15505

Regolith Breccia

1147 grams

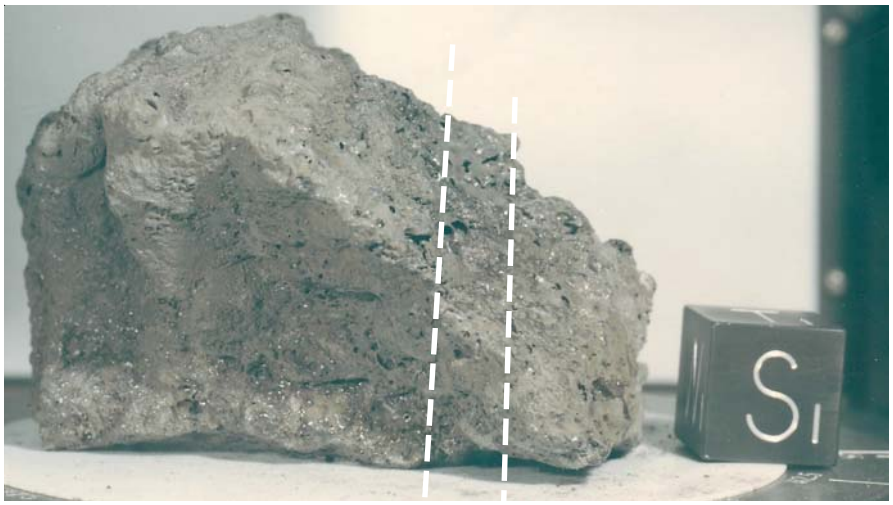


Figure 1: Photo of 15505 with location of slab indicated. Cube is 1 inch. S71-47366

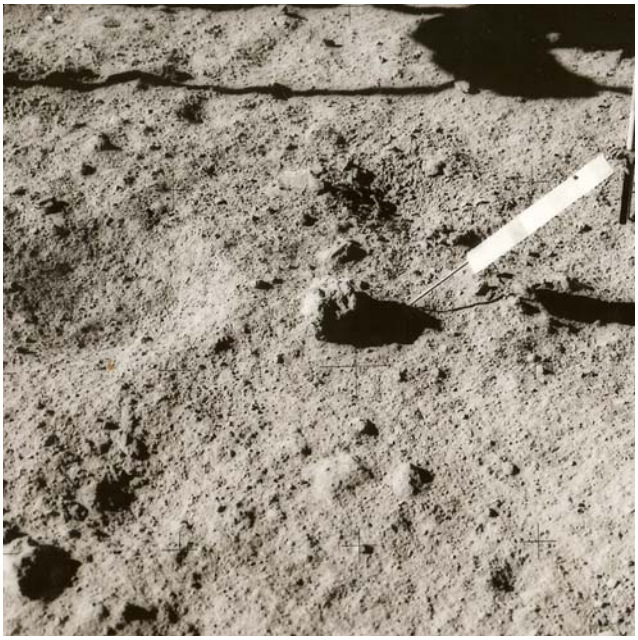


Figure 2: Surface photo of 15505. Gnomon is 50 cm. AS15-82-11105.

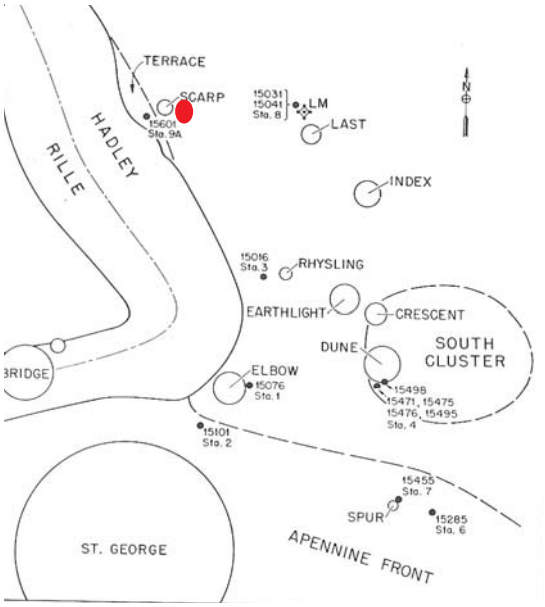


Figure 3: Map of Apollo 15 showing location of 15505.

Introduction

Large lunar breccia 15505 is from the area near Hadley Rrille were a large field of mare basalts were found (figure 3). It is similar to 15558 – from same location. It is a glass matrix breccia with an abundance for mare basalt clasts (figures 1 - 7).

Petrography

Fruland (1985), Simon et al. (1986) and McKay et al. (1989) compared 15505 with other Apollo 15 soil breccias. McKay et al. reported that the maturity index for 15505 was I_s/FeO = 26 and Simon et al. reported the mode.

Figure 4: Photos of 15505. 71-47364

Figure 5: Photo of frothy glass surface of 15505. S71-44461

Wilshire and Moore (1974) and Michel-Levy and Jahann (1973) studied the glass coating, finding that it was continuous with the interior veins and probably not a glass splash.

Engelhardt et al. (1973) found that 15505 was made up of primarily mare basalt components. A single large clast of mare basalt was exposed in the slab, but has apparently not been studied.

Chemistry

15505 is one of the most iron-rich breccias from Apollo 15 (figure 11). It has a REE pattern like that of soil from the Apollo 15 site (figure 12).

Moore et al. (1973) reported 104 ppm carbon (figure 6).

Winzer et al. (1978) reported the composition of the glass coat (but it is surely not homogeneous).

Mode for 15505 *(Simon et al. 1986)*

Matrix	<20 micron	40.1 %
	20-90 micron	90-1000 micron
Mare basalt	0.3 %	6.5
Plutonic Rx.	0.2	2.0
Feld. CMB	-	0.2
Feld. Basalt		-
KREEP basalt		0.3
Granulitic/Poik.	0.1	0.2
Reg Bx.	-	1.0
Agglutinate	-	-
Pyroxene	18.2	5.5
Olivine	3.1	1.0
Plagioclase	6.1	2.3
Opaque	1.4	
Glass	7	4

Radiogenic age dating

Schaeffer and Schaeffer (1977) reported Ar 39/40 data but could not obtain an age.

Cosmogenic isotopes and exposure ages

Rancitelli et al. (1972) determined the cosmic-ray-induced activity of ^{22}Na = 44 dpm/kg, ^{26}Al = 44 dpm/

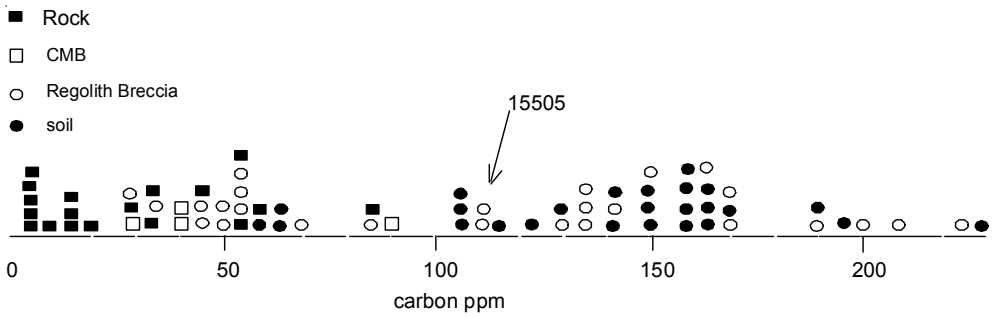


Figure 6: Carbon content.

Figure 7: Photo of slab 15505,4. S72-15536.

Figure 8: Photo of slab 15505,4. Clast is 1 inch. S72-15535.

kg. and ^{54}Mn = 42 dpm/kg. the Ar data of Schaeffer and Schaeffer should yield an exposure age.

Processing

A slab was cut through the middle of 15505. There are 9 thin sections.

Figure 9: Photo of sawn surface of small butt end of 15505,3. S72-15536

Figure 10: Photo of 15505,0 after slab was cut, and 15505,49 broke off. Cube is 1 inch. S93-40237

Table 1. Chemical composition of 15505

reference	Simon86		Laul73		Rancitelli72		McKay89		Silver73		
weight	222 mg										
SiO2 %											
TiO2	1.6	(a)	1.6	(a)			1.6	(a)			
Al2O3	12.3	(a)	12.4	(a)			12.4	(a)			
FeO	16	(a)	17.2	(a)			17.4	(a)			
MnO	0.21	(a)	0.212	(a)			0.21	(a)			
MgO	11.4	(a)	9	(a)			9	(a)			
CaO	10.2	(a)	10.9	(a)			9.9	(a)			
Na2O	0.39	(a)	0.365	(a)			0.4	(a)			
K2O	0.16	(a)	0.16	(a)	0.186	(b)					
P2O5											
S %											
sum											
Sc ppm	30.5	(a)	32	(a)			33.1	(a)			
V	130	(a)	150	(a)			150	(a)			
Cr	2915	(a)	3024	(a)			3310	(a)			
Co	46.1	(a)	53	(a)			49.6	(a)			
Ni	200	(a)					205	(a)			
Cu											
Zn											
Ga											
Ge ppb											
As											
Se											
Rb											
Sr	110	(a)					100	(a)			
Y											
Zr	270	(a)	570	(a)			290	(a)			
Nb											
Mo											
Ru											
Rh											
Pd ppb											
Ag ppb											
Cd ppb											
In ppb											
Sn ppb											
Sb ppb											
Te ppb											
Cs ppm							0.21	(a)			
Ba	220	(a)	150	(a)			210	(a)			
La	20.5	(a)	21	(a)			20.8	(a)			
Ce	50	(a)	57	(a)			55	(a)			
Pr											
Nd	34	(a)					32	(a)			
Sm	9.35	(a)	10	(a)			10.1	(a)			
Eu	1.2	(a)	1.2	(a)			1.25	(a)			
Gd											
Tb	2.05	(a)	1.7	(a)			1.99	(a)			
Dy	13.5	(a)	6.4	(a)							
Ho	2.9	(a)									
Er											
Tm	1.1	(a)									
Yb	6.89	(a)	7.5	(a)			6.9	(a)			
Lu	0.97	(a)	1.1	(a)			0.97	(a)			
Hf	6.7	(a)	9	(a)			7.9	(a)			
Ta	0.9	(a)	0.9	(a)			1.04	(a)			
W ppb											
Re ppb											
Os ppb											
Ir ppb							7.1	(a)			
Pt ppb											
Au ppb							3.8	(a)			
Th ppm	3.3	(a)	2.8	(a)	3.64	(b)	3.5	(a)	3.57	3.565	(c)
U ppm	0.82	(a)	0.9	(a)	0.94	(b)	0.87	(a)	0.984	0.975	(c)

technique: (a) INAA, (b) radiation count., (c) IDMS

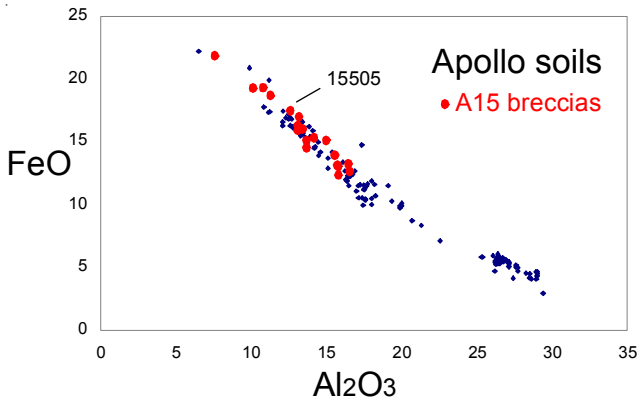


Figure 11: Composition of 15505 compared with that of Apollo soils and Apollo 15 breccias.

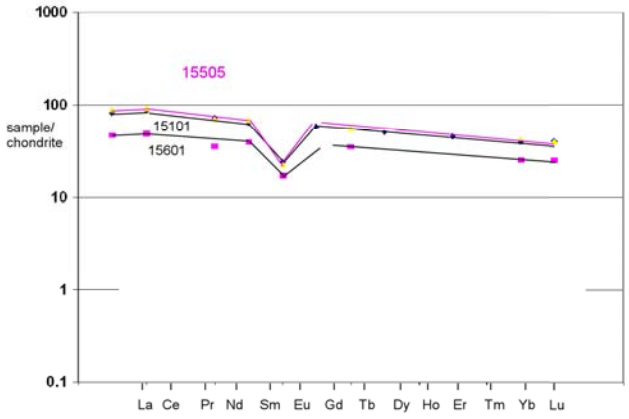
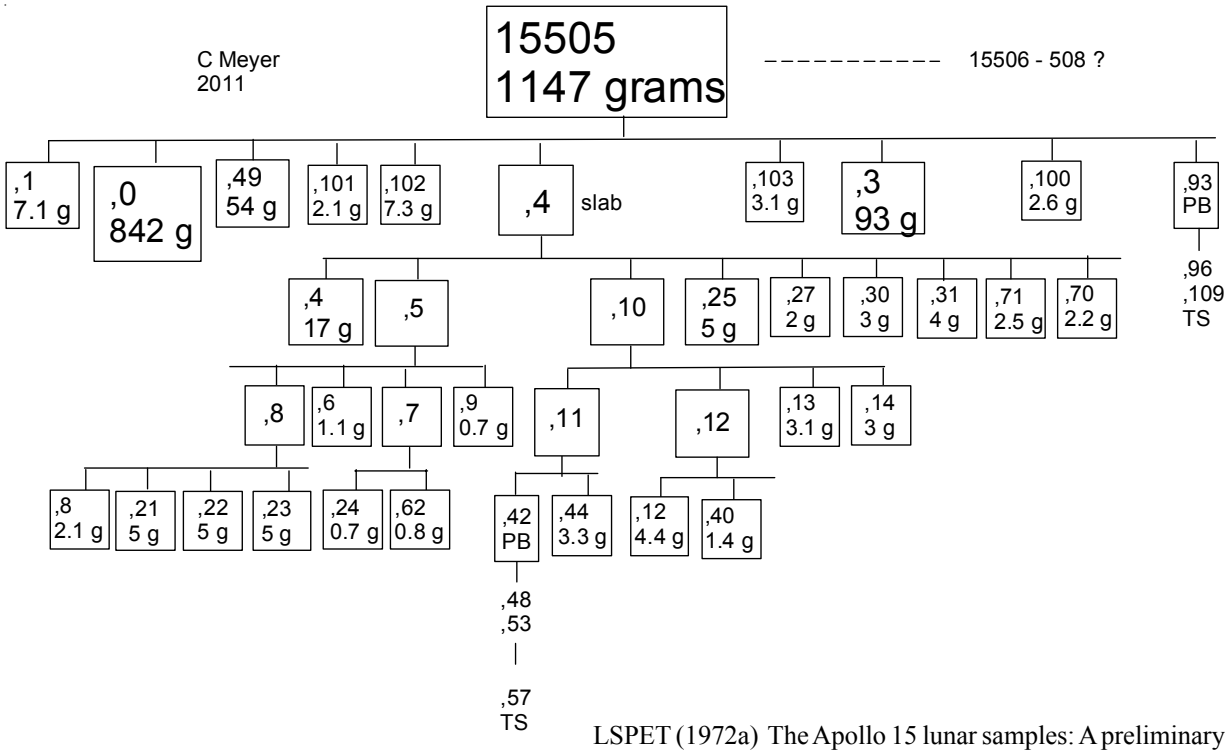


Figure 12: Normalized rare-earth-element diagram for 15505 compared with that of Apollo 15 soils.



References for 15505

Bogard D.D. and Nyquist L.A. (1972) Noble gas studies on regolith materials from Apollo 14 and 15. *Proc. 3rd Lunar Sci. Conf.* 1797-1819.

Butler P. (1971) Lunar Sample Catalog, Apollo 15. Curators' Office, MSC 03209

von Engelhardt W., Arndt J. and Schneider H. (1973) Apollo 15: Evolution of the regolith and origin of glasses. *Proc. 4th Lunar Sci. Conf.* 239-249.

Fruland R.M. (1983) Regolith Breccia Workbook. Curatorial Branch Publication # 66. JSC 19045.

Gleadow A.J.W., LeMaitre R.W., Sewell D.K.B. and Lovering J.F. (1974) Chemical discrimination of petrographically defined clast groups in Apollo 14 and 15 lunar breccias. *Chem. Geology* **14**, 39-61.

Hughes T.C., Keays R.R. and Lovering J.F. (1973) Siderophile and volatile trace elements in Apollo 14, 15 and 16 rocks and fines: Evidence for extralunar component and Tl-, Au- and Ag-enriched rocks in the ancient lunar crust (abs). *Lunar Sci.* **IV**, 400-402. Lunar Planetary Institute, Houston.

Laul J.C. and Schmitt R.A. (1973b) Chemical composition of Apollo 15, 16, and 17 samples. *Proc. 4th Lunar Sci. Conf.* 1349-1367.

LSPET (1972a) The Apollo 15 lunar samples: A preliminary description. *Science* **175**, 363-375.

McKay D.S., Morris R.V. and Wentworth S.J. (1984) Maturity of regolith breccias as revealed by ferromagnetic and petrographic indicies (abs). *Lunar Planet. Sci.* **XV**, 530-531. Lunar Planetary Institute, Houston.

McKay D.S., Bogard D.D., Morris R.V., Korotev R.L., Wentworth S.J. and Johnson P. (1989) Apollo 15 regolith breccias: Window to a KREEP regolith. *Proc. 19th Lunar Sci. Conf.* 19-41. Lunar Planetary Institute, Houston.

Michel-Levy M.C. and Johan Z. (1973) Apollo 15 lunar rocks 15555, 15565 and 15505 and their associated glasses (abs). *Lunar Sci.* **IV**, 136-137. Lunar Planetary Institute, Houston.

Moore C.B., Lewis C.F., and Gibson E.K. (1972) Carbon and nitrogen in Apollo 15 lunar samples. In **The Apollo 15 Lunar Samples**, 316-318. The Lunar Science Institute, Houston.

Moore C.B., Lewis C.F. and Gibson E.K. (1973) Total carbon contents of Apollo 15 and 16 lunar samples. *Proc. 4th Lunar Sci. Conf.* 1613-1923.

Rancitelli L.A., Perkins R.W., Felix W.D. and Wogman N.A. (1972) Lunar surface processes and cosmic ray characterization from Apollo 12-15 lunar samples analyses. *Proc. 3rd Lunar Sci. Conf.* 1681-1691.

Ryder G. (1985) Catalog of Apollo 15 Rocks (three volumes). Curatoial Branch Pub. # 72, JSC#20787

Ryder G. and Sherman S.B. (1989) The Apollo 15 Coarse Fines. Curators Office #81, JSC#24035

Schaeffer G.A. and Schaeffer O.A. (1977a) $^{39}Ar/^{40}Ar$ ages of lunar rocks. *Proc. 8th Lunar Sci. Conf*. 2253-2300.

Silver L.T. (1973a) Uranium-Thorium-Lead isotopic relations in the remarkable debris blanket at Hadley-Apennine (abs). *Lunar Sci.* **IV**, 670-671. Lunar Planetary Institute, Houston.

Simon S.B., Papike J.J., Grosselin D.C. and Laul J.C. (1986) Petrology of the Apollo 15 regolith breccias. *Geochim. Cosmochim. Acta* **50**, 2675-2691.

Sutton R.L., Hait M.H., Larson K.B., Swann G.A., Reed V.S. and Schaber G.G. (1972) Documentation of Apollo 15 samples. Interagency report: *Astrogeology* 47. USGS

Swann G.A., Hait M.H., Schaber G.C., Freeman V.L., Ulrich G.E., Wolfe E.W., Reed V.S. and Sutton R.L. (1971) Preliminary description of Apollo 15 sample environments. U.S.G.S. Interagency report: 36. pp219 with maps

Swann G.A., Bailey N.G., Batson R.M., Freeman V.L., Hait M.H., Head J.W., Holt H.E., Howard K.A., Irwin J.B., Larson K.B., Muehlberger W.R., Reed V.S., Rennilson J.J., Schaber G.G., Scott D.R., Silver L.T., Sutton R.L., Ulrich G.E., Wilshire H.G. and Wolfe E.W. (1972) 5. Preliminary Geologic Investigation of the Apollo 15 landing site. In Apollo 15 Preliminary Science Rpt. NASA SP-289. pages 5-1-112.

Wentworth S.J. and McKay D.S. (1984) Density and porosity calculations for Apollo 15 and 16 regolith breccias (abs). *Lunar Planet Sci*. **XV**, 906-907. Lunar Planetary Institute, Houston.

Wilshire H.G. and Moore H.J. (1974) Glass-coated lunar rock fragments. *J. Geol.* **82**, 403-417.

Winzer S.R., Breen K., Ritter A., Meyerhoff M. and Schuhmann P.J. (1978) A study of glass coatings from some Apollo 15 breccias (abs). *Lunar Sci*. **IX**, 1259-1261. Lunar Planetary Institute, Houston.