AMS, Radioisotopes, and Recent Supernovae.

G.Korschinek, K.Knie, T.Faestermann, W.Hillebrandt, G.Rugel, J.Scholten#, C.Wallner*

Technische Universitaet Muenchen, Fachbereich Physik, 85748 Garching/Germany
** Max-Planck Institut fuer Astrophysik, 85740 Garching/Germany*
 # Geologisches-Palaeontologisches Institut, Universitaet Kiel, 24098 Kiel/Germany

In a recent study we have considered the find of ^{60}Fe on earth as a possible indicator of a supernova event in the past [1]. A signature of ^{60}Fe, if it is above any background sources, would support such a statement. In addition, because of the short half live of 1.5 Myr, only a nearby supernova can leave these fingerprints. There are considerable discussions of the probability of such events and their possible impacts on the earth's biosphere [2, 3, 4]. We believe that ^{60}Fe is the most promising indicator [5]. The importance of ^{60}Fe as a supernova indicator has been pointed out already very early [6].

The reservoir where we have looked for was a deep-ocean ferromanganese crust. This is as the formation rate of this hydrogenetic crust was extremely low (only a few mm/Myr) and therefore was expected to show an efficient collection report of ^{60}Fe in the past. The sample originated from Mona Pihoa in the South Pacific (19° South, 149° West) at a depth of about 1300m. We have measured a depth profile of three layers corresponding to an age span of 0-2.8 Myr, 3.7-5.9 Myr, and 5.9-13.4 Myr.

Before the AMS measurement all iron has been chemically extracted from the ferromanganese crust. Negative FeO- ions have been produced and accelerated by the Munich Tandem accelerator to an energy of 155 MeV. At the end of the beam transport system, tuned to mass number 60 the interfering stable ^{60}Ni was separated by means of a 135° magnet, filled with 6 mbar nitrogen. Due to the interaction with the gas the ions resume an average charge state depending on their nuclear charge. Therefore isobaric ions exit the magnet at different positions. They than enter an ionization chamber, where the ^{60}Fe ions can be identified by their positions, residual energies, different energy losses and angles. Possible background rates have been determined with elder crust samples and therefore expected to bee nearly free of ^{60}Fe. Also artificial samples, which have been chemically processed in the same way than the other samples have been checked for background induced by the chemical treatment.

Several natural background samples have been considered, like:

Spallation of cosmic rays on krypton in earth's atmosphere and cosmic ray produced ^{60}Fe from extraterrestrial matter that settle gravitationally on earth which was not shielded by the atmosphere and the earth's magnetic field. In-situ production of ^{60}Fe can be neglected as well because of the effective shielding by 1300m of water.

We found in the first two layers a clear signal (^{60}Fe/Fe) above the background; the values are $2.1 * 10^{-15}$ and $1.4 * 10^{-15}$ respectively. The oldest sample has been measured too $4.5 * 10^{-16}$ which is about factor of 2 above our blank value.

The only reasonable explanation of our findings is that the crust contains live ^{60}Fe formed in one or more recent supernova explosions. This is supported by several arguments:

The amounts of ^{60}Fe we have found is in fair agreement with a supernova explosion about 5 Myr ago at a distance of about 30pc. Dust grains of such a close supernova do enter the solar system and end up finally on the Earth. There are several evidences that interstellar matter is entering the solar system like the dust measurements of Ulysses spacecraft and the ions measurements from the SAMPEX satellite. Also, it is known that our solar system is embedded in the so-called local hot bubble extending over a radius of about 100pc. It has been suggested that the hot gas has been produced by one or several supernovae exploding during the past 20 Myr. The presence of ^{60}Fe strongly support this idea.

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