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After Dinner Talk (A Diagrammatic Summary of Noble Gas Isotope Research in the Physics Department at Berkeley)

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Prof. Ozima asked me to speak informally. I assure you that my remarks will be very informal because I have been enjoying my days in Japan to the extent that I have not made much preparation for these remarks.

Prof. Ozima reminded me that many of the youthful participants in the workshop would be interested in hearing about some of the early work and how it came to be done.

It happens that several years ago when I was preparing for a speaking trip to the former Soviet Union, I put together a chart which tried to summarize the history of work in my lab. The chart had three sections. The upper section was entitled "Influences" and listed people and things that influenced the work in the lab. The bottom section was entitled "Consequences" and listed people and things that in some way resulted, in part anyway, from the lab work. I, of course, do not mean when a name appeared as a "Consequence" that we were in any way responsible for the existence of that person, but rather that we had at least a little to do with the work that person took up. The central part of the chart listed research topics.

The items in the chart were rectangular boxes with labels. I tried to show the connections between boxes in the chart by lines which simulated connections on a circuit diagram. When a line started from a box it was connected to it. When a line ended on a box it was connected by means of a dot. When the line was to pass over a box, it was shown as unconnected to the box in question. Boxes which were thought to be especially important were outlined more heavily. I need not say that when this project was finished the chart was so complicated that not for a moment could I consider exhibiting it to my Soviet audience. I tucked it away.

For this meeting, the chart might be of some use. The various connections suggest various stories and old stories are what Prof. Ozima said would be of interest. Thus with all the necessary apologies (a chart like this is very subjective and self-serving) I exhibit it here as a slide (or in the case of the Proceedings, Fig. 1).

If one looks at the lines, the most frequent connections are to the box entitled "Static Spect." Which says that perhaps the most important thing we did was to contrive a statically operated mass spectrometer. Prior to that development all noble gas analyses had been made dynamically, i.e. leaking the sample into the ion source and all the while pumping it away with the diffusion pumps. I reasoned that a

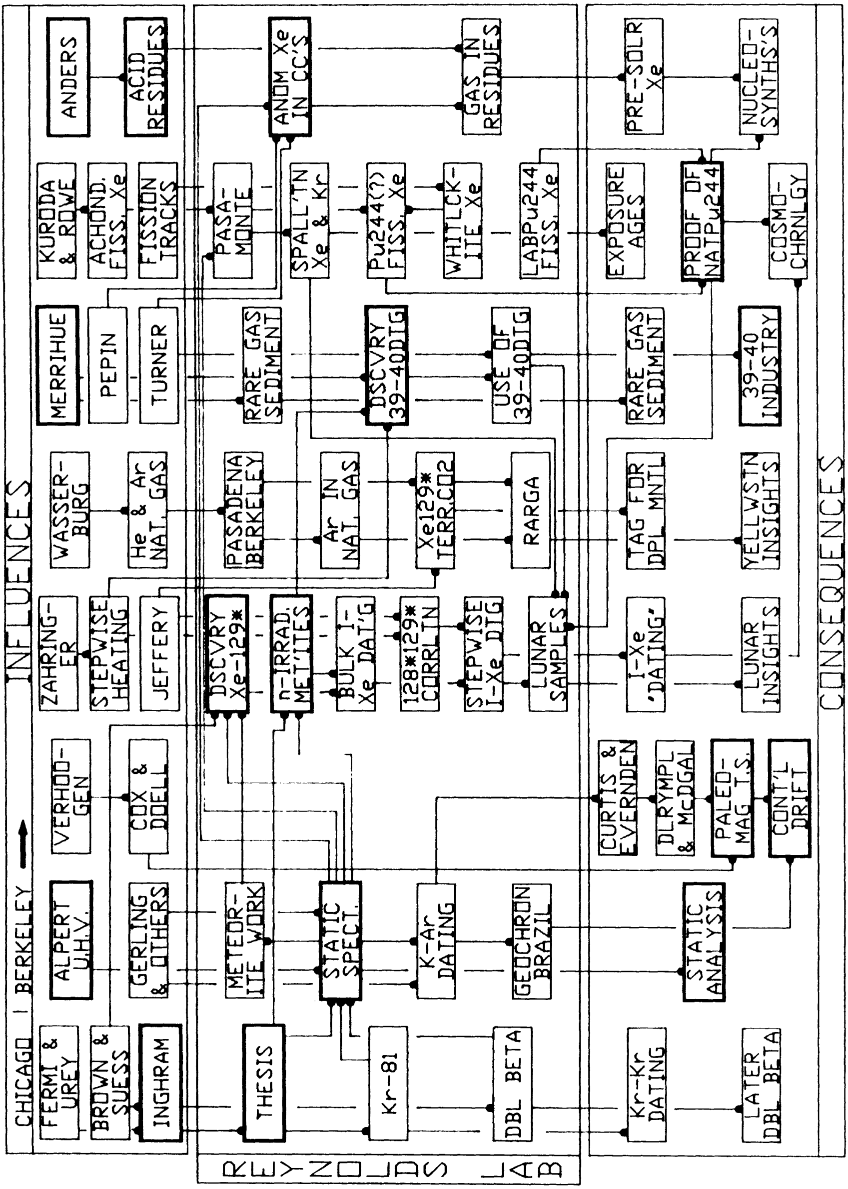
CHICAGO | BERKELEY
INFLUENCES
FERMI & UREY
BROWN & SUESS
INGHRAM
ALPERT U.H.V.
GERLING & OTHERS
VERHOOGEN
COX & DOELL
ZAHRINGER
STEPWISE HEATING
JEFFERY
WASSERBURG
He & Ar NAT. GAS
MERRIHUE
PEPIN
TURNER
KURODA & ROWE
ACHOND. FISS. Xe
FISSION TRACKS
ANDERS
ACID RESIDUES
REYNOLDS LAB
THESIS
Kr-81
DBL BETA
METEORITE WORK
STATIC SPECT.
K-Ar DATING
GEOCHRON BRAZIL
DSCVRY Xe-129*
n-IRRAD. MET'ITES
BULK I-Xe DAT'G
128*129* CORRLTN
STEPWISE I-Xe DTG
LUNAR SAMPLES
PASADENA BERKELEY
Ar IN NAT. GAS
Xe129* TERR.CO2
RARGA
RARE GAS SEDIMENT
DSCVRY 39-40DTG
USE OF 39-40DTG
PASAMONTE
SPALL'TN Xe & Kr
Pu244(?) FISS. Xe
WHITLCKITE Xe
LABPu244 FISS. Xe
ANOM Xe IN CC'S
GAS IN RESIDUES
CONSEQUENCES
Kr-Kr DATING
LATER DBL BETA
STATIC ANALYSIS
CURTIS & EVERNDEN
DLRYMPL & McDGAL
PALEOMAG T.S.
CONT'L DRIFT
I-Xe 'DATING'
LUNAR INSIGHTS
TAG FOR DPL MNTL
YELLWSTN INSIGHTS
RARE GAS SEDIMENT
39-40 INDUSTRY
EXPOSURE AGES
PROOF OF NATPu244
COSMOCHRNLGY
PRE-SOLR Xe
NUCLEOSYNTHS'S

Fig. 1.

spectrometer of small volume and good vacuum could permit the sample to be admitted with the spectrometer separated from the pumps so that most of the sample was not wasted. In order to test that idea, I drew up plans for a small, inexpensive glass instrument. By one of the fortunate coincidences that occur sometimes in science, just when I was starting to do this design a colleague, Wulf Kunkel, returned from a visit to the Westinghouse Research Laboratories and gave a physics department colloquium about Daniel Alpert's pioneering work in ultra-high vacuum technique—work in which he developed metal valves which could be baked out at temperatures as high as 450°C and ion gauges which were inside out (the "plate" a slender wire inside the grid rather than a cylinder of extensive area outside) so that the previously limiting effect on their sensitivity, photoelectrons released from the plate by soft x-rays generated at the grid, was essentially eliminated. These techniques came like manna from heaven and I was able to incorporate them into the so-called "Reynolds mass spectrometer" with success you all know about from your own work. I tell people as part of this story that they should not fail to attend the colloquia their departments arrange!

Another box which exhibits many connections, is the box labeled "Discvry Xe-129*". It is well known that one of the high points of my scientific work was finding the excess of ^{129}Xe in the Richardton chondrite, a discovery which represented the first instance of extinct radioactivity: the excess ^{129}Xe was a fossil, so to speak, of 17 million year ^{129}I which was alive at early times in the solar system but has since completely decayed away. Only a few us now remember that the discovery was challenged soon after its publication by Josef Zähringer at Heidelberg. Josef was a very gifted experimentalist who rose to become head of the cosmochemistry group at the Max Planck Institute at Heidelberg until he was tragically killed in an automobile accident in 1970 at the age of 41. His published work included many important contributions to meteoritics and lunar science. Thus a preprint which he circulated soon after the ^{129}Xe discovery claiming that the analysis could not be repeated, the implication being that the effect I had seen was an artifact, was a very disturbing development to cosmochemists. I remember that Harold Urey was especially upset about it. By the time Zähringer's reprint appeared, I at Berkeley had obtained much confirmation of the effect—analyses in other meteorites where the excess ^{129}Xe was even more pronounced than in Richardton, for example. Thus I was convinced that Zähringer had been misled by some memory effect which had caused the initial ^{129}Xe excess, he had fleetingly observed, to disappear as memory gas of ordinary composition grew in. I made the first transatlantic phone call in my life to talk to Zähringer and suggest that he analyze further samples, which I could provide, so as to clear the matter up. He did so right away and was soon able to confirm our work in print to everyone's relief. You will note that Zähringer's name appears as one of the "influences" of our lab. It was he who first described the technique of stepwise heating in noble mass mass spectrometry, a technique that we used to great advantage, following his lead, as the years went on.

Abbreviations Appearing in the Boxes:

ACHOND.	Achondrite
ANOM	Anomalous
CC'S	Carbonaceous chondrites
CHRNLGY	Chronology
CONT'L	Continental
CORRLTN	Correlation
DAT'G	Dating
DBL	Double
DLRYMPL	Dalrymple
DPL	Depleted
DSCVRY	Discovery
DTG	Dating
FISS.	Fission
LAB	Laboratory produced
McDGAL	McDougall
MET'ITES	Meteorites
MNTL	Mantle
n-IRRAD.	Neutron irradiated
NAT.	Natural
PALEO-MAG	Paleomagnetic
SOLR	Solar
SPALL'TN	Spallation
SPECT.	Spectrometer
SYNTHS'S	Synthesis
T.S.	Time scale
TERR.	Terrestrial
U.H.V.	Ultra High Vacuum
WHITLCKITE	Whitlockite
YELLWSTN	Yellowstone

It has been a great pleasure to attend this meeting and hear at first hand from those working in the field how active it continues to be. I am still working in the field myself as a volunteer in the relatively new Center for Isotopic Geochemistry at Berkeley.