New ^{36}Cl Measurements on Samples from Hiroshima

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Measurements of radionuclides produced by thermal neutrons in Hiroshima such as ^{36}Cl and ^{152}Eu, and calculations of their production based on the current dosimetry system DS86 [3] showed large discrepancies at distances beyond ≥1000 m from the hypocenter (see e.g. [1]). However, measurements of ^{36}Cl performed at the accelerator laboratory in Munich did not show any major discrepancies compared to DS86 calculations (see [2], [4]). To verify these results, additional samples were collected from various locations in Hiroshima (Fig. 1). Most of these samples consist of granite and were taken from gravestones or buildings. As a reference, granite from quarries around Hiroshima which was not exposed to A-bomb neutrons was also collected.

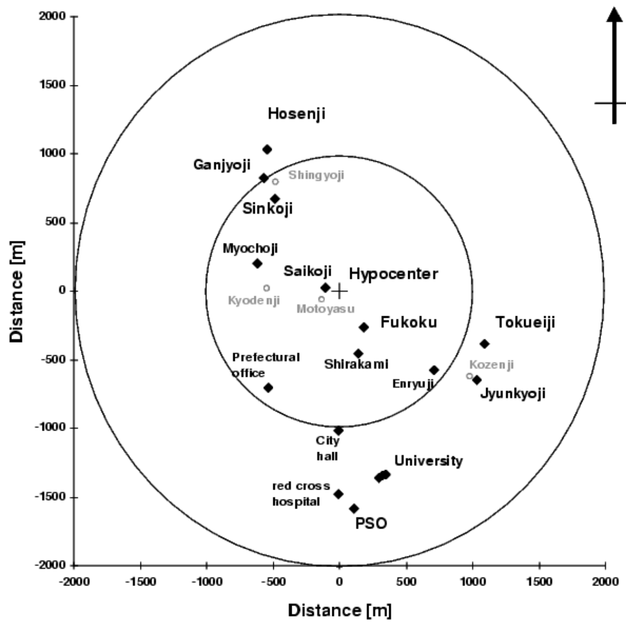

Fig. 1: Location of the investigated granite samples from Hiroshima. ◇ already measured ; ○ not measured yet.

The samples were chemically prepared by use of a carrier-free method [5], and the ^{36}Cl/Cl ratios determined by means of ams with completely stripped ions. Typical ^{36}Cl/Cl-ratios obtained for granite samples which were not exposed to A-bomb neutrons were in the range from $0.6{\cdot}10^{-13}$ to $1.0{\cdot}10^{-13}$, due to their exposure to cosmic radiation and to neutrons from the uranium and thorium decay series in the lithosphere. These ^{36}Cl/Cl ratios were added to the DS86 calculations, to account for the natural ^{36}Cl levels which become important in samples exposed to A-bomb neutrons at large distances from the epicenter.

^{36}Cl/Cl-ratios obtained on samples from short distances from the epicenter are generally lower than those calculated by DS86. This has also been observed for other radionuclides produced by A-bomb neutrons in Hiroshima such as ^{63}Ni [6]. One explanation for this observation could be that the height of burst was higher than assumed in the DS86 calculations. At larger distances, the measurements do not show significant discrepancies compared to the corresponding DS86 calculations, if ^{36}Cl/Cl ratios typical for natural samples were added to those calculated by DS86 (Fig. 2).

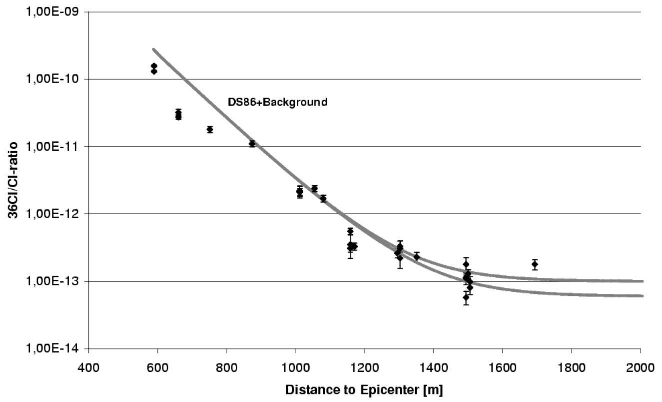

Fig. 2: Results of the new measurements performed at the accelerator laboratory in Munich. The solid lines represent DS86 calculations with a maximum and minimum ^{36}Cl/Cl ratio added, which was obtained from samples not exposed to A-bomb neutrons.

It is obvious that for the distant samples the in-situ background due to cosmic radiation is very important. This background depends on the depth within the quarry where the investigated granite samples came from, and on their chemical composition. For most of the investigated samples chemical analyses are already available. At present, the natural level of ^{36}Cl in the investigated samples is being calculated on an individual basis.

References

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