ZIRCONS AS A PROBE OF EARLY LUNAR IMPACT HISTORY. C. A. Crow[1], K. D. McKeegan[1], J. D. Gilmour[2], S. A. Crowther[2], D. J. Talor[1]. [1]ESS, University of California Los Angeles. (E-mail: ccrow@ucla.edu.) [2]SEAES, University of Manchester.

Introduction: Lunar zircons are among the oldest minerals on the Moon and their ages have been used to investigate its early magmatic and impact history. Zircons are ideal for investigating the early lunar bombardment because (1) low initial Pb results in high precision U-Pb age measurements, (2) these crystallization ages of lunar zircons all predate the proposed cataclysm at 3.9 Ga, (3) zircons incorporate both U and Pu, so we can measure both U-Pb crystallization ages and fissiongenic Xe degassing ages for the same crystal. We report preliminary U-Xe degassing ages in conjunction with Pb-Pb ages for two Apollo 14 zircons.

Samples: A total of seven zircons were separated from ~5g of Apollo 14259, a very mature lunar soil [1]. Three of the zircons were chosen for Xe analyses on the basis of their estimated U contents and large sizes (>300μm). The size requirement was determined during our previous Xe analyses of lunar zircons [2].

Method: U-Pb and Pb-Pb ages of all seven zircons were measured with the UCLA Cameca ims-1270 ion microprobe. The three large zircons were then irradiated in the UC Irvine Nuclear Reactor to induce ^{235}U fission in order to determine the U-Xe age [3]. Xe isotopes were measured with the University of Manchester Refrigerator Enhanced Laser Analyser for Xenon.

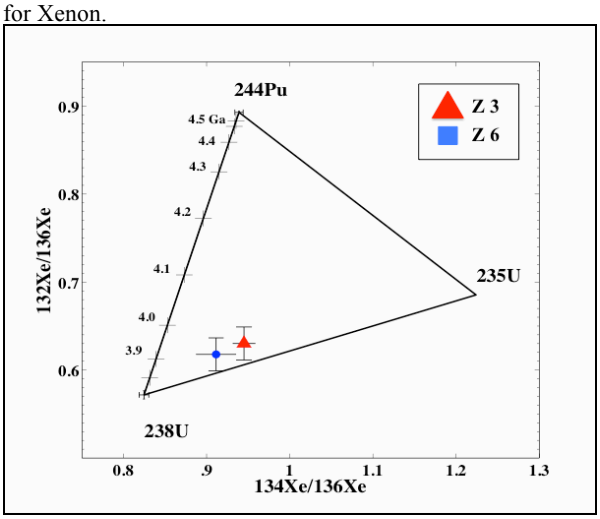

Figure 1: Results of Xe isotopic analysis for 2 large lunar zircons with blank, spallation, and air corrections. Both zircons had high temperature releases consistent with a mixture of spontaneous fission of 238U and induced fission of 235U.

Results: The Pb-Pb ages of the three large zircons are 4205±14 Ma (Z3), 4251±8 Ma (Z6), and 4190±22 Ma (Z7). Two of the grains (Z3 and Z7) are slightly discordant and both show evidence of a Pb mobility event within the last ~300 Myrs. Two of the three zircons (Z3 and Z6) produced sufficient xenon for precise xenon isotope ratios to be determined; the other did not due either to low U concentration or recent Xe degassing. Both zircons are consistent with a mixture of ^{235}U and ^{238}U fission, but neither shows evidence of ^{244}Pu (Table 1). All three zircons formed before the extinction of ^{244}Pu, so the absence of plutogenic Xe suggests that the zircons degassed more recent than 3.9 Ga, or they did not incorporate Pu during formation. We will present preliminary U-Xe degassing ages for both lunar zircons at the time of the meeting.

Table 1

Sample	132Xe/136Xe	134Xe/136Xe
Z3	0.618±0.019	0.911±0.024
Z6	0.630±0.019	0.944±0.013

References: [1] Meyer C. 2006. Lunar Sample Compendium,15455, (http://curator.jsc.nasa.gov/lunar/compendium.cfm). [2] Crow C. A., McKeegan K. D., Gilmour J. D., Crowther S. A., Taylor D. J. 2012. Abstract #1639. 43rd Lunar & Planetary Science Conference. [3] Turner G., Busfield A., Crowther S. A., Harrison M., Mojzsis S. J., Gilmour J. 2007. *Earth and Planetary Science Letters* 261: 491-499.