NOBLE GASES IN MID-ORDOVICIAN FOSSIL MICROMETEORITES FROM CHINA AND SWEDEN

C. Alwmark[1], M. M. M. Meier[1], B. Schmitz[2], H. Baur[1] and R. Wieler[1]. [1]ETH Zürich, Earth Sciences, NW C82, CH-8092 Zürich. E-mail: alwmark@erdw.ethz.ch. [2]Department of Geology, Lund University, SE-22362 Lund.

Introduction: The finding of more than 80 L-chondritic fossil meteorites in Middle Ordovician limestone in the Thorsberg quarry in southern Sweden [1, 2] as well as anomalously high quantities of sediment-dispersed extraterrestrial chromite (SEC) grains of L-chondritic composition in both Swedish and Chinese contemporary limestones [3] show that the meteorite flux was enhanced by two orders of magnitude following the disruption of the L-chondrite parent body at ~470 Ma [4]. A recent study [5] on SEC grains found in the fossil-meteorite-bearing limestone from the Thorsberg quarry revealed that the vast majority of the grains were delivered to Earth as micrometeorites, as they contain He and Ne of solar wind (SW) composition. Furthermore, ~25% of the grains showed cosmic-ray exposure (CRE) ages >3 Ma, implying that these grains have been pre-exposed, possibly in an asteroidal regolith. The aim of this study is to extend the previous work both geographically and in time, by noble gas analyses of L-chondritic SEC grains from two Chinese limestone beds ca. one and two Ma younger, respectively, as well as from one Swedish limestone bed ~300 Ka older, than that of [5].

Samples and Methods: 15 SEC grains from the ~2 Ma younger bed (P1) and 20 SEC grains from the ~1 Ma younger bed (Y10), from the Puxi River section in China [3] and 26 SEC grains from the Swedish limestone bed (Ark) were analyzed in a low-blank extraction line and an ultra-high-sensitivity mass spectrometer [6]. Detection limit for ^{21}Ne was ~4 x 10^{-16} cm^3 STP. In addition, two terrestrial chromite grains from each bed were analyzed, to control for a possible contribution of nucleogenic ^{21}Ne.

Results: The 35 SEC grains from Y10 and P1 all contained large amounts of SW-Ne. CRE ages, based on the excess $^{21}Ne_{cos}$ are generally low, with only two grains (13%) from P1 and 5 grains (25%) from Y10 showing a clear pre-exposure signature. As in the case of Y10 and P1, all 26 Ark SEC grains display SW-Ne. However, 17 of the grains (65%) have a CRE age implying a pre-exposure. The terrestrial chromite grains showed no or very low ^{21}Ne-excesses, demonstrating that the acquisition of nucleogenic ^{21}Ne is insignificant.

Discussion and Conclusion: All of the SEC grains from the three Ordovician limestone beds contain SW-Ne. Since only the topmost few nm of a meteoroid are exposed to SW, this implies that, as in the case of the SEC grains from the previous study [5], they were delivered to Earth as micrometeorites or parts thereof. The percentage of pre-exposed SEC grains, i.e. grains derived from the asteroidal regolith, decreases with time of delivery to Earth, following the disruption event. Whether this trend is a true reflection of a diminishing amount of regolith-derived material on Earth with time will require further investigations.

References: [1] Schmitz B. et al. 2001. *Earth and Planetary Science Letters* 194:1-15. [2] Schmitz B. and Häggström T. 2006. *Meteoritics & Planetary Science* 41:455-466. [3] Schmitz B. et al. 2008. *Nature Geoscience* 1:49-53. [4] Korochantseva E.V. 2007. *Meteoritics & Planetary Science* 42:113-130. [5] Meier M.M.M. et al. 2009. *Earth and Planetary Science Letters* 290:54-63. [6] Baur H. 1999. Abstract #F1118 Eos, Transactions, American Geophysical Union 46.