carl Friedrich von Weizacker, Karl Wirtz, Erich Bagge, Horst Korsching, Kurt Diebner

Hahn: I don't believe it.

Heisenberg: All I can suggest is that some dilettante in America who knows nothing about it has bluffed them in saying if you drop this it has the equivalent of 20 thousand tons of high explosive and in reality it doesn't work at all.

Hahn: At any rate Heisenberg you are just a second rater and you may as well pack up.

Heisenberg: I quite agree.

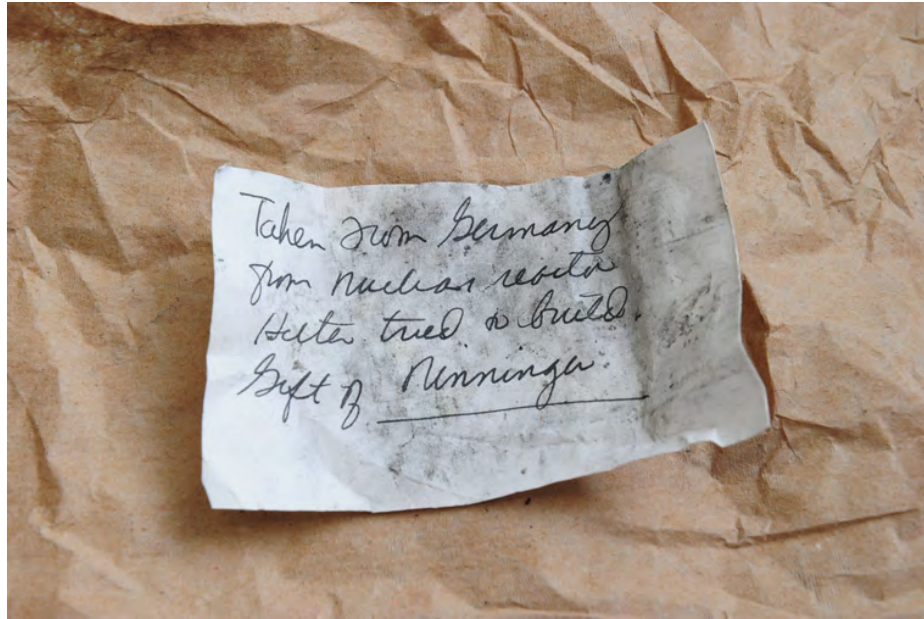
Hahn: They are fifty years further advanced than us.

Heisenberg: I don't believe a word of the whole thing.

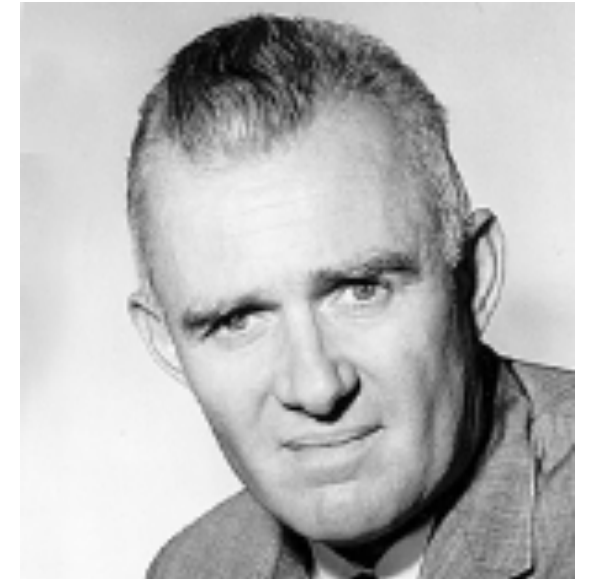
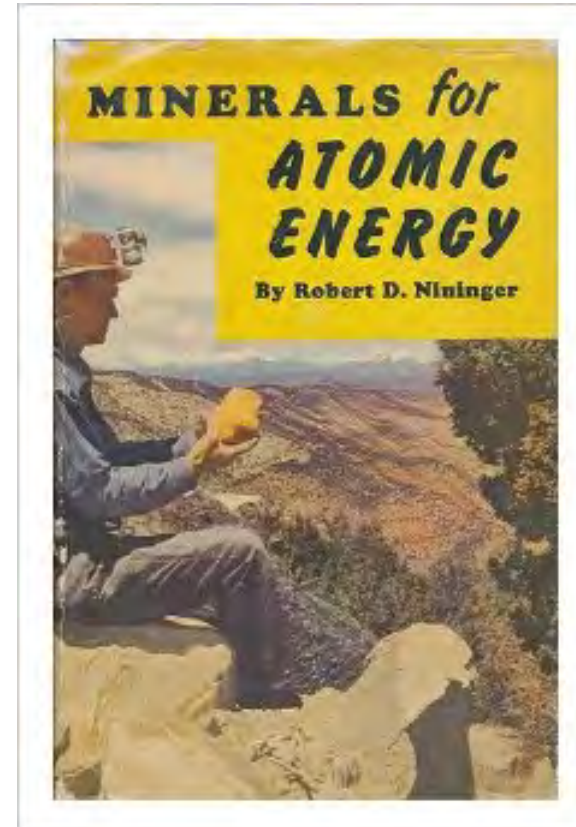
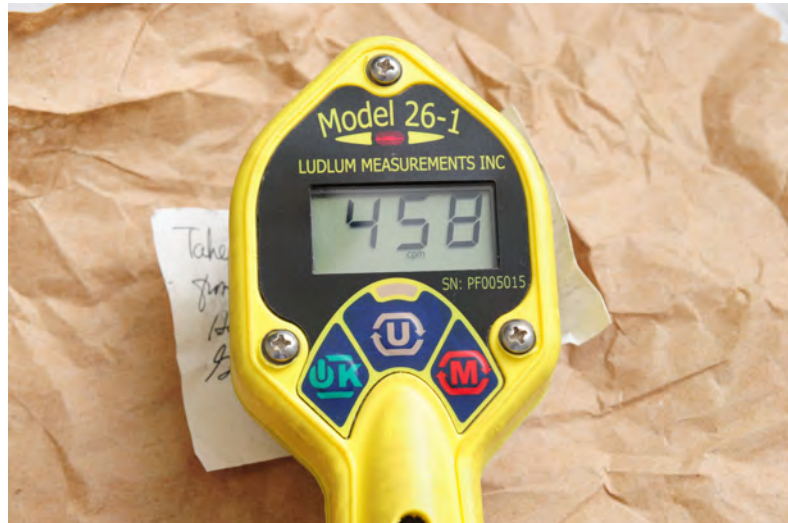


Gift of Ninninger.

Who is Ninninger ?



Paper reads: "Taken from Germany from nuclear reactor Hitler tried to build. Gift of Ninninger"

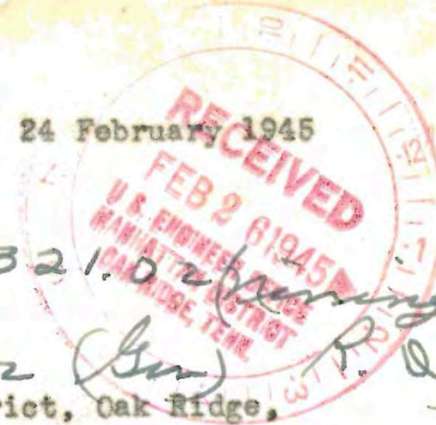


Robert D. Ninninger

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK 16, N. Y.
Murray Hill Area

IN REPLY
REFER TO
BIDM AE-1 MH-224

24 February 1945



Hamm

mar 32 1.02 (Burr)
X 140.2 (Burr)
W.R.D.

Subject: Property Accountability.
To: The District Engineer, Manhattan District, Oak Ridge,
Tennessee.

1. Reference is made to District Circular Letter (Prop. & Whse. 45-3) dated 9 February 1945.
2. Robert D. Nininger, 2nd Lt., C.E., O-1116686, has been appointed Accountable Property Officer for the Murray Hill Area effective 1 March 1945. This is an initial appointment and not a change in property accountable officers.
3. It is requested that a District Office Special Order be issued confirming this appointment.



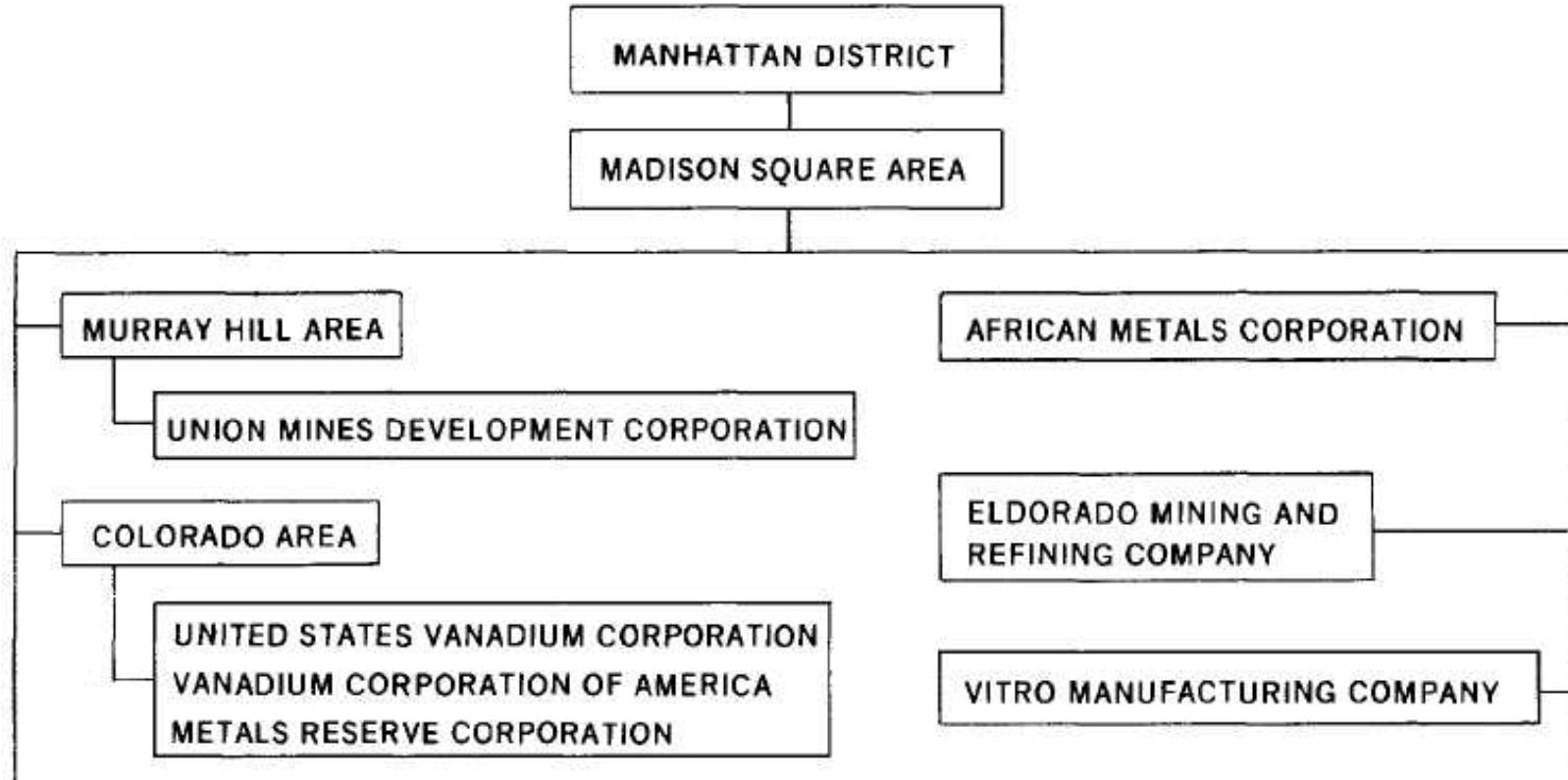
PAUL L. GUARIN
Lt. Col., Corps of Engineers
Area Engineer

“I told you it couldn’t be done without turning the whole country into a factory.”

- Niels Bohr to Edward Teller

Murray Hill Area – Part of the Uranium Procurement Network

CHART 4—FEED MATERIALS NETWORK, JANUARY 1945



Murray Hill Area

- Groves felt it was necessary to investigate new sources of uranium around the world
 - Contracted with Union Mines to make a study of all the literature on the world's uranium geology
- Lead by Paul Guarin
 - Mechanical engineer – worked in Texas oil industry
- Aided by a small team of geologists
 - George Selfridge (Amherst)
 - George Bain (Utah)
 - **Robert Nininger**

Securing New Uranium Sources

- Congolese uranium was purchased through the Belgian government
 - Paying for it was a problem... (Combined Development Trust formed)
- George Bain had a nose for uranium
 - Found a significant (millions of dollars worth) of overlooked uranium in South Africa
 - Believed that uranium should be found in monazite sands with thorium – also proved correct
- Colorado was determined to be a source of domestic uranium
- Arctic Circle and Ontario - Eldorado Mining Company
- **What do you do with a stockpile of confiscated German U?**
 - **We believe cubes were shipped to the Murray Hill Office from Paris...**

Later: WE Kelly

AREA ENGINEER
Lt. Col. J. R. Ruhoff
Maj. G. W. Russell
3 others

CLASSIFIED FILES
S/Sgt. C. Filippi
10 others (WAC)

MADISON SQUARE AREA OFFICE
Officers - 19
WACS - 14
Civilians - 171
FIELD OFFICES
Officers - 7
Civilians - 34
ATTACHED UNITS
Officers - 6
Civilians - 45

FIELD OFFICES
Lt. Col. J. R. Ruhoff

BEVERLY
Lt. D. Duffy
2 others

COLORADO
Lt. P. C. Leahy
11 others

MURRAY HILL
Maj. P. L. Guarin
1 other

ST. LOUIS
2nd Lt. M.L. Webb
4 others

TONAWANDA
Capt. E.L. Van Horn
Capt. R.E. Harris
14 others

WILMINGTON
Maj. W. L. Sapper
*

IOWA
**
2 others

*-FOR MADISON SQUARE AREA
CONTRACTS ONLY

** AREA ENGINEER NOT YET
APPOINTED.

TECHNICAL OFFICER
Major C. Hadlock

M. PRODUCTION
Lt. D.G. Sturges
Capt. R.D. Morse
27 others

RAW MATERIALS
Maj. P.L. Merritt
Capt. L.R. Dreveskracht
3 others

MISCL. MATERIALS
Capt. L.C. Burman
Capt. J.A. Anthes
2 others

ATTACHED UNITS
HAVING OFFICE SPACE

CONTACT
Col. K.D. Nichols
1 other

LEGAL & CONTRACT
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Maj. H. Greenstein
10 others

SPECIAL ACCOUNTS
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LABOR RELATIONS
& SAFETY
Capt. W.W. Stagg
2 others

PRIORITIES
Capt. G.W. Spaulding
2 others

MILITARY INTELLIGENCE
& PROTECTIVE SECURITY
Lt. B.W. Menke
13 others

GUARDS
Sgt. J. Feldman
18 others

COST
O.B. DiLorenzo
1 other

INSURANCE
C.H. Temps
1 other

AUDIT
S. P. Sullivan
7 others

ADMINISTRATION
Maj. E. A. Brinkman
Capt. A. H. Bright
2 others

METAL ACCOUNTABILITY
L. Chinsley
2 others

CIVILIAN PERSONNEL
R. E. Maiers
4 others

PROCUREMENT
I. A. Zolkos
12 others

PROPERTY & WAREHOUSE
H. A. Becker
17 others

TRAVEL
K. M. Jaquith
5 others

GARAGE
H. B. Tracy
6 others

MAIL & RECORDS
& REPRODUCTION
D. Blasenstein
14 others

OFFICE SERVICE
V. DiBiase
11 others

SWITCHBOARD
C.E. Green
5 others

TELETYPE
Cpl. Theban
2 operators, WAC

ORGANIZATION CHART
MADISON SQUARE AREA
October 5, 1943

Later: WE Kelly

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C.E. Green
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TELETYPE
Cpl. Theban
2 operators, WAC

ORGANIZATION CHART
MADISON SQUARE AREA
October 5, 1943



~~RESTRICTED~~

Beverly
NO. OFFICERS - 1
NO. CIVILIANS - 2

AREA ENGINEER
Lt. Dick Duffey

AREA ENGINEER
Lt. Dick Duffey
1 other

ACCT. & AUDITING SECTION
JOHN S. KLEIN, JR.

DECLASSIFIED
Authority *AND 73274*

ORGANIZATION CHART
BEVERLY AREA
1 NOVEMBER 1943

~~RESTRICTED~~

Beverly Area

Code name of Metal Hydrides Incorporated

- Founded in 1937 by Dr. Peter Alexander
- Developed a method for converting uranium oxide to uranium metal powder using calcium hydroxide
 - contracted to produce uranium metal powder for early reactor experiments.
- In 1943 – a better method for producing uranium metal was developed
- MHI turned to re-processing scrap uranium and turnings
- Remaining cubes were likely sent there for processing as scrap...

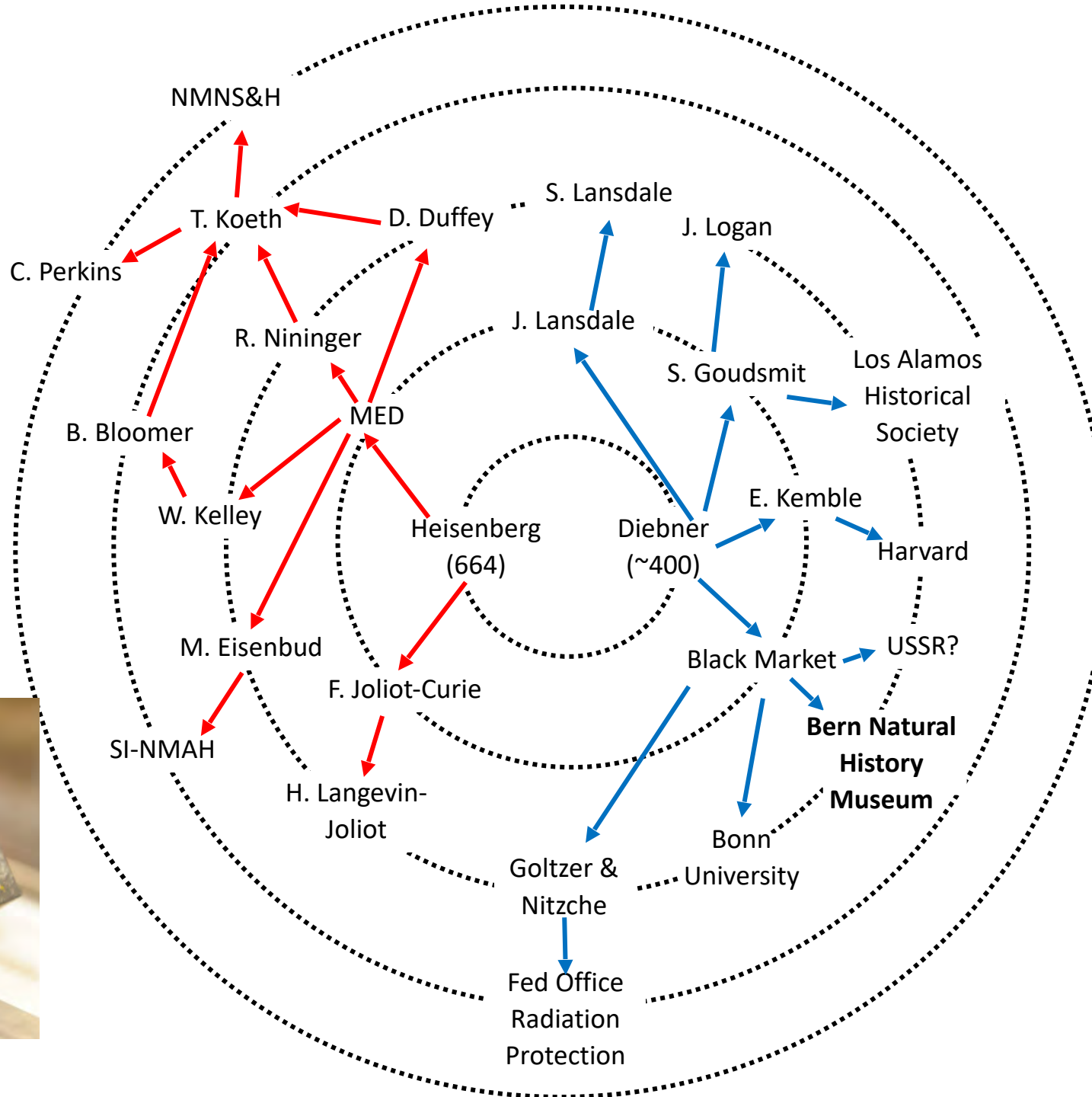


Dick Duffey

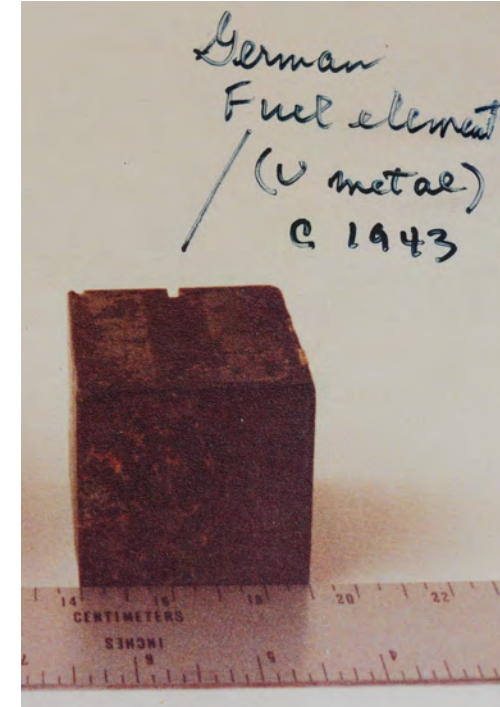
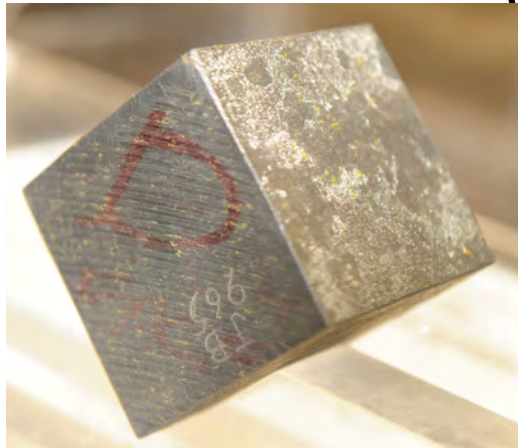
- Also had a cube!!!
- Second Director of MUTR; UMD Professor



The New Uranium Club



Others:
RIT?
PNNL?
Atomkeller?

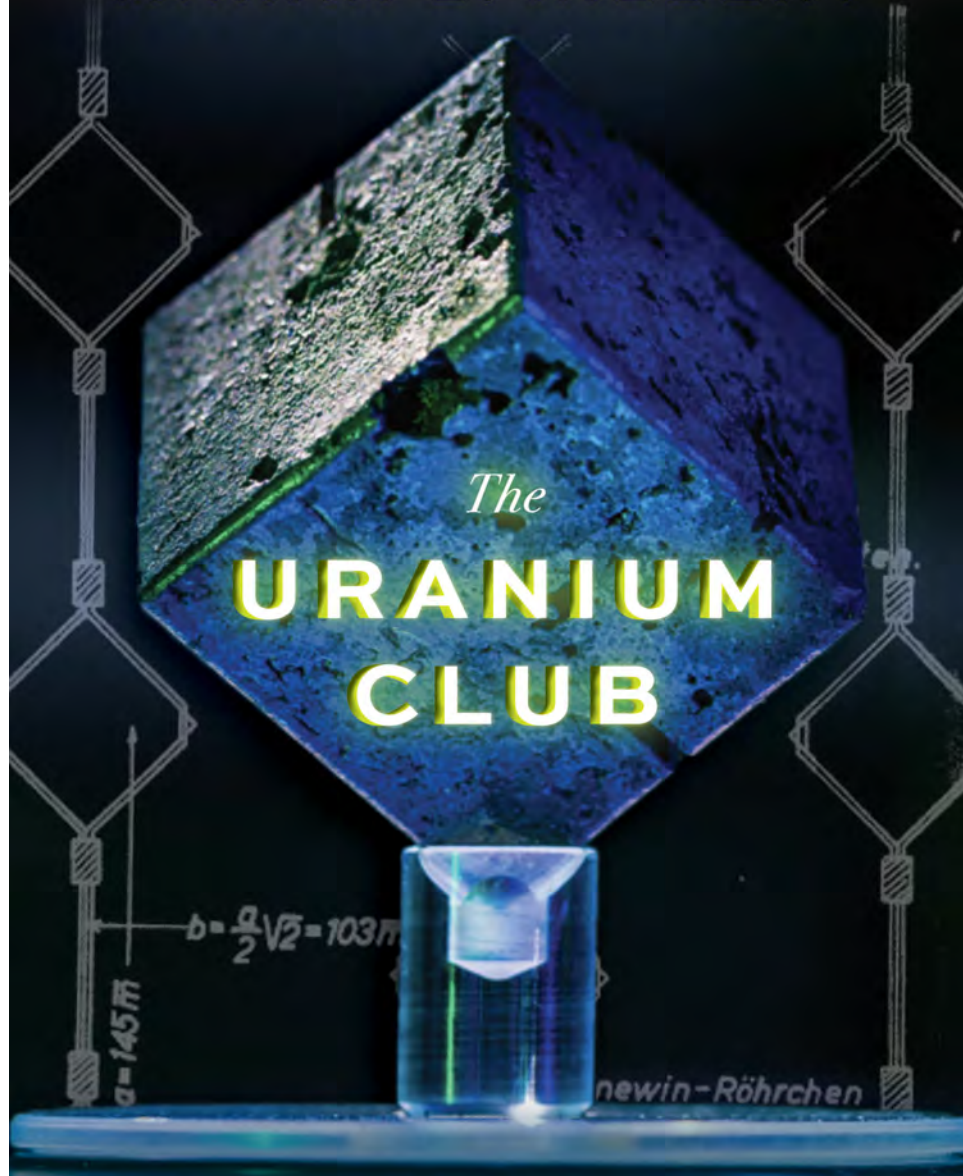


Acknowledgements

- National Museum of Nuclear Science and History
- Clay Perkins
- Ray Smith & Tim Gawne of ORNL
- Dwight Williams of DOE
- Alex Wellerstein of NJIT
- Cameron Reed of Alma College
- Roger Sherman & James Oakley Smithsonian NMAH
- Shane Bell of National Archives, Atlanta
- Niels Bohr Library, AIP in College Park
- Posthumously Robert D. Ninninger
- Dieter Hoffman of KWI in Berlin
- Roger Meade of LANL
- Richard Rhodes
- Sally Lansdale and Chloe Pitard

MIRIAM E. HIEBERT

The
**URANIUM
CLUB**



**UNEARTHING THE LOST RELICS OF
THE NAZI NUCLEAR PROGRAM**

