U-Pb AND ^{207}Pb-^{206}Pb AGE OF ZIRCONS FROM POLYMICT EUCRITES AND HOWARDITES. M. Righter[1] B. Shaulis[2], and T. J. Lapen[1], [1]Department of Earth and Atmospheric Science, University of Houston, Houston TX 77204-5007 (mrighter@mail.uh.edu).

Introduction: Polymict eucrites and howardites are regolith breccias formed by repeated impact onto the surface of the HED parent body [e.g. 1]. These meteorites are important for understanding the diversity and time frame of early magmatic activity on the HED parent body because they contain a wide variety of igneous lithologies. Since they have experienced impact heating and brecciation on their parent body, the age significance of isotope chronometers in those meteorites are difficult to interpret. Zircon is an important and useful mineral for U-Pb dating of these meteorites because it is a common accessory mineral and it is not easily susceptible to isotopic disturbances. The main focus of this study is to obtain *in situ* U-Pb and ^{207}Pb-^{206}Pb ages of zircon from variety of clasts from polymict eucrites and howardites in the U.S. Antarctic meteorite collection.

Samples and Analytical Techniques: We have examined five polymict (ALH 76005, EET 79004, EET 79005, EET 79006, and LEW 85300) and two howardites (EET 87503 and EET 99400) from the U.S. Antarctic meteorite collections. Polished thin sections of these samples were examined by scanning electron microscopy and electron probe microanalysis (Cameca SX100) at NASA-JSC. We found zircon grains from all samples. Baddeleyite was found in six samples (ALH 76005, EET 79004, EET 79005, EET 79006, LEW 85300, EET 87503 and EET 99400). Relatively large zircon (≥8 μm in size), which enables the use of the LA-ICP-MS for U-Pb isotopic analysis, were identified from five samples (ALH 76005, EET 79005, EET 79006, LEW 85300 and EET 87503).

In situ U-Pb isotopic analysis was carried out with a Photon Machines *Analyte.193* laser ablation system coupled to a Varian 810-MS ICP-MS at the University of Houston. The laser analyses used 10 μm spot sizes with repetition rate of 7Hz and an energy output of 3 J/cm^2. Individual spot analyses are 60 seconds in length and are split into three parts with each lasting approximately 20 seconds: background measurements, ablation and wash-out. The FC5z zircon (1099 Ma [2]) and Phalaborwa baddeleyite (2059.2 Ma[3]) were used as the external calibration standard and Plešovice Zircon (337 Ma) and FC5z baddeleyite (1099 Ma[2]) as the internal standard.

With this system we can consistently measure U-Pb ages of zircons within 1.5% of their known TIMS ages, and can routinely achieve precisions of pooled ages of ± ~ 0.3% (2σ) and 1-7% for individual spot analyses, depending on U concentration, age, and grain size [4].

Results: Total of 10 zircons and 5 baddeleyite from LEW 85300 and EET 79006 polymict eucrites and EET 87503 howardites have been analyzed for U-Pb systematics by LA-ICP-MS. LEW 85300 polymict eucrite is an impact breccia containing dark glassy matrix and numerous igneous and brecciated clasts [5-7]. Rubidium-Sr, Sm-Nd and Ar-Ar systematics reported before shows young disturbed ages (~3.5 Ga), [8, 9] but initial crystallization ages are unknown. The zircon grains found in this meteorite (Fig. 1) are most commonly in basaltic clasts associated with ilmenite (Fig. 2) and to a lesser extent pyroxene. Those zircon grains typically have rounded to subrounded shape. We analyzed 6 zircon grains from three different clasts. An average $^{207}Pb/^{206}Pb$ age of 4486 ± 37 (2σ; Fig. 3) is obtained. The U-Pb concordia diagram (Fig. 4) yields an age of 4450 ± 24, which is within error of the $^{207}Pb/^{206}Pb$ ages. The ^{207}Pb-^{206}Pb age of 4486 ±37 Ma are identical within error to a $^{206}Pb/^{238}U$ age of 4450 ± 24 Ma and are identical within error. Those ages are slightly younger than those of unbrecciated eucrites of 4548 ± 11 Ma [10]. It could be possible that magmatic activity on eucrite parent body lasted long and that there is a thermal disturbance at ~3.5 Ga, the zircon could be interpreted to have experienced Pb-loss at this time (Fig. 5).

Three zircons and three baddeleyite were analyzed from EET 79006 polymict eucrite. The ^{207}Pb-^{206}Pb age of 4446 ± 250 and 4523 ± 120 (2σ) are obtained from zircons and baddeleyites. Low precision is caused by scatter of the indivisual data points. Those zircon and baddeleyite grains occurred in the well-mixed matrix area; therefore those zircon/baddeleyite could have had different petrogenetic origins and were later mixed together.

EET 87503 howardite has a variety of fine- to coarse-grained diogenite, eucrite, impact melt/breccia clasts [11]. Ar-Ar data shows a ~ 3.7 Ga plateau age [12]. The Rb-Sr and Sm-Nd systematics of basaltic clasts were severely disturbed, but the presence of live ^{146}Sm indicate early crystallization age of those clasts [13]. We analyzed one zircon grain and obtained a ^{207}Pb-^{206}Pb age of 4557 ± 68 (2σ) and U-Pb concordia age of 4562 ± 53 (2σ).

The preliminary ^{207}Pb-^{206}Pb age of zircon and baddeleyite shows slightly younger ages than inferred formation age of eucrite basalt ~4.56 Ga and also zircon ages from other basaltic eucrites reported by Misawa et al. [14] and Righter et al. [10]. The U-Pb concordia diagram (Fig. 5) also shows that there is likely some Pb loss during the secondary events such as shock heating, brecciation and melting, giving relatively young U-Pb ages. The U-Pb dating of zircons and baddeleyites from other eucrites is still in progress.

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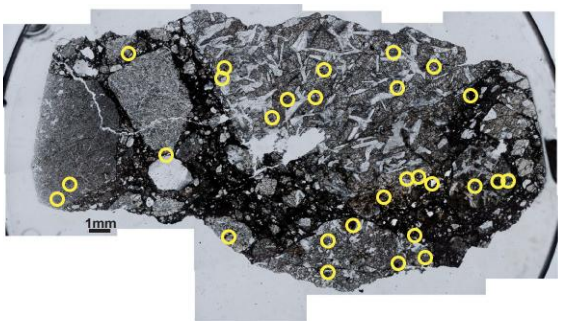

Fig. 1. Photomicrographs of LEW 85300 polymict eucrite. Yellow circles show occurrence of zircon grains in different clasts.

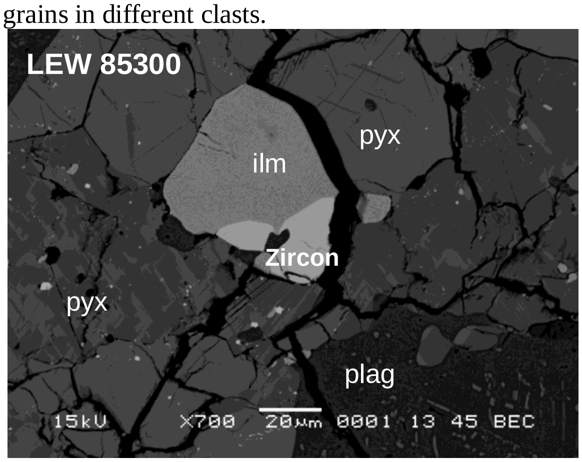

Fig. 2. BSE images of zircons in LEW 85300.

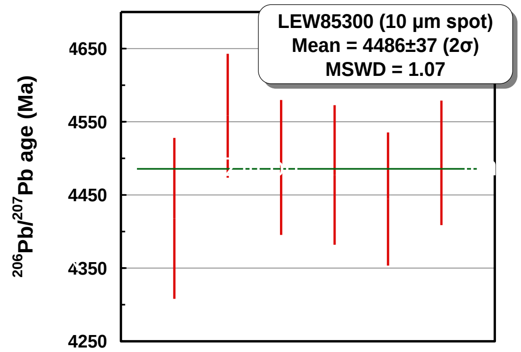

Fig. 3. The weighted mean of ^{207}Pb-^{206}Pb zircon age for LEW85300 polymict eucrites.

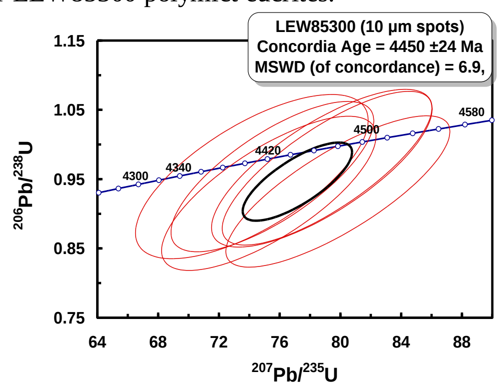

Fig. 4. U-Pb Concordia diagram for zircons in LEW85300 polymict eucrite, Black ellipse is the weighted average.

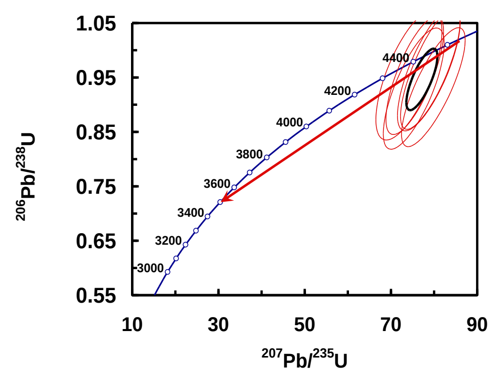

Fig. 5. Isotope systematcs of potential Pb-loss in zircons of LEW85300 at ~3.5 Ga assuming igneous crystallization at 4.55 Ga. Red arrow represents the Discordia.