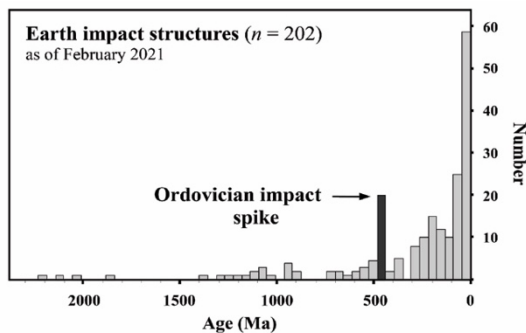


**IMPACT-CRATER AGES AND MICROMETEORITE PALEOFLUXES COMPARED: EVIDENCE FOR THE IMPORTANCE OF ORDINARY CHONDRITES IN THE FLUX OF METEORITES AND ASTEROIDS TO EARTH DURING THE PAST 500 MILLION YEARS.** B. Schmitz<sup>1</sup>, M. Schmieder<sup>2</sup>, S. Liao<sup>3</sup>, E. Martin<sup>1</sup>, and F. Terfelt<sup>1</sup>. <sup>1</sup>Astrogeobiology Laboratory, Department of Physics, Lund University, Lund, Sweden (birger.schmitz@nuclear.lu.se), <sup>2</sup>HNU Neu-Ulm University of Applied Sciences, Neu-Ulm, Germany, <sup>3</sup>Purple Mountain Observatory, Chinese Academy of Sciences, Nanjing, China.

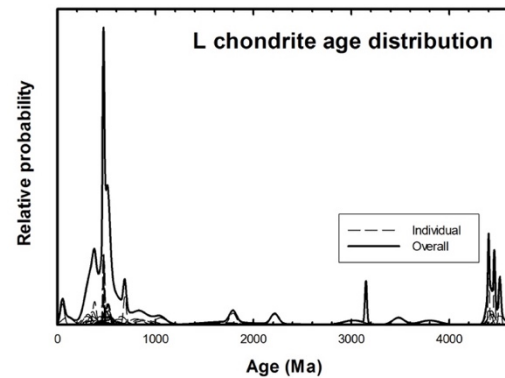
**Introduction:** Although the ~200 impact craters known on Earth represent only a small fraction of the craters originally formed, the available data suggest an excess by one order-of-magnitude of craters, by number, in the interval ~470-440 Ma in the Ordovician [1, 2]. It is a matter of debate whether the Ordovician "excess" craters reflect a preservation bias [3], or are related to the breakup of the L-chondrite parent body (LCPB) in the asteroid belt  $465.8 \pm 0.3$  Ma [2, 4]. Here we summarize five independent lines of empirical evidence providing support for the latter view.



**Figure 1.** Histogram showing the age distribution of terrestrial impact structures. Note the distinct Ordovician impact spike around 470 to 450 Ma, see further [1, 2, 5].

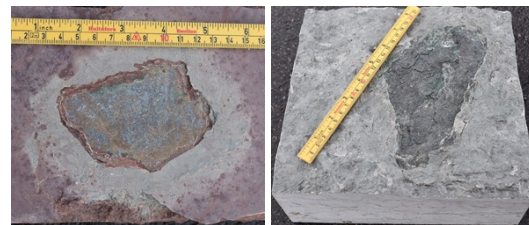
**Crater densities:** Most of the Ordovician craters are found in eastern North America and Baltoscandia, regions with enhanced preservation potential for impact craters. However, this fact can also be used to establish minimum crater spatial densities for the largest craters with the highest preservation potential [1]. Extrapolations of such observed densities on a global scale are consistent with a one order-of-magnitude increase in the flux of large impactors following the LCPB breakup.

**K-Ar ages of recent meteorites:** The record of K-Ar gas retention ages of many different types of recently fallen meteorites only document one major breakup in the asteroid belt during the Phanerozoic, the LCPB event [6, 7]. Among the meteorites falling on Earth today about a third originate from this event. It would be remarkable if the conspicuous peak in L-chondritic K-Ar ages at ~470 Ma was not matched by a corresponding enhanced flux of L chondrites to Earth shortly after the breakup.



**Figure 2.** K-Ar ages of recent L chondrites, from [7]. The plots show individual probability distribution for ages of individual meteorites (dashed line) and a combined probability distribution (solid line) for all of the data, see [7] for details.

**Fossil meteorites:** More than 130 fossil meteorites (1-21 cm large) have now been found during quarrying of marine limestone that formed within two million years after the LCPB event, providing strong empirical support for an enhanced flux of meteorites at the time [1]. Both the spatial density of the meteorites on the Ordovician seafloor and the ratio of fossil L chondrites versus other types of meteorites found provide appealing evidence for a two orders-of-magnitude increase in the flux of L chondrites. Only one non-L-chondritic meteorite has so far been found.



**Figure 3.** Examples of two large fossil ordinary chondrites found in the Thorsberg quarry, southern Sweden, in recent years. The measuring stick in the image to the right is 20 cm long.

**Micrometeorite flux:** A similar pattern as in the cratering and K-Ar isotopic records, with only one prominent flux peak, is emerging in studies of the flux of micrometeoritic chrome-spinel through the Phanero-

