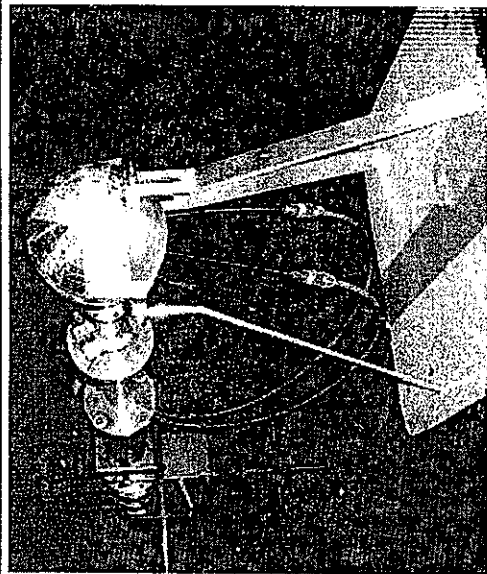
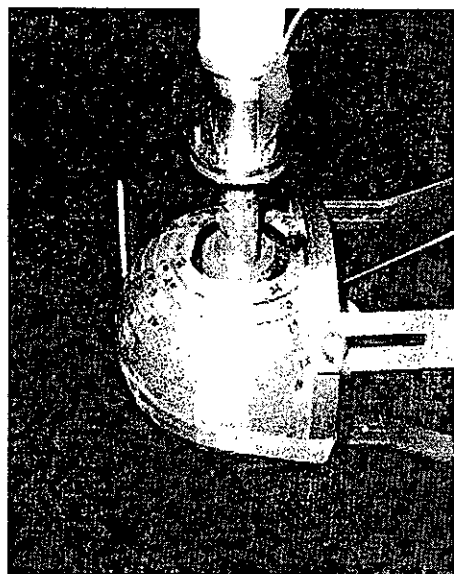


Recent Experiment [irradiation]



◇ setup

⇒ exact setup
confirm target position before
and after the irradiation



◇ irradiation

⇒ 4.5 MV Dynamitron
(FNL, Tohoku Univ.)
⇒ $E_n = 1.77 \sim 6.48 \text{ MeV (D(d,n))}$

Recent Experiment [measurement]

Electrolysis

Remove almost the whole Cu



Anion exchange



Extraction

Refinement of Ni component



β -ray measurement

Low BGD liquid scintillation counter

Result [excitation function]

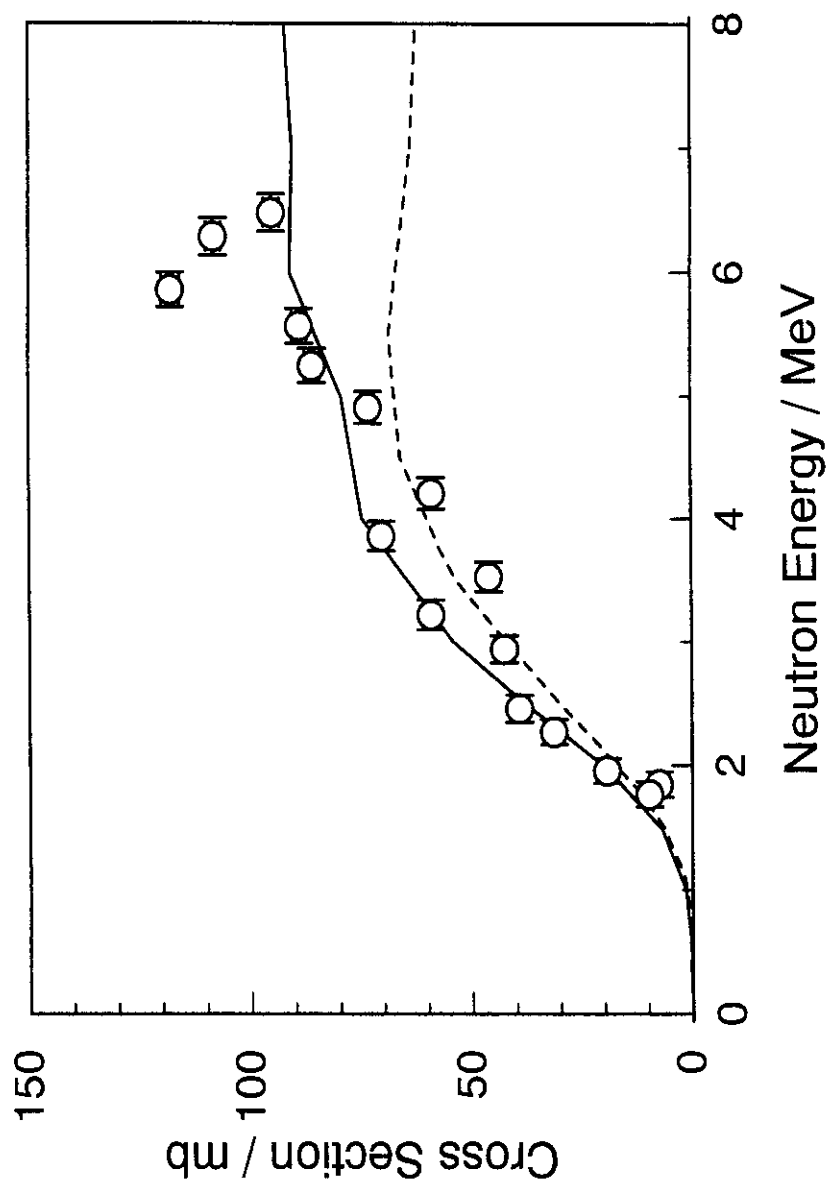
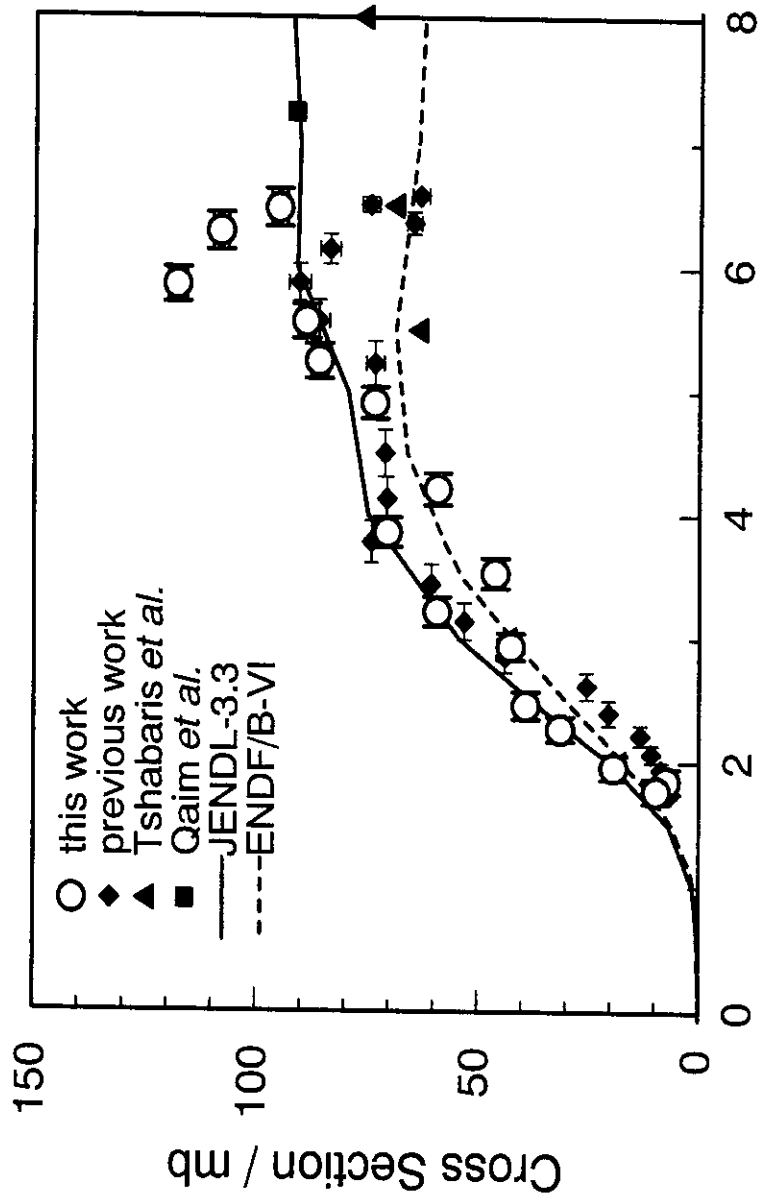


Fig. Excitation function of $^{63}\text{Cu}(n,p)^{63}\text{Ni}$.

Result [excitation function]



Neutron Energy / MeV

Fig. Excitation function of $^{63}\text{Cu}(n,p)^{63}\text{Ni}$.

Result [low energy region]

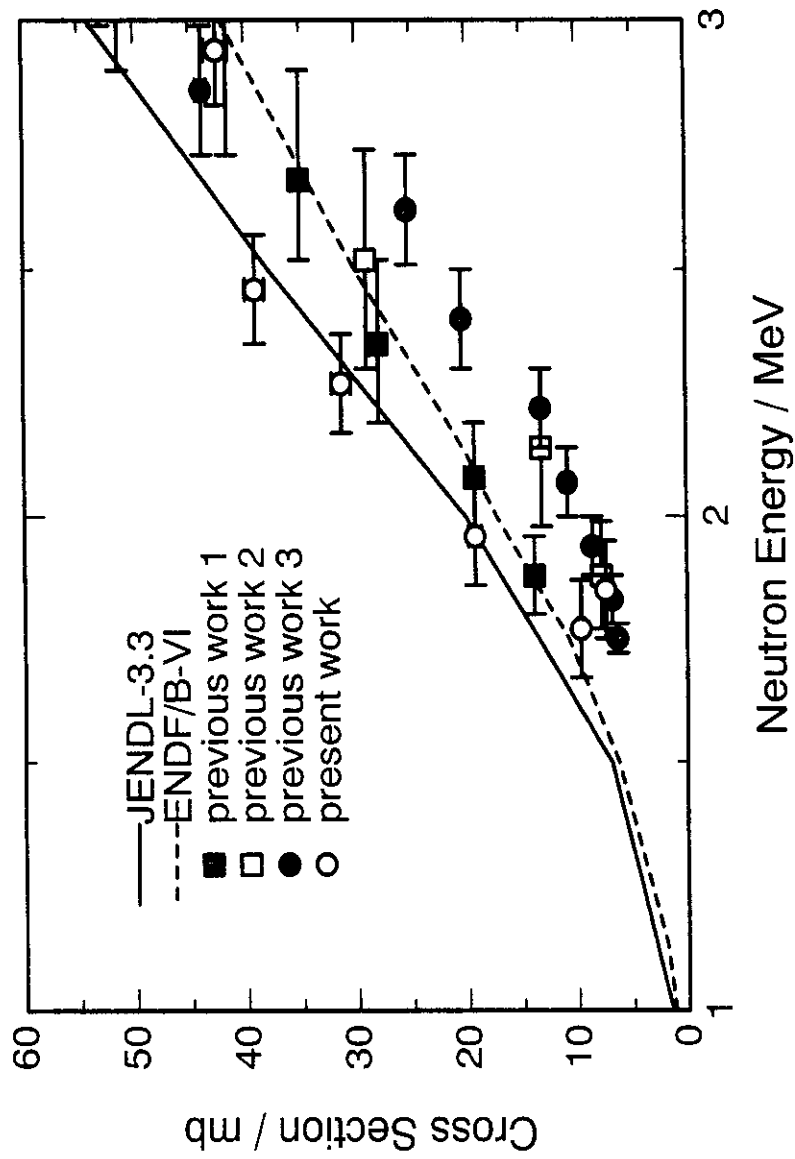


Fig. Excitation function of $^{63}\text{Cu}(n,p)^{63}\text{Ni}$.

Samples

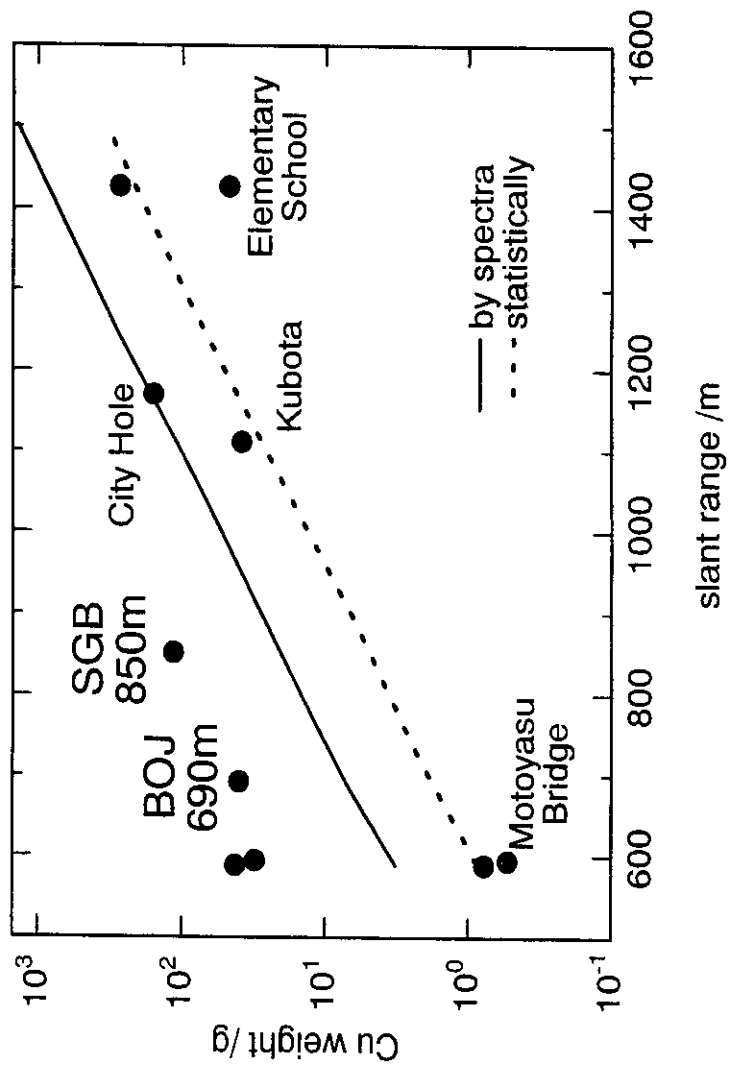


Fig. Sufficient amount of copper samples.

Chemical Separation

Electrolysis (12~30 hours)

Remove almost the whole Cu



Anion exchange



Extraction



Refinement of Ni component

Cation exchange

Removing impurity



Heat by furnace

Removing organic compound



β -ray measurement

Low BGD liquid scintillation counter

sample chemical yield

SGB

53 %

BLANK

45 %

β -ray Measurement

- detector → Low background liquid scintillation counter
at RI centre, Univ. of Tokyo
- samples → A-bombed samples, blank sample,
and quenching correction (^{63}Ni standard) samples
- scintillator cocktail → 1 mL solution and 5 mL clear-sol I
- measuring time → 15,500 min

β -ray spectra

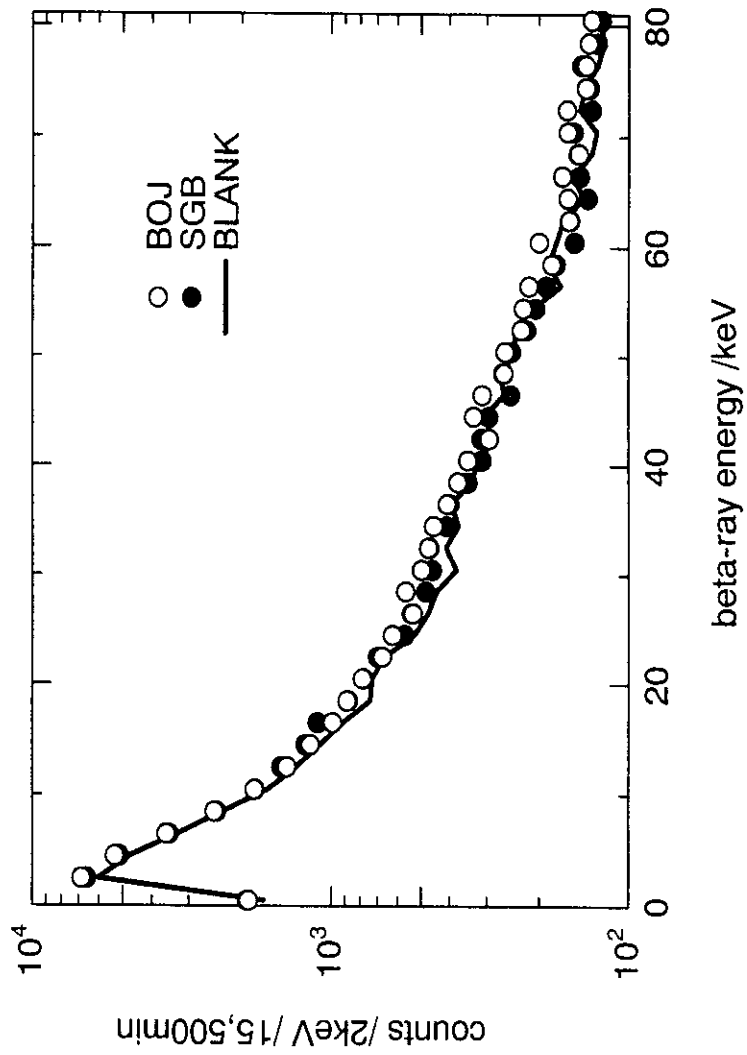


Fig. Beta-ray spectra for BOJ, SGB and BLANK samples.

Net Spectra

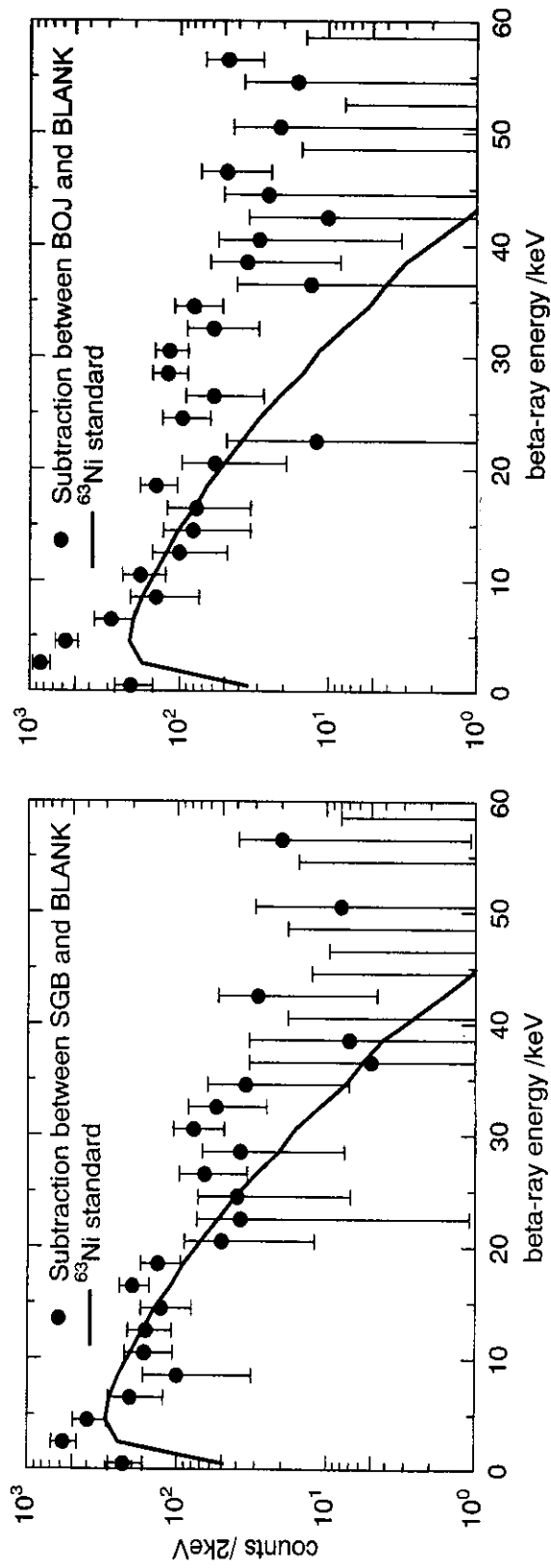


Fig. Beta-ray spectra for subtraction between A-bombed and blank samples.

Analysis

Analysis at energy region 10~31 keV



Quenching correction



Correction for chemical yield

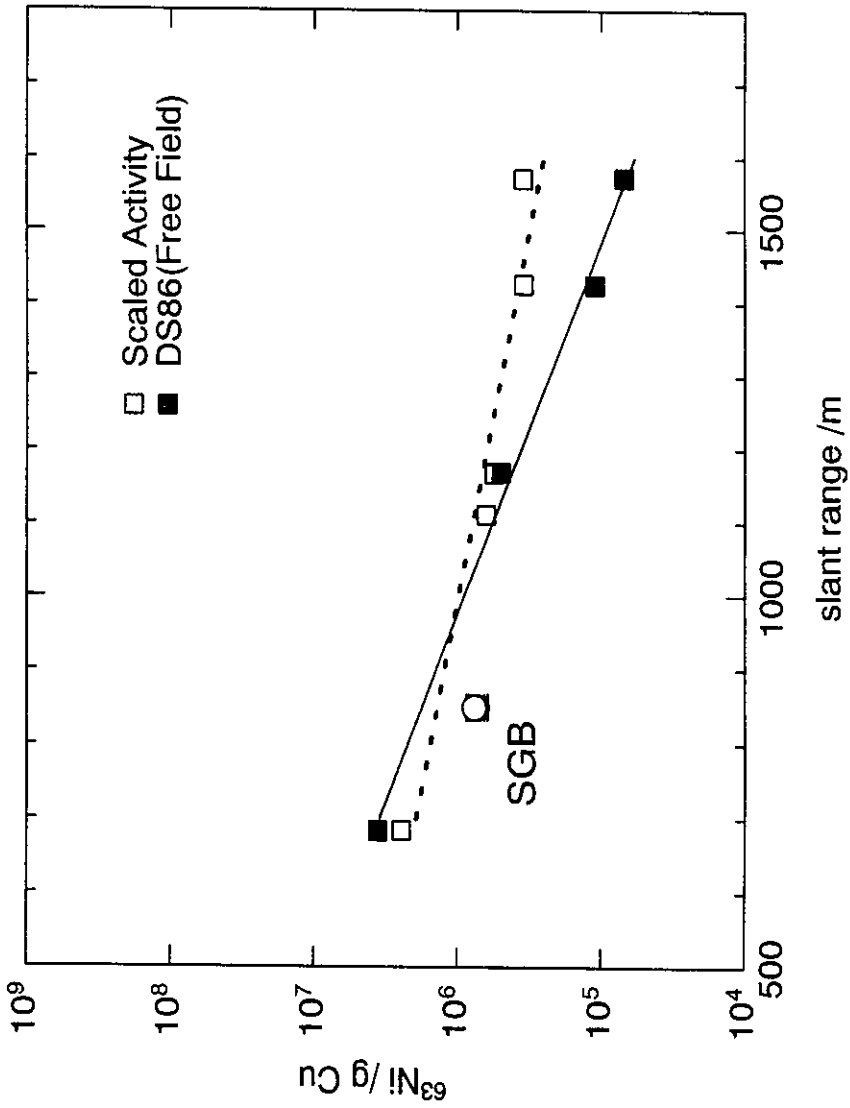


Correction for $^{62}\text{Ni}(n_{\text{th}}, \gamma)^{63}\text{Ni}$



Amount of ^{63}Ni produced in 1 g Cu (ATB)

Results



SGB1 | 7.28E+05 ± 1.12E+05
 SGB2 | 7.60E+05 ± 1.12E+05

Correction for $^{62}\text{Ni}(n_{\text{th}}, \gamma)^{63}\text{Ni}$

SGB 1: DS86

SGB 2: Meas. Data

Fig. Slant range dependence of ^{63}Ni amount produced in 1g Cu (ATB).

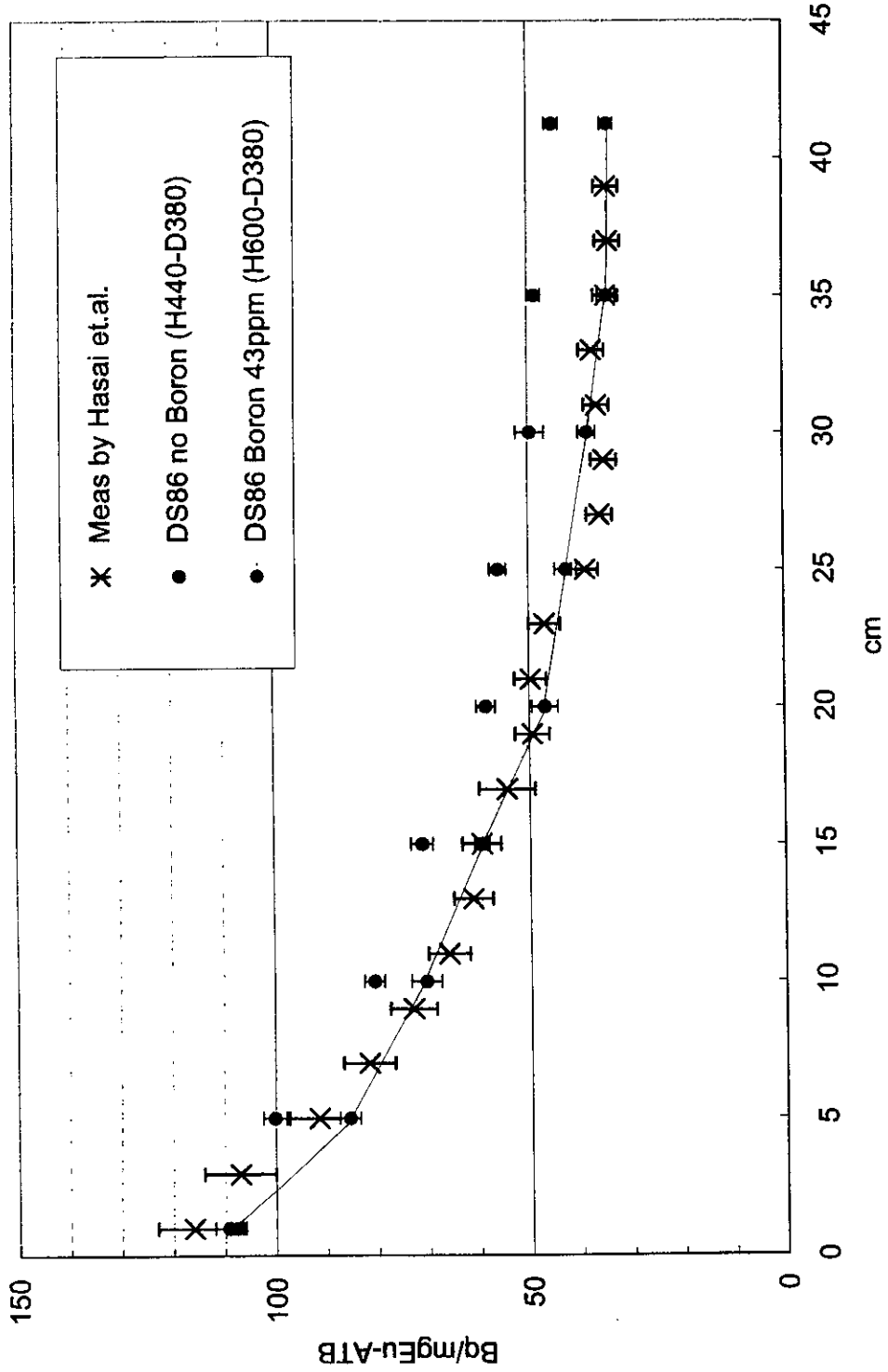


Fig. 1 Motoyasu#1 Depth Profile: Boron addition Water 0.59% DS86 Source

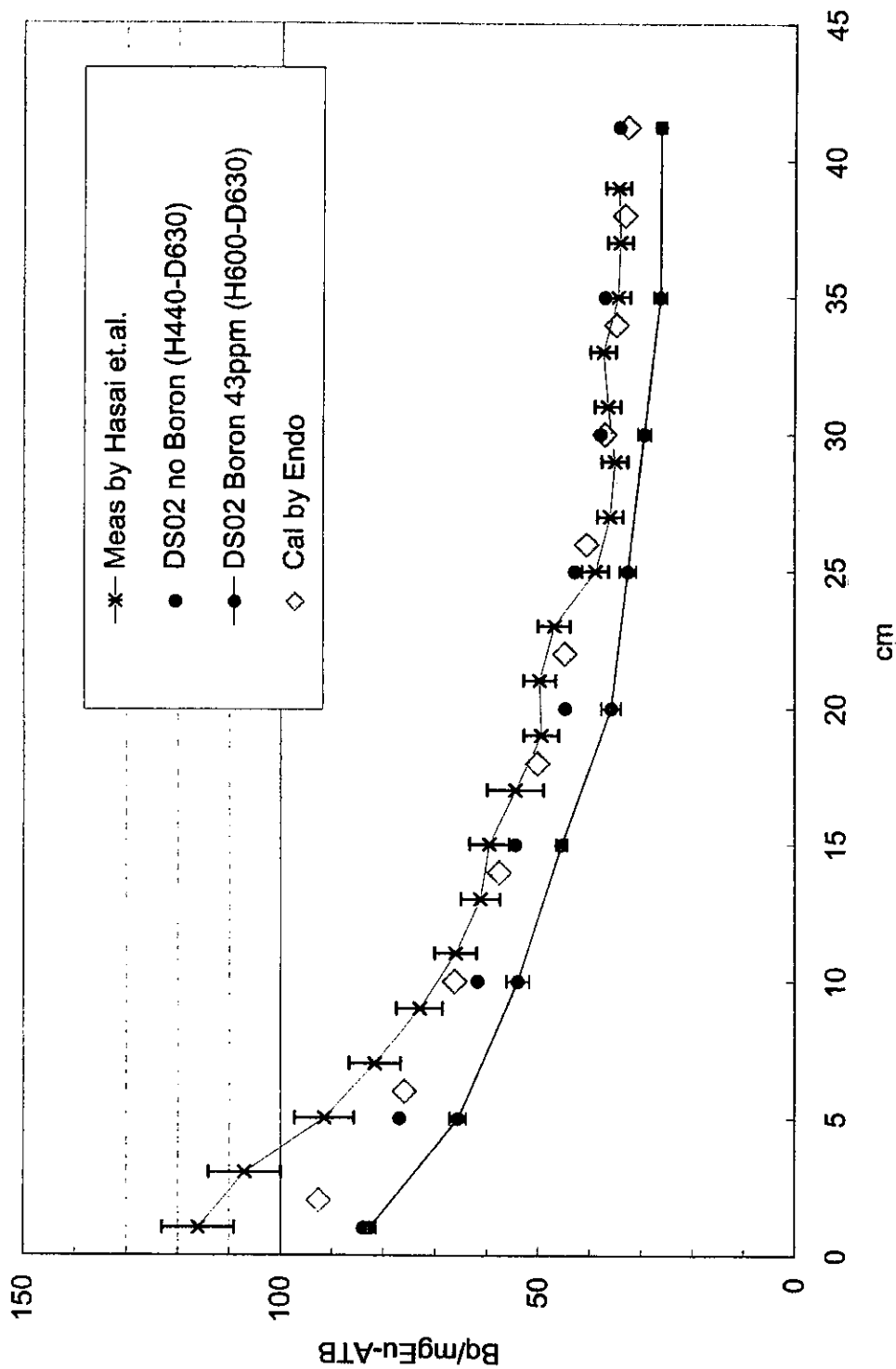


Fig. 2 Motoyasu#1 Depth Profile: Boron addition, Water 0.59%, DS02 Source

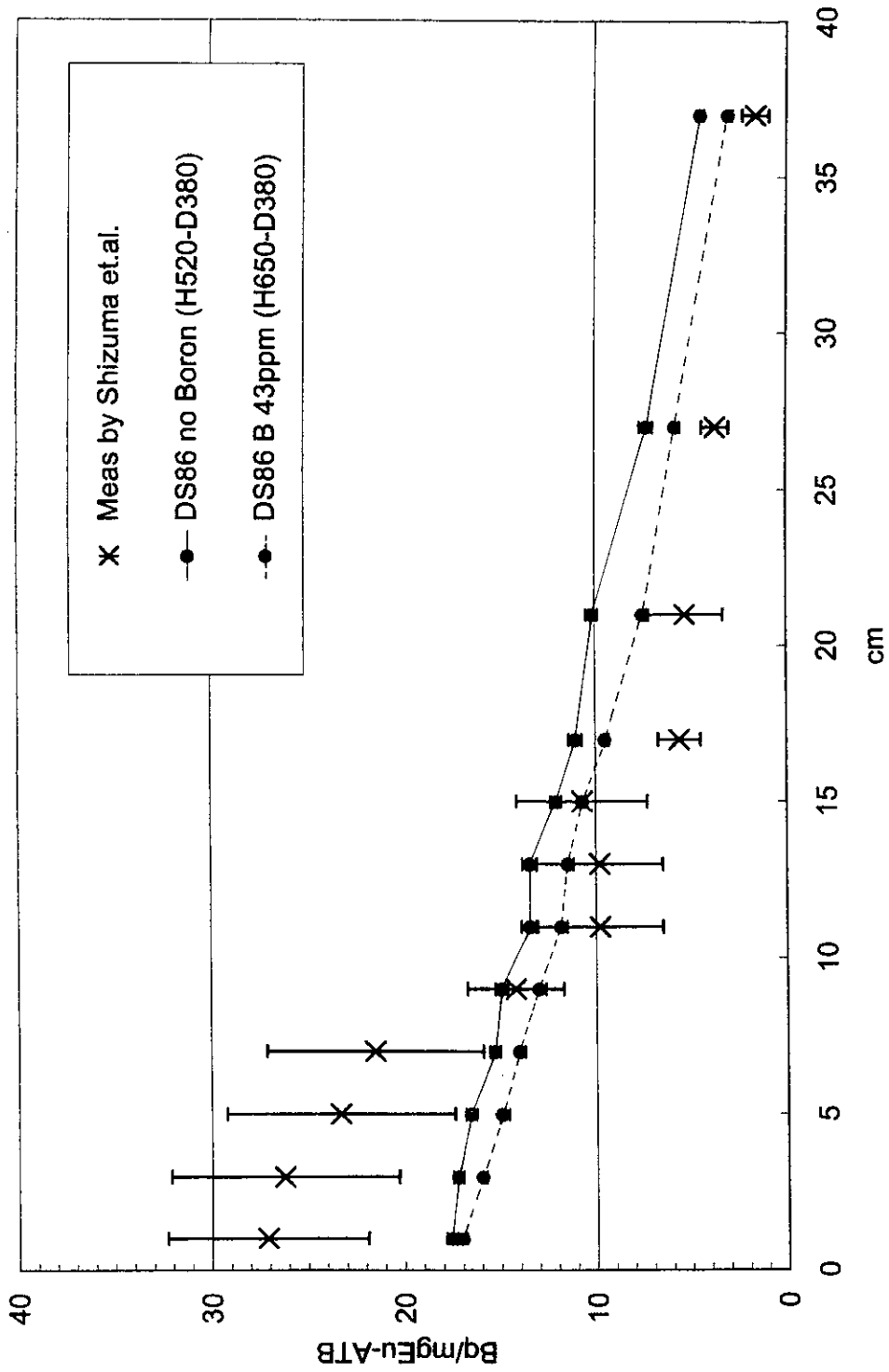


Fig. 3 Eu152 Depth Profile Shirakami S: DS86 Source

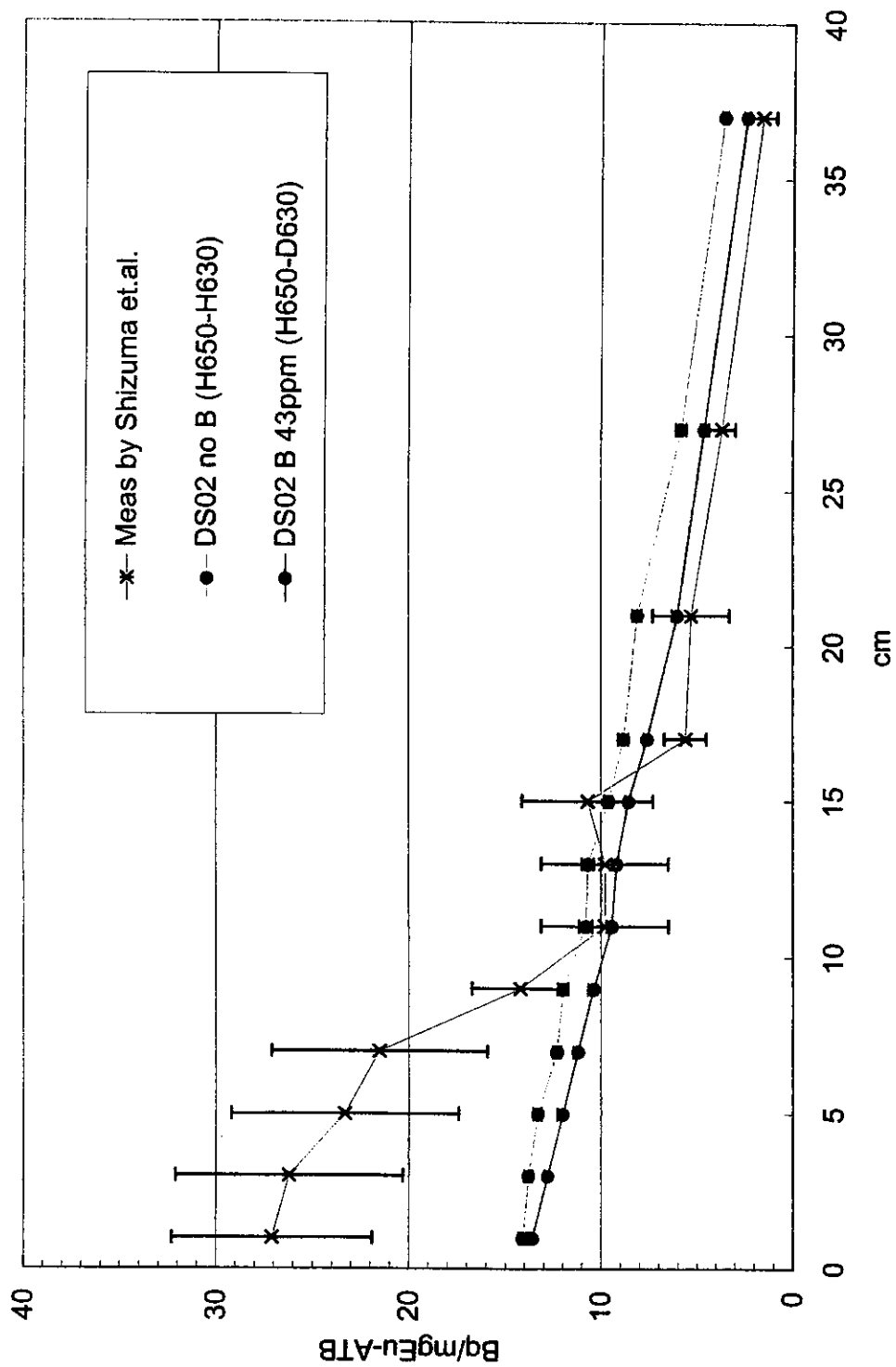


Fig. 4 Eu152 Depth Profile Shirakami S: DS02 Source

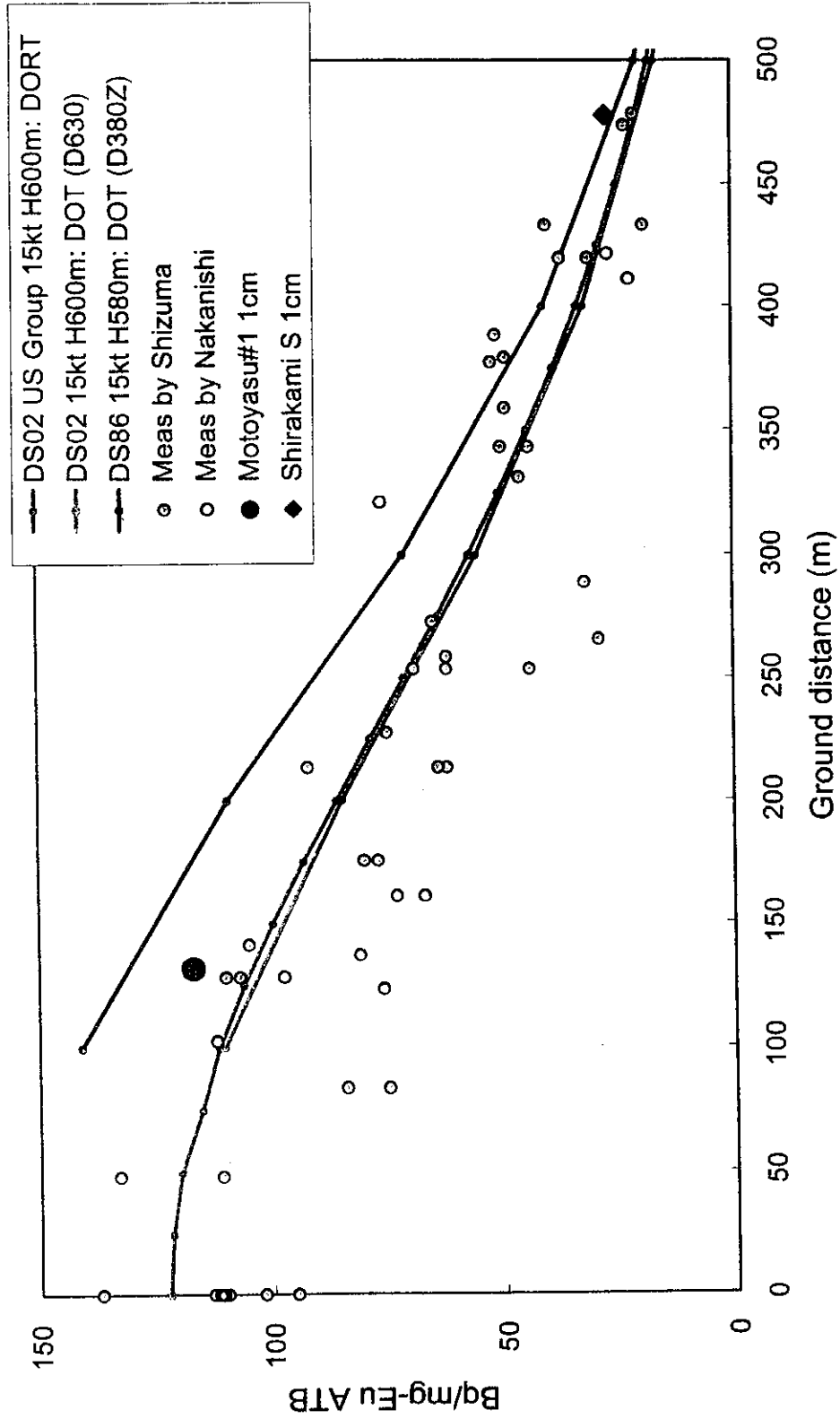


Fig.5 Free-in-air Eu152 activity in Hiroshima: Ground distance

Table 1, Decorative tile and brick samples provided from RERF and Hiroshima University after DS86.

City	Building	Ground distance	Samples	Building age
Hiroshima	University Office	1,277-1,469m	Tiles	61-64yr.
	Red cross Hospital	1,413-1,501m	Tiles	56yr.
	Teishin Hospital			
Nagasaki	Univercity Hospital	655m	Tiles	56ys
	Koudou Primary School	720m	Tiles	
	Sakamoto Cemetery	1,039m	Bricks	61ys
	Charnel House	1,435m	Bricks	56ys
	Yamada Oil Storehouse	2,043m	Bricks	92-68ys

Table 2. The gamma-ray dose from the atomic bombs in Hiroshima.

(Doses were evaluated for the collected samples after the DS86).

	Dist- ance m	Total dose Gy	Std	Beta dose microGy/y	Std	Gamma dose microGy/y	Std	Elaps- ed time year	Std	Bomb dose Gy	Std
Univ.RI.	1462	0.92	0.21	2290	160	1250	40	63	0	0.70	0.21
	1497	0.78	0.23	2290	160	1250	40	63	0	0.56	0.23
	1469	0.90	0.29	2290	160	1250	40	63	0	0.68	0.29
Red Hoptit facility	1451	0.93	0.14	2340	160	1210	70	55	2	0.73	0.14
	1451	1.02	0.15	2340	160	1210	70	55	2	0.82	0.15
	1451	0.95	0.12	2340	160	1210	70	55	2	0.75	0.12
	1451	0.99	0.12	2340	160	1210	70	55	2	0.79	0.12
	1451	0.94	0.13	2340	160	1210	70	55	2	0.74	0.13
	1501	0.93	0.14	2340	160	1210	70	55	2	0.73	0.14
	1501	0.81	0.13	2340	160	1210	70	55	2	0.61	0.13
	1501	0.90	0.11	2340	160	1210	70	55	2	0.70	0.11
	1501	0.94	0.15	2340	160	1210	70	55	2	0.74	0.15
	1501	0.86	0.11	2340	160	1210	70	55	2	0.66	0.11

Table 2. The gamma-ray dose from the atomic bombs in Nagasaki.

(Doses were evaluated for the collected samples after the DS86).

	Dist- ance m	Total dose Gy	Std	Beta dose microGy/y	Std	Gamma dose microGy/y	Std	Elaps- ed time year	Std	Bomb dose Gy	Std
Univ.	655	38	3.4	2.4	1.8					40.4	3.85
hospital	655	31	3.5	2.4	1.8					33.4	3.94
	655	22	1.8	2.4	1.8					24.4	2.55
				Supralinear corr.							
Sakamoto	1039	4.98	0.81	2950	380	1050	60	57	2	4.75	1.14
Cemetary	1039	3.90	0.74	2950	380	1050	60	57	2	3.67	1.09
	1039	4.71	0.40	2950	380	1050	60	57	2	4.48	0.90
	1039	5.59	0.49	2950	380	1050	60	57	2	5.36	0.94
				Supralinear corr.							
				Gy	Std					Final	
		4.75	0.817	1.52	0.21					6.27	0.84
		3.67	0.748	1.28	0.50					4.95	0.90
		4.48	0.414	1.50	0.16					5.98	0.44
		5.36	0.50	1.17	0.32					6.53	0.59
Charnel	1435	1.46	0.21	1800	110	1050	60	79	3	1.23	0.20
	1435	1.51	0.18	1800	110	1050	60	79	3	1.28	0.18
	1435	1.40	0.15	1800	110	1050	60	79	3	1.17	0.15
Warehouse	2043	0.38	0.05	1870	130	1100	40	75	12	0.16	0.06
	2043	0.45	0.05	1870	130	1100	40	75	12	0.23	0.06
	2043	0.43	0.05	1870	130	1100	40	75	12	0.21	0.06
	2043	0.43	0.05	1870	130	1100	40	75	12	0.21	0.06
	2043	0.35	0.03	1870	130	1100	40	75	12	0.13	0.05
	2043	0.39	0.04	1870	130	1100	40	75	12	0.17	0.06
	2043	0.45	0.07	1870	130	1100	40	75	12	0.23	0.08

Fig.1 Hiroshima

