STUDYING THE CONSTANCY OF GALACTIC COSMIC RAYS USING COSMOGENIC NOBLE GASES AND RADIONUCLIDES ON IRON METEORITES.

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Introduction: The constancy of the galactic cosmic rays (GCR) is a long-standing question in meteorite research. The temporal variability of GCR intensities over the last billion years can be investigated studying meteorites [1]. Indeed, during their travel in space, meteoroids are exposed to GCRs; the interactions producing (among others) stable and radioactive cosmogenic nuclides. Being interested in the long-term GCR variability, we study iron meteorites because they typically have cosmic ray exposure (CRE) ages in range of a few hundred millions years (Myr) and – for some – even up to two billion years [2]. It has been demonstrated that periodic GCR flux variations can induce peaks in CRE age histograms. Therefore, setting up a consistent exposure age histogram and searching for periodic peaks permits us to study hypothetical GCR flux variations.

Experimental methods: Noble gas isotopes (He, Ne, and Ar) are analyzed by noble gas mass spectrometry at the University of Bern, using two self-made mass spectrometers [3,4]. Analyses of the cosmogenic radionuclides (^{10}Be, ^{26}Al, ^{36}Cl, and ^{41}Ca) are performed at the DREsden Accelerator Mass Spectrometry facility (DREAMS, [5]) adapted from the procedure described in [6].

Results: So far, 28 iron meteorite samples, mainly of class IIIAB, have been investigated for their noble gas and cosmogenic radionuclide contents. The first terrestrial ages have been determined using the ^{36}Cl/^{10}Be-^{10}Be method [1]. They range between 10 kyr and 500 kyr. Because doubts exist on the use of ^{26}Al, ^{21}Ne and probably ^{10}Be as proxies for CRE age determination, due to inhomogeneous sulfur and phosphorus distribution [3,7], the CRE ages were calculated using the radioactive-stable nuclide pair ^{36}Cl-^{36}Ar, as described in [1]. The calculated ages range between ~5 and ~700 Myr, which is in the expected range for iron meteorites [2,8]. Additionally, the first ^{53}Mn and ^{60}Fe measurements have been performed at the Australian National University (ANU) and at the TUM in Munich. On the CRE ages histogram, two peaks, centered at ~50 and ~350 Myr are visible, but statistics are still poor. Additional measurements of iron meteorites are thus needed and ongoing, that will help to study possible variation in the GCR intensities over the last billion years.

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