surface-correlated radiogenic ^{129}Xe as well [2]. The presence of these two components strongly suggests that the solar noble gases were also trapped very early, which makes these samples attractive for studying properties of the ancient solar corpuscular radiation.

We explore here the suitability of the closed-system stepped-etching (CSSE) technique [4] to separate parentless and solar components. We report preliminary data on a bulk sample of breccia 14301 gently crushed and sieved to 25–150 µm. By the time of this writing, roughly 40% of the total Ne and 20% of the Xe have been released in 20 etch steps. Trapped Ne shows the familiar two-component structure SW-SEP (solar energetic particles [4]), with $^{20}Ne/^{22}Ne$ ratios ranging between ~13.6 and ~11.6. This indicates that we also need to consider the presence of two solar Xe components with slightly different isotopic compositions [5]. In a diagram $^{134}Xe/^{132}Xe$ vs. $^{136}Xe/^{132}Xe$ all data points fall between the two straight lines that connect the ^{244}Pu fission Xe point on the one hand with the SW-Xe and SEP-Xe points, respectively, on the other. The highest $^{136}Xe/^{132}Xe$ ratio of ~0.42 is observed in one of the first steps. The last etch steps analyzed so far are essentially devoid of fission Xe, since the data plot between the SW-Xe and SEP-Xe points. The data pattern thus clearly confirms that ^{244}Pu is the source of the parentless fission Xe and that this component is released even more easily than the SW-Xe [2].

All steps so far release radiogenic ^{129}Xe, including those that are devoid of fission Xe. This corroborates that at least part of the $^{129}Xe_{rad}$ is sited in places more resistant to etching than the fission Xe [2]. The noble gas data reveal the existence of several phases of different etchability, as expected for a bulk sample. It is conceivable that the $^{129}Xe_{rad}$ resides more deeply in the grains than the fission Xe or that the more acid resistant phases (e.g., mineral grains?) may contain $^{129}Xe_{rad}$ but no fission Xe. CSSE analyses of mineral separates may help to decide between the alternatives.

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A WEATHERING SCALE FOR THE ORDINARY CHONDRITES.

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Weathering categories A, B, and C are used by the Meteorite Working Group at the NASA Johnson Space Center in Houston for Antarctic meteorite finds, denoting minor, moderate, and severe rustiness of hand specimens. A different scale can be set up from the weathering effects seen in polished sections with the microscope. These weathering effects finally lead to the disintegration of the meteorite; they are important in connection with its terrestrial age and an estimate of the true fall rate of meteorites.

In order to avoid confusion with the hand specimen classification A, B, C, the weathering grades determined on polished sections were named W1–W6. Weathering affects first the metal grains, later troilite, and finally the silicates. The following progressive stages can be distinguished:

W0: No visible oxidation of metal or sulfide. A limonitic staining may already be noticeable in transmitted light. Fresh falls are usually of this grade, although some are already W1.

W1: Minor oxide rims around metal and troilite; minor oxide veins.

W2: Moderate oxidation of metal, about 20–60% being affected.

W3: Heavy oxidation of metal and troilite, 60–95% being replaced.

W4: Complete (>95%) oxidation of metal and troilite, but no alteration of silicates.

W5: Beginning alteration of mafic silicates, mainly along cracks.

W6: Massive replacement of silicates by clay minerals and oxides.

More or less massive veining with iron oxides can already be found in stage W2. These veins develop independently from the weathering grade, apparently in cracks that form through mechanical forces. Broad cracks are often filled with carbonates. Grades W5 and W6 are rare. The silicate alteration first affects the olivines; it starts inside the grains, not from the rim. In stage W6 intact chondrules were found, where olivines were completely replaced by a mixture of clay minerals and iron oxides, with the feldspathic mesostasis being unaffected.

A correlation between these weathering grades and the terrestrial ages was shown for meteorite finds from Roosevelt County, New Mexico [1]. In these climatic conditions the weathering grades W2 to W6 develop in the following times: W2, 5000 to 15,000 yr; W3, 15,000 to 30,000 yr; W4, 20,000 to 35,000 yr; W5 and W6, 30,000 to >45,000 yr. Similar terrestrial ages were found for chondrites of these weathering grades from the Lybian and Algerian Sahara [2,3]. Antarctic meteorite finds weather much more slowly. A check of 53 Antarctic ordinary chondrites (of hand specimen weathering categories A–C) showed only 9 of grade W2, the rest being W1. Among the W1s is ALHA 77278 (category A) with a terrestrial age of 320,000 yr [4].

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MULTIVARIATE STATISTICAL ANALYSIS OF VOLATILE TRACE ELEMENTS IN H CHONDRITES: IMPLICATIONS FOR PARENT BODY STRUCTURE.

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The perception among meteoriticists is that contents of the volatile trace elements systematically decrease with shock and particularly petrologic type. This perception affects views that investigators have of the early history and structure of the H chondrite parent body. Measurement of a variety of volatile trace elements in a statistically significant number of samples accompanied by chemometric data analysis techniques developed for interpretation of trace-element data [1] should maximize the amount of genetic information available from the volatile trace elements and offer clues to the early thermal history of the H chondrite parent body. Volatile-trace-element data exist for 58 H chondrite falls: The complete dataset includes Co, Rb, Ag, Se, Cs, Te, Zn, Cd, Bi, Tl, and In (listed in increasing order of volatility) [2,3]. This dataset includes 13 H4, 32 H5, and 13 H6 chondrites, which cover the full range of shock facies a–f.

To examine the effect that shock has on volatile-trace-element