

SIDEROPHILE, VOLATILE, AND INCOMPATIBLE TRACE ELEMENTS IN APOLLO BRECCIA 66095

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Under the auspices of L.A. Taylor's Rusty Rock Consortium, we have analyzed 8 samples of 66095 by RNAA for 25 trace elements. Results for a few representative elements are given below.

Sample	Abbr.	Classif.	Ir ppb	Pd ppb	In ppb	Cd ppb	Tl ppb	Rb ppm	U ppb	Ce ppm
241	Mx	Matrix	41.7	61.2	128	143	273	4.43	1070	33.0
280	BG	Black Glass	24.8	48.1	56	58	113	3.61	862	54.8
254	AB	Anorth. Bc.	0.964	1.15	1280	1574	406	5.51	22.3	2.25
261	CA	Catacl. An.	3.00	21.0	156	206	210	1.89	116	7.24
268	T	Troctolite	0.0028	0.34	1.4	5.8	2.4	0.06	2.3	1.18
263	B1	Basalt	0.736	≤1.5	15.8	22.1	20	1.05	174	11.7
350	B2	Basalt	18.5	57.3	131	136	132	2.7	1050	69.7
351	B3	Basalt	61.3	96.0	150	177	108	2.46	950	53.8

Siderophiles. Matrix, glass, and two basaltic clasts are very strongly enriched in Ir and other siderophiles; the troctolite is pristine, and the remaining 4 samples are in between. On a ternary Ir Au Re diagram (Hertogen *et al.*, 1977), most samples fall in ancient meteoritic groups 1H, 1L, and 2. However, since the clasts have much lower siderophile content than do matrix and glass, it will be necessary to rule out contamination by Mx and BG; as little as 1-2% adhering Mx would suffice in some cases to move the sample to another group. CA has a very low Ir/Au ratio, and falls on the Au-rich side of group 1L, along with a few other Apollo 16 rocks and soils that had been placed in a tentative group 1LL (Hertogen *et al.*, 1977). The low Ir/Au ratio is not due to Au contamination or volatilization, as Pd and Ni are enriched in about the same proportion as Au.

Volatiles. Most samples show the extraordinary enrichment in volatiles (Tl, Ge, Sb, Se, Zn, and Cd) that was observed in a number of Apollo 16 samples from the southern part of the site (most notably Rusty Rock), and was attributed to fumarolic volcanism (Krähenbühl *et al.*, 1973; Ganapathy *et al.*, 1974; Hertogen *et al.*, 1977). We now find that In--not measured in our previous studies--also belongs to this group. Although In remains a treacherous element, thanks to the notorious In-Ag vacuum gaskets whose remnants continue to spook around in the Curatorial Facility, the In enrichment in 66095 correlates with Tl and especially Zn and Cd, and hence seems to be indigenous.

A novel trend is the enrichment of Rb and Cs relative to U and REE (except Eu), in some cases exceeding the average lunar ratio by more than an order of magnitude. Such enrichments are found not only in samples of 66095 (AB, CA, T), but also in several other Apollo 16 rocks studied by Hertogen *et al.* (1977) and the present authors. For the most feldspathic, U- and REE-poor samples this trend may reflect crystal chemical factors, but for the others, it probably implies volatilization of Rb and Cs (Palme, 1977). In the two most conspicuous cases (AB and CA), the Rb-Cs enrichment parallels the In-Zn-Cd enrichment, suggesting that it, too, is of fumarolic origin. It would be interesting to determine the time of the enrichment by Rb-Sr dating, complementing the U-Rb study by Nunes and Tatsumoto (1973).

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Interestingly, Au shows no such correlation with volatiles, although it has repeatedly been proclaimed to be volatile in various encyclicals from Canberra and Mainz. Instead, it closely correlates with Pd and Ni.

Classification of clasts. Some of our chemical data do not support the preliminary petrographic classification of the clasts, as given in the table above. Sample 261 is too high for a CA in siderophiles, alkalis, REE, and U; the possibility exists for a small amount of contamination by matrix material or melt rock. All CA's we have studied thus far were essentially meteorite-free, resembling the 268 troctolite in siderophiles and KREEP elements. Similarly, basalts 1-3 are too high in siderophiles for a true, igneous basalt (e.g. 15382,15 or 72275,91,9006); we regard them as impact melts.

References

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