

15665 and 15669

Vesicular Olivine-normative Basalt

10.2 and 4.4 grams



Figure 1: Photo of 15665. Sample is 2.5 cm.
S75-22672.

Mineralogical Mode

	15665	15669
Olivine	8 %	10
Pyroxene	56	59
Plagioclase	25	20
Opaques	8	7
Silica	-	
Meostasis	3	4

Dowty et al. 1973

Introduction

Lunar samples 15665 and 15669 are rake samples from the edge of Hadley Rille in an area called The Terrace (see section on 15614). They are similar to the rest of the olivine-normative basalt samples from this location, except, perhaps, they contains abundant Fe-rich pyroxene rather than fayalite in the residuum. The habit of ilmenite is also unusual. They have not been dated.

Petrography

The matrix of 15665 and 15669 is rather fine-grained, with scattered, eroded olivine phenocrysts (figure 2 a,b). Ilmenite in 15665 is platy and skelytal (Dowty et al. 1973) and these two basalt fragments sem to have more Ti. The eroded olivine phenocrysts have silicate melt inclusions (figure 2b). The pyroxene grains are optically and chemically zoned. Nehru et al. (1974) noted that chromite has a distinct boundary with ulvospinel overgrowth. Metallic iron grains with significant Co and Ni are present.

Chemistry

The chemical composition of 15665 and 15669 is somewhat high in TiO_2 , but otherwise similar to other olivine-normative basalts at Apollo 15 (figures 4, 5 and 6).

Processing

There are 4 thin sections of 15665 and three thin sections of 15669.

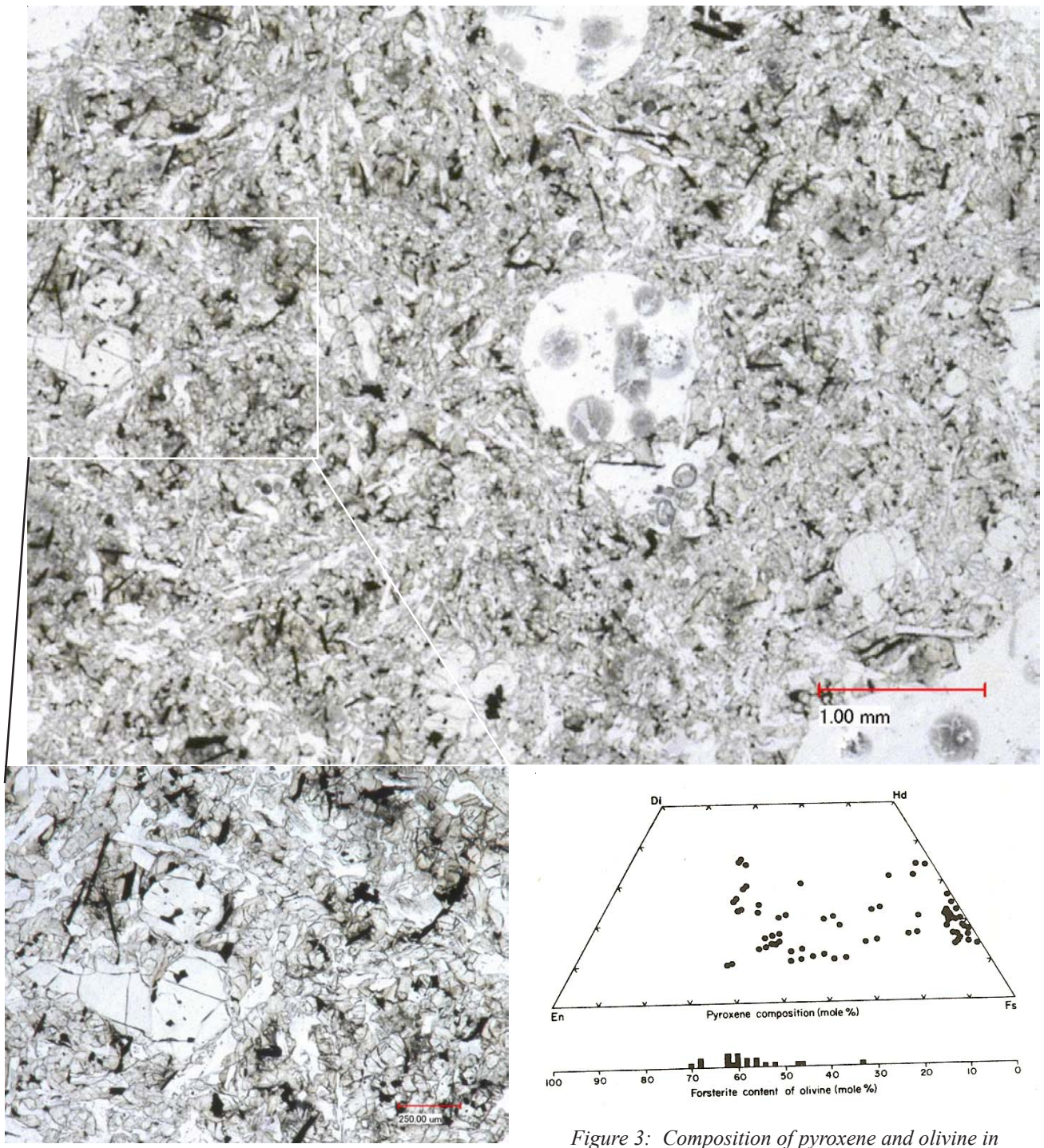


Figure 2a: Photomicrographs of thin section 15665, 13 by C Meyer @ 50x and 150x.

Figure 3: Composition of pyroxene and olivine in 15665 (Dowty et al. 1973).

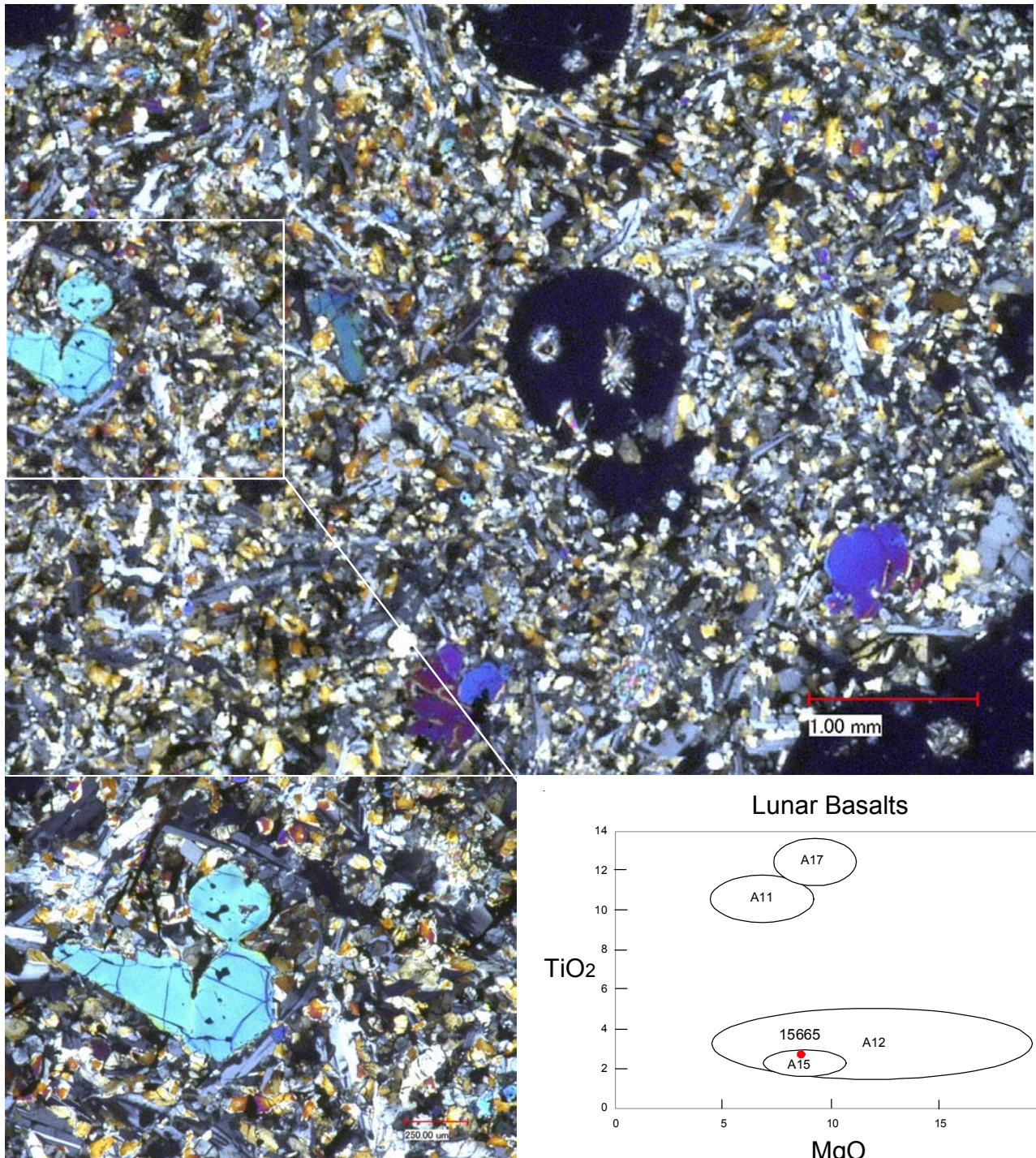


Figure 2b: Photomicrographs of thin section 15665, 13 by C Meyer @ 50x and 150x (crossed polarizers).

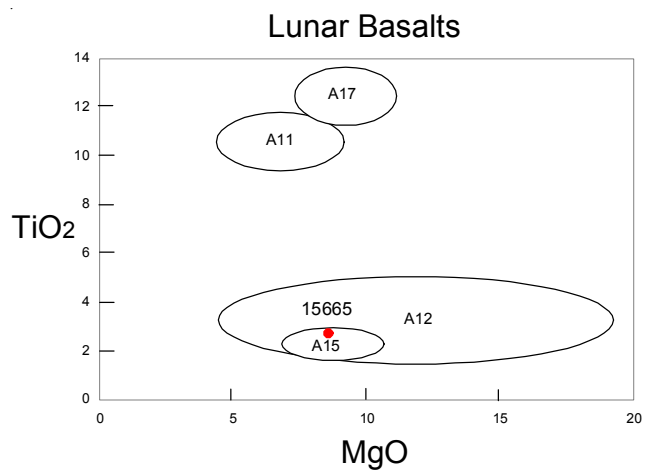


Figure 4: Chemical composition of 15665 compared with that of other Apollo basalts.

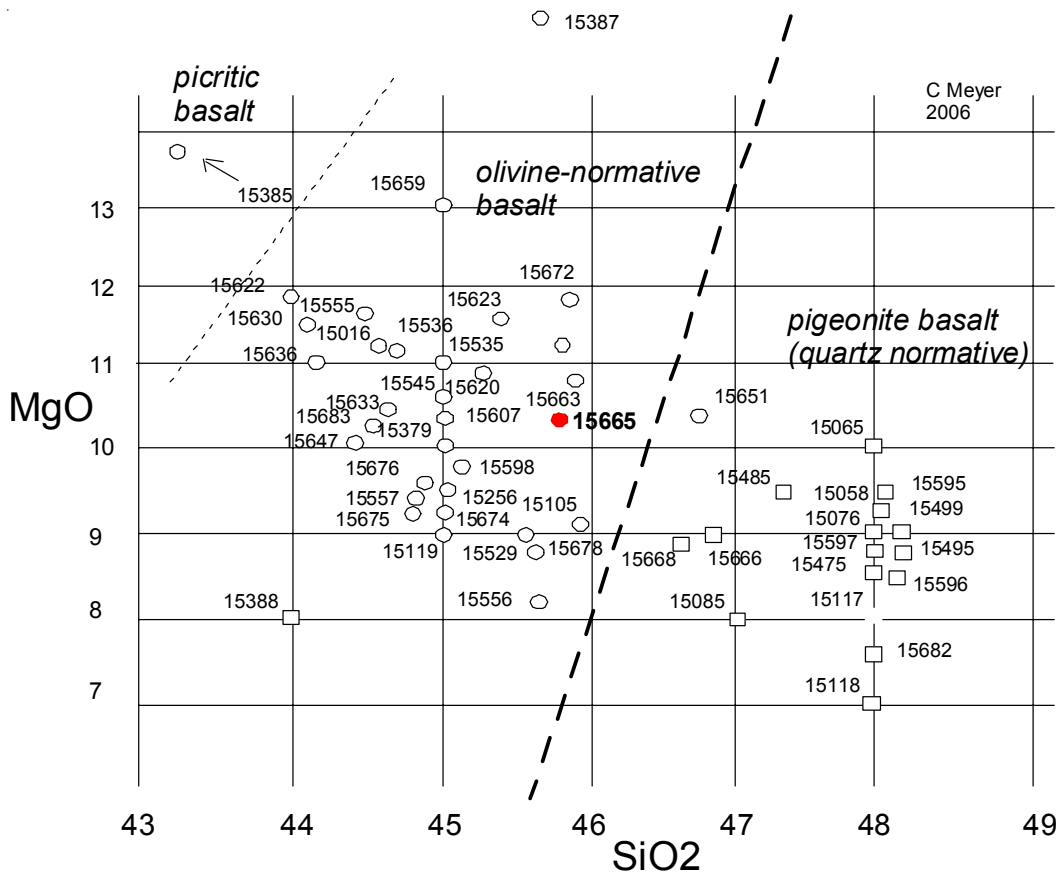


Figure 5: Chemical composition of 15665 compared with other Apollo 15 basalts.

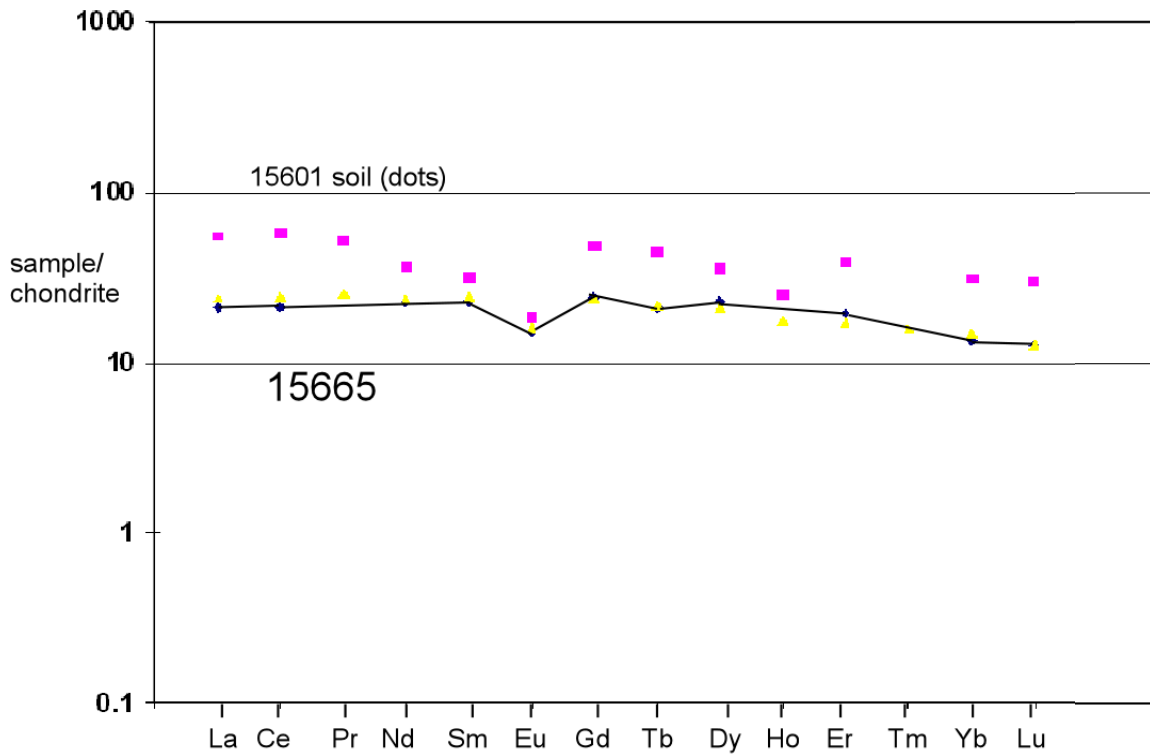


Figure 6: Normalized rare-earth-element diagram for 15665 with 15601 soil for comparison.

Table 1. Chemical composition of 1566x.

reference	15665 Helmke73	15665 Dowty73	15669 Ma et al. 78	15669 Dowty73
<i>weight</i>				
SiO ₂ %	44.4	(a) 46.7	(b)	44.3 (b)
TiO ₂	2.64	(a) 2.94	(b) 2.4	(a) 3.1 (b)
Al ₂ O ₃	8.25	(a) 10.2	(b) 9.3	(a) 8 (b)
FeO	23.4	(a) 21.7	(b) 22.3	(a) 24.3 (b)
MnO				0.28 (b)
MgO	10.3	(a) 7.7	(b) 10	(a) 10.1 (b)
CaO	9.42	(a) 10.6	(b) 11.3	(a) 9.4 (b)
Na ₂ O	0.3	(a) 0.39	(b) 0.267	(a) 0.31 (b)
K ₂ O	0.046	(a) 0.06	(b) 0.04	(a) 0.03 (b)
P ₂ O ₅		0.09	(b)	0.07 (b)
S %				
<i>sum</i>				
Sc ppm	43.2	(a)	41	(a)
V			203	(a)
Cr	3950	(a) 4450	(b) 3670	(a)
Co	54	(a)	45	(a)
Ni			65	(a)
Cu				
Zn				
Ga	3.1	(a)		
Ge ppb				
As				
Se				
Rb	1.1	(a)		
Sr				
Y				
Zr				
Nb				
Mo				
Ru				
Rh				
Pd ppb				
Ag ppb				
Cd ppb				
In ppb				
Sn ppb				
Sb ppb				
Te ppb				
Cs ppm	0.021	(a)		
Ba			55	(a)
La	4.87	(a)	5.1	(a)
Ce	12.6	(a)		
Pr				
Nd	10.2	(a)		
Sm	3.39	(a)	3.5	(a)
Eu	0.84	(a)	0.87	(a)
Gd	4.7	(a)		
Tb	0.75	(a)	0.8	(a)
Dy	5.5	(a)	4.4	(a)
Ho	1	(a)		
Er	3.1	(a)		
Tm				
Yb	2.23	(a)	2.1	(a)
Lu	0.31	(a)	0.32	(a)
Hf	2.2	(a)	2.6	(a)
Ta			0.37	(a)
W ppb				
Re ppb				
Os ppb				
Ir ppb				
Pt ppb				
Au ppb				
Th ppm				
U ppm				

technique: (a) AA, INAA, (b) broad-beam e-probe

References for 15665

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

Dowty E., Conrad G.H., Green J.A., Hlava P.F., Keil K., Moore R.B., Nehru C.E. and Prinz M. (1973a) Catalog of Apollo 15 rake samples from stations 2 (St. George), 7 (Spur Crater) and 9a (Hadley Rille). *Inst. Meteoritics Spec. Publ. No 11*, 51-73. Univ. New Mex. ABQ.

Dowty E., Prinz M. and Keil K. (1973b) Composition, mineralogy, and petrology of 28 mare basalts from Apollo 15 rake samples. *Proc. 4th Lunar Sci. Conf.* 423-444.

Helmke P.A., Blanchard D.P., Haskin L.A., Telander K., Weiss C. and Jacobs J.W. (1973) Major and trace elements in igneous rocks from Apollo 15. *The Moon* **8**, 129-148.

Lofgren G.E., Donaldson C.H. and Usselman T.M. (1975) Geology, petrology and crystallization of Apollo 15 quartz-normative basalts. *Proc. 6th Lunar Sci. Conf.* 79-99.

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

LSPET (1972b) Preliminary examination of lunar samples. Apollo 15 Preliminary Science Report. NASA SP-289, 6-1—6-28.

Nehru C.E., Prinz M., Dowty E. and Keil K. (1974) Spinel-group minerals and ilmenite in Apollo 15 rake samples. *Am. Mineral.* **59**, 1220-1235.

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

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. (1971b) 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.