I-Xe SYSTEM IN CAMPO DEL CIELO SILICATES. O. Pravdivtseva[1], A. Meshik[1], C. M. Hohenberg[1] and G. Kurat[2]. [1]McDonnell Center for the Space Sciences and Physics Department of Washington University, One Brookings Drive, Saint Louis, MO 63130, USA (olga@physics.wustl.edu), [2]Naturhistorisches Museum, Burgring 7, 1010, Vienna, Austria (gero.kurat@univie.ac.at).

Iron meteorites may seem to present a challenge for I-Xe dating because it is the inclusions, not the metal, that contains the iodine; therefore, it is the inclusions that are dated, not the metal. However, this is a good thing since different minerals close at different times, providing diverse ages and the potential for cooling rate information. Silicate inclusions are frequent only in types IAB and IIE, and earlier studies demonstrate that diverse I-Xe systems can survive intact in these inclusions, preserving a spectrum of age information [1–5].

An early study of noble gases from Campo del Cielo IA (El Taco mass) was done on separated silicate inclusions which were crushed, sieved and chemically treated, but not irradiated. That work [6] confirmed that silicate inclusions indeed contain excess ^{129}Xe, but specific carrier phases were not identified.

Our previous studies [7] involved a silicate-graphite-metal inclusion (SiGrMet) from Campo del Cielo in a slice from the Museum of Natural History, Vienna, which demonstrated presence of radiogenic ^{129}Xe in two different silicates [7]. Eight different 300×300μm laser-raster excavations were made, each approximately 12 μm deep. Typical raster areas are shown in Fig. 1 (data in Table 1). As expected, no radiogenic ^{129}Xe was found in the metal itself, nor was it found in the rust or in the olivine. These particular silicates contained Xe that was nearly monoisotopic ^{129}Xe, with almost no measurable trapped Xe.

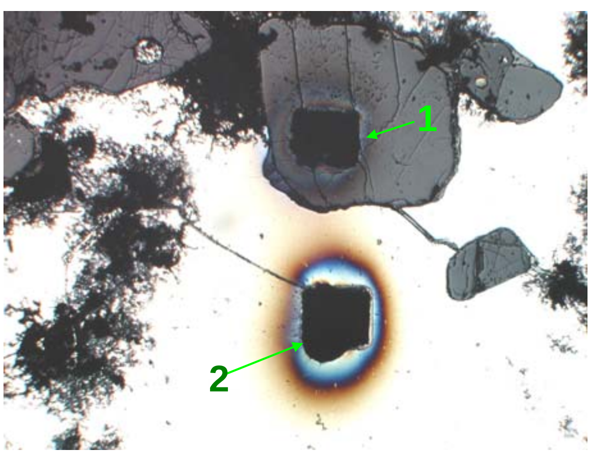

Fig. 1. Excavated 300×300 μm areas of Campo del Cielo iron. 1 – silicate (cpx inclucion ge#1, 2 – metal. Rust lace is visible on the left.

Table 1.

Concentration of radiogenic ^{129}I in various grains from SiGrMet inclusion of Campo del Cielo [7].

Rastered mineral	^{129}Xe* × 10^{-7}cm^{2}/g
Diopside (ge#1)	4.5
Diopside (ge#3)	5.4
Albite without Fe (ge#6)	0.9
Albite with Fe (ge#8)	5.6
Olivine (ge#4)	< 0.01
Rusty spot (ge#2)	< 0.02
Metal (ge#7)	< 0.04
Metal (ge#5)	< 0.03

Although diopside ge#3 demonstrated slightly higher concentrations of radiogenic ^{129}Xe, dioside ge#1 was larger and did not have any visible micro-inclusions, so we selected it for irradiation and further I-Xe studies. Diopside ge#1 was manually excavated from the metal matrix as a single 2.15 mg crystal. Albite, containing the rastered area ge#8, was brittle and was recovered from the metal matrix in three pieces with combined weight of 0.18 mg. These selected silicates, along with Shallowater enstatite irradiation standard, were sealed under vacuum in fused-quartz ampoules and irradiated with thermal neutrons in the pool area of the Missouri University Research Reactor (MURR) in a continuously rotating water-flooded capsule. Samples, after cooling, were wrapped in platinum foil and placed in the extraction system of the mass-spectrometer. The Xe was released in step-wise extractions, purified by gettering, and statically measured in an ion-counting mass spectrometer.

Usually the first extraction steps are dominated by uncorrelated ^{128}Xe, indicating loss of radiogenic ^{129}Xe or superficial iodine contamination. In case of the Campo del Cielo silicates studied here, no uncorrelated ^{128}Xe was observed in ge#1 and ge#8. Ge#1 had 94% of its radiogenic ^{128}Xe and ^{129}Xe released in temperature range 1200-1350 °C, with 70% of radiogenic gases released in single extraction step 1300-1350 °C. Its isochron is defined by 10 succesive steps, correspondsing to an age 5.9 ± 0.2 Ma younger than the Shallowater internal standard (4562.3 ± 0.3 Ma [8]).

Ge#8 demonstrates two broad peaks in the ^{128}Xe and ^{129}Xe release profiles, indicating discrete iodine trapping sites or a phase transition during step-wise heating. The isochron, defined by 7 successive experimental points, corresponds to an I-Xe age 4.3 ± 0.6 Ma younger than Shallowater.

The absolute ages of ge#8 and ge#1, 4558 ± 0.6 Ma and 4556.4 ± 0.3 Ma, respectively, are in good agreement with previously reported I-Xe ages for silicates from the iron meteorites [9, 10], but are unique in a way that step-wise heating experiments were conducted on single silicate crystals, extracted from metal. There is 1.6 Ma difference in closure time of the I-Xe system in these two silicates. These ages, determined with high precision, provide valuable information on the thermal history of Campo del Cielo. Preliminary mineralogical studies have identified these silicates as diopside and albide. More detailed study utilizing a JEOL-840A electron scanning microscope is uder way.

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References: [1] Alexander E. C., Jr and Manuel O. K. (1968) *EPSL* 4, 113–117. [2] Bogard D. D. et al. (1971) *GCA 35*, 1231–1254. [3] Alexander E. C. Jr. et al. (1969) *EPSL* 6, 355–358. [4] Alexander E. C. Jr. et al. (1970) *EPSL* 8, 188. [5] Podosek F. A. (1970) *GCA* 34, 341–365. [6] Hintenberger H. et al. (1968) in *Meteorite Research*, 895–900. [7] Meshik A. P. et al. (2004) *35th LPSC*, Abstract #1687. [8] Gilmour J. D. et al. (2006) *MAPS* 40, 207 -224. [9] Niemeyer S. (1979) GCA 43, 843860. [10] Bogard D. D. et al. (2005) *MAPS* 40, 207– 224.

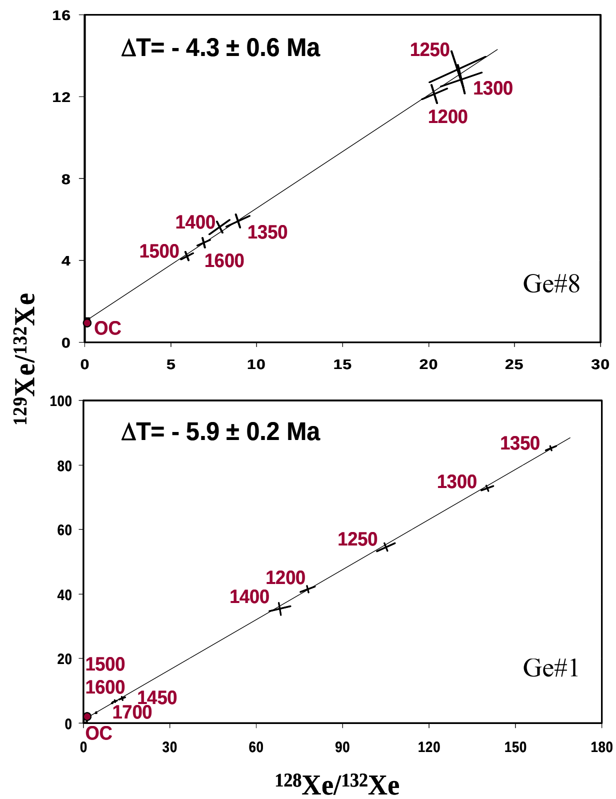

Fig 2. Three-isotope plots for Campo del Cielo silicates. Ages are shown relative to Shallowater (4562.3 ± 0.3 Ma [8]). OC stands for the Ordinary Chondrites component, numbers represent extraction temperatures.