RB-SR SYSTEMATICS IN CLASTS AND APHANITES FROM CONSORTIUM BRECCIA 73215.

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During 1975 and 1976, successive fragments of the breccia 73215 were selected and documented (1) for Rb-Sr and other work by O.B. James as consortium leader. Rb, Sr and ^{87}Sr/^{86}Sr were determined in duplicate for eleven samples of aphanitic clasts and matrix, two clasts of anorthositic gabbro and their component olivine and plagioclase, one clast of felsite plus feldspar, quartz and glass concentrates separated from it, and one clase of granulated feldspathic material and separated plagioclase.

One of the anorthositic gabbros gave an internal isochron of 4.24±0.31 AE (26) in agreement with the high temperature plateau age of 4.24±0.02 AE for the same clast (2). Because of the lack of deformation/recrystallization in the clast and its low initial ^{87}Sr/^{86}Sr, 0.69918∓16, we interpret the isochron as the age of crystallization from melt. The range in Rb/Sr for the second anorthositic gabbro was not sufficient for an internal age, but the data can fit the 4.24 AE isochron.

The tie-line between the granulated feldspathic material 46-102 and separated plagioclase has an excessively old "age" of 5.10±.15 AE (σ). Therefore at least one component of the total sample has an excess model Rb-Sr age and either was not cogenetic with the plagioclase (which has a normal model age) or was selectively depleted in Rb during some post-crystallization event. A grey aphanitic clast found within the feldspathic material has a model age of 4.5 AE and thus cannot be part of the exotic or modified constituent.

Analyses of a 9 mg fragment of felsite tested our prediction for the age of apparently identical microclasts found in Station 2 Boulder 1 aphanites (3). The felsite is so highly radiogenic that the model age for each analyzed fraction is insensitive to error in choice of initial ^{87}Sr/^{86}Sr. Model ages for the total rock, feldspar - and quartz-rich samples are identical at 4.00 AE, whereas that of the (secondary) glass-rich sample is slightly younger at 3.95 AE. If the molten glass reached Sr isotope equilibrium with the crystalline phases of the felsite, then the time of melting is given by the internal isochron (Fig. 2) at 3.90±0.5 AE. We favour 4.00 AE as the original age of crystallization of the felsite as a differentiated intrusion or flow on the lunar surface, and the high initial ^{87}Sr/^{86}Sr for the internal isochron, 0.707±.004, as signifying Sr isotope redistribution during the later event that formed the glass.

The dispersion in Rb/Sr between aphanites is due mainly to differences in their Rb concentrations, which vary largely because of their differing contents of Rb-rich felsite clasts. For the group of aphanites first analyzed, sample 38-49 (Fig. 1) has both the highest Rb and highest felsite content, and subsequently sample 36-31 was selected for analysis specifically as a test of this hypothesis. The presence of even very small amounts of felsite displaces the data to the right-hand side on the Sr evolution diagram, towards the felsite end-member (Fig. 1). Accurate independent estimates of the felsite content of each sample are needed to present the data on a felsite-free basis.

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Several aphanites, e.g. 46-45, 258, 178 and 38-57 (Fig. 1), show the unusual feature of an excessively old model age (>4.5 AE) even without correction for their contents of felsite. The probable explanation for this is the presence of a post-4.5 AE magmatic differentiate, in the groundmass melt and/or in lithic or mineralic microclasts, that is low in ^{87}Rb/^{86}Sr (≤.04) but high in initial ^{87}Sr/^{86}Sr (≥0.6996). We have not positively identified such a component but the fraction of the feldspathic material 46-102 that has an excess model age would be a suitable candidate. We do not favour the alternative explanation that Rb was volatilized from the groundmass melt during the impact process, as Rb/U and Cs/Rb ratios are not consistent with volatile losses (4).

Their variable contents of plagioclase fragments, such as the 46-10 plagioclase, and of anorthositic clasts must variably displace the aphanites towards the ^{87}Sr/^{86}Sr axis at .6991 on the Sr evolution diagram. In addition, admixture with lithic clasts as represented by the abundant anorthositic gabbros also displaces them towards lower y,x coordinates. For example, sample 157 should be richer in clasts of the above two types and sample 38-49 poorer. Because all the aphanites contain such clasts, the magmatic differentiate having high initial ^{87}Sr/^{86}Sr that we propose as a necessary additional component must lie above most or all of the measured points. It is shown on Figure 1 as the "Hypothetical Igneous Suite", in which we have generalized from a single low Rb/Sr end-member to a range ofcogenetic differentiates that would be more reasonably expected.

If the impact event that formed breccia 73215 also produced the melting observed in the felsite, the age of the impact is constrained as certainly less than 4.00 AE (the age of the felsite magma) and probably equal to 3.90± 0.05 AE (the felsite internal isochron). The 3.90 AE value is corroborated by laser probe Ar-Ar dating (5), and agrees also with the age of the youngest components of the Station 7 Boulder (6). It is significantly younger than a frequency peak at 3.99 AE observed in Ar-Ar dates from the Apollo 17 site (7). Evidently the groundmass melt was not completely degassed during its formation, and the South Serenitatis basin-forming event occurred at 3.9 AE not 4.0 AE.

REFERENCES: (1) James O.B. 1976, Proc. Lunar Sci. Conf. 7th, in press. (2) Jessburger E., Kirsten T. and Standacher T. 1976, Proc. Lunar Sci. Conf. 7th, in press. (3) Compston W., Foster J.J. and Gray C.M. 1975, The Moon, 14, p. 445-462. (4) Morgan J.W., Gros J., Takahashi H. and Hertogen J. 1976. Proc. Lunar Sci. Conf. 7th, in press. (5) Müller H.W., Plieninger T., James O.B. and Schaeffer O.A. 1977, Lunar Science VIII. (6) Stettler A., Eberhardt P., Geiss J., Grögler N. and Guggisberg S. 1975, Lunar Science VI, p. 771-773. (7) Turner G. and Cadogan P.H. 1975, Proc. Lunar Sci. Conf. 6th, p.1509-1538.

Figure 1. Sr evolution diagram for components of breccia 73215 (filled circles) and Boulder I samples (open symbols) calculated for 3.90 AE ago, immediately after aggregation of the breccias.

Figure 2. Sr evolution diagram for felsite.

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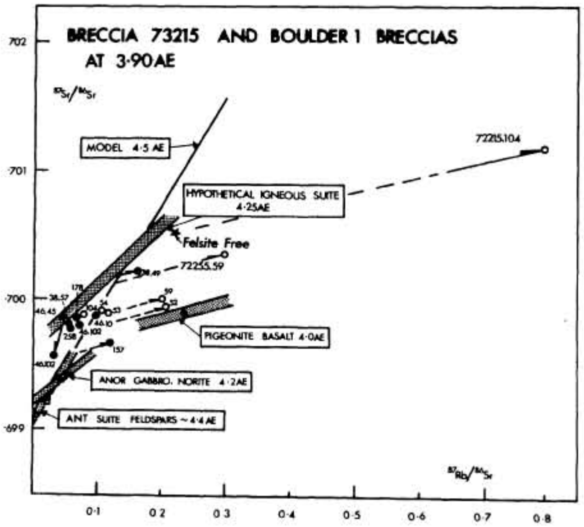

Figure 1.

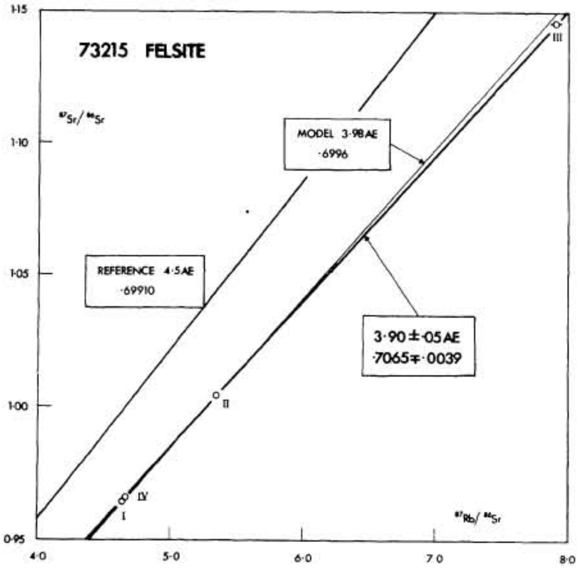

Figure 2.

TABLE I: **Rb-Sr analytical data,** 73215 **breccia fragments. Almost all values shown are the means of duplicates.** Precision 13.3% for ^{87}Rb/^{86}Sr **and** .01% **for** ^{87}Sr/^{86}Sr**, except where indicated.**

		Rb ppm	Total Sr ppm	^{87}Rb/^{86}Sr	^{87}Sr/^{86}Sr
Gabbroic anorthosite	29-9	2.45	167.1	.0423	.70174
Plagioclase	29-9	1.54	197.2	.0227	.70058
Olivine I	29-9	.40	15.4	.0755	.7041±2
Olivine II	29-9	.70	39.2	.0510	.70220
Gabbroic anorthosite	46-25	2.26	143.4	.0454	.70190
Plagioclase	46-25	3.38	187.0	.0522	.70238
Feldspathic material	46-102	1.76	154.5	.0330	.70141
Plagioclase	46-102	.51	203.5	.0072	.69951
Felsite chip	43.5	255.5	158.0	4.666	.96616
White fraction	43.5	342.8	213.4	4.634	.96423
Grey fraction	43.5	290.0	156.4	5.350	1.00460
Brown fraction	43.5	252.0	91.9	7.910	1.14662
Black aphanite clast	46-10	4.92	140.4	.1011	.70551
Plagioclase clast	46-10	1.55	202.4	.0221	.70043
Grey aphanite clast	46-102	3.36	132.2	.0734	.70380
Grey spheroid	38-57	2.98	152.9	.0562	.70296
Heterogeneous matrix	157	5.81	139.2	.1205	.70638
Heterogeneous matrix	258	2.94	143.6	.0591	.70307
Light grey matrix	46-45	2.29	139.9	.0472	.70249
Schlieren-rich matrix	178	3.35	139.4	.0693	.70372
Black matrix	38-49	8.26	147.7	.1615	.70922
Grey spheroid	38-32	7.01	148.0	.1369	.70762
Black aphanite clast	46-19	3.65	136.1	.0773	.70427
Black matrix I	**36-3**	**58.2**	**165.4**	**1.0214**	.75908
Black matrix II	**36-3**	10.5	173.5	.1753	.70969