

from naturally occurring radioactive materials within the tiles.

Unless otherwise noted the procedures used in preparation of samples and the analysis of samples by thermal activation characteristic (TAC), multiple activation (MA), modified additive dose (MAD), and spike procedure are as described previously.¹⁻⁵

Utah Analysis of NBS Irradiated Quartz

Sample Preparation and Method. Twenty-six grams of nonmetallic crystalline material in the range of 75 to 250 μm was removed from 1.2 kg of Nagasaki Ieno-cho wall brick sample 8 using a hand operated milling machine and Frantz magnetic separator. The crystals were annealed at 800°C in air for nine hours and cooled rapidly to room temperature. Samples were placed in four quartz containers with internal dimensions 18.7 high \times 10 \times 10 mm, wall and base thickness 2.7 mm, and lid thickness 3.0 mm. Sample weight per container averaged 2.30 ± 0.04 g. Samples were placed in a lead container with 1-inch thick walls and air freighted from Utah to Washington, DC. Irradiations were performed at NBS as described by Haskell et al (Chapter 4 Appendix 10). Samples were returned to the University of Utah (UU) by air freight, but without lead shielding. Each of the four samples was weighed and separated into five portions for shipment via air freight without lead shielding to the participating laboratories.

Table 1. Results of University of Utah Analysis of NBS Irradiated Quartz

NBS 1		NBS 2		NBS 3		NBS 4	
Laboratory Beta Dose	Estimate of NBS Dose	Laboratory Beta Dose	Estimate of NBS Dose	Laboratory Beta Dose	Estimate of NBS Dose	Laboratory Beta Dose	Estimate of NBS Dose
2	-1.45	3	4.23	5	8.57	20	37.76
4	0.79	6	6.64	10	13.24	20	34.62
6	-0.88	10	5.79	10	15.30	25	49.57
8	-0.53	12	10.26	15	16.92	30	35.71
10	2.48	15	8.23	15	12.89	35	42.49
15	0.01	15	7.10	20	18.07	40	35.90
20	0.06	18	9.12	20	19.00	40	59.76
25	0.52	20	5.72	20	15.10	45	45.25
30	-0.88	20	3.54	25	13.77	10	22.39
		25	6.25	30	23.20	20	30.69
		30	7.88			40	34.88
						60	47.71
						10	28.61
						40	34.66
						60	50.57

The portions remaining for analysis at UU were prepared according to standard procedures. Both unetched and hydrogen fluoride (HF)-washed samples were used in the analysis. The HF-washing procedure included a 3-minute wash in 24% HF acid, followed by 15 minutes in a saturated solution of AlCl_3 followed by washing in glass-distilled H_2O , methanol, and spectral grade acetone. Grain size used for the analysis was 150 to 250 μm .

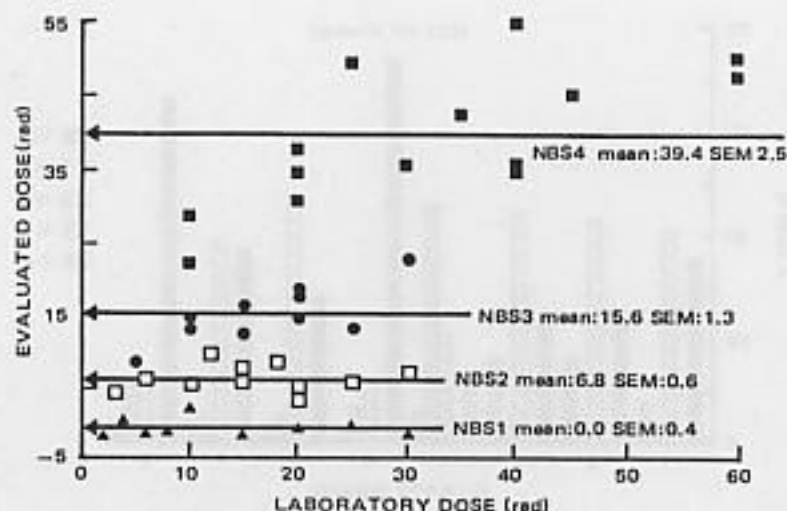


Figure 1. Results of University of Utah analysis of NBS-irradiated quartz

Results. The data collected for the NBS samples are shown in Table 1 and in Figure 1. The overall dose estimate for each sample was computed in two ways: (1) by taking the mean of all MA estimates for each sample, and (2) by fitting a linear regression line to the MA estimates and interpolating to the value for which the dose estimate was equivalent to the applied beta-particle dose (Figure 1). Results of the overall dose estimates are given in Table 2.

Table 2. Overall Dose Estimates for the University of Utah Analysis of NBS Irradiated Quartz

	NBS 1	NBS 2	NBS 3	NBS 4
Mean (\pm SEM ^a)	0.0 (0.4)	6.8 (0.6)	15.6 (1.3)	39.4 (2.5)
Linear regression (\pm SEE ^b)	0.0 (0.7)	6.5 (1.0)	14.7 (1.0)	43.8 (2.4)

^aStandard error of the mean.

^bStandard error of the estimate.

Discussion. The Ieno-cho wall brick which was used for this study was determined by glow curve analysis⁶ and x-ray diffraction⁷ to have a high plagioclase content. X-ray fluorescence at the UU revealed high sodium content (Figure 2). Because of the large reduction in sample quantity following 40-minute etch with concentrated HF, several of the laboratories were unable to obtain sufficient quantities of sample for accurate measurement of the low applied doses. Further work on the Ieno-cho brick and the effect of sample preparation treatment on pre-dose TL results are presented below.

Dose-Rate Effect

Irradiation and Sample Preparation Procedure. Geological quartz was crushed to a grain