^{36}Cl Measurements with Respect to the Hiroshima Discrepancy

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Measurements of radionuclides produced by thermal neutrons and neutron activations calculated in the actual dosimetry system DS86 show large discrepancies. At a distance of 1500m from the epicenter the ratio measured/calculated is in the range of 10 (see Fig. 1). For a detailed discussion see e.g. [4].

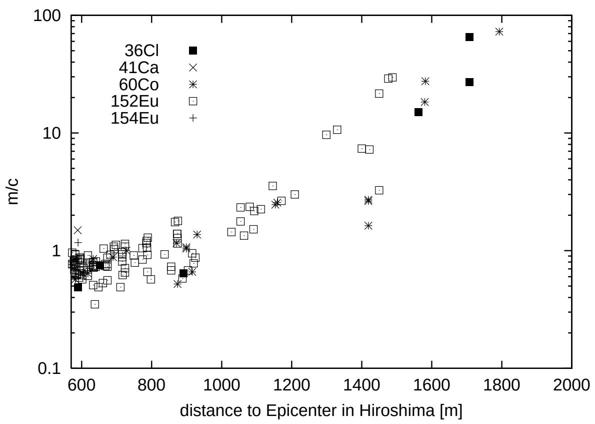

Fig. 1: measured to calculated neutronactivations in Hiroshima (see e.g. ref. [2])

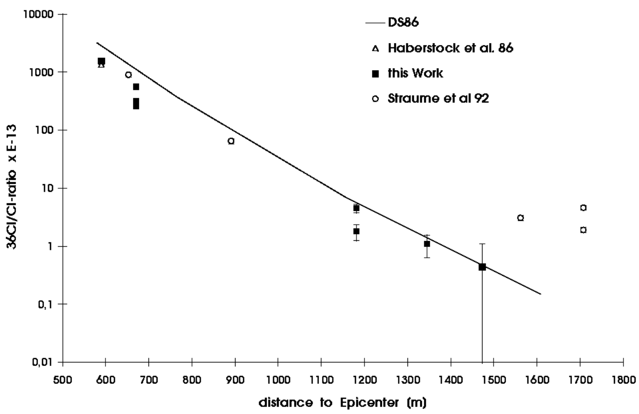

Fig. 2: ^{36}Cl measurements in Hiroshima

A discrepancy of this range would affect current radiation risk estimates [5]. Especially results for ^{36}Cl which was produced by thermal neutrons via the reaction ^{35}Cl(n,γ)^{36}Cl, show large discrepancies to DS86 calculations, at distances beyond $\geq$1500m. At present, however, only few ^{36}Cl measurements have been made (see [3], [2]). To reexamine the calculated neutron activations in Hiroshima new ^{36}Cl measurements were performed at the accelerator laboratory of LMU and TUM by accelerator mass spectrometry (AMS) with completely stripped ions, using the postaccelerator SchweIN.

Several granite samples from Hiroshima at distances between 590m and 1475m from the epicenter were collected. About 100g of each sample were crushed and Cl was extracted by use of a carrier-free extraction method wich was developed recently (see ref. [1]). In addition, unirradiated blank granite samples from Japan were prepared and measured in order to determine ^{36}Cl background due to in-situ production by secondary neutrons of cosmic radiation. Three rock-salt samples served as chemical blanks and machine blanks. The results are summarized in Tab. 1.

Sample	distance to Epicenter [m]	^{36}Cl/Cl ratio $\cdot 10^{-13}$
salt1	–	0.3 ± 0.1
salt2	–	0.2 ± 0.1
salt3	–	0.14 ± 0.08
Agi-stone	–	0.4 ± 0.3
Giin-stone	–	1.0 ± 0.4
Odochi-stone	–	1.3 ± 0.3
Saikoji-gravestone	590	1570 ± 70 1300 ± 70
Fukoku-building	670	560 ± 60 310 ± 40 260 ± 20
Ganjyoji (gravestones)	1181	4.5 ± 0.7 1.8 ± 0.6
Jyunkyoji (gravestone)	1345	1.2 ± 0.7
Hiroshima-University	1473	0.44 ± 0.49

Table 1: All samples from Hiroshima are background corrected, using the measurements of the not irradiated granite samples Agi, Giin and Odochi.

The data for the salt samples indicate a laboratory background low enough for our measurements. The samples from Hiroshima show, when corrected for the results of the un-irradiated blank granites, no significant discrepancies to the DS86 calculations (see Fig. 2). To verify these results new samples from Hiroshima are already collected and will soon be prepared and measured.

References

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