AGE OF ZIRCONS IN THE IMPACT-MELT BRECCIA IN SAU 169 LUNAR METEORITE: BEIJING SHRIMP II STUDY. Dunyi Liu[1], Yushen Wan[1], Yuhai Zhang[1], Chunyan Dong[1], Bradley L. Jolliff[2], Ryan A. Zeigler[2], and Randy L. Korotev[2], [1]Beijing SHRIMP Center, Institute of Geology, Chinese Academy of Geological Science, Beijing, 100037, P. R. China; [2]Department of Earth and Planetary Sciences and the McDonnell Center for the Space Sciences, Washington University, St. Louis, Missouri 63130. (liudunyi@bjshrimp.cn).

Introduction: Sayh al Uhaymir (SaU) 169 is an unusual and important lunar meteorite. The meteorite consists of a complex regolith breccia with impact-melt breccia lithic components [1]. Its incompatible-element enrichment and compositional signature suggest an origin in the Procellarum KREEP Terrane [1,2]. Moreover, the impact-melt-breccia portion of the meteorite contains zircons and these were originally dated by Gnos et al. [1] to be 3909±13 Ma by $^{207}Pb/^{206}Pb$ analyses of zircon using the Cameca IMS 1270 at Bern.

Zeigler et al. [2] found and reported a new impact-melt breccia group among small rock fragments from Apollo 12 and showed that the composition of this group is nearly identical to that of the SaU 169 impact-melt breccia. This group of impact-melt breccia rocklets has on average ~30 ppm Th, which is the highest among impact-melt-breccia groups from all Apollo sites. As part of a comparison of the Apollo 12 high-Th IMB group and SaU 169 impact-melt breccia, we have begun a collaborative study of the ages of these rocks through the analysis of zircons using the SHRIMP II at the Chinese Academy of Geological Sciences in Beijing. In this abstract, we report the results of analyses of zircons in SaU 169. To summarize our results, we find an age for zircons in the impact-melt breccia lithology of 3918±9 Ma, consistent with the age found by [1]. We interpret this to be the age of crystallization of the impact melt.

Methods and Data: Zircon U-Th-Pb dating was performed on the SHRIMPII at the Beijing SHRIMP Center, Chinese Academy of Geological Sciences. The analytical procedures are essentially as given by [3].

Because the zircons from SaU169 are small, the spot size of the primary beam was reduced to 10 μm during the measurements of the SaU 169 zircons. Consequently the primary beam intensity was as low as ~1 nA.

Standard zircon BR266 [4] was used in the calculation of U concentrations and age corrections. Common lead was monitored using ^{204}Pb and assumed to be related to gold coating. The corrections were small and not sensitive to the radiogenic Pb isotopic compositions.

The software of SQUID 1.02 and ISOPLOT [5,6] was used for data reduction and age computation. The

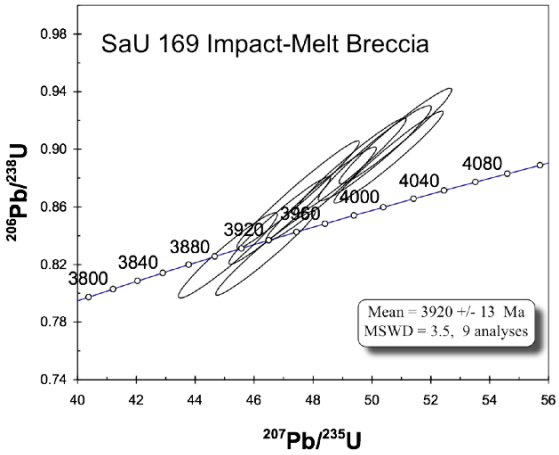

Figure 1. Concordia diagram showing U-Pb age dating results for zircon grains in SaU 169 lunar meteorite, determined with the Beijing SHRIMP II at the Chinese Academy of Geological Sciences.

errors in age quoted in the figures and text represent 2σ, whereas the errors of individual analyses in Table 1 and in the concordia diagram are expressed as 1σ.

All data are basically concordant showing only a slight reverse discordance from 1% to -6% (Table 1).

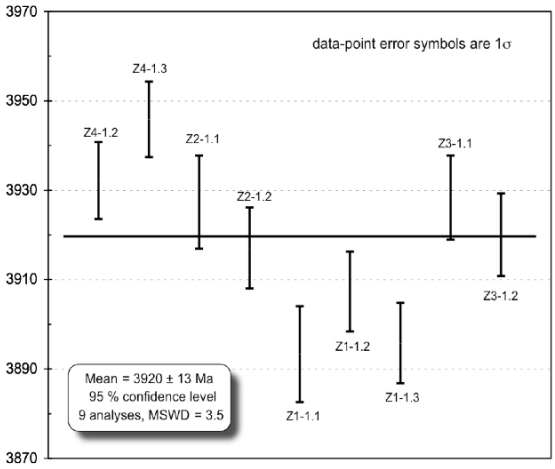

Figure 2. Ages and uncertainties for each of the spot analyses on four zircon grains in SaU 169 Impact-melt breccia.

Table 1. Isotopic data for SHRIMP II spot anslyses of zircons in SaU 169 impact-melt breccia

Spot	% $^{206}Pb_c$	ppm U	ppm Th	Th/U	$^{232}Th/^{238}U$	ppm $^{206}Pb^*$	$^{207}Pb^*/^{206}Pb^*$	±%	$^{207}Pb^*/^{235}U$	±%	$^{206}Pb^*/^{238}U$	±%	err corr	$^{206}Pb/^{238}U$ Age		$^{207}Pb/^{206}Pb$ Age		% Discordant
FRAG4-Z4-1.2	0.54	202	118	0.58	0.60	144	0.4062	0.57	46.4	2.4	0.828	2.3	0.97	3889	±69	3932	± 9	1
FRAG4-Z4-1.3	0.27	200	*35*	*0.18*	0.18	154	0.4099	0.56	50.6	2.4	0.895	2.4	0.97	4119	±72	*3946*	± 8	-4
FRAG2-Z2-1.1	0.61	161	118	0.74	0.76	125	0.4049	0.70	50.1	2.5	0.897	2.4	0.96	4129	±74	3927	±10	-5
FRAG2-Z2-1.2	0.22	264	187	0.71	0.73	202	0.4021	0.60	49.3	2.6	0.888	2.5	0.97	4098	±75	3917	± 9	-5
FRAG1-Z1-1.1	*1.66*	171	147	0.86	0.89	124	0.3958	0.71	45.1	2.5	0.826	2.4	0.96	3883	±69	*3893*	±11	0
FRAG1-Z1-1.2	0.47	234	288	1.23	1.27	172	0.3995	0.59	46.9	2.4	0.851	2.4	0.97	3968	±70	3907	± 9	-2
FRAG1-Z1-1.3	0.30	294	268	0.91	0.94	220	0.3965	0.60	47.5	2.9	0.869	2.8	0.98	4031	±85	3896	± 9	-3
FRAG2-Z3-1.1	0.55	228	242	1.06	1.09	179	0.4052	0.63	50.8	2.5	0.909	2.4	0.97	4169	±74	3928	± 9	-6
FRAG2-Z3-1.2	0.35	208	193	0.93	0.96	156	0.4029	0.61	48.3	2.6	0.869	2.5	0.97	4032	±75	3920	± 9	-3
Average	0.55	218.08	177	0.80	0.83	149	0.4062	0.57	46.4	2.40	0.828	2.3	0.97	4035	74	3919	10	
Best Average*	0.43	227.33	202	0.88	0.91	144	0.4062	0.57	46.4	2.40	0.828	2.3	0.97	4045	75	3918	9	

*Best Average excludes FRAG4-Z4-1.3, which has low Th and Th/U, and FRAG1-Z1-1.1, which had anomalous Pb(206). See italicized values.
Gnos et al. (2004) age: 3909+/- 13 (207/206)

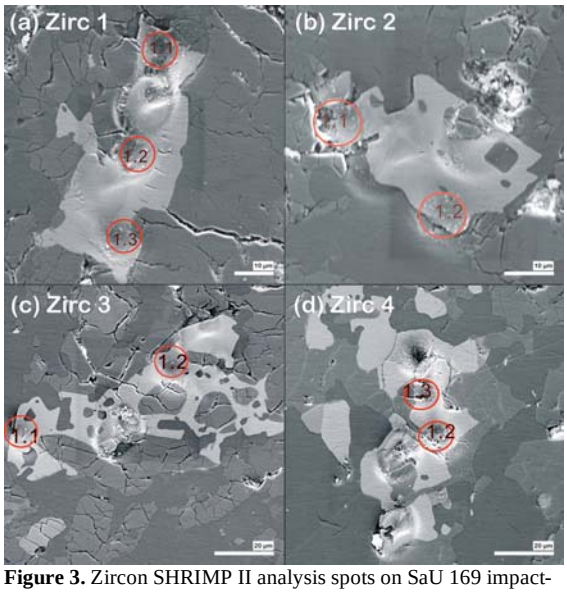

Figure 3. Zircon SHRIMP II analysis spots on SaU 169 impact-melt breccia.

Results & Discussion: Analysis of 9 spots on 4 different zircon grains (Fig. 3) yielded $^{207}Pb/^{206}Pb$ ages of 3893-3946 Ma, with a 'best' average age of 3918±9 Ma. This age is consistent with the results of Gnos et al. [1]. What is interesting and potentially of great significance is that these ages appear to exceed the average age of dated impact-melt breccias from Apollos 14, 15, and 16 (ranging 3.84-3.88 Ga) thought to have been produced by the Imbrium basin-forming impact (e.g., 3850±20 Ma [7]; 3865±20 Ma [8]). Thus, the SaU impact-melt breccia and by inference, the Apollo 12 Th-rich impact-melt-breccia group may have formed in a slightly older basin-forming event within the Procellarum KREEP Terrane.

References: [1] Gnos E. et al. (2004) *Science, 305*, 657-659. [2] Zeigler R. A. et al. (2006) *Lunar Planet. Sci. Conf. 37*, #2366. [3] Compston W. et al. (1984) *PLPSC, 14*, 525-534. [3] Richard A. Stern (2001) Reference Standard. [5] Ludwig K. R. (2001) Squid 1.02: Berkeley Geochronology Center Special Publication 2. [6] Ludwig K. R. (2003) Isoplot/Ex 3.00, Berkeley Geochronology Center Special Publication 4. [7] Stöffler D. et al.,(2006) NVM RiM-G, Vol 60, 519-596. [8] Dalrymple, G. B., and Ryder G. (1993) *J. Geophys. Res., 98*, 13085-13096.

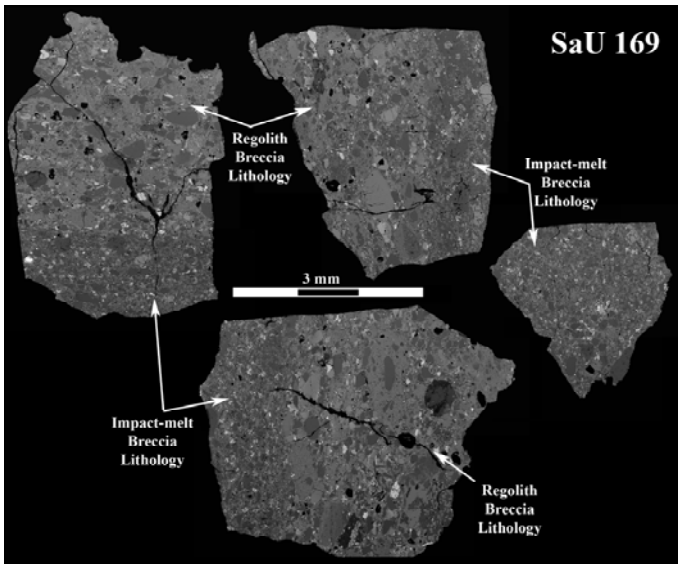

Figure 4. Backscattered electron mosaic of different fragments of SaU 169 showing the distribution of the impact-melt breccia lithology and the regolith breccia lithology.