

**LSCREF15**  
**REFERENCES**  
**LUNAR SAMPLE COMPENDIUM**  
(February 2008, incomplete, always under construction)

*Note: The abstract volumes of the annual Lunar Science and Lunar and Planetary Science Conferences were issued by the Lunar and Planetary Science Institute, Houston. Starting with LPS XXIX, the abstracts have been issued as CD-ROM, but are also available by the world wide web@ <http://www.lpi.usra.edu/publications/abstracts.shtml>. Initially, the Proceedings of these annual conferences were supplements to *Geochim. Cosmochim. Acta* (volumes 1-12), later *J. Geophys. Res.* (volumes 13-17). Proceedings 18-22 were produced and published by the Lunar Planetary Institute. There is an index to the first nine Lunar Science Conferences. Proceedings papers were peer-reviewed, while abstracts were not.*

Adams J.B. and Charette M.P. (1975) Spectral reflectance of highland rock types at Apollo 17: Evidence from Boulder 1, Station 2. *The Moon* 14, 483-489.

Aeschlimann U., Eberhardt P., Geiss J., Grogler N., Kurtz J. and Marti K. (1982) On the age of cumulate norite 78236 (abs). *Lunar Planet. Sci.* XIII, 1-2. Lunar Planetary Institute, Houston.

Agee C.B. and Cirone S. (1995) Crystal-liquid density inversions in high-TiO<sub>2</sub> lunar basalts (abs). *Lunar Planet. Sci.* XXVI, 5-6. Lunar Planetary Institute, Houston.

Agrell S.O., Agrell J.E., Arnold A.R. and Bristol C.C. (1973) Observations on glass from 15425, 15426, 15427 (abs). *Lunar Sci.* IV, 12-14. Lunar Planetary Institute, Houston.

Ahrens T.J. and Cole D.M. (1974) Shock compression and adiabatic release of lunar fines from Apollo 17. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2333-2346.

Ahrens T.J. and Watt J.P. (1980a) Dynamic properties of mare basalts: Relations of equations of state to petrology. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 2059-2074.

Ahrens T.J. and Watt J.P. (1980b) Dynamic properties of mare basalts: Relation of equations of state to petrology (abs). *Lunar Planet. Sci.* XI, 6-8. Lunar Planetary Institute, Houston.

Ahrens T.J., Jackson I. and Jeanloz R. (1977a) Shock compression and adiabatic release of a titaniferous lunar basalt. Proc. 8<sup>th</sup> Lunar Sci. Conf. 3437-3455.

Ahrens T.J., Jackson I. and Jeanloz R. (1977b) Dynamic properties of ilmenite-rich mare basalt and the relative ages of lunar cratered surfaces (abs). *Lunar Sci.* VIII, 1-3. Lunar Planetary Institute, Houston.

Albarede F. (1978) The recovery of spatial isotopic distributions from stepwise degassing data. *Earth Planet. Sci. Lett.* 39, 387-397.

Albee and others (1970) see "Lunatic Asylum"

Albee and 8 others (1972) Mineralogy, petrology and chemistry of a Luna 16 basaltic fragment, sample B1. *Earth Planet. Sci. Lett.* 13, 353-367.

Albee A.L., Gancarz A.J. and Chodos A.A. (1973) Metamorphism of Apollo 16 and 17 and Luna 20 metaclastic rocks at about 3.95 AE: Samples 61156, 64423, 14-2, 65015, 67483, 15-2, 76055, 22006, and 22007. Proc. 4<sup>th</sup> Lunar Sci. Conf. 569-595.

Albee A.L., Chodos A.A., Dymek R.F., Gancarz A.J., Goldman D.S., Papanastassiou D.A. and Wasserburg G.J. (1974a) Dunite from the lunar highlands: petrography, deformational history, Rb-Sr age (abs). *Lunar Sci.* V, 3-5. Lunar Planetary Institute, Houston.

Albee A.L., Chodos A.A., Dymek R.F., Gancarz A.J. and Goldman D.S. (1974b) Preliminary investigation of Boulders 2 and 3, Apollo 17, Station 2: Petrology and Rb-Sr model ages.(abs). *Lunar Sci.* V, 6-8. Lunar Planetary Institute, Houston.

Albee A.L., Dymek R.F. and DePaolo D.J. (1975) Spinel symplectites: High pressure solid-state reaction or late-stage magmatic crystallization? (abs) *Lunar Sci.* VI, 1-3. Lunar Planetary Institute, Houston.

Alibert C., Norman M.D. and McCulloch M.T. (1994) An ancient Sm-Nd age for a ferroan noritic anorthosite clast from lunar breccia 67016. *Geochim. Cosmochim. Acta* 58, 2921-2926.

Alibert C., Norman M.D. and McCulloch M.T. (1994) Erratum. *Geochim. Cosmochim. Acta* 58, 5369-5370.

Alexander E.C. (1970) Rare gases from stepwise heating of lunar rock 12013. *Earth Planet. Sci. Lett.* 9, 201-207.

Alexander E.C., Davis P.K. and Lewis R.S. (1972) Rubidium-strontium and potassium-argon age of lunar sample 15555. *Science* 175, 417-419.

Alexander E.C. and Davis P.K. (1974) 40Ar-39Ar ages and trace element contents of Apollo 14 breccias: an interlaboratory cross-claibration of 40Ar-39Ar standards. *Geochim. Cosmochim. Acta* 38, 911-928.

Alexander E.C. and Kahl S.B. (1974) 40Ar-39Ar studies of lunar breccias. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1353-1373.

Alexander E.C., Coscio M.R., Dragon J.C., Pepin R.O. and Saito K. (1977) K/Ar dating of lunar soils III: Comparison of 39Ar – 40Ar and conventional techniques: 12032 and the age of Copernicus. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 2725 – 2740.

Alexander E.C., Coscio M.R., Dragon J.C. and Saito K. (1978)  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  studies of glasses from lunar soils.(abs). *Lunar Planet. Sci. IX*, 7-9. Lunar Planetary Institute, Houston.

Alexander E.C., Coscio M.R., Dragon J.C., Pepin R.O. and Saito K. (1980) K/Ar dating of lunar soils IV: Orange glass from 74220 and agglutinates from 14259 and 14163. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 1663-1677.

Allegre, C.J., Shinizu N. and Treuil M. (1977) Comparative chemical history of the Earth, Moon and parent body of achondrite. *Phil. Trans. Roy. Soc. London* A285, 55-68.

Allegre C.J., Birk J.-L., Loubet M. and Provost A. (1971) “Age” 87Rb-87Sr et teneur en K, Rb, Sr, Ba et Terres rares de sol de la Mer de la Feconde (Lune) rapporte par la mission sovietique Luna 16. *Compt. Rend. Acad. Sc. Paris* 273, 779.

Allen F.M., Bence A.E. and Grove T.L. (1979) Olivine vitrophyres in Apollo 14 breccia 14321: Samples of the high-Mg component of the lunar highlands. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 695-712.

Allen R.O., Jovanovic S. and Reed G.W. (1975) Heavy element affinities in Apollo 17 samples. *Earth Planet Sci. Lett.* 27, 163-169.

Allen R.O., Jovanovic S. and Reed G.W. (1977) Volatile metals - mode of transport (abs). *Lunar Sci.* VIII, 22-24. Lunar Planetary Institute, Houston.

Allton J.H. and Waltz S.R. (1980) Depth scales for Apollo 15, 16, 17 drill cores. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 1463-1477.

Alibert C., Norman M.D. and McCulloch M.T. (1994) An ancient age for a ferroan anorthosite clast from lunar breccia 67016. Geochim. Cosmochim. Acta 58, 2921-2926.

Alvarez R. (1974a) Electrical properties of sample 70215. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2663-2671.

Alvarez R. (1974b) Electrical properties of sample 70215 in the temperature range of 100 to 373°K (abs). Lunar Sci. V, 15-17. Lunar Planetary Institute, Houston.

Anand M., Taylor L.A., Neal C.R., Snyder G.A., Patchen A., Sano Y. and Terada K. (2003) Petrogenesis of lunar meteorite EET96008. Geochim. Cosmochim. Acta 67, 3499-3518.

Anders E. (1977) Chemical composition of the Moon, Earth and eucrite parent body. Phil. Trans. Roy. Soc. London A285, 23-40.

Anders E. (1979) Procrustean science: Indigenous siderophiles in the Lunar Highlands, according to Delano and Ringwood. The Moon 20, 219-239.

Anders E. and Grevesse N. (1989) Abundance of elements. Geochim. Cosmochim. Acta 53, 197-214.

Andersen C.A. and Hinckley J.R. (1973) 207Pb/206Pb ages and REE abundances in returned lunar materials by ion microprobe mass analysis (abs). Lunar Sci. IV, 37-42. Lunar Planetary Institute, Houston.

Andersen D.J. and Lindsley D.H. (1979) The olivine-ilmenite thermometer. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 493-507.

Andersen D.J. and Lindsley D.H. (1982) Application of a two-pyroxene thermometer (abs). Lunar Planet. Sci. XIII, 15-16. Lunar Planetary Institute, Houston.

Anderson A.T. (1971) Exotic armalcolite and the origin of Apollo 11 ilmenite basalts. Geochim. Cosmochim Acta 35, 969-973.

Anderson A.T., Braziunas T.F., Jacoby J. and Smith J.V. (1972) Thermal and mechanical history of breccias 14306, 14063, 14270 and 14321. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 819-835.

Anderson A.T. (1973) The texture and mineralogy of lunar peridotite 15445,10. J. Geol. 81, 219-226.

Anderson D.H. (1970) Introduction. The preliminary examination and preparation of lunar sample 12013. Earth Planet. Sci. Lett. 9, 94-102.

Arai T. and Warren P.H. (1999) Lunar meteorite Queen Alexandra Range 94281: Glass compositions and other evidence for launch pairing with Yamato 793274. Meteoritics & Planet. Sci. 34, 209-234.

Ari T., Takeda H., Miyamoto M. and Kojima H. (2006) Apollo 14 oldest mare basalt revisited: Possible petrogenetic connection between mg Gabbronorite and VHK basalt. (abs) Lunar Planet. Sci. XXXVII #2387

Ari T., Kaiden H., Misawa K. and Kojima H. (2006) Ion microprobe study of Apollo 14 oldest basalt. (abs) Antarctic Meteorites XXX, 3-4.

Arndt J., Engelhardt W. v., Gonzalez-Cabeza I. and Meier B. (1984) Formation of Apollo 15 green glass beads. Proc. Lunar Planet. Sci. Conf. 15<sup>th</sup>, J. Geophys. Res. 89, C225-C232.

Arndt J. and Engelhardt W. von (1987) Formation of Apollo 17 orange and black glass beads. Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf., in J. Geophys. Res. 92, E372-E376.

Arnold J.R., Kohl C.P. and Nishiizumi K. (1993) Measurements of cosmogenic nuclides in lunar rock 64455 (abs). Lunar Planet. Sci. XXIV, 39-40. Lunar Planetary Institute, Houston.

Arvidson R., Crozaz G., Drozd R.J., Hohenberg C.M. and Morgan C.J. (1975) Cosmic ray exposure ages of features and events at the Apollo landing sites. The Moon 13, 259-276.

Arvidson R., Drozd R., Guiness E., Hohenberg C., Morgan C., Morrison R. and Oberbeck V. (1976) Cosmic ray exposure ages of Apollo 17 samples and the age of Tycho. Proc. 7<sup>th</sup> Lunar Sci. Conf. 2817-2832.

Ashwal L.D. (1975) Petrologic evidence for a plutonic igneous origin of anorthositic norite clasts in 67955 and 77017. Proc. 6<sup>th</sup> Lunar Sci. Conf. 221-230.

Baedeker P.A., Chou C-L. and Wasson J.T. (1972) The extralunar component in lunar soils and breccias. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1343-1359.

Baedeker P.A., Chou C-L., Sunberg L.L. and Wasson J.T. (1972) Extralunar materials in Apollo 16 soils and the decay rate of the extralunar flux 4.0 GY ago. Earth Planet. Sci. Lett. 17, 79-83.

Baedeker P.A., Chou C.-L., Grudewicz E.B. and Wasson J.T. (1974) Volatile and siderophile trace elements in Apollo 15 samples: Geochemical implications and characterization of the long-lived and short-lived extralunar materials. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1177-1195.

Baedeker P.A., Chou C.-L., Sundberg L.L. and Wasson J.T. (1974) Volatile and siderophile trace elements in the soils and rocks of Taurus-Littrow. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1625-1643.

Bailey and Ulrich (1975) Apollo 15 voice transcript. USGS report # GD74-029.

Baker M.B. and Herzberg C.T. (1980a) Spinel cataclasites in 15445 and 72435: Petrology and criteria for equilibrium. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. , 535-553.

Baker M.B. and Herzberg C.T. (1980b) Spinel cataclasites in 15445 and 72435: Petrography, mineral chemistry, and criteria for equilibrium (abs). Lunar Planet. Sci. XI, 52-54. Lunar Planetary Institute, Houston.

Banerjee S.K. and Mellema J.P. (1976a) Early lunar magnetism. Nature 260, 230-231.

Banerjee S.K. and Mellema J.P. (1976b) A solar origin for the large lunar magnetic field at  $4.0 \times 10^9$  yrs ago? Proc. 7<sup>th</sup> Lunar Sci. Conf. , 3259-3270.

Banerjee S.K. and Mellema J.P. (1976c) A solar origin for the large lunar magnetic field at  $4.0 \times 10^9$  yrs ago? (abs) Lunar Sci. VII, 29-31. Lunar Planetary Institute, Houston.

Banerjee S.K. and Swits G. (1975) Natural remanent magnetization studies of a layered breccia boulder from the lunar highland region. The Moon 14, 473-481.

Banerjee S.K., Hoffman K. and Swits G. (1974a) Remanent magnetization directions in a layered boulder from the South Massif. Proc. Lunar Sci. Conf. 5<sup>th</sup> , 2873-2881.

Banerjee S.K., Hoffman K. and Swits G. (1974b) Reversed polarity remanent magnetization in a layered boulder near South Massif (abs). Lunar Sci. V, 32-34. Lunar Planetary Institute, Houston.

Bansal B.M., Church S.E., Gast P.W., Hubbard N.J., Rhodes J.M. and Weismann H. (1972) The chemical composition of soil from the Apollo 16 and Luna 20 sites. *Earth Planet. Sci. Lett.* 17, 29-35.

Bansal B.M., Wiesmann H. and Nyquist L. (1975) Rb-Sr ages and initial  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios for Apollo 17 mare basalts. In Conference on Origins of Mare Basalts and Their Implications for Lunar Evolution (Lunar Science Institute, Houston), 1-5.

Barnes I.L. and others (1973) Isotopic abundance ratios and concentrations of selected elements in some Apollo 15 and Apollo 16 samples. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1197-1207.

Barra F., Swindle T.D., Korotev R.L., Jolliff B.L., Zeigler R.A. and Olson E. (2006)  $^{40}\text{Ar}/^{39}\text{Ar}$  dating of Apollo 12 regolith: Implications for the age of Copernicus and the source of nonmare materials. *Geochim. Cosmochim. Acta* 70, 6016-6031.

Barraclough B.L. and Marti K. (1985) In search of the Moon's indigenous volatiles: Noble gasses and nitrogen in vesicular lunar glasses (abs). *Lunar Planet. Sci. XVI*, 31-32. Lunar Planetary Institute, Houston.

Barsukov V.L. (1977) Preliminary data for the regolith core brought to earth by the automatic lunar station Luna 24. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 3303-3318.

Basford J.R., Dragon J.C., Pepin R.O., Coscio M.R. and Murthy V.R. (1972) Krypton and Xenon in lunar fines. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1915-1955.

Basu A., Des Marais D.J., Hayes J.M. and Meinschein W.G. (1975) Integrated investigation of the mixed origin of Lunar Sample 72161. *The Moon* 14, 129-138.

Basu A. and Meinschein W.G. (1976) Agglutinates and carbon accumulation in Apollo 17 lunar soils. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 337-349.

Basu A., McKay D.S., Moore C.H. and Shaffer N.R. (1979) A note on the Apollo 15 green glass vitrophyres. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 301-310.

Basu A., McKay D.S., Griffiths S.A. and Nace G-A. (1981) Regolith maturation on the earth and the moon with an example from Apollo 15. *Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf.* 433-449.

Basu A. and McKay D.S. (1984) Petrologic Comparisons of Cayley and Descartes on the basis of Apollo 16 soils from stations 4 and 11. *Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res.* 89, B535-B541.

Basu A. and McKay D.S. (1984) Petrologic profile of Apollo 16 regolith at station 4. *Proc. 15<sup>th</sup> Lunar Planet. Sci. Conf.* C133-142. *JGR* 89

Basu A. and McKay D.S. (1985) Chemical variablitiy and origin of agglutinate glass. *Proc. 16<sup>th</sup> Lunar Planet. Sci. Conf.* D87-94. *JGR* 90

Bayer G, Felsche J., Schulz H. and Ruegger P. (1971) X-ray study and Mossbauer spectroscopy on lunar ilmenites (Apollo 11). *Earth Planet. Sci. Lett.* 16, 273-274.

Beard B.L., Snyder G.A. and Taylor L.A. (1994) Deep melting and residual garnet in the sources of lunar basalts: Lu-Hf isotopic systematics (abs). *Lunar Planet. Sci. XXV*, 73-74. Lunar Planetary Institute, Houston.

Beard B.L., Taylor L.A., Scherer E.E., Johnson C.M. and Snyder G.A. (1998) The source region and melting mineralogy of high-titanium and low-titanium lunar basalts deduced from Lu-Hf isotope data. *Geochim. Cosmochim. Acta* 62, 525-544.

Beaty D.W. and Albee A.L. (1978) Comparative petrology and possible genetic relations among the Apollo 11 basalts. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 359-463.

Beaty D.W. and Albee A.L. (1980) The geology and petrology of the Apollo 11 landing site. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 23-35.

Becker R.H. and Clayton R.N. (1975) Nitrogen abundances and isotopic compositions in lunar samples. Proc. 6<sup>th</sup> Lunar Sci. Conf. 2131-2149.

Becker R.H. and Epstein S. (1981) Carbon isotopic ratios in some low-d<sup>15</sup>N lunar breccias. Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf. 289-293.

Beckinsale R.D. (1977) Hydrogen, oxygen and silicon isotopic systematics in lunar material. Phil. Trans. Roy. Soc. London A285, 417-426.

Begemann F., Ludwig K.R., Lugmair G.W., Min K., Nyquist L.E., Patchett P.J., Renne P.R., Shih C.-Y., Villa I.M. and Walker R.J. (2001) Call for an improved set of decay constants for geochronological use. Geochim. Cosmochim. Acta 65, 111-121.

Behrmann C.J., Drozd R.J. and Hohenberg C.M. (1973) Extinct lunar radioactivities: Xenon from <sup>244</sup>Pu and <sup>129</sup>I in Apollo 14 breccias. Earth Planet. Sci. Lett. 17, 446-455.

Behrmann C.J., Crozaz G., Drozd R., Hohenberg C., Ralston C., Walker R. and Yuhas D. (1973) Cosmic-ray exposure history of North Ray and South Ray material. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1957-1974.

Bell P.M., El Goresy A. and Mao H.K. (1974) A study of iron-rich particles on the surfaces of orange glass spheres from 74220. Proc. 5<sup>th</sup> Lunar Sci. Conf. 187-191.

Bell P.M. and Mao H.K. (1975) Cataclastic plutonites: Possible keys to the evolutionary history of the early Moon (abs). Lunar Sci. VI, 34-35. Lunar Planetary Institute, Houston.

Bell P.M., Mao H.K., Roedder E. and Weiblen P.W. (1975) The problem of the origin of symplectites in olivine-beating lunar rocks. Proc. 6<sup>th</sup> Lunar Sci. Conf. 231-248.

Bence A.E., Papike J.J. and Prewitt C.T. (1970) Apollo 12 clinopyroxene chemical trends. Earth Planet. Sci. Lett. 8, 393-399.

Bence A.E., Holzwarth W. and Papike J.J. (1971) Petrology of basaltic and monomineralic soil fragments from the Sea of Fertility. Earth Planet. Sci. Lett. 13, 299-311.

Bence A.E. and Papike J.J. (1972) Pyroxenes as recorders of lunar basalt petrogenesis: Chemical trends due to crystal-liquid interaction. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 431-469.

Bence A.E., Papike J.J., Sueno S. and Delano J.W. (1973) Pyroxene poikiloblastic rocks from the lunar highlands. Proc. 4<sup>th</sup> Lunar Sci. Conf. 597-611.

Bence A.E., Taylor S.R., Muir P.M., Nance W.B., Rudowski R. and Ware N. (1975) Chemical and petrologic relations among highland rock types (abs). Lunar Sci. VI, 36-38. Lunar Planetary Institute, Houston.

Bence A.E., Grove T.L. and Seambos T. (1977) Gabbros from Mare Crisium: An analysis of the Luna 24 soil. Geophys. Res. Lett. 4, 493-496.

Benkert J.P., Baur H., Pedroni A., Wieler R. and Signer P. (1988) Solar He, Ne and Ar in regolith minerals: All are mixtures of two components (abs). Lunar Planet. Sci. XIX, 59-60. Lunar Planetary Institute, Houston.

- Benkert J.P., Kerridge J.F., Kim J.S., Kim Y., Marti K., Signer P. and Wieler R. (1991) Evolution of isotopic signatures in lunar regolith nitrogen: Noble gases and N in ilmenite grain-size fractions from regolith breccia 79035 (abs). *Lunar Planet. Sci.* XXII, 85-86. Lunar Planetary Institute, Houston.
- Berdot J.L., Chetrit G.C., Lorin J.C., Pellas P. and Poupeau G. (1972) Track studies of Apollo 14 rocks and Apollo 14, Apollo 15 and Luna 16 soils. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 2867-2881.
- Berdot J.L., Chetrit G.C., Lorin J.C., Pellas P. and Poupeau G. (1972) Irradiation studies of lunar soils: 15100, Luna 20 and compacted soil from breccia 14307. *The Apollo 15 Samples*, 333-335. Lunar Planetary Institute, Houston.
- Bernatowitz T., Drozd R.J., Hohenberg C.M., Lugmair G., Morgan C.J. and Podosek F.A. (1977) The regolith history of 14307. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 2763-2783.
- Bernatowicz T.J., Hohenberg C.M., Hudson B., Kennedy B.M. and Podosek F. (1978a) Argon ages for lunar breccias 14064 and 15405. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 905-919.
- Bernatowicz T.J., Hohenberg C.M., Hudson B., Kennedy B.M. and Podosek F. (1978b) Excess fission xenon at Apollo 16. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 1571-1597.
- Bersch M.G., Taylor G.J. and Keil K. (1988) Ferroan anorthosites and the magma ocean: Searching for trends in the Sea of Confusion (abs). *Lunar Planet. Sci. XIX*, 67-68. Lunar Planetary Institute, Houston.
- Bersch M.G., Taylor G.J., Keil K. and Norman M.D. (1991) Mineral compositions in pristine lunar highland rocks and the diversity of highland magmatism. *Geophys. Res. Letters* 18, 2085-2088.
- Best J.B. and Minkin J.A. (1972) Apollo 15 glasses of impact origin. In *The Apollo 15 Lunar Samples*. 34-39. Lunar Planetary Institute, Houston.
- Bhandari N. (1977a) Solar flare exposure ages of lunar rocks and boulders based on  $^{26}\text{Al}$ . *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 3607-3615.
- Bhandari N. (1977b) Solar flare induced A1-26 in short exposure age rocks (abs). *Lunar Sci. VIII*, 100-102. Lunar Planetary Institute, Houston.
- Bhandari N., Goswami J.N., Gupta S.K., Lal D., Tamhane A.S. and Venkatavaradan V.S. (1972) Collision controlled radiation history of the lunar regolith. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 2811-2829.
- Bhandari N., Goswami J. and Lal D. (1973) Surface irradiation and evolution of the lunar regolith. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 2275-2290.
- Bhandari N., Bhattacharya S.K. and Padia J.T. (1976a) Solar proton fluxes during the last million years. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 513-523.
- Bhandari N., Bhattacharya S.K. and Padia J.T. (1976b) Solar flare records in lunar rocks (abs). *Lunar Sci. VII*, 49-51. Lunar Planetary Institute, Houston.
- Bhattacharya S.K., Goswami J.N., Lal D., Patel P.P. and Rao M.N. (1975) Lunar regolith and gas-rich meteorites: Characterization based on particle tracks and grain-size distributions. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 3509-3526.
- Bickel C.E. (1977) Petrology of 78155: An early, thermally metamorphosed polymict breccia. *Proc. Lunar Sci. Conf. 8<sup>th</sup>*, 2007-2027.

- Bickel C.E. and Warner J.L. (1977) Petrology of 78155: An early, thermally metamorphosed polymict breccia (abs). *Lunar Sci.* VIII, 109-111. Lunar Planetary Institute, Houston.
- Bickel C.E. and Warner J.L. (1978a) Survey of lunar plutonic and granulitic lithic fragments. *Proc. Lunar Planet. Sci. Conf.* 9<sup>th</sup>, 629-652.
- Bickel C.E. and Warner J.L. (1978b) Textural-mineralogical relationships in a population of ANT samples (abs). *Lunar Planet. Sci. IX*, 82-84. Lunar Planetary Institute, Houston.
- Bickel C.E., Warner J.L. and Phinney W.C. (1976a) Petrology of 79215: Brecciation of a lunar cumulate. *Proc. Lunar Sci. Conf.* 7<sup>th</sup>, 1793-1819.
- Bickel C.E., Warner J.L. and Phinney W.C. (1976b) 79215: A unique, early lunar breccia (abs). *Lunar Sci. VII*, 55-57. Lunar Planetary Institute, Houston.
- Binder A.B. (1976) On the compositions and characteristics of the mare basalt magmas and their source regions. *The Moon* 16, 115-150.
- Binder A.B., Lange M.A., Brandt H.-J. and Kahler S. (1980) Mare basalt units and the compositions of their magmas. *The Moon and Planets* 23, 445-481.
- Binder A.B. (1985) Mare basalt genesis: Modeling trace elements and isotopic ratios. *Proc. 16<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res.* 90, C396-C404.
- Birck J.L., Fourcade S. and Allegre C.J. (1975)  $^{87}\text{Rb}/^{86}\text{Sr}$  age of rocks from the Apollo 15 landing site and significance of internal isochron. *Earth Planet. Sci. Lett.* 26, 29-35.
- Birck J.L., Manhes G., Richard P., Joron J.L., Treuil M. and Allegre C.J. (1977) 87Rb/87Sr age of Luna 24 micrrograbbros and isotopic and trace element study of soil 24096 (abs). *Conf. on Luna 24.* 34-36. Lunar Planetary Institute, Houston.
- Birck J.L. and Allegre C.J. (1994) Contrasting Re/Os magmatic fractionation in planetary basalts. *Earth Planet. Sci. Lett.* 124, 139-148.
- Bishop K.M., Jolliff B.L., Korotev R.L. and Haskin L.A. (1993) North Massif lithologies and chemical compositions viewed from 2-4 mm particles of soil sample 76503. In *Workshop on Geology of the Apollo 17 Landing Site.* LPI Tech. Rpt. 92-09.2-3.
- Black D. (1972) On the origins of trapped helium, neon, and argon isotopic variations in meteorites: I, Gas-rich meteorites, lunar soil and breccia. *Geochim. Cosmochim. Acta* 36, 347-376.
- Blanchard D.P., Haskin L.A., Jacobs J.W., and Brannon J.C. and Korotev R.L. (1975) Major and trace element chemistry of Boulder 1 at Station 2, Apollo 17. *The Moon* 14, 359-371.
- Blanchard D.P., Krotev R.L., Brannon J.C., Jacobs J.W., Haskin L.A. Reid A.M., Donaldson C. and Brown R.W. (1975) A geochemical and petrographic study of 1-2 mm fines from Apollo 17. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 2321-2342.
- Blanchard D.P., Jacobs J.W., Brannon J.C. and Haskin L.A. (1976) Major and trace element compositions of matrix and aphanitic clasts from consortium breccia 73215. *Proc. Lunar Sci. Conf. 7th*, 2179-2187.
- Blanchard D.P., Jacobs J.W. and Brannon J.C. (1977) Chemistry of ANT-suite and felsite clasts from consortium breccia 73215 and of gabbroic anorthosite 79215. *Proc. Lunar Sci. Conf. 8<sup>th</sup>*, 2507-2524.

Blanchard D.P., Brannon J.C., Jacobs J.W. and Haskin L.A. (1977) Major and trace element abundances in anorthositic gabbro clasts and a clast of K-rich felsite from consortium breccia 73215 (abs). *Lunar Sci.* VIII, 124-126. Lunar Planetary Institute, Houston.

Blanchard D.P. and Budahn J.R. (1978) Chemistry of orange/black soils from core 74001/2. *Proc. Lunar 9<sup>th</sup> Planet. Sci. Conf.* 1969-1980.

Blanchard D.P., Budahn J.R., Kerridge J.F. and Compston W. (1978) Consortium breccia 73255: Rare-earth-element, light-element, and Rb-Sr chemistry of aphanitic lithologies (abs). *Lunar Planet. Sci. IX*, 103-105. Lunar Planetary Institute, Houston.

Blanchard D.P. and Budahn J.R. (1979a) Remnants from the ancient lunar crust: Clasts from consortium breccia 73255. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 803-816.

Blanchard D.P. and Budahn J.R. (1979b) Clasts from consortium breccia 73255: Remnants from the early lunar crust? (abs) *Lunar Planet. Sci. X*, 134-136. Lunar Planetary Institute, Houston.

Blanchard D.P. and McKay G.A. (1981) Remnants from the ancient lunar crust: Norite 78236 (abs). *Lunar Planet. Sci. XII*, 83-85. Lunar Planetary Institute, Houston.

Blanford G.E., Fruland R.M., McKay D.S. and Morrison D.A. (1974a) Lunar surface phenomena: Solar flare track gradients, microcraters, and accretionary particles. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 2501-2526.

Blanford G.E., McKay D. and Morrison D. (1974b) Accretionary particles and microcraters (abs). *Lunar Sci. V*, 67-69. Lunar Planetary Institute, Houston.

Blank H., Nobiling R., Traxel K. and El Goresy A. (1981) Partitioning of trace elements among coexisting opaque oxides in Apollo 17 basalts using a proton probe microanalyzer (abs). *Lunar Planet. Sci. XII*, 89-91. Lunar Planetary Institute, Houston.

Blank H., E1Goresy A., Janicke J., Nobiling R. and Traxel K. (1984) Partitioning of Zr and Nb between coexisting opaque phases in lunar rocks - determined by quantitative proton microprobe analysis. *Earth Planet. Sci. Letters* 68, 19-33.

Boeckl R.S. (1972) A depth profile of <sup>14</sup>C in the lunar rock 12002. *Earth Planet. Sci. Lett.* 16, 269-272.

Bogard D.D. (1983) A meteorite from the Moon. *Geophys. Res. Lett.* 10, 773. (editorial)

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

Bogard D.D. and Nyquist L.E. (1973) 40Ar/36Ar variations in Apollo 15 and 16 regolith. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1975-1986.

Bogard D.D., Nyquist L.E., Hirsch W.C. and Moore D.R. (1973b) Trapped solar and cosmogenic noble gas abundances in Apollo 15 and 16 deep drill samples. *Earth Planet. Sci. Lett.* 21, 52-69.

Bogard D.D., Funkhouser J.G., Schaeffer O.A. and Zahringer J. (1971) Noble gas abundances in lunar material-cosmic ray spallation products and radiation ages from the Sea of Tranquility and the Ocean of Storms. *J. Geophys. Res.* 76, 2757-2779.

Bogard D.D., Nyquist L.E. and Hirsch W.C. (1974) Noble gases in Apollo 17 boulders and soils (abs). *Lunar Sci. V*, 73-75. (unpublished data is available in Phinney 1981)

Bogard D.D. and Nyquist L.E. (1974) 76535: An old lunar rock? (abs) *Lunar Sci. V*, 70-72. Lunar Planetary Institute, Houston.

Bogard D.D. and Gibson E.K. (1975) Volatile gases in breccia 68115 (abs). *Lunar Sci.* VI, 63-65. Lunar Planetary Institute, Houston.

Bogard D.D., Nyquist L.E., Bansal B.M., Wiesmann H. and Shih C.-Y. (1975) 76535: An old lunar rock. *Earth Planet. Sci. Lett.* 26, 69-80.

Bogard D.D. and Hirsch W.C. (1978) Depositional and irradiational history and noble gas contents of orange-black droplets in the 74002/1 core from Shorty Crater. *Proc. 9<sup>th</sup> Lunar Sci. Conf.* 1981-2000.

Bogard D.D., Garrison D.H., Shih C.-Y. and Nyquist L.E. (1994) <sup>39</sup>Ar-<sup>40</sup>Ar dating of two lunar granites: The age of Copernicus. *Geochim. Cosmochim. Acta* 58, 3093-3100.

Borchardt R., Stoffler D., Spettel B., Palme H., Wanke H., Wacker K. and Jessberger E.K. (1986) Composition, structure and age of the Apollo 16 subregolith basement as deduced from the chemistry of post-Imbrium melt bombs. *Proc. 16<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res.* 90, E43-E54.

Borg L.E., Norman M., Nyquist L., Bogard D., Snyder G., Taylor L. and Lindstrom M. (1999) Isotopic studies of ferroan anorthosite 62236: A younger lunar crustal rock from a light rare-earth-element-depleted source. *Geochim. Cosmochim. Acta* 63, 2679-2691.

Borg L.E., Schearer C.K., Asmerom Y. and Papike J.J. (2004) Prolonged KREEP magmatism on the Moon indicated by the youngest dated lunar igneous rock. *Nature* 432, 209-211.

Boyd F.R. and Smith D. (1971) Compositional zoning in pyroxenes from lunar rock 12021, Oceanus Procellarum. *J. Petrol.* 12, 439-464.

Boynton W.V., Baedecker P.A., Chou C.-L., Robinson K.L. and Wasson J.T. (1975a) Mixing and transport of lunar surface materials: Evidence obtained by the determination of lithophile, siderophile, and volatile elements. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 2241-2259.

Boynton W.V., Chou C.-L., Bild R.W. and Wasson J.T. (1975b) Surface correlation of volatile elements in Apollo-16 soils (abs). *Lunar Sci.* VI, 74-76. Lunar Planetary Institute, Houston.

Boynton W.V., Chou C.-L., Robinson Karen Lee, Warren Pablo H. and Wasson J.T. (1976) Lithophiles, siderophiles and volatiles in Apollo 16 soils and rocks. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 727-742.

Braddy D., Hutcheon I.D. and Price P.B. (1975a) Crystal chemistry of Pu and U and concordant fission track ages of lunar zircons and whitlockites. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 3581-3600.

Braddy D., Hutcheon I.D. and Price P.B. (1975b) Crystal chemistry of Pu and U and concordant fission track ages of lunar zircons and whitlockites (abs). *Lunar Sci.* VI, 77-79. Lunar Planetary Institute, Houston.

Brecher A. (1974) Inferences from comparative magnetic studies of some Apollo 17 basalts, breccias and soils (abs). *Lunar Sci.* V, 83-85. Lunar Planetary Institute, Houston.

Brecher A. (1975) Textural remanence: A new model of lunar rock magnetism (abs). *Lunar Sci.* VI, 83-85. Lunar Planetary Institute, Houston.

Brecher A. (1976a) Textural remanence: A new model of lunar rock magnetism. *Earth Planet. Sci. Lett.* 29, 131-145.

Brecher A. (1976b) The magnetic characteristics of highland breccia 73215: Evidence for textural control of magnetization. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 2217-2231.

- Brecher A. (1976c) Textural control of magnetization in lunar, meteoritic and terrestrial rocks (abs). *Lunar Sci.* VII, 91-93. Lunar Planetary Institute, Houston.
- Brecher A. (1977a) Interrelationships between magnetization directions, magnetic fabric and oriented petrographic features in lunar rocks. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 703-723.
- Brecher A. (1977b) New evidence for textural magnetization (TXM) in lunar rocks synthetic analogs and meteorites (abs). *Lunar Sci. VIII*, 142-144. Lunar Planetary Institute, Houston.
- Brecher A. and Morash K.R. (1973) Magnetic characteristics of Apollo 17 orange and grey soils (abs). *EOS Trans. AGU* 54, 581-582.
- Brecher A., Menke W.H. and Morash K.R. (1974) Comparative magnetic studies of some Apollo 17 rocks and soils and their implications. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 2795-2814.
- Brecher A., Menke W.H., Adams J.B. and Gaffey M.J. (1975) The effects of heating and subsolidus reduction on lunar materials: An analysis by magnetic methods, optical, Mossbauer, and X-ray diffraction spectroscopy. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 3091-3109.
- Brett R. (1993) The lunar crust: A product of heterogeneous accretion or differentiation of a homogeneous Moon? *Geochim. Cosmochim. Acta* 37, 2697-2703.
- Brett R. (1976) Reduction of mare basalts by sulfur loss. *Geochim. Cosmochim. Acta* 40, 997-1004.
- Brett R., Butler P., Meyer C., Reid A.M., Takeda H. and Williams R. (1971) Apollo 12 igneous rocks 12004, 12008, 12009 and 12022: A mineralogical and petrological study. *Proc. 2<sup>nd</sup> Lunar Sci. Conf.* 301-317.
- Brown G.M. (1970) Petrology, mineralogy and genesis of lunar crystalline igneous rocks. *J. Geophys. Res.* 75, 6480-6496.
- Brown G.M. (1977) Two-stage generation of lunar mare basalts. *Phil. Trans. Roy. Soc. London* A285, 169-176.
- Brown G.M. and Peckett A. (1971) Selective volitization on the lunar surface: Evidence from Apollo 14 feldspar-phyric basalts. *Nature* 234, 262-266.
- Brown G.M. and Gay P. (1971) Lunar Antiperthites. *Earth Planet. Sci. Lett.* 11, 23-27.
- Brown G.M., Emeleus C.H., Holland G.J., Peckett A. and Phillips R. (1972) Mineral-chemical variations in Apollo 14 and Apollo 15 basalts and granitic fractions. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 141-157.
- Brown G.M., Holland J.G. and Peckett A. (1973) Orange soil from the moon. *Nature* 242, 515.
- Brown G.M., Peckett A., Emeleus C.H. and Phillips R. (1974) Mineral-chemical properties of Apollo 17 mare basalts and terra fragments (abs). *Lunar Sci. V*, 89-91. Lunar Planetary Institute, Houston.
- Brown G.M., Peckett A., Emeleus C.H., Phillips R. and Pinsent R.H. (1975a) Petrology and mineralogy of Apollo 17 mare basalts. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1-13.
- Brown G.M., Peckett A., Phillips R. and Emeleus C.H. (1975b) Mineralogy and petrology of Apollo 17 basalts (abs). *Lunar Sci. VI*, 95-97. Lunar Planetary Institute, Houston.
- Brunfeldt A.O., Heier K.S., Nilssen B., Sundvoll B. and Steinnes E. (1972) Distribution of elements between different phases of Apollo 14 rocks and soils. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1133-1147.

Brunfelt A.O., Heier K.S., Nilssen B., Sundvoll B. and Steinnes E. (1973) Geochemistry Apollo 15 and 16 materials. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1209-1218.

Brunfelt A.O., Heier K.S., Nilssen B., Steinnes E. and Sundvoll B. (1974) Elemental composition of Apollo 17 fines and rocks. Proc. 5<sup>th</sup> Lunar Sci. Conf. 981-990.

Bunch T.E., Prinz M., Keil K. and Dowty E. (1972a) Composition and origin of glasses and chondrules in Apollo 15 rake samples from Spur Crater (abs). Meteoritics 8, 21-22.

Bunch T.E., Quaide W., Prinz M., Keil K. and Dowty E. (1972b) Lunar ultramafic glasses, chondrules and rocks. Nature 239, 57-59.

Bunch T.E., Prinz M and Keil K. (1972c) Electron microprobe analyses of lithic fragments and glasses from Apollo 12 lunar samples. Special. Pub. #4, UNM Institute of Meteoritics, ABQ

Burnett D.S. (1975) Lunar Science: The Apollo Legacy. Rev. Geophys. Space Phys. 13, 13-

Burnett D.S. and Woolum D.S. (1977) Exposure ages and erosion rates for lunar rocks. Phys. Chem. Earth 10, 63-101.

Burnett D.S., Monnin M., Seitz M., Walker R., Woolum D. and Yuhas D. (1970) Charged particle track studies in lunar rock 12013. Earth Planet. Sci. Lett. 9, 127-136.

Burnett D.S., Huneke J.C., Podosek F.A., Russ G.P., Turner G. and Wasserburg G.J. (1972) The irradiation history of lunar samples (abs). Lunar Sci. III, 105-107. Lunar Planetary Institute, Houston.

Burns R.G. and Dyar M.D. (1983) Spectral chemistry of green-glass-bearing 15426 regolith. Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 88, B221-B228.

Bushe F.D., Conrad G.H., Keil K., Prinz M., Bunch T.E., Erlichman J. and Quaide W.L. (1971) Electron microprobe analysis of minerals from Apollo 12 lunar samples. Special Pub. #3, UNM Institute of Meteoritics. ABQ

Bushe F.D., Prinz M., Keil K. and Bunch T.E. (1972) Spinels and the petrogenesis of some Apollo 12 igneous rocks. Am. Mineral. 57, 1729-1747.

Butler J.C., Greene G.M. and King E.A. (1973) Grain size frequency distribution and modal analysis of Apollo 16 fines. Proc. 4<sup>th</sup> Lunar Sci. Conf. 267-278.

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

Butler P. (1972) Lunar Sample Information Catalog Apollo 16. Lunar Receiving Laboratory. MSC 03210 Curator's Catalog. pp. 370.

Butler P. (1972) Compositional characteristics of olivines from Apollo 12 samples. Geochim. Cosmochim. Acta 36, 773-785.

Butler P. (1973) Lunar Sample Information Catalog Apollo 17. Lunar Receiving Laboratory. MSC 03211 Curator's Catalog. pp. 447.

Butler P. (1978) Recognition of lunar glass droplets produced directly from endogenous liquids: The evidence from S-Zn coatings. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 1459-1471.

Butler P. and Dealing T.E. (1974) The dissection and consortium allocation of Apollo 17 lunar rocks from the boulder at Station 7. Earth Planet. Sci. Lett. 23, 429-434.

- Butler P. and Meyer C. (1976) Sulfur prevails in coatings on glass droplets: Apollo 15 green and brown glasses and Apollo 17 orange and black (devitrified) glasses. Proc. 7<sup>th</sup> Lunar Sci. Conf. 1561-1581.
- BVSP (1981) Basaltic Volcanism on the Terrestrial Planets. Pergamon Press, Inc. New York. 1286 pp.
- Cadenhead D.A. and Stetter J.R. (1974) The interaction of water vapor with a lunar soil, a compacted soil and a cinder-like rock fragment. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2301-2316.
- Cadenhead D.A. and Buerget W.G. (1974) The interaction of hydrogen with Taurus-Littrow orange soil. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2287-2300.
- Cadenhead D.A., Brown M.G., Rice D.K. and Stetter J.R. (1977) Some surface area and porosity characterizations of lunar soils. Proc. 8<sup>th</sup> Lunar Sci. Conf. 1291-1303.
- Cadogan P.H. (1974) The oldest and largest lunar basin? Nature 250, 315-316.
- Cadogan P.H. (1981) The Moon-Our Sister Planet. Cambridge Univ. Press, pp. 391.
- Cadogan P.H., Eglinton G., Maxwell J.R. and Pillinger C.T. (1971) Carbon chemistry of the lunar surface. Nature 231, 29-31.
- Cadogan P.H., Eglinton G., Firth J.N.M., Maxwell J.R., Mays B.J. and Pillinger C.T. (1972) Survey of lunar carbon compounds: II. The carbon chemistry of Apollo 11, 12, 14 and 15 samples. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 2069-2090.
- Cadogan P.H., Eglinton G., Gowar A.P., Jull A.J.T., Maxwell J.R. and Pillinger C.T. (1973a) Location of methane and carbide in Apollo 11 and 16 lunar fines. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1493-1508.
- Cadogan P.H., Eglinton G., Maxwell J.R. and Pillinger C.T. (1973b) Distribution of methane and carbide in Apollo 12 fines. Nature 241, 81-83.
- Cadogan P.H. and Turner G. (1976) The chronology of the Apollo 17 Station 6 boulder. Proc. 7<sup>th</sup> Lunar Sci. Conf. 2267-2285.
- Cadogan P.H. and Turner G. (1977) 40Ar-39Ar dating of Luna 16 and Luna 20 samples. Philos. Trans. Roy. Soc. London A284, 167-177.
- Caffee M., Hohenberg C. and Hudson B. (1981a) Troctolite 76535: A study in the preservation of early isotopic records (abs). Lunar Planet. Sci. XII, 120-122. Lunar Planetary Institute, Houston.
- Caffee M., Hohenberg C.M. and Hudson B. (1981b) Troctolite 76535: A study in the preservation of early isotopic records. Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf. 99-115.
- Cameron K.L., Delano J.W., Bence A.E. and Papike J.J. (1972) Petrology of the 2-4 mm sized soil fragments from Apollo 15. In The Apollo 15 Lunar Samples. 1-4. Lunar Planetary Institute, Houston
- Cameron K.L., Delano J.W., Bence A.E. and Papike J.J. (1973) Petrology of the 2-4 mm soil fraction from the Hadley-Apennine region of the moon. Earth Planet. Sci. Lett. 19, 9-21.
- Cameron K.L. and Fischer G.W. (1975) Olivine-matrix reactions in thermally metamorphosed Apollo 14 breccias. Earth Planet. Sci. Lett. 25, 197-207.
- Canup R.M. and Righter K. (2000) Origin of the Earth and Moon. Univ. of Arizona Press pp. 391.
- Carlson I.C. and Walton W.J.A. (1978) Apollo 14 Rock Samples. Curators Office. JSC 14240

Carlson R.W. and Lugmair G.W. (1979a) Early history recorded by norite 78236. In Papers Presented to the Conference on the Lunar Highlands Crust. LP1 Contr. 394, 9-11. Lunar Planetary Institute, Houston

Carlson R.W. and Lugmair G.W. (1979b) Sm-Nd constraints on early lunar differentiation and the evolution of KREEP. Earth Planet. Sci. Lett. 45, 123-132.

Carlson R.W. and Lugmair G.W. (1980) 78236, a primary, but partially senile, lunar norite (abs). Lunar Planet. Sci. XI, 125-128. Lunar Planetary Institute, Houston

Carlson R.W. and Lugmair G.W. (1981a) Time and duration of lunar highlands crust formation. Earth Planet. Sci. Lett. 52, 227- 238.

Carlson R.W. and Lugmair G.W. (1981b) Sm-Nd age of lherzolite 67667: Implications for the processes involved in lunar crustal formation. Earth Planet. Sci. Lett. 56, 1-8.

Carlson R.W. and Lugmair G.W. (1988) The age of ferroan anorthosite 60025: oldest crust on a young Moon? Earth Planet. Sci. Lett. 90, 119-130.

Carr L.P., Wright I.P., and Pillinger C.T. (1985) Nitrogen abundance and isotopes in lunar breccias - a progress report (abs). Lunar Planet. Sci. XVI, 115-116. Lunar Planetary Institute, Houston

Carr M.H. and Meyer C.E. (1974) The regolith at the Apollo 15 site and its stratigraphic implications. Geochem. Cosmochim. Acta 38, 1183-1197.

Carrier W.D., Olhoeft G.R. and Mendell W. (1991) Physical properties of the Lunar Surface. In Lunar Sourcebook: a users guide to the moon. (eds. Heiken et al. ) Cambridge Univ. Press

Carter J.L., Taylor H.C. and Padovani E. (1973) Morphology and chemistry of particles from Apollo 17 soils 74220, 74241 and 75081 (abs). EOS Trans. AGU 54, 582.

Carter J.L., Clanton U.S., Fuhrman R., Laughton R.B., McKay D.S. and Usselman T.M. (1975) Morphology and composition of chalcopyrite, chromite, Cu, Ni-Fe, pentandite, and troilite in vugs of 76015 and 76215. Proc. 6<sup>th</sup> Lunar Sci. Conf. 719-728.

Carusi, A., Cavaretta G., Cinotti F., Civitelli G., Coradini A., Funiciello R., Fulchignoni M. and Taddeucci A. (1972) Lunar Glasses as an index of the impacted sites lithology: The source area of Apollo 15 "green glasses." Geol. Romana 11, 137-151.

Carusi A. and various authors (1972) The source of the Apollo 15 green glass (abs). In The Apollo 15 Lunar Samples. 5-9. Lunar Planetary Institute, Houston

Cavaretta G., Funiciello R., Giles H., Nicholls G.D., Taddeucci A. and Zussman J. (1972) Geochemistry of green glass spheres from Apollo 15 samples (abs). In The Apollo 15 Lunar Samples. 202-205 Lunar Planetary Institute, Houston

Chabot N.L. and Agee C.B. (2003) Core formation in the Earth and Moon: New experimental constraints from V, Cr and Mn. Geochim. Cosmochim. Acta 67, 2077-2091.

Chang S., Kvendalen K., Lawless J., Ponnamperuma C. and Kaplan I.R. (1971) Carbon, carbides and methane in an Apollo 12 sample. Science, 474-477.

Chang S. and Lennon K. (1975) Implantation of carbon and nitrogen ions into lunar fines: Trapping efficiencies and saturation concentrations. Proc. 6<sup>th</sup> Lunar Sci. Conf. 2171-2188.

Chao E.C.T. (1973a) The petrology of 76055,10, a thermally metamorphosed fragment-laden olivine micronorite homfels. Proc. 4<sup>th</sup> Lunar Sci. Conf. 719-732.

Chao E.C.T. (1973b) 76055, a fragment-laden contact-metamorphosed :magnesian hornfels (abs). EOS 54, 584.

Chao E.C.T. (1973c) Geologic implications of the Apollo 14 Fra Mauro breccias and comparison with ejecta from the Ries Crater, Germany. J. Res. U.S. Geol. Survey 1, 1-18.

Chao E.C.T. (1977) Basis for interpretation regarding the ages of the Serenitatis, Imbrium and Orientale events. Phil. Trans. Roy. Soc. London A285, 115-126.

Chao E.C.T. and Minkin J.A. (1972) Apollo 14 breccias: General characteristics and classification. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 645-659.

Chao E.C.T. and Minkin J.A. (1974a) Preliminary description of Apollo 17 station 7 boulder consortium rocks (abs). Lunar Sci.V, 109-111. Lunar Planetary Institute, Houston

Chao E.C.T. and Minkin J.A. (1974b) The petrogenesis of 77135, a fragment-laden pigeonite feldspathic basalt - a major highland rock type (abs). Lunar Sci. V, 112-114.

Chao E.C.T., Boreman J.A., Minkin J.A. and James O.B. (1970) Lunar glasses of impact origin: Physical and chemical characteristics and geologic implications. J. Geophy. Res. 75, 7445-7479.

Chao E.C.T., Minkin J.A. and Best J.B. (1972a) Apollo 14 breccias: General characteristics and classification. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 645-659.

Chao E.C.T., Best J.B. and Minkin J.A. (1972b) Apollo 14 glasses of impact origin and their parent rock types. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 907-925.

Chao E.C.T., Minkin J.A. and Thompson C.L. (1974) Preliminary petrographic description and geologic implications of the Apollo 17 Station 7 Boulder Consortium samples. Earth Planet. Sci. Lett. 23, 413-428.

Chao E.C.T., Minkin J.A., Thompson C.L. and Heubner J.S. (1975a) The petrogenesis of 77115 and its xenocrysts: Description and preliminary interpretation. Proc. 6<sup>th</sup> Lunar Sci. Conf. 493-515.

Chao E.C.T., Minkin J.A. and Thompson C.L. (1975b) The petrogenesis of 77115 and its xenocrysts: Description and preliminary interpretation (abs). Lunar Sci. VI, 134-136. Lunar Planetary Institute, Houston

Chao E.C.T., Minkin J.A. and Thompson C.L. (1976a) The petrology of 77215, a noritic impact breccia. Proc. 7<sup>th</sup> Lunar Sci. Conf. 2287-2308.

Chao E.C.T., Minkin J.A. and Thompson C.L. (1976b) The petrology of 77215, a noritic impact ejecta breccia (abs). Lunar Sci. VII, 129-131. Lunar Planetary Institute, Houston

Chen H-K., Delano J.W. and Lindsley D.H. (1982) Chemistry and phase relations of VLT volcanic glasses from Apollo 14 and Apollo 17. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. A171-A181.

Chou C.L., Boynton W.V., Sundberg L.L. and Wasson J.T. (1975) Volatiles on the surfaces of Apollo 15 green glass and trace-element distributions among Apollo 15 soils. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1701-1727.

Chappell B.W., Compston W., Green D.H. and Ware N.G. (1972) Chemistry, geochronology and petrogenesis of lunar sample 15555. Science 175, 415-416

Chappell B.W. and Green D.H. (1973) Chemical compositions and petrogenetic relationships in Apollo 15 mare basalts. Earth Planet. Sci. Lett. 18, 237-246.

Charette M.P. and Adams J.B. (1975a) Mare basalts: Characterization of compositional parameters by spectral reflectance. In Papers presented to the Conference on Origins of Mare Basalts and their Implications for Lunar Evolution (Lunar Science Institute, Houston), 25-28. Lunar Planetary Institute, Houston

Charette M.P. and Adams J.B. (1975) Agglutinates as indicators of lunar soil maturity: The rare gas evidence at Apollo 16. Proc. 6<sup>th</sup> Lunar Sci. Conf. 2281-2290.

Charette M.P., Soderblom L.A., Adams J.B., Gaffey M.J. and McCord T.B. (1976) Age-color relationships in the lunar highlands. Proc. 7<sup>th</sup> Lunar Sci. Conf. 2579-2592.

Charette M.P. and Adams J.B. (1977) Spectral reflectance of lunar highland rocks (abs). Lunar Sci. VIII, 172-174. Lunar Planetary Institute, Houston

Chen H.-K., Delano J.W. and Lindsley D.H. (1982) Chemistry and phase relations of VLT volcanic glasses from Apollo 14 and Apollo 17. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. A171-A181.

Chen J.H., Tilton G.R., Mattinson J.M. and Vidal P. (1978a) Lead isotope systematics of mare basalt 75075. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 509-521.

Chen J.H., Tilton G.R. and Mattinson J.M. (1979) Lead isotope systematics of three Taurus-Littrow mare basalts (abs). Lunar Planet. Sci. X, 195-197. Lunar Planetary Institute, Houston

Chen J.H. and Wasserburg G.J. (1980) The isotopic composition of U in meteorites and lunar samples (abs). Lunar Planet. Sci. XI, 131-133. Lunar Planetary Institute, Houston

Chert J.H., Mattinson J.M., Tilton G.R. and Vidal P. (1978b) Lead isotope systematics of mare basalt 75075 (abs). Lunar Planet. Sci. IX, 160-162. Lunar Planetary Institute, Houston

Christian R.P., Berman S., Dwornik E.J., Rose H.J. and Schneppf M.M. (1976) Composition of some Apollo 14, 15 and 16 lunar breccias and two Apollo 15 fines (abs). Lunar Sci. VII, 138-140. Lunar Planetary Institute, Houston

Christie J.M., Griggs D.T., Heuer A.H., Nord G.L., Radcliffe S.V., Lally J.S. and Fischer R.M. (1973) Electron petrography of Apollo 14 and 15 breccias and shock-produced analogs. Proc. 4<sup>th</sup> Lunar Sci. Conf. 365-382.

Christophe-Michel-Levy M. and Levy C. (1972) The magnesian spinel-bearing rocks from the Fra Mauro formation. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 887-894.

Chung D.H., Westphal W.B. and Olhoeft G.R. (1972) Dielectric properties of Apollo 14 lunar samples. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 3161-3172.

Church S.E. and Tilton G.R. (1975) Lead isotope systematics of soils and soil breccias from Taurus-Littrow (abs). Lunar Sci. VI, 143-145. Lunar Planetary Institute, Houston

Chyi L.L. and Ehmann W.D. (1973) Zirconium and hafnium in some lunar materials and implications of their ratios. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1219-1226.

Chyi L.L. and Ehmann W.D. (1974) Implications of Zr and Hf abundances and their ratios in lunar materials (abs). Lunar Sci. V, 118-120.

Cimbalnikova A., Palivova M., Frana J. and Mastalka A. (1977) Chemical composition of crystalline rock fragments from Luna 16 and Luna 20 fines. In The Soviet-American conference on cosmochemistry of the moon and planets. 263-275.

Cirlin E.H. and Housley R.M. (1977) A flameless atomic absorption study of the volatile trace metal lead in lunar samples. Proc. 8<sup>th</sup> Lunar Sci. Conf. 3931-3940.

Cirlin E.H. and Housley R.M. (1979) Scanning Auger microprobe and atomic absorption studies of lunar volcanic volatiles. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 341-354.

Cirlin E.H. and Housley R.M. (1977) An atomic absorption study of volatile trace metals in lunar samples (abs). Lunar Sci. VIII, 184-186. Lunar Planetary Institute, Houston

Cirlin E.H. and Housley R.M. (1979) Scanning Auger microprobe and atomic absorption studies of lunar volcanic volatiles. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 341-354.

Circone S. and Agee C.B. (1996) Compressibility of molten high-Ti mare glass: Evidence for crystal-liquid inversions in the lunar mantle. Geochim. Cosmochim. Acta 60, 2709-2720.

Cisowski S.M. and Fuller M. (1983) Lunar sample magnetic stratigraphy (abs). Lunar Planet. Sci. XIV, 115-116. Lunar Planetary Institute, Houston

Cisowski C.S., Dunn J.R., Fuller M., Rose M.F. and Wasilewski P.J. (1974) Impact processes and lunar magnetism. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2841-2858.

Cisowski S.M., Hale C. and Fuller M. (1977) On the intensity of ancient lunar fields. Proc. 8<sup>th</sup> Lunar Sci. Conf. 725-750.

Cisowski S.M., Collinson D.W., Runcom S.K., Stephenson A., and Fuller M. (1983) A review of lunar paleointensity data and implications for the origin of lunar magnetism. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. A691-A704.

Clanton U.S. and Fletcher C.R. (1976) Sample size and sampling errors as the source of dispersion in chemical analyses. Proc. 7<sup>th</sup> Lunar Sci. Conf. 1413-1428.

Clanton U.S., McKay D.S., Watts G. and Fuhrman R. (1978) Sublimate morphology on 74001 and 74002 orange and black glassy droplets. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 1945-1957.

Clanton U.S. and Morrison D.A. (1979) Hypervelocity impact craters less than 1000A diameter (abs). Lunar Planet. Sci. X, 212-214. Lunar Planetary Institute, Houston

Clanton U.S., Carter J.L. and McKay D.S. (1975) Vapor-phase crystallization of sulfides? (abs) Lunar Sci. VI, 152-154. Lunar Planetary Institute, Houston

Clark R.S. and Keith J.E. (1973) Determination of natural and cosmic ray induced radionuclides in Apollo 16 lunar samples. Proc. 4<sup>th</sup> Lunar Sci. Conf. 2105-2113.

Clayton R.N. and Mayeda T.K. (1973) Oxygen isotopic fractionation within ultrabasic clasts of lunar breccia 15445. J. Geol. 81, 227-228.

Clayton R.N. and Mayeda T.K. (1975a) Genetic relations between the moon and meteorites. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1761-1769.

Clayton R.N. and Mayeda T.K. (1975b) Genetic relations between the Moon and meteorites (abs). Lunar Sci. VI, 155-157. Lunar Planetary Institute, Houston

Clayton R.N., Mayeda T.K. and Hurd J.M. (1974) Loss of oxygen, silicon, sulfur, and potassium from the lunar regolith. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1801-1809.

Cohen B.A. (2001) Lunar meteorites and the lunar cataclysm. Planetary Science Research Discoveries.  
<http://www.psrn.hawaii.edu/Jan01/lunarCataclysm.html>

Cohen B.A., Swindle T.D. and Kring D.A. (2000) Support for the lunar cataclysm hypothesis from lunar meteorite impact melt ages. *Science* 290, 1754-1756.

Cohen B.A., James O.B., Taylor L.A., Nazarov M. and Barsukova L.D. (2005) Lunar highland meteorite Dhofar 026 and Apollo sample 15418: Two strongly shocked, partially melted, granulitic breccias. *Meteoritics & Planet. Sci.* 40, 755.

Cohen B.A., Swindle T.D., Kring D.A. and Olson E.K. (2005) Geochemistry and  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  geochronology of impact-melt clasts in lunar meteorites Dar al Gani 262 and Calcalong creek (abs). *Lunar Planet. Sci. XXXV # 1481*. Lunar Planetary Institute, Houston

Cohen B.A., Symes S.J. and Swindle T.D. (2006) Petrography and chemistry of impact-melt clasts in Apollo 16 breccias (abs). *Lunar Planet. Sci. 37, #1379* Lunar Planetary Institute, Houston

Cohen B.A., Symes S.J., Swindle T.D., Weirich J. and Isachsen C. (2007) Ages of Impact-melt clasts in Apollo 16 breccias (abs). *Lunar Planet. Sci. 38 #1006* Lunar Planetary Institute, Houston

Coish R.A. and Taylor L.A. (1978) Mineralogy and petrology of basaltic fragments from the Luna 24 drill core. In *Mare Crisium: The View from Luna 24*. (ed. Merrill and Papike) Pergamon 403-417.

Collinson D.W., Runcorn S.K., Stephenson A. and Manson A.J. (1972) Magnetic properties of Apollo 14 rocks and fines. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 2343-2361.

Collinson D.W., Runcom S.K. and Stephenson A. (1975) On changes in the ancient lunar magnetic field intensity (abs). *Lunar Sci. VI*, 158-160. Lunar Planetary Institute, Houston

Collinson D.W., Stephenson A. and Runcorn S.K. (1977) Intensity and origin of the ancient magmatic field. *Phil. Trans. Roy. Soc. London A285*, 241-248.

Compston W., Arriens P.A., Vernon M.J. and Chappell B.W. (1970a) Rubidium-strontium chronology and chemistry of lunar material. *Science* 167, 474-476.

Compston W., Chappell B.W., Arriens P.A. and Vernon M.J. (1970b) The chemistry and age of Apollo 11 lunar material. *Proc. Apollo 11 Lunar Sci. Conf.* 1007-1027.

Compston W., Berry H., Vernon M.J., Chappell B.W. and Kay M.J. (1971) Rubidium-strontium chronology and chemistry of lunar material from the Ocean of Storms. *Proc. 2<sup>nd</sup> Lunar Sci. Conf.* 1471-1485.

Compston W., Vernon M.J., Berry H. and Rudowski R. (1971) The age of the Fra Mauro Formation: A radiometric older limit. *Earth Planet. Sci. Lett.* 12, 55-58.

Compston W., Vernon M.J., Berry H., Rudowski R., Gray C.M., Ware N., Chappell B.W. and Kaye M. (1972) Apollo 14 mineral ages and the thermal history of the Fra Mauro formation. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1487-1501.

Compston W., Vernon M.J., Chappell B.W. and Freeman R. (1973) Rb-Sr model ages and chemical composition of nine Apollo 16 soils (abs). *Lunar Sci. IV*, 158.

Compston W., Foster J.J. and Gray C.M. (1975) Rb-Sr ages of clasts from within Boulder 1, Station 2, Apollo 17. *The Moon* 14, 445-462.

- Compston W., Foster J.J. and Gray C.M. (1977a) Rb-Sr systematics in clasts and aphanites from consortium breccia 73215. Proc. 8<sup>th</sup> Lunar Sci. Conf. 2525-2549.
- Compston W., Foster J.J. and Gray C.M. (1977b) Rb-Sr systematics in clasts and aphanites from consortium breccia 73215 (abs). Lunar Sci. VIII, 199-201. Lunar Planetary Institute, Houston
- Compston W., Williams I.S. and Meyer C. (1983) U-Pb geochronology of zircons from breccia 73217 using a Sensitive High Mass-Resolution Ion Microprobe (SHRIMP) (abs). Lunar Planet. Sci. XIV, 130-131.
- Compston W., Williams I.S. and Meyer C. (1984a) U-Pb geochronology of zircons from lunar breccia 73217 using a sensitive high mass-resolution ion microprobe. Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf. B525-B534.
- Compston W., Williams I.S. and Meyer C. (1984b) Age and chemistry of zircons from late atage differentiates (abs). Lunar Planet. Sci. XV, 182-184. Lunar Planetary Institute, Houston
- Compston W., Williams I.S. and Meyer C. (1991) Initial Pb isotopic compositions of lunar granites as determined by ion microprobe. In Stable Isotope Geochemistry, Spec. Pub. 3 (eds. Taylor et al.) 473-486.
- Crawford I.A., Fagents S.A. and Joy K.H. (2007) The survival of ancient solar wind, galactic cosmic ray particles and samples of the early earth in lunar paleoregolith deposits (abs). Lunar Planet. Sci. XXXVIII #1323
- Crawford M.L. (1973) Crystallization of plagioclase in mare basalts. Proc. 4<sup>th</sup> Lunar Sci. Conf. 705-717.
- Crawford M.L. (1975a) Magma genesis by in situ melting within the lunar crust. Proc. 6<sup>th</sup> Lunar Sci. Conf. 249-261.
- Crawford M.L. (1975b) Closed system partial melting of a K-rich highlands rock (abs). Lunar Sci. VI, 164-166. Lunar Planetary Institute, Houston
- Cripe J.D. and Moore C.B. (1975) Total sulfur contents of Apollo 15, 16, and 17 samples (abs). Lunar Sci. VI, 167-169. Lunar Planetary Institute, Houston
- Crozaz G. (1978) Regolith depositional history at Shorty Crater. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 2001-2009.
- Crozaz G. (1979) Regolith reworking at Shorty Crater. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 1381-1384.
- Crozaz G., Drozd R., Graf H., Hohenberg C.M., Monnin M., Ragan D., Ralston C., Seitz M., Shirck J., Walker R.M. and Zimmerman J. (1972a) Uranium and extinct Pu244 effects in Apollo 14 materials. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1623-1636.
- Crozaz G., Drozd R., Hohenberg C.M., Hoyt H.P., Rajan D., Walker R.M. and Yuhas D. (1972b) Solar flare and galactic cosmic ray studies of Apollo 14 and 15 samples. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 2917-2931.
- Crozaz G., Drozd R., Hohenberg C., Morgan C., Ralston C., Walker R. and Yuhas D. (1974a) Lunar surface dynamics: Some general conclusions and new results from Apollo 16 and 17. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2475-2499.
- Crozaz G., Drozd R., Hohenberg C., Morgan C., Walker R. and Yuhas D. (1974b) Lunar surface dynamics: Some general conclusions and new results from Apollo 16 and 17 (abs). Lunar Sci. V, 157-159. Lunar Planetary Institute, Houston

- Crozaz G. and Plachy A.L. (1976) Origin of the Apollo 17 deep drill coarse-grained layer. Proc. 7<sup>th</sup> Lunar Planet. Sci. Conf. 123-131.
- Crozaz G. and Ross L.M. (1979) Deposition and irradiation of the Apollo 17 deep drill core. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 1229-1241.
- Crozaz G., Poupeau G., Walker R.M., Zinner E. and Morrison D.A. (1977) The record of solar and galactic radiations in the ancient lunar regolith and their implications for the early history of Sun and Moon. Phil. Trans. Roy. Soc. London A285, 587-592.
- Culler T.S., Becker T.A., Muller R.A. and Renne P.R. (2000) Lunar impact history from 40Ar/39Ar dating of glass spherules. Science 287, 1785 – 1788.
- Curtis D.B. and Wasserburg G.J. (1975) Apollo 17 neutron stratigraphy – sedimentation and mixing in the lunar regolith. The Moon 13, 185-227.
- Curtis D.B. and Wasserburg G.J. (1977) Transport and erosional processes in the Taurus-Littrow Valley – Inferences from neutron fluences in lunar soils. Proc. 8<sup>th</sup> Lunar Sci. Conf. 3045-3057.
- Cushing J.A., Taylor G.J., Norman M.D. and Keil K. (1993a) The granulite suite: Impact melts and metamorphic breccias of the early lunar crust (abs). Lunar Planet. Sci. XXIV, 369-370. Lunar Planet. Institute, Houston
- Cushing J.A., Taylor G.J., Norman M.D. and Keil K. (1993b) Refining the granulite suite. In Workshop on Geology of the Apollo 17 Landing Site. LPI Tech. Rpt. 92-09.4-5. Lunar Planet. Institute, Houston
- Cushing J.A., Taylor G.J., Norman M.D. and Keil K. (1999) The granulitic impactite suite: Impact melts and metamorphic breccias of the early lunar crust. Meteoritics & Planet. Sci. 34, 185-195.
- Czank M., Grigis K., Harnik A.B., Laves F., Schmid R., Schultz H. and Weber L. (1972) Crystallographic studies of lunar plagioclases from samples 14053, 14163, 14301 and 14310. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 603-613.
- Dankwerth P.A., Hess P.C. and Rutherford M.J. (1979) The solubility of sulfur in high-TiO<sub>2</sub> mare basalts. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 517-530.
- Dalrymple G.B. and Ryder G. (1991) 40Ar/39Ar ages of six Apollo 15 impact melt rocks by laser step heating. Geophys. Res. Lett. 18, 1163-1166.
- Dalrymple G.B. and Ryder G. (1993) 40Ar/39Ar age spectra of Apollo 15 impact melt rocks by laser step-heating and their bearing on the history of lunar basin formation. J. Geophys. Res. 98, 13,085-13,095.
- Dalrymple G.B. and Ryder G. (1996) Argon-40/argon-39 age spectra of Apollo 17 highlands breccia samples by laser step heating and the age of the Serenitatis basin. J. Geophys. Res. 101, 26069-26084.
- Dash E.J., Shih C.-Y., Bansal B.M., Wiesmann H. and Nyquist L.E. (1987) Isotopic analysis of basaltic fragments from lunar breccia 14321: Chronology and petrogenesis of pre-Imbrium mare volcanism. Geochim. Cosmochim. Acta 51, 3241-3254.
- Dash E.J., Ryder G. and Nyquist L.E. (1989) Chronology and complexity of the lunar crust. Tectonophysics 161, 157-164.
- Dauber I.J., Kring D.A., Swindle T.D. and Jull A.J.T. (2002) Northwest Africa 482: A crystalline impact-melt breccia from the lunar highlands. Meteoritics & Planet. Sci. 37, 1797-1814.
- Delaney J.S. (1989) Lunar basalt breccia identified among Antarctic meteorites. Nature 342, 889-890.

Delaney J.S. and Sutton S.R. (1991) Fe-Mn-Mg in plagioclase from lunar basalt and highland samples (abs). *Lunar Planet. Sci.* XXII, 299-300. Lunar Planetary Institute, Houston

Delaney J.S., Sutton S.R., Bait S. and Smith J.V. (1992) In situ microXANES determination of ferrous/ferric ratio in terrestrial and extraterrestrial plagioclase: First reconnaissance (abs). *Lunar Planet. Sci.* XXIII, 299-300. Lunar Planetary Institute, Houston

Delano J.W. (1977) Experimental melting relations of 63545, 76015, and 76055. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 2097-2123.

Delano J.W. (1979) Apollo 15 green glass: Chemistry and possible origin. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 275-300.

Delano J.W. (1980) Chemistry and liquidus relations of Apollo 15 red glass: Implications for the deep lunar interior. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 251-288.

Delano J.W. (1980) Constraints on the chemical nature of magmas parental to pristine highland cumulates (abs). *Lunar Planet. Sci. XI*, 216-218. Lunar Planetary Institute, Houston

Delano J.W. (1986) Pristine lunar glasses: Criteria, data and implications. *Proc. 16<sup>th</sup> Lunar Planet. Sci. Conf.*, *J. Geophys. Res.* 91, D201-D213.

Delano J.W. (1987) Apollo 14 regolith breccias: Different glass populations and their potential for charting space/time variations. *Proc. 18<sup>th</sup> Lunar Planet. Sci. Conf.* 59-65.

Delano J.W. (1991) Geochemical comparison of impact glasses from lunar meteorites ALHA81005 and MAC88105 and Apollo 16 regolith 64001. *Geochim. Cosmochim. Acta* 55, 3019-3029.

Delano J.W. (1993) Mare volcanism in the Taurus-Littrow region. In *Workshop on Geology of the Apollo 17 Landing Site*. LPI Tech. Rpt. 92-09.5-6. Lunar Planetary Institute, Houston

Delano J.W. and Ringwood A.E. (1979) Indigenous abundances of siderophile elements in the lunar highlands: Implications for the origin of the Moon. *The Moon* 18, 385-425.

Delano J.W. and Livi K. (1981) Lunar volcanic glasses and their constraints on mare petrogenesis. *Geochim. Cosmochim. Acta* 45, 2137-2149.

Delano J.W., Lindsley D.H. and Rudowski R. (1981) Glasses of impact origin from Apollo 11, 12, 15 and 16: Evidence for fractional vaporization and mare/highland mixing. *Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf.* 339-370.

Delano J.W. and Lindsley D.H. (1982) Chromium, nickel, and titanium abundances in 74275 olivines: More evidence for a high-pressure origin of high-titanium mare basalts (abs). *Lunar Planet. Sci. XIII*, 160-161.

Delano J.W. and Lindsley D.H. (1983a) Mare volcanic glasses from Apollo 17 (abs). *Lunar Planet. Sci. XIV*, 156-157. Lunar Planetary Institute, Houston

Delano J.W. and Lindsey D.H. (1983) Mare glasses from Apollo 17: Constraints on the moon's bulk composition. *Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf.* in *J. Geophys. Res.* 88, B3-B16.

Delano J.W. and McGuire J. (1993) Abundances of sodium, sulfur, and potassium in lunar volcanic glasses: Evidence for volatile loss during eruption. In *Workshop on Geology of the Apollo 17 Landing Site*. LPI Tech. Rpt. 92-09. 7-8. Lunar Planetary Institute, Houston

- de Laeter J.R., Vernon M.J. and Compston W. (1973) Revision of lunar Rb-Sr ages. *Geochem. Cosmochim. Acta* 37, 700-702.
- Dence M.R. (1977) The contribution of major impact processes to lunar crustal evolution. *Phil. Trans. Roy. Soc. London A285*, 259-266.
- Dence M.R. and Plant A.G. (1972) Analysis of Fra Mauro samples and the origin of the Imbrium Basin. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 379-399.
- Dence M.R. and Grieve R.A.F. (1976) Secondary impact mixing in the formation of Apollo 17 grey breccias (abs). *Lunar Sci. VII*, 196-198. Lunar Planetary Institute, Houston
- Dence M.R., Grieve R.A.F. and Plant A.G. (1976) Apollo 17 grey breccias and crustal composition in the Serenitatis Basin region. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1821-1832.
- Des Marais D.J. (1978a) Carbon, nitrogen and sulfur in Apollo 15, 16 and 17 rocks. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 2451-2467.
- Des Marais D.J. (1978b) Carbon isotopes, nitrogen and sulfur in lunar rocks (abs). *Lunar Planet. Sci. IX*, 247-249.
- Des Marais D.J. (1980) Six lunar rocks have little carbon and nitrogen and some rocks have detectable spallogenic  $^{13}\text{C}$  (abs). *Lunar Planet. Sci. XI*, 228-230. Lunar Planetary Institute, Houston
- Des Marais D.J., Hayes J.M. and Meinschein W.G. (1973a) The distribution in lunar soils of carbon released by pyrolysis. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1543-1558.
- Des Marais D.J., Hayes J.M. and Meinschein W.G. (1973b) Accumulation of carbon in lunar soils. *Nature* 246, 65-68.
- Deutsch A. and Stöffler D. (1987) Rb-Sr-analyses of Apollo 16 melt rocks and a new age estimate for the Imbrium basin: Lunar basin chronology and the early heavy bombardment of the moon. *Geochem. Cosmochim. Acta* 51, 1951-1964.
- Dickey J.S. (1970) Nickel-iron in lunar anorthosites. *Earth Planet. Sci. Lett.* 8, 387-392.
- Dickinson T., Taylor G.J., Keil K., Schmitt R.A., Hughes S.S. and Smith M.R. (1985) Apollo 14 aluminous mare basalts and their possible relationship to KREEP. *Proc. 15<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res.* 90, C365-C374.
- Dickinson T., Bild R.W., Taylor G.J. and Keil K. (1988) Late-stage enrichment of Ge in the magma ocean: Evidence from lunar basalts (abs). *Lunar Planet. Sci. XIX*, 277-278. Lunar Planetary Institute, Houston
- Dickinson T., Taylor G.J., Keil K. and Bild R.W. (1989) Germanium abundances in lunar basalts: Evidence of mantle metasomatism. *Proc. 19<sup>th</sup> Lunar Planet. Sci.* 189-198. Lunar Planetary Institute, Houston
- Dixon J.R. and Papike J.J. (1975) Petrology of anorthosites from the Descartes region of the moon: Apollo 16. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 263-291.
- Dollfus A. and Geake J.E. (1977) Polarimetric and photometric studies of lunar samples. *Phil. Trans. Roy. Soc. London A285*, 397-402.
- Domeneghetti M.C., McCallum I.S., Schwartz J.M., Camara F., Zema M., McCammon C. and Ganguly J. (2001) Complex cooling histories of lunar troctolite 76535 and Stillwater orthopyroxenite SC-936 (abs). *Lunar Planet. Sci. XXX CD-ROM #1151* Lunar Planetary Institute, Houston

Dominik B. and Jessberger E.K. (1978) Early lunar differentiates: 4.42-AE-old plagioclase clasts in Apollo 16 breccia 67435. *Earth Planet. Sci. Lett.* 38, 407-415.

Donaldson C.H., Drever H.I. and Johnston R. (1977) Supercooling on the lunar surface: a review of analogue information. *Phil. Trans. Roy. Soc. London A285*, 207-218.

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.

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

Dowty E., Keil K. and Prinz M. (1973c) Major-element vapor fractionation on the lunar surface: An unusual lithic fragment from the Luna 20 fines. *Earth Planet. Sci. Lett.* 21, 91-96.

Dowty E., Keil K. and Prinz M. (1974a) Plagioclase twin laws in lunar highland rocks; possible petrogenetic significance. *Meteoritics* 9, 183-197.

Dowty E., Keil K. and Prinz M. (1974a) Igneous rocks from Apollo 16 rake samples. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 431-445.

Dowty E., Prinz M. and Keil K. (1974b) Ferroan anorthosite: a widespread and distinctive lunar rock type. *Earth Planet. Sci. Lett.* 24, 15-25.

Dowty E., Keil K. and Prinz M. (1974c) Lunar pyroxene-phyric basalts: Crystallization under supercooled conditions. *J. Petrology* 15, 419-453.

Dowty E., Prinz M. and Keil K. (1974d) Very high alumina basalt: A mixture and not a magma type. *Science* 183, 1214-1215.

Drake M.J. (1975) Lunar anorthosite paradox. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 293-299.

Drake M.J. (1983) Geochemical constraints on the origin of the Moon. *Geochim. Cosmochim. Acta* 47, 1759-1767.

Drake M.J., McCallum I.S., McKay G.A. and Weill D.F. (1970) Mineralogy and petrology of Apollo 12 sample no. 12013: a progress report. *Earth Planet. Sci. Lett.* 9, 103-123.

Drake M.J. and Weill D.F. (1971) Petrology of Apollo 11 sample 10071. A differentiated mini-igneous complex. *Earth Planet. Sci. Lett.* 13, 61-70.

Drake M.J. and Consolmagno G.J. (1976) Critical review of models for the evolution of high-Ti mare basalts. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1633-1657.

Drake M.J., Newsom H.E. and Capobianco C.J. (1989) V, Cr and Mn in the Earth, Moon, EPB and SPB and the origin of the moon: Experimental studies. *Geochim. Cosmochim. Acta* 53, 2101-2111.

Dran J.C., Duraud J.P., Maurette M., Durrieu L., Jouret C. and Legressus C. (1972) Track metamorphism in extraterrestrial breccias. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 2883-2903.

Dran J.C., Duraud J.P., Klossa J., Langevin Y. and Maurette M. (1977) Microprobe studies of space weathering effects in extraterrestrial dust grains. *Phil. Trans. Roy. Soc. London A285*, 433-440.

- Dreibus G., Spettel B. and Wanke H. (1977) Lithium and halogens in lunar samples. *Phil. Trans. Roy. Soc. London A285*, 49-54.
- Drever H.I. and Johnston R. (1972) Metastable growth patterns in some terrestrial and lunar rocks. *Meteorites* 7, 327-340.
- Drever H.I., Johnston R., Butler P. and Gibb F.G.F. (1972) Some textures in Apollo 12 lunar igneous rocks and in terrestrial analogs. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 171-184.
- Drozd R.J., Hohenberg C.M., Morgan C.J. and Ralston C.E. (1974) Cosmic-ray exposure history at the Apollo 16 and other lunar sites: lunar surface dynamics. *Geochim. Cosmochim. Acta* 38, 1625-1642.
- Drozd R., Hohenberg C. and Morgan C. (1975) Krypton and xenon in Apollo 14 samples: Fission and neutron capture effects in gas-rich samples. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1857-1877.
- Drozd R.J., Kennedy B.M., Morgan C.J., Podosek F.A. and Taylor G.J. (1976) The excess fission xenon problem in lunar samples. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 599-623.
- Drozd R.J., Hohenberg C.M., Morgan C.J., Podosek F.A. and Wroe M.L. (1977) Cosmic-ray exposure history at Taurus-Littrow. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 3027-3043.
- Duke M.B. and Nagle J.S. (1974) Lunar Core Catalog. JSC09252. Curators' Office
- Duke M.B. and Nagle J.S. (1976) Lunar Core Catalog. JSC09252 rev.
- Duncan A.R., Erlank A.J., Willis J.P. and Ahrens L.H. (1973) Compsotion and inter-relationships of some Apollo 16 samples. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1097-1113.
- Duncan A.R., Erlank A.J., Willis J.P., Sher M.K. and Ahrens L.H. (1974a) Trace element evidence for a two-stage origin of some titaniferous mare basalts. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1147-1157.
- Duncan A.R., Erlank A.J., Willis J.P., Sher M.K. and Ahrens L.H. (1974b) Trace element evidence for a two-stage origin of high-titanium mare basalts (abs). *Lunar Sci. V*, 187-189. Lunar Planetary Institute, Houston
- Duncan A.R., Erlank A.J., Willis J.P. and Sher M.K. (1974c) Compositional characteristics of the Apollo 17 regolith (abs). *Lunar Sci. V*, 184-186. Lunar Planetary Institute, Houston
- Duncan A.R., McKay S.M., Stoeser J.W., Lindstrom M.M., Lindstrom D.J., Fruchter J.S. and Goles G.C. (1975a) Lunar polymict breccia 14321: A compositional study of its principal components. *Geochim. Cosmochim. Acta* 39, 247-260.
- Duncan A.R., Grieve R.A.F. and Weill D.F. (1975b) The life and times of Big Bertha: lunar breccia 14321. *Geochim. Cosmochim. Acta* 39, 265-273.
- Duncan A.R., Erlank A.J., Sher M.K., Abraham Y.C., Willis J.P. and Ahrens L.H. (1976a) Some trace element constraints on lunar basalt genesis. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1659-1671.
- Duncan A.R., Sher M.K., Abraham Y.C., Erlank A.J., Willis J.P. and Marens L.H. (1976b) Source region constraints for lunar basalt types inferred from trace element chemistry (abs). *Lunar Sci. VII*, 218-220. Lunar Planetary Institute, Houston
- Dungan M.A. and Brown R.W. (1977) The petrology of the Apollo 12 basalt suite. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 1339-1381.

Dunlap D.J., Gose W.A., Pearce G.W. and Strangway D.W. (1973) Magnetic properties and granulometry of metallic iron in lunar breccia 14313. Proc. 4<sup>th</sup> Lunar Sci. Conf. 2977-2990.

Dunn J.R. and Fuller M. (1972) On the remanent magnetization of lunar samples with special reference to 10048,55 and 14053,48. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 2363-2386.

Dunn J.R., Fuller M. and Clauter D.A. (1981) On the estimation of lunar paleointensities: Studies of synthetic analogues of stably magnetized samples. Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf. 1747-1758.

Durrani S.A. (1972) Refrigeration of lunar samples destined for thermoluminescence studies. Nature 240, 96-97.

Durrani S.A. and Hwang F.S.W. (1975) Thermoluminescence and thermal environment of some Apollo 17 fines. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2689-2702.

Durrani S.A., Khazal K.A.R. and Ali A. (1976) Temperature and duration of some Apollo 17 boulder shadows. Proc. 7<sup>th</sup> Lunar Sci. Conf. 1157-1177.

Durrani S.A. (1977) Charged-particle track analysis, thermoluminescence and microcratering studies of lunar samples. Phil. Trans. Roy. Soc. London A285, 309-318.

Dyar M.D. (1984) Experimental methods for quenching structures in lunar-analog silicate melts. Proc. 15<sup>th</sup> Lunar Planet. Sci. Conf. J. Geophys. Res. 89, C233-C239.

Dymek R.F., Albee A.L. and Chodos A.A. (1975a) Comparative mineralogy and petrology of Apollo 17 mare basalts: Samples 70215, 71055, 74255, and 75055. Proc. 6<sup>th</sup> Lunar Sci. Conf. 49-77.

Dymek R.F., Albee A.L. and Chodos A.A. (1975b) Comparative petrology of lunar cumulate rocks of possible primary origin: Dunite 72415, troctolite 76535, norite 78235, and anorthosite 62237. Proc. 6<sup>th</sup> Lunar Sci. Conf. 301-341.

Dymek R.F., Albee A.L. and Chodos A.A. (1976a) Petrology and origin of Boulders #2 and #3, Apollo 17 Station 2. Proc. 7<sup>th</sup> Lunar Sci. Conf. 2335-2378.

Dymek R.F., Albee A.L. and Chodos A.A. (1976b) Petrographic investigation of lunar sample 72435 with emphasis on the nature of its clasts (abs). Lunar Sci. VII, 227-229. Lunar Planetary Institute, Houston

Dymek R.F., Albee A.L. and Chodos A.A. (1976c) Chemical and mineralogical homogeneity of Boulder #2, Apollo 17 Station #2 (abs). Lunar Sci. VII, 230-232. Lunar Planetary Institute, Houston

Eberhardt P., Geiss J., Graf H., Grogler N., Krahenbuhl U., Schwaller H., Schwarzmuller J. and Stettler A. (1970) Correlation between rock type and irradiation history of Apollo 11 igneous rocks. Earth Planet. Sci. Lett. 10, 67-72.

Eberhardt P., Geiss J., Graf H. and Schwaller H. (1971) On the origin of excess  $^{131}\text{Xe}$  in lunar rocks. Earth Planet. Sci. Lett. 12, 260-262.

Eberhardt P., Geiss J. Grögler N. and Stettler A. (1973) How old is the crater Copernicus? The Moon 8, 104-114.

Eberhardt P., Eugster O., Geiss J., Graf H., Grögler N., Guggisberg S., Jungk M., Maurer P., Morgeli M. and Stettler A. (1974a) Solar wind and cosmic radiation history of Taurus-Littrow regolith (abs). Lunar Sci. V, 197-199. Lunar Planetary Institute, Houston

Eberhardt P., Geiss J., Graf H., Grogler N., Krahenbuhl U. Schwaller H. and Stettler A. (1974b) Noble gas investigations of lunar rocks 10017 and 10071. Geochim. Cosmochim. Acta 38, 97-120.

Eberhardt P., Eugster O., Geiss J., Graf H., Grögler N., Morgeli M. and Stettler A. (1975a) Kr81-Kr exposure ages of some Apollo 14, Apollo 16 and Apollo 17 rocks (abs). *Lunar Sci. VI*, 233-235. Lunar Planetary Institute, Houston

Eberhardt P., Eugster O., Geiss J., Grögler N., Jungck M., Mauer P., Mörgeli M. and Stettler A. (1975b) Shorty Crater, noble gasses, and chronology (abs). *Meteoritics* 10, 93-94.

Eberhardt P., Eugster O., Geiss J., Grogler N., Guggisberg S. and Morgeli M. (1976) Noble gases in the Apollo 16 special soils from the east west split and the permanently shadowed area. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 563-585.

Ebihara M., Wolf R., Warren P.H. and Anders E. (1992) Trace elements in 59 mostly highland moon rocks. *Proc. 22<sup>nd</sup> Lunar Planet. Sci. Conf.* 417-426. Lunar Planetary Institute, Houston

Eckert J.O., Taylor L.A. and Neal C.R. (1991a) Spinel troctolite from Apollo 17 breccia 73215: Evidence for petrogenesis as deep-seated lunar crust (abs). *Lunar Planet. Sci. XXII*, 329-330. Lunar Planetary Institute, Houston

Eckert J.O., Taylor L.A., Neal C.R. and Schmitt R.A. (1991b) Cumulate lithologies and melt rocks from Apollo 17 breccias: Correlations of whole-rock and mineral chemistry (abs). *Lunar Planet. Sci. XXII*, 333-334. Lunar Planetary Institute, Houston

Eckert J.O., Taylor L.A., Neal C.R. and Patchen A.D. (1991c) Anorthosites with negative Eu anomalies in Apollo 17 breccias: Further evidence for "REEP" metasomatism (abs). *Lunar Planet. Sci. XXII*, 331-332. Lunar Planetary Institute, Houston

Edmunson J., Borg L.E., Nyquist L.E. and Asmerom Y. (2005) Three-system isotopic study of lunar norite 78238: Rb-Sr results (abs#1473). *Lunar Planet. Sci. XXXVI*, Lunar Planetary Institute, Houston

Edmunson J., Gaffney A.M. and Borg L.E. (2006) Disturbance of U-Pb isotopic systematics in lunar samples: Mare basalt 10017 and norite 78235 (abs#1506). *Lunar Planet. Sci. XXXVII*, Lunar Planetary Institute, Houston

Edmunson J., Nyquist L.E. and Borg L.E. (2007) Sm-Nd isotopic systematics of troctolite 76335 (abs). *Lunar Planet. Sci. 38*, #1962, Lunar Planetary Institute, Houston

Eglinton G., Mays B.J., Pillinger C.T., Agrell S.O., Scoon J.H., Dran J.C., Maurette M., Bowell E., Dollfus A., Geake J.E., Schultz L. and Signer P. (1974) The history of lunar breccia 14267. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1159-1180.

Eglinton et al. (1977) The history of lunar breccia 15015. see European Consortium

Ehmann W.D. and Chyi L.L. (1974) Abundances of the group IVB elements, Ti, Zr, and Hf and implications of their ratios in lunar materials. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1015-1024.

Ehmann W.D., Miller M.D., Ma M.-S. and Pacer R.A. (1974) Compositional studies of the lunar regolith at the Apollo 17 site (abs). *Lunar Sci. V*, 203-205. Lunar Planetary Institute, Houston

Ehmann W.D., Chyi L.L., Garg A.N., Hawke B.R., Ma M.-S., Miller M.D., James W.D. and Pacer R.A. (1975a) Chemical studies of the lunar regolith with emphasis on zirconium and hafnium. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1351-1361.

Ehmann W.D., Chyi L.L., Hawke B.R., Ma M.-S., Miller M.D. and Pacer R.A. (1975b) Chemical studies of the lunar regolith with emphasis on zirconium and hafnium (abs). *Lunar Sci. VI*, 236-238. Lunar Planetary Institute, Houston

Eichhorn G., James O.B., Schaeffer O.A. and Muller H.W. (1978a) Laser 39Ar-40Ar dating of two clasts from consortium breccia 73215. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 855-876.

Eichhorn G., James O.B., Schaeffer O.A. and Muller H.W. (1978b) Laser-probe 39Ar40Ar dating of two clasts from consortium breccia 73215 (abs). Lunar Planet. Sci. IX, 279-281. Lunar Planetary Institute, Houston

Eichhorn G., McGee J.J., James O.B. and Schaeffer O.A. (1979a) Consortium breccia 73255: Laser 39Ar-40Ar dating of aphanite samples. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 763-788.

Eichhorn G., James O.B., McGee J.J. and Schaeffer O.A. (1979b) Consortium breccia 73255: Preliminary 39Ar40Ar laser dating of aphanite samples (abs). Lunar Planet. Sci. X, 346-348. Lunar Planetary Institute, Houston

Eisentraut K.J., Black M.S., Hilman F.D., Sievers R.F. and Ross W.D. (1972) Beryllium and chromium abundances in Fra Mauro and Hadley-Apennine lunar samples. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1327-1333.

Eldridge J.S., O'Kelley G.D. and Northcutt K.J. (1972) Abundances of primordial and cosmogenic radionuclides in Apollo 14 rocks and fines. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1651-1658.

Eldridge J.S., O'Kelley G.D. and Northcutt K.J. (1973) Radionuclide concentrations in Apollo 16 lunar samples determined by nondestructive gamma-ray spectrometry. Proc. 4<sup>th</sup> Lunar Sci. Conf. 2115-2122.

Eldridge J.S., O'Kelley G.D. and Northcutt K.J. (1974a) Primordial radioelement concentrations in rocks and soils from Taurus-Littrow. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1025-1033.

Eldridge J.S., O'Kelley G.D. and Northcutt K.J. (1974b) Primordial radioelement concentrations in rocks and soils from Taurus-Littrow (abs). Lunar Sci. V, 206-208. Lunar Planetary Institute, Houston

Eldridge J.S., O'Kelley G.D. and Northcutt K.J. (1975a) Primordial and cosmogenic radionuclides in Descartes and Taurus-Littrow materials: extension of studies by nondestructive x-my spectrometry. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1407-1418.

Eldridge J.S., O'Kelley G.D. and Northcutt K.J. (1975b) Primordial radioelements and cosmogenic nuclides in rocks and soils from Descartes and Taurus-Littrow (abs). Lunar Sci. VI, 242-244. Lunar Planetary Institute, Houston

El Goresy A., Ramdohr P. and Taylor L.A. (1971) The geochemistry of the opaque minerals in Apollo 14 crystalline rocks. Earth Planet. Sci. Lett. 13, 121-129.

El Goresy A., Taylor L.A. and Ramdohr P. (1972) Fra Mauro crystalline rocks: Mineralogy, geochemistry and subsolidus reduction of the opaque minerals. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 333-349.

El Goresy A., Ramdohr P., Pavicevic M., Medenbach O., Muller O. and Gentner W. (1973a) Zinc, lead, chlorine and FeOOH-bearing assemblages in the Apollo 16 sample 66095: Origin by impact of a comet or a carbonaceous chondrite? Earth Planet. Sci. Lett. 18, 411-419.

El Goresy A., Ramdohr P. and Medenbach O. (1973b) Lunar samples from Descartes site: Opaque mineralogy and geochemistry. Proc. 4<sup>th</sup> Lunar Sci. Conf. 733-750.

El Goresy A., Ramdohr P., Medenbach O. and Bernhardt H.-J. (1974a) Taurus-Littrow TiO<sub>2</sub>-rich basalts: Opaque mineralogy and geochemistry. Proc. 5<sup>th</sup> Lunar Sci. Conf. 627-652.

El Goresy A., Ramdohr P., Medenbach O. and Bernhardt H.-J. (1974b) Taurus-Littrow crystalline rocks: Opaque mineralogy and geochemistry (abs). Lunar Sci. V, 209-211. Lunar Planetary Institute, Houston

El Goresy A. and Ramdohr P. (1975a) Subsolidus reduction of lunar opaque oxides: Textures, assemblages, geochemistry, and evidence for a late-stage endogenic gaseous mixture. Proc. 6<sup>th</sup> Lunar Sci. Conf. 729-745.

El Goresy A. and Ramdohr P. (1975b) Subsolidus reduction of lunar opaque oxides: Evidence, assemblages, geochemical relevance, and evidence for a late-stage reducing gaseous mixture (abs). Lunar Sci. VI, 245-247. Lunar Planetary Institute, Houston

El Goresy A. and Ramdohr P. (1975c) Taurus-Littrow TiO<sub>2</sub>-rich basalts: Opaque mineralogy and geochemistry (abs). Lunar Sci. VI, 248-250. Lunar Planetary Institute, Houston

El Goresy A., Engelhardt W. von, Arndt J. and Mangliers D. (1976) Shocked norite 78235: Primary textures and shock features (abs). Lunar Sci. VII, 239-241. Lunar Planetary Institute, Houston

El Goresy A. and Ramdohr P. (1977a) Apollo 17 TiO<sub>2</sub>-rich basalts: Reverse spinel zoning as evidence for the subsolidus equilibration of the spinel-ilmenite assemblage. Proc. 8<sup>th</sup> Lunar Sci. Conf. 1611-1624.

El Goresy A. and Ramdohr P. (1977b) Apollo 17 TiO<sub>2</sub>-rich basalts: Spinel chemical bimodality in the two major basalt types and genetic significance of inverted zoning in chromian ulvöspinel (abs). Lunar Sci. VIII, 281-283. Lunar Planetary Institute, Houston

Elkins L.T., Fernandes V.A., Delano J.W. and Grove T.L. (2000) Origin of lunar ultramafic green glasses: Constraints from phase equilibrium studies. Geochim. Cosmochim. Acta 64, 2339-2350.

Engelhardt W. von (1979) Ilmenite in the crystallization sequence of lunar rocks. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 677-694.

Engelhardt W. von and Stengelin R. (1977) Chemical changes at impact-induced phase transitions on the lunar surface. Phil. Trans. Roy. Soc. London A285, 285-292.

Engelhardt W. von and Stengelin R. (1981) Normative composition and classification of lunar igneous rocks and glasses. II Lunar glasses. Earth Planet. Sci. Lett. 52, 55-66.

Epstein S. and Taylor H.P. (1972) O<sup>18</sup>/O<sup>16</sup>, Si<sup>30</sup>/Si<sup>28</sup>, C<sup>13</sup>/C<sup>12</sup> and D/H studies of Apollo 14 and 15 samples. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1429-1454.

Epstein S. and Taylor H.P. (1973) O<sup>18</sup>/O<sup>16</sup>, Si<sup>30</sup>/Si<sup>28</sup>, C<sup>13</sup>/C<sup>12</sup>, D/H and hydrogen and carbon concentration data on Apollo 17 soils (abs). EOS Trans. AGU 54, 585-586.

Epstein S. and Taylor H.P. (1975) Investigation of carbon, hydrogen, oxygen and silicon isotope and concentration relationships on the grain surfaces of a variety of lunar soils and in some Apollo 15 and 16 core samples. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1171-1798.

Esat T.M. and Taylor S.R. (1992) Magnesium isotope fractionation in lunar soils. Geochim. Cosmochim. Acta 56, 1025-1031.

Etique P., Derkens U., Funk H., Horn P., Signer P. and Wieler R. (1978) He, Ne, Ar in 61501 agglutinates: Implications to gas studies on complex samples. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 2233-2267.

Eugster O. (1989) History of meteorites from the Moon collected in Antarctica. Science 245, 1197-1202.

Eugster O. (1999) Chronology of dimict breccias and the age of South Ray crater at the Apollo 16 site. Meteoritics & Planet. Sci. 34, 385-391.

Eugster O. (2003) Cosmic-ray exposure ages of meteorites and lunar rocks and their significance. *Chemie der Erde* 63, 3-30.

Eugster O., Tera F., Burnett D.S. and Wasserburg G.J. (1970) The isotopic composition of Gd and the neutron capture effects in samples from Apollo 11. *Earth Planet. Sci. Lett.* 8, 20-30.

Eugster O., Eberhardt P., Geiss J., Grögler N., Jungck M. and Mörgeli M. (1977) The cosmic-ray exposure history of Shorty Crater samples; the age of Shorty Crater. *Proc. 8<sup>th</sup> Lunar Sci. Conf.*, 3059-3082.

Eugster O., Grögler N., Eberhardt P. and Geiss J. (1979) Double drive tube 74001/2: History of the black and orange glass; Determination of a pre-exposure 3.7 AE ago by  $^{136}\text{Xe}/^{235}\text{U}$  dating. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 1351-1379.

Eugster O., Grogler N., Eberhardt P. and Geiss J. (1980) Noble gases trapped 3.7 AE ago in orange and black glasses from drive tubes 74001/2 (abs). *Lunar Planet. Sci. XI*, 268-270.

Eugster O., Grögler N., Eberhardt P. and Geiss J. (1980) Double drive tube 74001/2: Composition of noble gases trapped 3.7 AE ago. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 1565-1592.

Eugster O., Grögler N., Eberhardt P., Geiss J. and Kiesl W. (1981) Double drive tube 74001/2: A two-stage exposure model based on noble gases, chemical abundances and predicted production rates. *Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf.* 541-558.

Eugster O., Eberhardt P., Geiss J. and Grögler N. (1983) Neutron induced fission of uranium: a dating method for lunar surface material. *Science* 219, 170-172.

Eugster O., Eberhardt P., Geiss J., Grogler N., Jungck M., Meier F., Morgell M. and Niederer F. (1984a) Cosmic ray exposure histories of Apollo 14, Apollo 15 and Apollo 16 rocks. *Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf.* in *J. Geophys. Res.* 89, B498-B512.

Eugster O., Eberhardt P., Geiss J., Grögler N. and Schwaller H. (1984b) Cosmic ray exposure histories and  $^{235}\text{U}-^{136}\text{Xe}$  dating of Apollo 11, Apollo 12, and Apollo 17 mare basalts. *Proc. 15<sup>th</sup> Lunar Planet. Sci. Conf.* in *J. Geophys. Res.* 89, C171-C181.

Eugster O. and Niedermann S. (1986) Single-stage exposure history of lunar highlands breccias 60018, 67435 and 67455. *Proc. 16<sup>th</sup> Lunar Planet. Sci. Conf.* in *J. Geophys. Res.* 91, E55-E63.

Eugster O., Terribilini D., Polnau E. and Kramers J. (2001) The antiquity indicator argon-40/argon-36 for lunar surface samples calibrated by uranium-235-xenon-136 dating. *Meteoritics & Planet. Sci.* 36, 1097-1115.

European Consortium (1977) The history of lunar breccia 15015. In *Lunar Sample Studies*, NASA SP-418.

Evans H.T., Huebner J.S. and Konnert J.A. (1978) The crystal structure and thermal history of orthopyroxene from lunar anorthositic 15415. *Earth Planet. Sci. Lett.* 37, 476-484.

Evensen N.M., Murthy V.R. and Coscio M.R. (1973) Rb-Sr ages of some mare basalts and the isotopic and trace element systematics in lunar fines. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1707-1724.

Evensen N.M., Murthy V.R. and Coscio M.R. (1973b) Taurus-Littrow: Age of mare volcanism; chemical and Rb-Sr isotopic systematics of the dark mantle soil (abs). *EOS* 54, 587-588.

Evensen N.M., Murthy V.R. and Coscio M.R. (1974) Provenance of KREEP and the exotic component: Elemental and isotopic studies of grain size fractions in lunar soils. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1401-1418.

Fagan T.J. and 16 coauthors (2002) Northwest Africa 032: Product of volcanism. Meteoritics & Planet. Sci. 371-394.

Fang C.Y., Yannon H. and Uhlmann D.R. (1983) Cooling rates for glass containing lunar compositions. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. A907-911.

Fechtig H., Hartung J.B., Nagel K., Neukum G. and Storzer D. (1974a) Lunar microcrater studies, derived meteoroid fluxes, and comparison with satellite-borne experiments. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2463-2474.

Fechtig H., Hartung J.B., Nagel K., Neukum G. and Storzer D. (1974b) Microcrater studies, derived meteoroid fluxes and comparison with satellite experiments (abs). Lunar Sci. V, 22-224. Lunar Planetary Institute, Houston

Fernandes V.A. and Burgess R. (2005) Volcanism in Mare Fecunditatis and Mare Crisium: Ar-Ar age studies. Geochim. Cosmochim. Acta 69, 4919 – 4934.

Filleux C., Tombrello T.A. and Burnett D.S. (1977) Direct measurement of surface carbon concentrations. Proc. 8<sup>th</sup> Lunar Sci. Conf. 3755-3772.

Filleux C., Spear R.H., Tombrello T.A. and Burnett D.S. (1978a) Direct measurement of surface carbon concentrations for lunar soil breccias. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 1599-1617.

Filleux C., Spear R.H., Tombrello T.A. and Burnett D.S. (1978b) Carbon depth distributions for soil breccias (abs). Lunar Planet. Sci. IX, 317-319. Lunar Planetary Institute, Houston

Fink D., Klein J., Middleton R., Vogt S., Herzog G.F. and Reedy R.C. (1998) <sup>41</sup>Ca, <sup>26</sup>Al and <sup>10</sup>Be in lunar basalt 74275 and <sup>10</sup>Be in double drive tube 74002/74001. Geochim. Cosmochim. Acta 62, 2389-2402.

Finkelman R.B., Baedecker P.A., Christian R.P., Berman S., Schnepfe M.M. and Rose H.J. (1975) Trace-element chemistry and reducing capacity of size fractions from the Apollo 16 regolith. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1385-1398.

Finnerty A.A. and Rigden S.M. (1981) Olivine barometry: Application to pressure estimation for terrestrial and lunar rocks (abs). Lunar Planet. Sci. XII, 279-281. Lunar Planetary Institute, Houston

Finnila A., Hess P. and Rutherford M. (1994) Assimilation by lunar mare basalts: Melting of crustal material and dissolution of anorthosite. J. Geophys. Res. 99, 14677-14690.

Fireman E.L., D'Amico J., DeFelice J. and Spannagel G. (1972) Radioactivities in returned lunar materials. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1747-1762.

Fireman E.L., D'Amico J. and DeFelice J. (1973) Radioactivities vs. depth in Apollo 16 and 17 soil. Proc. 4<sup>th</sup> Lunar Sci. Conf. 2131-2144.

Flavill R.P., Allison R.J.J. and McDonnell J.A.M. (1978) Primary, secondary and tertiary microcrater populations on lunar rocks: Effects of hypervelocity impact microejecta on primary populations. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 2539-2556.

Fleischer R.L. and Hart H.R. (1973) Particle track record of Apollo 15 green soil and rock. Earth Planet. Sci. Lett. 18, 357-364.

Fleischer R.L. and Hart H.R. (1974a) Uniformity of the uranium content of lunar green and orange glasses. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2251-2255.

Fleischer R.L. and Hart H.R. (1974b) Particle track record of Apollo 16 rocks from Plum crater. J. Geophys. Res. 79, 766-769.

Floran R.J., Cameron K.L., Bence A.E. and Papike J.J. (1972) Apollo 14 breccia 14313: a mineralogic and petrologic report. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 661-671.

Floran R.J., Phinney W.C., Blanchard D.P., Warner J.L., Simonds C.H., Brown R.W., Brannon J.C. and Korotev R.L. (1976) A comparison between geochemistry and petrology of Apollo 16 – terrestrial impact melt analogs (abs). Lunar Sci. VII, 263-265. Lunar Sci. Inst. Houston

Flory D.A., Wikstrom S., Gupta S., Gibert J.M. and Oro J. (1972) Analysis of organogenic compounds in Apollo 11, 12 and 14 lunar samples. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 2091-2108.

Floss C., James O.B., McGee J.J. and Crozaz G. (1998) Lunar ferroan anorthosite petrogenesis: Clues from trace distributions in FAN subgroups. Geochim. Cosmochim. Acta 62, 1255-1283.

FOCUS (1977) Friends of Crisium Unmanned Sampling – see explanation in Vaniman and Papike 1977.

Ford C.E. (1976) Effects of explosive depressurization on lunar anorthositic gabbro melts. In Progress in Experimental Petrology. Natural Environment Research Council Rept. 3, pp. 176-178.

Ford C.E., O'Hara M.J. and Spencer P.M. (1977) The origin of lunar feldspathic liquids. Phil. Trans. Roy. Soc. London A285, 193-198.

Freidman I., Hardcastle K. and Gleason J.D. (1974) Water and carbon in rusty rock 66095. Science 185, 346-349.

Fredriksson K., Brenner P., Nelen J., Noonan A., Dube A. and Reid A. (1974) Comparative studies of impact glasses and breccias (abs). Lunar Sci. V, 245-247. Lunar Planetary Institute, Houston

French B.M., Walter L.S., Heinrich K.F.J., Loman P.D., Doan A.S. and Adler I. (1972) Composition of major and minor minerals in five Apollo 12 crystalline rocks. NASA SP-306

Frick U., Becker R.H. and Pepin R.O. (1987) Solar wind record in the lunar regolith: nitrogen and noble gases. Proc. 18<sup>th</sup> Lunar Planet. Sci. Conf. 87-120. Lunar Planetary Institute, Houston

Friebel E.J., Griscom D.L., Marquardt C.L., Weeks R.A. and Prestel D. (1974) Temperature dependence of the ferromagnetic resonance linewidth of lunar soils. Proc. 4<sup>th</sup> Lunar Sci. Conf. 2729-2736.

Friedman I., Hardcastle K.G. and Gleason J.D. (1974) Water and carbon in rusty lunar rock 66095. Science 185, 346-349.

Friel J.J. and Goldstein J.I. (1977) Metallic phases in the Luna 24 soil samples. Geophys. Res. Lett. 10, 481-483.

Frondel J. W. (1975) Lunar Mineralogy. Wiley, N.Y. 325 pp.

Fruchter J.S., Kriedelbaugh S.J., Robyn M.A. and Goles G.G. (1974) Breccia 66055 and related clastic materials from the Decartes region, Apollo 16. Proc. 5<sup>th</sup> Lunar Sci. conf. 1035-1046.

Fruchter J.S., Rancitelli L.A. and Perkins R.W. (1975) Primordial radionuclide variations in the Apollo 15 and 17 deep core samples and in Apollo 17 igneous rocks and breccias. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1399-1406.

Fruchter J.S., Rancitelli L.A. and Perkins R.W. (1976) Recent and long-term mixing of the lunar regolith based on 22Na and 26Al measurements in Apollo 15, 16 and 17 deep drill stems and drive tubes. Proc. 7<sup>th</sup> Lunar Planet. Sci. Conf. 27-39.

Fruchter J.S., Rancitelli L.A., Evans J.C. and Perkins R.W. (1978a) Lunar surface processes and cosmic ray histories over the past several million years. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 2019-2032.

Fruchter J.S., Evans J.C., Rancitelli L.A. and Perkins R.W. (1978b) Lunar surface processes and cosmic ray histories over the past several million years (abs). Lunar Planet. Sci. IX, 350-352. Lunar Planetary Institute, Houston

Fruchter J.S., Reeves J.H., Evans J.C. and Perkins R.W. (1981) Studies of lunar regolith dynamics using measurements of cosmogenic radionuclides in lunar rocks, soils and cores. Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf. vol. 12A, 567-575.

Fruchter J.S., Evans J.C., Reeves J.H. and Perkins R.W. (1982) Measarement of  $^{26}\text{Al}$ in Apollo 15 core 15008 and  $^{22}\text{Na}$  in Apollo 17 rock 74275 (abs). Lunar Planet. Sci. XIII, 243-244. Lunar Planetary Institute, Houston

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

Fruland R.M., Morris R.V., McKay D.S. and Clanton U.S. (1977) Apollo 17 ropy glasses. Proc. 8<sup>th</sup> Lunar Sci. Conf. 3095-3111.

Fuller M.D. (1977) Review of effects of shock on magnetism of lunar samples. Phil. Trans. Roy. Soc. London A285, 409-416.

Fuller M.D., Meshkov E., Ciscowski S.M. and Hale C.J. (1979) On the natural remanent magnetism of certain mare basalts. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 2211-2233.

Gaffney A.M., Borg L.E. and Asmerom Y. (2005) 238U-206Pb age and uranium-lead isotope systematics of mare basalt 10017 (abs#1478). Lunar Planet. Sci. XXXVI Lunar Planetary Institute, Houston

Galbreath K.C., Sherarer C.K., Papike J.J. and Shimizu N. (1990) Inter- and intra-group compositional variations in Apollo 15 pyroclastic green glass: An electron- and ion-microprobe study. Geochim. Cosmochim. Acta 54, 2565-2575.

Gamble R.P. and Taylor L.A. (1979) The effects of kinetics on crystal-liquid partitioning in augite (abs). Lunar Planet. Sci. X, 419-421. Lunar Planetary Institute, Houston

Gamble R.P. and Taylor L.A. (1980) Crystal/liquid portioning in augit: Effects of cooling rate. Earth Planet. Sci. Lett. 47, 21-33.

Gammage and Holmes H.F. (1975) Blocking of the water-lunar fines reaction by air and water concentration effects. Proc. 6<sup>th</sup> Lunar Sci. Conf. 3305-3316.

Ganapathy R., Morgan J.W., Krahenbuhl U. and Anders E. (1973) Ancient meteoritic components in lunar highland rocks: Clues from trace elements in Apollo 15 and 16 samples. Proc. 4<sup>th</sup> Lunar Sci. Conf., 1239-1261.

Ganapathy R., Morgan J.W., Higuchi H., Anders E. and Anderson A.T. (1974) Meteoritic and volatile elements in Apollo 16 rocks and in separated phases from 14306. Proc. 5<sup>th</sup> Lunar Sci. Conf., 1659-1683.

Gancarz A.J., Albee A.L. and Chodos A.A. (1971) Petrologic and mineralogic investigation of some crystalline rocks returned by Apollo 14 mission. Earth Planet. Sci. Lett. 12, 1-18.

Gancarz A.J., Albee A.L. and Chodos A.A. (1972) Comparative petrology of Apollo 16 sample 68415 and Apollo 14 samples 14276 and 14310. Earth Planet. Sci. Lett. 16, 307-330.

Garg A.N. and Ehmann W.N. (1976a) Zr-Hf fractionation in chemically defined lunar rock groups. Proc. 7<sup>th</sup> Lunar Sci. Conf. 3397-3410.

Garg A.N. and Ehmann W.N. (1976b) Chemical fractionation in the lunar crust with emphasis on zirconium and hafnium (abs). Lunar Sci. VII, 281-283. Lunar Planetary Institute, Houston

Garlick G.F.J. (1977) Lunar surface movements – the evidence and the causes. Phil. Trans. Roy. Soc. London A285, 325-330.

Garner E.L., Machlan L.A. and Barnes I.L. (1975) The isotopic composition of lithium, potassium, and rubidium in some Apollo 11, 12, 14, 15, and 16 samples. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1845-1855.

Garrick-Bethell. I. and Weiss B.J. (2007) Early lunar magmtism (abs). Lunar Planet. Sci. 38, #2405. Lunar Planetary Institute, Houston

Garrison J.R. and Taylor L.A. (1979) Breccia Guidbook No. 2 , 66095 “Rusty Rock”. JSC 16198. Curatorial Branch, JSC 27 pp.

Garrison J.R. and Taylor L.A. (1980) Genesis of highland basalt breccias: A view from 66095. In Proc. Conf. Lunar Highland Crust (ed. Papike and Merrill). 395-417. GCA Supp. 12, Lunar Planetary Institute, Houston

Gast P.W. (1972) The chemical composition and structure of the moon. The Moon 5, 121-148.

Gast P.W. and Hubbard N.J. (1970a) Abundance of alkali metals, alkaline and rare earths and strontium-87/strontium-86 ratios in lunar samples. Science 167, 485-487.

Gast P.W. , Hubbard N.J. and Wiesmann H. (1970b) Chemical composition and pterogenesis of basalts from Tranquillity Base. Proc. Apollo 11 Lunar Sci. Conf. 1143-1163.

Gast P.W. and Hubbard N.J. (1970c) Rare earth abundances in soil and rocks from the Ocean of Storms. Earth Planet. Sci. Lett. 10, 94-101.

Gay P., Brown M.G. and Rickson K.O. (1970) Mineralogic studies of lunar rock 12013,10. Earth Planet. Sci. Lett. 9, 124-126.

Gay P., Brown M.G. and Muir I.D. (1972) Mineralogical and petrographic features of two Apollo 14 rocks. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 351-362.

Geake J.E., Walker G., Telfer D.J. and Mills A.A. (1977) The cause and significance of luminescence in lunar plagioclase. Phil. Trans. Roy. Soc. London A285, 403-408.

Geiss J., Eberhardt P., Grogler N., Guggisbert S., Maurer P. and Stettler A. (1977) Absolute time scale of lunar mare formation and filling. Phil. Trans. Roy. Soc. London A285, 151-158.

Gibb F.G.F., Stumpfl E.F. and Zussman J. (1970) Opaque minerals in an Apollo 12 rock. Earth Planet. Sci. Lett. 9, 217-224.

Gibb F.G.F. and Zussman J. (1971) Zoned olivine in four Apollo 12 samples. Earth Planet. Sci. Lett. 11, 161-167.

Gibb T.C., Greatrex R., Greenwood N.N. and Battey M.H. (1972) Mossbauer studies of Apollo 14 lunar samples. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 2479-2493.

Gibb T.C., Greatrex R. and Greenwood N.N. (1977) An assessment of results obtained from Mosbauer spectra of lunar smplses. Phil. Trans. Roy. Soc. London A285, 235-240.

Gibson E.K. and Moore G.W. (1973a) Carbon, sulfur and inorganic gases abundances and distribution from soils collected at Shorty Crater on Apollo 17. EOS Trans. AGU 54, 589-590.

Gibson E.K. and Moore G.W. (1973b) Variable carbon contents of lunar soil 74220. Earth Planet. Sci. Lett. 20, 404-408.

Gibson E.K. and Moore G.W. (1973c) Volatile rich lunar soil: Evidence of possible cometary impact. Science 179, 69-71.

Gibson E.K. and Moore G.W. (1974a) Sulfur abundances and distributions in the valley of Taurus-Littrow. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1823-1837.

Gibson E.K. and Moore G.W. (1974b) Total sulfur abundances and distributions in the valley of Taurus-Littrow: Evidence of mixing (abs). Lunar Sci. V, 267-269. Lunar Planetary Institute, Houston

Gibson E.K., Chang S., Lennon K., Moore G.W. and Pearce G.W. (1975a) Sulfur abundances and distributions in mare basalts and their source magmas. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1287-1301.

Gibson E.K., Chang S., Lennon K., Moore G.W. and Pearce G.W. (1975b) Carbon, sulfur, hydrogen and metallic iron abundances in Apollo 15 and Apollo 17 basalts (abs). Lunar Sci. VI, 290-292. Lunar Planetary Institute, Houston

Gibson E.K., Usselman T.M. and Morris R.V. (1976a) Sulfur in the Apollo 17 basalts and their source regions. Proc. 7<sup>th</sup> Lunar Sci. Conf. 1491-1505.

Gibson E.K., Morris R.V. and Usselman T.M. (1976b) Nature of the sulfur in the Apollo 17 basalts and their source regions (abs). Lunar Sci. VII, 290-292. Lunar Planetary Institute, Houston

Gibson E.K. and Andrawes F.F. (1978a) Nature of the gases released from lunar rocks and soils upon crushing. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 2433-2450.

Gibson E.K. and Andrawes F.F. (1978b) Sulfur abundances in the 74001/74002 drive tube from Shorty Crater Apollo 17. Proc. 9<sup>th</sup> Lunar Sci. Conf. 2011-2017.

Gibson E.K., Bustin R., Skaugset A., Can R.H., Wentworth S.J. and McKay D.S. (1987) Hydrogen distributions in lunar materials (abs). Lunar Planet. Sci. XVIII, 326-327. Lunar Planetary Institute, Houston

Gillis J.J., Jolliff B.L. and Korotev R.L. (2004) Lunar surface geochemistry: Global concentrations of Th, K, and FeO as derived from Lunar Prospector and Clementine data. Geochim. Cosmochim. Acta 68, 3791-3805.

Glass B.P. (1971) Investigation of glass recovered from Apollo 12 soil 12057. J. Geophys. Res. 76, 5649-5657.

Glass B.P. (1976a) High-silica lunar glasses in an Apollo 14 soil sample: Evidence for silicic lunar volcanism? Earth Planet. Sci. Lett. 33, 79-85.

Glass B.P. (1976b) Major element compositions of glasses from Apollo 11, 16 and 17 soil samples. Proc. 7<sup>th</sup> Lunar Sci. Conf. 679-693.

Gnos J., Takahashi H., Hertogen J., Morgan J.W. and Anders E. (1976) Composition of the projectiles that bombarded the lunar highlands. Proc. 7<sup>th</sup> Lunar Sci. Conf. 2403-2425.

Gnos E., Hofmann B.A., Al-Katgiri A., Lorenzetti S., Eugster O., Whitehouse M.J., Villa I.M., Jull and others (2004) Pinpointing the source of a lunar meteorite: Implications for the evolution of the Moon. *Science* 305, 657-659.

Goel P.S. and Kothari B.K. (1972) Total nitrogen contents of some Apollo 14 lunar samples by neutron activation analysis. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 2041-2050.

Goel P.S., Shukla P.N., Kothari B.K. and Garg A.N. (1975) Total nitrogen in lunar soils, breccias, and rocks. *Geochim. Cosmochim. Acta* 39, 1347-1352.

Goldberg R.H., Trombrello T.A. and Burnett D.S. (1976) Flourine as a constituent in lunar magmatic gases. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1597-1613.

Gold T., Bilson E. and Baron R.L. (1977) The relationship of surface chemistry and albedo of lunar soil samples. *Phil. Trans. Roy. Soc. London* A285, 427-432.

Gold T., Bilson E. and Baron R.L. (1976a) The surface chemical composition of lunar samples and its significance for optical properties. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 901-911.

Gold T., Bilson E. and Baron R.L. (1976b) Electrical properties of Apollo 17 rock and soil samples and a summary of the electrical properties of lunar material at 450 MHz frequency. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 2593-2603.

Gold T., Bilson E. and Baron R.L. (1976c) Electrical properties of Apollo 17 rock and soil samples and a summary of the electrical properties of lunar material at 450 MHz frequency (abs). *Lunar Sci. VII*, 298-300. Lunar Planetary Institute, Houston

Goldberg R.H., Burnett D.S. and Tombrello T.A. (1975a) Fluorine surface films on lunar samples: Evidence for both lunar and terrestrial origins. *Proc. 6<sup>th</sup> Lunar Sci. Conf.*, 2189-2200.

Goldberg R.H., Burnett D.S., Tombrello T.A. and Weller R.A. (1975b) Hydrogen, carbon and teflon on the surfaces of lunar samples (abs). *Lunar Sci. VI*, 299-301. Lunar Planetary Institute, Houston

Goldberg R.H., Trombrello T.A. and Burnett D.S. (1976a) Flourine as a constituent in lunar magmatic gases. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1597-1613.

Goldberg R.H., Weller R.A., Tombrello T.A. and Burnett D.S. (1976b) Surface concentrations of F, H and C (abs). *Lunar Sci. VII* 307-309. Lunar Planetary Institute, Houston

Goldstein J.I., Hewins R.H. and Romig A.D. (1976a) Carbides in lunar soils and rocks. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 807-818.

Goldstein J.I., Hewins R.H. and Romig A.D. (1976b) Carbides in lunar soils and rocks (abs). *Lunar Sci. VII*, 310-312. Lunar Planetary Institute, Houston

Goles G. (1971) Comments on the genesis and evolution of Apollo XI soil. *Lithos* 4, 71-81.

Goles G., Randle K., Osawa M., Schmitt R.A., Wakita H., Ehmann W.D. and Morgan J.W. (1970) Elemental abundances by instrumental activation analyses in chips from 27 lunar rocks. *Proc. Apollo 11 Lunar Sci. Conf.* 1165-1176.

Gooley R.C., Brett R. and Warner J.L. (1973) Crystallization history of metal particles in Apollo 16 rake samples. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 799-810.

Gooley R., Brett R., Warner J. and Smyth J.R. (1974) A lunar rock of deep crustal origin: Sample 76535. *Geochim. Cosmochim. Acta* 38, 1329-1339.

Gose W.A., Pearce G.W., Strangway D.W. and Larson E.E. (1972) Magnetic properties of Apollo 14 breccias and their correlation with metamorphism. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 2387-2395.

Gose W.A., Strangway D.W. and Pearce G.W. (1976) Origin of magnetization in lunar breccias: An example of thermal overprinting (abs). Lunar Sci. VII, 322-324. Lunar Planetary Institute, Houston

Gose W.A., Strangway D.W. and Pearce G.W. (1978) Origin of magnetization in lunar breccias: An example of thermal overprinting. Earth Planet. Sci. Letters 38, 373-384.

Goswami J.N. and Hutcheon I.D. (1975) Cosmic ray exposure history and compaction age of Boulder 1 from Station 2. The Moon 14, 395-405.

Goswami J.N. and Lal D. (1974) Cosmic ray irradiation pattern at the Apollo 17 site: implications to lunar regolith dynamics. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2643-2662.

Goswami J.N., Braddy D. and Price P.B. (1976a) Microstratigraphy of the lunar regolith and compaction ages of lunar breccias. Proc. 7<sup>th</sup> Lunar Sci. Conf. 55-74.

Goswami J.N., Braddy D. and Price P.B. (1976b) Microstratigraphy of the lunar regolith and compaction ages of lunar breccias (abs). Lunar Sci. VII, 328-330. Lunar Planetary Institute, Houston

Goswami J.N. and Lal D. (1979) Depositional history of the Apollo 17 deep drill core based on particle track record. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 1253-1267.

Graham A.L. and Ringwood A.E. (1971) Lunar basalt genesis: The origin of the Europium anomaly. Earth Planet. Sci. Lett. 13, 105-115.

Graf H., Shirck J., Sun S and Walker R. (1973) Fission track astrology of three Apollo 14 gas-rich breccias. Proc. 4<sup>th</sup> Lunar Sci. Conf. 2145-2155.

Grant R.W., Housley R.M., Szalkowski F.J. and Marcus H.L. (1974) Auger electron spectroscopy of lunar samples. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2423-2439.

Green D.H., Ware N.G., Hibberson W.O. and Major A. (1971a) Experimental petrology of Apollo 12 basalts: Part 1, Sample 12009. Earth Planet. Sci. Lett. 13, 85-96.

Green D.H., Ringwood A.E., Ware N.G., Hibberson W.O., Major A. and Kiss E. (1971a) Experimental petrology and petrogenesis of Apollo 12 basalts. Proc. 2<sup>nd</sup> Lunar Sci. Conf. 601-615.

Green D.H., Ware N.G. and Hibberson W.O. (1972) Experimental evidence against the role of selective volatilization on the lunar surface. Nature 238, 450.

Green D.H. and Ringwood A.E. (1973) Significance of a primitive lunar basaltic composition present in Apollo 15 soils and breccias. Earth Planet. Sci. Lett. 19, 1-8.

Green D.H., Ringwood A.E., Ware N.G. and Hibberson W.O. (1974) Petrology and petrogenesis of Apollo 17 basalts and Apollo 17 orange glass (abs). Lunar Sci. V, 287-289. Lunar Planetary Institute, Houston

Green D.H., Ringwood A.E., Hibberson W.O. and Ware N.G. (1975a) Experimental petrology of Apollo 17 mare basalts. Proc. 6<sup>th</sup> Lunar Sci. Conf. 871-893.

Green D.H., Ringwood A.E., Ware N.G. and Hibberson W.O. (1975b) Experimental petrology and petrogenesis of Apollo 17 mare basalts (abs). Lunar Sci. VI, 311-313. Lunar Planetary Institute, Houston

- Greegor R.B. and Lytle F.W. (1983) Preliminary investigation of Ti-site geometry in lunar volcanic and impact glasses by x-ray absorption spectroscopy (abs). *Lunar Planet. Sci.* XIV, 257-258.
- Grieve R.A.F., McKay G.A. and Weill D.F. (1972) Microprobe studies of three Luna 16 basalt fragments. *Earth Planet. Sci. Lett.* 13, 233-242.
- Grieve R.A.F. and Plant A.G. (1973) Partial melting on the lunar surface, as observed in glass coated Apollo 16 samples. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 667-679.
- Grieve R.A.F., McKay G.A., Smith H.D. and Weill D.F. (1975) Lunar polymict breccia 14321: A petrographic study. *Geochim. Cosmochim. Acta* 39, 229-245.
- Griffin W.L., Amli R. and Heier K.S. (1972) Whilockite and apatite from lunar rock 14310 and from odegarden, Norway. *Earth Planet. Sci. Lett.* 15, 53-58.
- Griscom D.L., Friebel E.J. and Marquart C.L. (1973) Evidence for a ubiquitous, sub-microscopic "magnetite-like" constituent in lunar soils. *Proc. 4<sup>th</sup> Lunar Sci. Conf.*, 2709-2727.
- Griscom D.L., Marquart C.L. and Friebel E.J. (1975) Magnetic phases in lunar green and orange glass droplets: possible relics of mare volcanism (abs). *Lunar Sci.* VI, 315-317. Lunar Planetary Institute, Houston
- Gros J., Takahashi H., Hertogen J., Morgan J.W. and Anders E. (1976) Composition of the projectiles that bombarded the lunar highlands. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 2403-2425.
- Grossman L., Clayton R.N. and Mayeda T.K. (1974) Oxygen isotopic constraints on the composition of the Moon. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1207-1212.
- Grove T.L. (1981) Compositional variations among Apollo 15 green glass spheres. *Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf.* 935-948.
- Grove T.L., Walker D., Longhi J., Stolper E. and Hays J.F. (1973) Petrology of 12002 and the origin of picritic basalts. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 995-1011.
- Grove T.L. and Lindsley D.H. (1978) Compositional variation and origin of lunar ultramafic green glasses (abs). *Lunar Planet. Sci. IX*, 430-432.
- Grove T.L. and Vaniman D.T. (1978) Experimental petrology of very low Ti (VLT) basalts. In *Mare Crisium*. 445-471.
- Grove T.L. and Beaty D.W. (1980) Classification, experimental petrology and possible volcanic histories of the Apollo 11 high-K basalts. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 149-177.
- Guggisberg S., Eberhardt P., Geiss J., Grogler N., Stettler A., Brown G.M. and Pecket A. (1979) Classification of the Apollo-11 basalts according to Ar39-Ar40 ages and petrological properties. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 1-39.
- Hagerty J., Shearer C.K. and Papike J.J. (2005) Trace element characteristics of the Apollo 14 high-alumina basalts: Implications for early magmatism on the Moon. *Geochim. Cosmochim. Acta* 69, 5831-5845.
- Haggerty S.E. (1971a) Compositional variations in lunar spinels. *Nature* 233, 156.
- Haggerty S.E. (1971b) Luna 16: An opaque mineral study and systematic examination of compositional variations of spinels from Mare Fecunditatis. *Earth Planet. Sci. Lett.* 13, 328-352.

- Haggerty S.E. (1972) Apollo 14: Subsolidus reduction and compositional variations of spinels. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 305-332.
- Haggerty S.E. (1973a) Amalcolite and genetically associated opaque minerals in the lunar samples. Proc. 4<sup>th</sup> Lunar Sci. Conf. 777-797.
- Haggerty S.E. (1973b) Apollo 17: Armalcolite paragenesis and subsolidus reduction of chromian-ulvöspinel and chromian-picro ilmenite (abs). EOS 54, 593-594.
- Haggerty S.E. (1973c) Ortho and para-armalcolite samples in Apollo 17. Nature Phys. Sci. 242, 123-125.
- Haggerty S.E. (1974) Apollo 17 orange glass: Textural and morphological characteristics of devitrification. Proc. 5<sup>th</sup> Lunar Sci. Conf. 193-205.
- Haggerty S.E. (1975) Geochemistry of opaque oxides in troctolites and basalts from Taurus Littrow (abs). Lunar Sci. VI, 321-323. Lunar Planet. Inst. Houston
- Haggerty S.E. (1977a) Luna 24: Opaque mineral chemistry. Geophys. Res. Lett 4, 489-492.
- Haggerty S.E. (1977b) Apollo 14: Oxide, metal and olivine mineral chemistries in 14072 with a bearing on the temporal relationships of subsolidus reduction. Porc. 8<sup>th</sup> Lunar Sci. Conf. 1809-1829.
- Haggerty S.E. and Meyer H.O.A. (1970) Apollo 12: Opaque oxides. Earth Planet. Sci. Lett. 9, 379.
- Haines E.L., Albee A.L., Chodos A.A. and Wasserburg G.J. (1971) Uranium-bearing minerals of lunar rock 12013. Earth Planet. Sci. Lett. 12, 145-154.
- Hale C.J., Fuller M. and Bailey R.C. (1978) On the application of microwave heating to lunar paleointensity determination. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 3165-3179.
- Halliday A.N. and Lee D.-C. (1999) Tungsten isotopes and the early development of the Earth and Moon. Geochim. Cosmochim Acta 63, 4157-4179.
- Halliday A.N., Rehkamper M., Lee D.-C. and Yi W. (1996) Early evolution of the Earth and Moon: new constraints from Hf-W isotope geochemistry. Earth Planet. Sci. Lett. 142, 75-89.
- Halliday A.N., Lee D.-C. and Jacobsen S.B. (2000) Tungsten isotopes, the timing of metal-silicate fractionation, and the origin of the Earth and Moon. In Origin of the Earth and Moon (Canup and Righter eds)
- Hanan B.B. and Tilton G.R. (1987) 60025: relict of primitive lunar crust? Earth Planet. Sci. Lett. 84, 15
- Hansen E.C., Steele I.M. and Smith J.V. (1979a) Lunar highland rocks: Element partitioning among minerals 1: Electron microprobe analyses of Na, K, and Fe in plagioclase; mg partitioning with orthopyroxene. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 627-638.
- Hansen E.C., Steele I.M. and Smith J.V. (1979b) Minor elements in plagioclase from lunar highland rocks: New data, especially for granulitic impactites. In Papers Presented to the Conference on the Lunar Highlands Crust. LPI Contr. 394, 39-41. Lunar Planetary Institute, Houston
- Hansen E.C., Steele I.M. and Smith J.V. (1979c) Minor elements in plagioclase and mafic minerals from lunar plagioclase-rich rocks (abs). Lunar Planet. Sci. X, 497-499. Lunar Planetary Institute, Houston
- Hansen E.C., Smith J.V. and Steele I.M. (1980) Minor elements in lunar olivine: Electron probe analyses of Na, Al, P, Ca, Ti, Cr, Mn, and Ni (abs). Lunar Planet. Sci. XI, 391-393. Lunar Planetary Institute, Houston

- Hapke B.W., Partlow W.D., Wagner J.K. and Cohen A.J. (1978) Reflectance measurements of lunar materials in the vacuum ultraviolet. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 2935-2947.
- Hargraves R.B. and Dorety N. (1972) Natural remanent magnetization in lunar breccia 14321. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 2417-2421.
- Hargraves R.B. and Dorety N.F. (1975) Remanent magnetism in two Apollo 16 and two Apollo 17 rock samples (abs). Lunar Sci. VI, 331-333. Lunar Planetary Institute, Houston
- Harrison W.J. and Horz F. (1981) Experimental shock metamorphism of calcic plagioclase (abs). Lunar Planet. Sci. XII, 395-397.
- Hart H.R., Comstock G.M. and Fleischer R.L. (1972) The particle track record of Fra Mauro. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 2831-2844.
- Hartmann W.K., Phillips R.J. and Taylor G.J. (1986) Origin of the Moon. Lunar Planetary Institute, Houston pp. 781.
- Hartung J.B. (1980) Lunar rock surfaces as detectors of solar processes. In Proc. Conf. Ancient Sun (Pepin et al. eds) Geochim. Cosmochim. Acta, Suppl. 13, 227-243.
- Hartung J.B. and Storzer D. (1974) Lunar microcraters and their solar flare track record. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2527-2541.
- Hartung J.B., Horz F., Aitken F.K., Gault D.E. and Brownlee D.E. (1973) The development of microcrater populations on lunar rocks. Proc. 4<sup>th</sup> Lunar Planet. Sci. Conf. 3213-3234.
- Hartung J.B., Plieninger T., Muller H.W. and Schaeffer O.A. (1977) Helium, neon, and argon on sunlit and shaded surfaces of lunar rock 12054. Proc. 8<sup>th</sup> Lunar Sci. Conf. , 865-881
- Hartung J.B., Hauser E.E., Horz F., Morrison D.A., Schonfeldt E., Zook H.A., Mandville J.C., Shaal R.B. and Zinner E. (1978) Lunar surface processes: Report of the 12054 consortium. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 2507-2537.
- Haselton J.D. and Nash W.P. (1975a) A model for the evolution of opaques in mare lavas. Proc. 6<sup>th</sup> Lunar Sci. Conf. 747-755.
- Haselton J.D. and Nash W.P. (1975b) Observations on titanium in lunar oxides and silicates (abs). Lunar Sci. VI, 343-345. Lunar Planetary Institute, Houston
- Haskin L.A., Helmke P.A., Blanchard D.P., Jacobs J.W. and Telunder K. (1973) Major and trace element abundances in samples from the lunar highlands. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1275-1296.
- Haskin L.A., Shih C.-Y., Bansal B.M., Rhodes J.M., Wiesmann H. and Nyquist L.E. (1974a) Chemical evidence for the origin of 76535 as a cumulate. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1213-1225.
- Haskin L.A., Shih C.-Y., Bansal B.M., Rhodes J.M., Wiesmann H. and Nyquist L.E. (1974b) Chemical evidence for the origin of 76535 as a cumulate (abs). Lunar Sci. V, 313-315. Lunar Planetary Institute, Houston
- Haskin L.A. and Warren P.H. (1991) Lunar Chemistry. In Lunar Sourcebook: a users guide to the moon. (eds. Heiken et al. ) Cambridge Univ. Press
- Haskin L.A., Korotev R.L., Rockow K.M. and Jolliff B.L. (1998) The case for an Imbrium origin of the Apollo thorium-rich impact-melt breccias. Meteoritics & Planet. Sci. 33, 959-975.

- Haskin L.A., Gillis J.J., Korotev R.L. and Jolliff B.L. (2000) The materials of the lunar Procellarum KREEP terrane: A synthesis of data from geomorphological mapping, remote sensing and sample analysis. *J. Geophys. Res.* 105, 20403-20415.
- Haskin L.A., Moss B.E. and McKinnon W.B. (2003) On estimating the basin ejecta to regolith deposits of lunar saites. *Meteoritics & Planet. Sci.* 38, 13-33.
- Hawke B.R., Peterson C.A., Blewett D.T., Bussey D.B.J., Lucey P.G., Taylor G.J. and Spudis P.D. (2003) Distribution and modes of occurrence of lunar anorthosite. *J. Geophys. Res.* 108, E6
- Hays J.F. and Walker D. (1977) Lunar igneous rocks and the nature of the lunar interior. In The Soviet-American conference on cosmochemistry and the Moon and planets. 127-151.
- Hays, J.M. (1972) Extralunar sources for carbon on the moon. *Space Life Sci.* 3, 474-483.
- Hazen R.M., Mao H.K. and Bell P.M. (1977) Effects of compositional variation on absorption spectra of lunar olivines. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 1081-1090.
- Hazen R.M., Bell P.M. and Mao H.K. (1978) Effects of compositional variation on absorption spectra of lunar pyroxenes. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 2919-2934.
- Head J.W. (1974a) Morphology and structure of the Taurus-Littrow highlands (Apollo 17): Evidence for their origin and evolution. *The Moon* 9, 355-395.
- Head J.W. (1974b) Stratigraphy of the Descartes region (Apollo 16): Implications for the origin of samples. *The Moon* 11, 77-99.
- Head J.W. (1976a) Evidence for the sedimentary origin of Imbrium sculpture and lunar basin radial texture. *The Moon* 15, 445-462.
- Head J.W. (1976b) Lunar volcanism in space and time. *Rev. Geophys. Space Phys.* 14, 265-300.
- Heavilon C.F. and Crozaz G. (1989) REE and selected minor and trace element microdistributions in some pristine lunar highlands rocks (abs). *Lunar Planet. Sci. XX*, 398-399. Lunar Planetary Institute, Houston
- Heiken G.H. (1974) A catalog of lunar soils. JSC Curator
- Heiken G.H. (1975) Petrology of lunar soils. *Rev. Geophys. Space Phys.* 13, 567-587.
- Heiken G.H., Butler P., Simonds C.H., Phinney W.C., Warner J., Schmitt H.H., Bogard D.D. and Pearce W.G. (1973a) Preliminary data on boulders at Station 6, Apollo 17 landing site. NASA TMX-58116, pp. 56.
- Heiken G.H., McKay D.S. and Fruland R.M. (1973b) Apollo 16 soils – grain size analysis and petrography. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 251-266.
- Heiken G.H. and McKay D.S. (1974) Petrology of Apollo 17 soils. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 843-860.
- Heiken G.H., McKay D.S. and Brown R.W. (1974) Lunar deposits of possible pyroclastic origin. *Geochim. Cosmochim. Acta* 38, 1703-1718.
- Heiken G.H. and McKay D.S. (1977) A model for the eruption behavior of a volcanic vent in eastern Mare Serenitatis. *Proc. 8<sup>th</sup> Lunar Planet. Sci. Conf.* 3243-3255.

- Heiken G.H. and McKay D.S. (1978) Petrology of a sequence of pyroclastic rocks from the valley of Taurus-Littrow (Apollo 17 landing site). Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 1933-1943.
- Heiken G.H. and Vaniman D.T. (1989) Petrography of lunar ilmenite resources (abs). Lunar Planet. Sci. XX, 400-401. Lunar Planetary Institute, Houston
- Heiken G.H., Vaniman D.T. and French B. (1991) Lunar Sourcebook. Cambridge Univ. Press
- Helmke P.A., Haskin L.A., Korotev R.L. and Ziege K.E. (1972) Rare earths and other trace elements in Apollo 14 samples. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1275-1292.
- 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.
- Hertz R.T. (1972) Rock 14068: An unusual lunar breccia. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 865-886.
- Helz R.T. and Appleman D.E. (1974) Poikilitic and cumulate textures in rock 77017, a crushed anorthositic gabbro (abs). Lunar Sci. V, 322-324. Lunar Planetary Institute, Houston
- Hertogen J., Janssens M.-J., Takahashi H., Palme H. and Anders E. (1977) Lunar basins and craters: Evidence for systematic compositional changes of bombarding population. Proc. 8<sup>th</sup> Lunar Sci. Conf. 17-45.
- Hertogen J. and Janssens M-J. (1977) Is Osmium chemically fractionated in the moon? Proc. 8<sup>th</sup> Lunar Sci. Conf. 47-52.
- Herzberg C.T. (1978) The bearing of spinel cataclasites on the crust-mantle structure of the Moon. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 319-336.
- Herzberg C.T. (1979) Identification of pristine lunar highland rocks: Criteria based on mineral chemistry and stability (abs). Lunar Planet. Sci. X, 537-539. Lunar Planetary Institute, Houston
- Herzberg C.T. and Baker M.B. (1980) The cordierite-to-spinel-cataclasite transition: Structure of the lunar crust. Proc. Conf. Lunar Highlands Crust. Geochim. Cosmochim. Acta, Suppl. 12. Pergamon Press. 113-132. Lunar Planetary Institute, Houston
- Hess P.C. (1991) Diapirism and the origin of high TiO<sub>2</sub> mare glasses. Geophys. Res. Lett. L8, 2069-2072.
- Hess P.C. (1994) Petrogenesis of lunar troctolites. J. Geophys. Res. 99, 19083-19093.
- Hess P.C. (2000) Petrogenesis of lunar troctolites – Implications for the Moon and its evolution (abs). Lunar Planet. Sci. XXXI CD-ROM #1389 Lunar Planetary Institute, Houston
- Hess P.C., Rutherford M.J., Guillemette R.N., Ryerson F.J. and Tudfeld H.A. (1975) Residual products of fractional crystallization of lunar magmas: An experimental study. Proc. 6<sup>th</sup> Lunar Sci. Conf. 895-909.
- Hess P.C. and Parmentier E.M. (1995) A model for the thermal and chemical evolution of the Moon's interior: implications for the onset of Mare magmatism. Earth Planet. Sci. Lett. 134, 501-514.
- Heuer A.H., Christie J.M., Lally J.S. and Nord G.L. (1974) Electron petrographic study of some Apollo 17 breccias. Proc. 5<sup>th</sup> Lunar Sci. Conf. 275-286.
- Hewins R.H. and Goldstein J.I. (1974) Metal-olivine association and Ni-Co contents in two Apollo 12 mare basalts. Earth Planet. Sci. Lett. 24, 59-70.

Hewins R.H. and Goldstein J.I. (1975a) The provenance of metal in anorthositic rocks. Proc. 6<sup>th</sup> Lunar Sci. Conf. 343-362.

Hewins R.H. and Goldstein J.I. (1975b) The provenance of metal in anorthositic rocks (abs). Lunar Sci. VI, 358-360. Lunar Planetary Institute, Houston

Hewins R.H. and Goldstein J.I. (1975c) Comparison of silicate and metal geothermometers for lunar rocks (abs). Lunar Sci. VI, 356-358 Lunar Planetary Institute, Houston

Heymann D. (1975) Argon-lead isotopic correlation in samples from lunar maria: records from the ancient lunar regolith. Earth Planet. Sci. Lett. 27, 445-448.

Heymann D. and Hubner W. (1974) Origin of the inert gases in “rusty rock” 66095. Earth Planet. Sci. Lett. 22, 423-426.

Heymann D., Walton J.R., Jordan J.L., Lakatos S. and Yaniv A. (1975) Light and dark soils at the Apollo 16 landing site. The Moon 13, 81-110.

Heymann D., Jordan J.L., Walker A., Dziczkaniec M., Rey J. and Palma R. (1976) Inert gas measurements in the Apollo 16 drill core and an evaluation of the stratigraphy and depositional history of this core. Proc. 9<sup>th</sup> Lunar Sci. Conf. 1885-1912.

Higuchi H. and Morgan J.W. (1975a) Ancient meteoritic component in Apollo 17 boulders. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1625-1651.

Higuchi H. and Morgan J.W. (1975b) Ancient meteoritic component in Apollo 17 boulders (abs). Lunar Sci. VI, 364-366. Lunar Planetary Institute, Houston

Hintenberger H. and Weber H.W. (1973) Trapped rare gases in lunar fines and breccias. Proc. 4<sup>th</sup> Lunar Sci. Conf. 2003-2019.

Hintenberger H., Weber H.W. and Schultz L. (1974a) Solar, spallenogenic, and radiogenic rare gases in Apollo 17 soils and breccias. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2005-2022.

Hintenberger H., Weber H.W. and Schultz L. (1974b) Solar, spallenogenic, and radiogenic rare gases in Apollo 17 soils and breccias (abs). Lunar Sci. V, 334-336. Lunar Planetary Institute, Houston

Hintenberger H., Schultz L. and Weber H.W. (1975a) A comparison of noble gases in lunar fines and soil breccias: Implications for the origin of soil breccias. Proc. 6<sup>th</sup> Lunar Sci. Conf. 2261-2270.

Hintenberger H., Schultz L. and Weber H.W. (1975b) Rare gases in ilmenite and bulk samples of Apollo 17 soils and breccias (abs). Lunar Sci. VI, 370-372. Lunar Planetary Institute, Houston

Hinckley J.R., Conrad R.L. and Andersen C.A. (1975) Lead-lead and trace element abundances in lunar troctolite, 76535 (abs). Lunar Sci. VI, 373-375. Lunar Planetary Institute, Houston

Hinckley J.R., Conrad R.L. and Church S.E. (1977) Lead-lead age and rare earth element determinations in lunar norite 78235 (abs). Lunar Sci. VIII, 444-446. Lunar Planetary Institute, Houston

Hlava P.F., Prinz M. and Keil K. (1972) Niobian rutile in an Apollo 14 KREEP fragment. Meteoritics 7, 479-485.

Hlava P.F., Green J.A., Prinz M., Keil K., Dowty E. and Bunch T.E. (1973) Apollo 15 rake samples, microbreccias and non-mare rocks: Bulk rock, mineral and glass electron microprobe analyses. Inst. Meteoritics Spec. Publ. No 11, 51-73. Univ. New Mex.

- Hodges F.N. and Kushiro I. (1974a) Apollo 17 petrology and experimental determination of differentiation sequences in model Moon compositions. Proc. 5<sup>th</sup> Lunar Sci. Conf. 505-520.
- Hodges F.N. and Kushiro I. (1974b) Apollo 17 petrology and experimental determination of differentiation sequences in model Moon compositions (abs). Lunar Sci. V, 340-342.
- Hohenberg C.M., Marti K., Podosek F.A., Reedy R.C. and Shirck J.R. (1978) Comparison between observed and predicted cosmogenic noble gases in lunar samples. Proc. 9<sup>th</sup> Lunar Sci. Conf. 2311-2344.
- Hohenberg C.M., Hudson B., Kennedy B.M. and Podosek F.A. (1980) Fission xenon in troctolite 76535. In Proc. Conf. Lunar Highlands Crust. Geochim. Cosmochim. Acta, Suppl. 12. Pergamon Press. 419-439. Lunar Planetary Institute, Houston
- Holland P.T., Simoneit B.R., Wszolek P.C. and Burlingame A.L. (1972) Compounds of carbon and other volatile elements in Apollo 14 and 15 samples. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 2131-2147.
- Holland P.T., Simoneit B.R., Wszolek P.C. and Burlingame A.L. (1972) Study of carbon compounds in Apollo 12 and 14 samples. Space Life Sci. 3, 551-561.
- Holmes H.F., Fuller E.L. and Gammage R.B. (1973) Interaction of gases with lunar materials – Apollo 12, 14 and 16 samples. Proc. 4<sup>th</sup> Lunar Sci. Conf. 2413-2424.
- Holmes H.F., Fuller E.L. and Gammage R.B. (1974) Some surface properties of Apollo 17 soils. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2275-2286.
- Horai K. and Winkler J. (1975) Thermal diffusivity of three Apollo 17 rock samples: 70215,18, 77035,44 and 70017,77 (abs). Lunar Sci. VI, 390-392. Lunar Planetary Institute, Houston
- Horai K. and Winkler J.L. (1976) Thermal diffusivity of four Apollo 17 rock samples. Proc. 7<sup>th</sup> Lunar Sci. Conf. 3183-3204.
- Horai K. and Winkler J.L. (1980) Thermal diffusivity of two Apollo 11 samples, 10020,44 and 10065,23: Effect of petrofabrics on the thermal conductivity of porous lunar rocks under vacuum. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 1777-1788.
- Horn P., Jessberger E.K., Kirsten T. and Richter H. (1975)  $^{39}\text{Ar}$ - $^{40}\text{Ar}$  dating of lunar rocks: Effects of grain size and neutron irradiation. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1563-1591.
- Horn P. and Kirsten T. (1977) Lunar highland stratigraphy and radiometric dating. Phil. Trans. Roy. Soc. London A285, 145-150.
- Hörz F., Hartung J.B. and Gault D.E. (1971a) Micrometeorite craters on lunar rock surfaces. J. Geophys. Res. 76, 5770-5798.
- Hörz F., Hartung J.B. and Gault D.E. (1971b) Micrometeorite craters and related features on lunar rock surfaces. Earth Planet. Sci. Lett. 10, 381-386.
- Hörz F. and Hartung J.B. (1971c) The lunar-surface orientation of some Apollo 12 rocks. Proc. 2<sup>nd</sup> Lunar Planet. Sci. 2629-2638.
- Hörz F., Morrison D.A. and Hartung J.B. (1972) The surface orientation of some Apollo 14 rocks. Modern Geology 3, 93-104.
- Hörz F., Carrier W.D., Young J.W., Duke C.M., Nagle J.S. and Fryxell R. (1972) Apollo 16 special samples. In Apollo 16 Preliminary Science Rpt. NASA SP315 page 7-24 to 7-54

- Hörz F., Gibbons R.V., Gault D.E., Hartung J.B. and Brownlee D.E. (1975a) Some correlation of rock exposure ages and regolith dynamics. Proc. 6<sup>th</sup> Lunar Sci. Conf. 3495-3508.
- Hörz F., Schneider E., Gault D.E., Hartung J.B. and Brownlee D.E. (1975b) Catastrophic rupture of lunar rocks: A Monte Carlo simulation. *The Moon* 13, 235-258.
- Hörz F., Brownlee D.E., Fechtig H., Hartung J.B., Morrison D.A., Neukum G., Schneider E., Vedder J.F. and Gault D.E. (1975) Lunar microcraters: Implications for the micrometeoroid complex. *Planet. Space Sci.* 23, 151-172.
- Hörz F. and Schaal R.B. (1979) Glass production in massive versus porous basalts via shock (abs). *Lunar Planet. Sci. X*, 573-575. Lunar Planetary Institute, Houston
- Houck K.J. (1982a) Petrologic variations in Apollo 16 surface soils. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. J.Geophys. Res. 87, A197-A209.
- Houck K.J. (1982b) Modal petrology of six soils from Apollo 16 double drive tube core 64002. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 87, A210-A220.
- Housley R.M., Grant R.W. and Abdel-Gawad M. (1972) Study of excess Fe metal in the lunar fines by magnetic separation, Mossbauer spectroscopy and microscopic examination. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1065-1076.
- Housley R.M. (1977) Solar wind and micrometeorite effects in the lunar regolith. *Phil. Trans. Roy. Soc. London A285*, 363-368.
- Housley R.M., Cirlin E.H., Goldberg I.B., Crowe H., Weeks R.A. and Perhac R. (1975) Ferromagnetic resonance as a method of studying the micrometeorite bombardment history of the lunar surface. Proc. 6<sup>th</sup> Lunar Sci. Conf. 3173-3186.
- Housley R.M., Cirlin E.H., Goldberg I.B. and Crowe H. (1976) Ferromagnetic resonance studies of lunar core stratigraphy. Proc. 7<sup>th</sup> Lunar Sci. Conf. 13-26.
- Howard K.A., Williams D.E. and Scott D.H. (1974) Lunar basin formation and highland stratigraphy. *Rev. Geophys. Space Phys.* 12, 309-327.
- Hu H-N. and Taylor L-A. (1977) Lack of chemical fractionation in major and minor elements during agglutinate formation. Proc. 8<sup>th</sup> Lunar Sci. Conf. 3645-3656.
- Hubbard N.J., Gast P.W. and Wiesmann H. (1970) Rare earth, alkaline and alkali metal and  $^{87/86}\text{Sr}$  data for subsamples of lunar sample 12013. *Earth Planet. Sci. Lett.* 9, 181-184.
- Hubbard N.J., Meyer C., Gast P.W. and Wiesmann H. (1971a) The composition and derivation of Apollo 12 soils. *Earth Planet. Sci. Lett.* 10, 341-350.
- Hubbard N.J., Gast P.W., Meyer C., Nyquist L.E. and Shih C.-Y. (1971b) Chemical composition of lunar anorthosites and their parent liquids. *Earth Planet. Sci. Lett.* 13, 71-75.
- Hubbard N.J., Gast P.W., Rhodes J.M., Bansal B.M., Wiesmann H. and Church S.E. (1972) Nonmare basalts: Part II. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1161-1179.
- Hubbard N.J., Rhodes J.M. and Gast P.W. (1973a) Chemistry of lunar basalts with very high alumina contents. *Science* 181, 339-342.

Hubbard N.J., Rhodes J.M., Gast P.W., Bansal B.M., Shih C.-Y., Wiesmann H. and Nyquist L.E. (1973b) Lunar rock types: The role of plagioclase in non-mare and highland rock types. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1297-1312.

Hubbard N.J., Rhodes J.M., Wiesmann H., Shih C.Y. and Bansal B.M. (1974) The chemical definition and interpretation of rock types from the non-mare regions of the Moon. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1227-1246.

Hubbard N.J. and Minear J.W. (1976) Petrogenesis in a moderately endowed moon. Proc. 7<sup>th</sup> Lunar Sci. Conf. 3421-3437.

Huebner J.S. (1976) Diffusively rimmed xenocrysts in 77115 (abs). Lunar Sci. VII, 396-398. Lunar Planetary Institute, Houston

Huebner J.S., Ross M. and Hickling N. (1975a) Significance of exsolved pyroxenes from lunar breccia 77215. Proc. 6<sup>th</sup> Lunar Sci. Conf. 529-546.

Huebner J.S., Ross M. and Hickling N.L. (1975b) Cooling history and significance of exsolved pyroxene in lunar noritic breccia 77215 (abs). Lunar Sci. VI, 408-410. Lunar Planetary Institute, Houston

Huffman G.P., Schwerer F.C., Fisher R.M. and Nagata T. (1974) Iron distribution and metallic-ferrous ratios for Apollo lunar samples: Mossbauer and magnetic analyses. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2779-2794.

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

Hughes J.M., Jolliff B.L. and Gunter Micky.E. (2006) The atomic arrangement of merrillite from the Fra Mauro Formation, Apollo 14 lunar missions: The first structure of merrillite from the Moon. Am. Mineral. 91, 1547-1552.

Hughes S.S., Delano J.W. and Schmitt R.A. (1988) Apollo 15 yellow-brown volcanic glass: Chemistry and petrogenetic relations to green volcanic glass and olivine-normative basalts. Geochim. Cosmochim. Acta 52, 2379-2391.

Hughes S.S., Neal C.R. and Taylor L.A. (1990) Petrogenesis of Apollo 14 high-alumina (HA) parental basaltic magma (abs). Lunar Planet. Sci. XXI, 540-541. Lunar Planetary Institute, Houston

Huffman G.P., Schwerer F.C., Fisher R.M. and Nagata T. (1974a) Iron distributions and metallic-ferrous ratios for Apollo lunar samples: Mossbauer and magnetic analyses. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2779-2794.

Huffman G.P., Schwerer F.C., Fisher R.M. and Nagata T. (1974b) Iron distributions and metallic-ferrous ratios for Apollo lunar samples: Mossbauer and magnetic analyses (abs). Lunar Sci. V, 372-374. Lunar Planetary Institute, Houston

Huffman G.P. and Dunmyre G.R. (1975) Superparamagnetic clusters of Fe<sup>2+</sup> spins in lunar olivine: Dissolution by high temperature annealing. Proc. 6<sup>th</sup> Lunar Sci. Conf. 757-772.

Hughes S.S. and Schmitt R.A. (1985) Zr-Hf-Ta fractionation during lunar evolution. Proc. 16<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. D31-D45.

Hughes S.S. and Schmitt R.A. (1988) Confirmation of Zr-Hf fractionation in lunar petrogenesis - an interim report (abs). Lunar Planet. Sci. XV, 385-386. Lunar Planetary Institute, Houston

- Hughes S.S., Delano J.W. and Schmitt R.A. (1990) Chemistries of individual mare volcanic glasses: Evidence for distinct regions of hybridized mantle and a KREEP component in Apollo 14 magmatic sources. Proc. 20<sup>th</sup> Lunar Planet. Sci. Conf. 127-138. Lunar Planetary Institute, Houston
- Hulme G. and Fielder G. (1977) Effusion rates and rheology of lunar lavas. Phil. Trans. Roy. Soc. London A285,227-234.
- Huneke J.C. (1978)  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  microanalysis of single 74220 glass balls and 72435 breccia clasts. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 2345-2362.
- Huneke J.C., Podosek F.A. and Wasserburg G.J. (1972) Gas retention and cosmic-ray exposure ages of a basalt fragment from Mare Fecunditatis. Earth Planet. Sci. Lett. 13, 375-383.
- Huneke J.C., Podosek F.A. and Wasserburg G.J. (1973a) An argon bouillabaisse including ages from the Lunar 20 site (abs). Lunar Sci. IV, 403-405. Lunar Planetary Institute, Houston
- Huneke J.C., Jessberger E.K., Podosek F.A. and Wasserburg G.J. (1973b)  $^{40}\text{Ar}$ / $^{39}\text{Ar}$  measurements in Apollo 16 and 17 samples and the chronology of metamorphic and volcanic activity in the Taurus Littrow region. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1725-1756.
- Huneke J.C., Jessberger E.K. and Wasserburg G.J. (1974) The age of metamorphism of a highland breccia (65015) and a glimpse at the age of its protolith (abs). Lunar Sci. V, 375-377. Lunar Planetary Institute, Houston
- Huneke J.C. and Wasserburg G.J. (1975) Trapped  $^{40}\text{Ar}$  in troctolite 76535 and evidence for enhanced  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  age plateaus (abs). Lunar Sci. VI, 417-419. Lunar Planetary Institute, Houston
- Huneke J.C. and Wasserburg G.J. (1978)  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  ages of single orange glass balls and highland breccia phenocrysts (abs). Lunar Planet. Sci. IX, 567-569. Lunar Planetary Institute, Houston
- Huneke J.C., Jessberger E.K., Podosek F.A. and Wasserburg G.J. (1973)  $^{40}\text{Ar}$ / $^{39}\text{Ar}$  measurements in Apollo 16 and 17 samples and the chronology of metamorphic and volcanic activity in the Taurus-Littrow region. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1725-1756.
- Huneke J.C., Radicati di Brozolo F. and Wasserburg G.J. (1977)  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  measurements on lunar highlands rocks with primitive  $^{87}\text{Sr}$ / $^{86}\text{Sr}$  (abs). Lunar Sci. VIII, 481-483. Lunar Planetary Institute, Houston
- Hunter R.H. and Taylor L.A. (1981) Rust and schreibersite in Apollo 16 highland rocks: Manifestations of volatile-element mobility. Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf. 253-259.
- Hunter R.H. and Taylor L.A. (1983) The magma ocean from the Fra Mauro shoreline: An overview of the Apollo 14 crust. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 88, A591-A602.
- Husain L. (1972)  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  and cosmic ray exposure ages of the Apollo 15 crystalline rocks, breccias and glasses (abs). In The Apollo 15 Lunar Samples. 374-375. Lunar Planetary Institute, Houston
- Husain L. (1974)  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  chronology and cosmic ray exposure ages of the Apollo 15 samples. J. Geophys. Res. 79, 2588-2606.
- Husain L. and Schaeffer O.A. (1973) Lunar volcanism: Age of the glass in the Apollo 17 orange soil. Science 180, 1358-1360.
- Husain L. and Schaeffer O.A. (1975) Lunar evolution: The first 600 million years. Geophys. Res. Lett. 2, 29-32.

Husain L., Sutter J.F. and Schaeffer O.A. (1971) Ages of crystalline rocks from Fra Mauro. *Science* 173, 1235-

Hutcheon I.D. (1975a) Microcraters in oriented vugs - evidence for an anisotropy in the micrometeoroid flux (abs). *Lunar Sci. VI*, 420-422. Lunar Planetary Institute, Houston

Hutcheon I.D. (1975b) Micrometeorites and solar flare particles in and out of the ecliptic. *J. Geophys. Res.* 80, 4471-4483.

Hutcheon I.D. and Price P.B. (1972) Plutonium-244 fission tracks: Evidence in a lunar rock 3.95 billion years old. *Science* 176, 909-911.

Hutcheon I.D., Phakey P.P. and Price P.B. (1972) Studies bearing on the history of lunar breccias. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 2845-2866.

Hutcheon I.D., Macdougall D. and Price P.B. (1974a) Improved determination of the long-term average Fe spectrum from 1 to 460 MeV/amu. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 2561-2576.

Hutcheon I.D., Macdougall D. and Stevenson J. (1974b) Apollo 17 particle track studies: surface residence times and fission track ages for orange glass and large boulders. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 2597-2608.

Hutcheon I.D., Macdougall D. and Price P.B. (1974c) Rock 72315: A new lunar standard for solar flare and micrometeorite exposure (abs). *Lunar Sci. V*, 378-380. Lunar Planetary Institute, Houston

Imamura M., Finkel R.C. and Wahlen M. (1973) Depth profile of  $^{53}\text{Mn}$  in the lunar surface. *Earth Planet. Sci. Lett.* 20, 107-112.

Imamura M., Nishiizumi K., Honda M., Finkle R.C., Arnold J.R. and Kohl C.P. (1974) Depth profiles of  $^{53}\text{Mn}$  in Lunar Rocks and Soils. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 2093-2104.

Ireland T. and Wlotzke F. (1992) The oldest zircons in the solar system. *Earth Planet. Sci. Lett.* 109, 1-10.

Irving A.J. (1975) Chemical, mineralogical, and textural systematics of non-mare melt rocks: implications for lunar impact and volcanic processes. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 363-394.

Irving A.J. (1977a) Chemical and experimental constraints on the genesis of Apollo 15 and Apollo 17 KREEP basalts (abs). *Lunar Sci. VIII*, 493-495. Lunar Planetary Institute, Houston

Irving A.J. (1977b) Chemical variation and fractionation of KREEP basalt magmas. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 2433-2448.

Irving A.J., Merrill R.B. and Singleton D.E. (1978) Experimental partitioning of rare earth elements and scandium among armalcolite, olivine, and mare basalt liquids. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 601-612.

Irving A.J., Steele I.M. and Smith J.V. (1974) Lunar noritic fragments and associated diopside veins. *Am. Mineral.* 59, 1062-1068.

Ishii T., Miyamoto M. and Takeda H. (1976) Pyroxene geothermometry and crystallization, subsolidus equilibration temperatures of lunar and, achondritic pyroxenes (abs). *Lunar Sci. VII*, 408-410. Lunar Planetary Institute, Houston

Ishii T., McCallum I.S. and Ghose S. (1980) Multiple impact history of a genomict breccia 73217 as inferred from pyroxene crystallization sequences (abs). *Lunar Planet. Sci. XI*, 499-501. Lunar Planetary Institute, Houston

Ishii T., Ghose S. and McCallum I.S. (1981) Inversion, decomposition, and exsolution phenomena of lunar pyroxenes observed in breccia 73217 (abs). *Lunar Planet. Sci.* XII, 494-496.

Ishii T., McCallum S. and Ghose S. (1983) Petrological and thermal histories of a lunar breccia 73217 as inferred from pyroxene crystallization sequences, exsolution phenomena, and pyroxene geothermometry. *Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res.* 88, A631-A644.

Ivanov A.V., Tarsov L.S., Rode O.D., and Florensky K.P. (1973) Comparative characteristics of regolith samples delivered from the lunar mare and highland regions by automatic stations Luna 16 and Luna 20. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 351-364.

Jackson E.D., Sutton R.L. and Wilshire H.G. (1975) Structure and petrology of a cumulus norite boulder sampled by Apollo 17 in Taurus-Littrow valley, the Moon. *Geol. Soc. Am. Bull.* 86, 433-442.

Jacobsen S.B. (2005) The Hf-W isotopic system and the origin of the earth and moon. *Ann. Rev. Earth Sci.* 531-570.

Jagodzinski H. and Korekawa M. (1975) Diffuse scattering by domains in lunar and terrestrial plagioclases (abs). *Lunar Sci. VI*, 429-431. Lunar Planetary Institute, Houston

Jagodzinski H., Korekawa M., Muller W.F. and Schropfer L. (1975a) X-ray diffraction and electron microscope studies of clinopyroxenes from lunar basalts 75035 and 75075. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 773-778.

Jagodzinski H., Korekawa M., Muller W.F. and Schropfer L. (1975b) X-ray study of clinopyroxenes of lunar basalts 75035 and 75075 (abs). *Lunar Sci. VI*, 432-434. Lunar Planetary Institute, Houston

Jakes P., Warner J., Ridley W.I., Reid A.M., Harmon R.S., Brett R. and Brown R.W. (1972) Petrology of a portion of the Mare Fecunditatis regolith. *Earth Planet. Sci. Lett.* 12, 257-271.

James O.B. (1970) Petrology of lunar microbreccia 12013,6. *Interagency Report: Astrogeology* 23.

James O.B. (1972) Lunar anorthosite 15415: Texture, mineralogy and metamorphic history. *Science* 175, 432-436.

James O.B. (1973) Crystallization history of lunar feldspathic basalt 14310. *U.S. Geol. Survey Prof. Paper* 841, 29 pages.

James O.B. (1975) Petrography of the matrix of light gray (consortium) breccia 73215 (abs). *Lunar Sci. VI*, 438-440. Lunar Planetary Institute, Houston

James O.B. (1976a) Petrology of aphanitic lithologies in consortium breccia 73215. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 2145-2178.

James O.B. (1976b) Petrology of aphanitic lithologies in consortium breccia 73215 (abs). *Lunar Sci. VII*, 420-422. Lunar Planetary Institute, Houston

James O.B. (1977a) Petrology of four clasts from consortium breccia 73215 (abs). *Lunar Sci. VIII*, 502-504. Lunar Planetary Institute, Houston

James O.B. (1980) Rocks of the early lunar crust. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 365-393.

James O.B. (1981) Petrologic and age relations of the Apollo 16 rocks: Implications for subsurface geology and the age of the Nectaris Basin. *Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf.* 209-233.

James O.B. (1982) Subdivision of the Mg-suite plutonic rocks into Mg-norites and Mg-gabbro-norites (abs). *Lunar Planet. Sci.* XIII, 360-362. Lunar Planetary Institute, Houston

James O.B. (1993) The ancient lunar crust, Apollo 17 region (abs). In *Workshop on Geology of the Apollo 17 Landing Site*. LPI Tech. Rpt. 92-09, 17-18. Lunar Planetary Institute, Houston

James O.B. (1994) Siderophile and volatile elements in Apollo 17 impact melts (abs). *Lunar Planet. Sci.* XXV, 617-618. Lunar Planetary Institute, Houston

James O.B. (1995) Siderophile elements in lunar impact melts: Nature of the impactors (abs). *Lunar Planet. Sci.* XXVI, 671-672. Lunar Planetary Institute, Houston

James O.B. (1996) Siderophile elements in lunar impact melts define nature of the impactors (abs). *Lunar Planet. Sci.* XXVII, 603-604. Lunar Planetary Institute, Houston

James O.B. and Jackson E.D. (1970) Petrology of the Apollo 11 ilmenite basalts. *J. Geophys. Res.* 75, 5793-5824.

James O.B. and Wright T.L. (1972) Apollo 11 and 12 mare basalts and gabbros: Classification, compositional variations and possible petrogenetic relations. *Geol. Soc. Am. Bull.* 83, 2357-2382.

James O.B. and Blanchard D.P. (1976) Consortium studies of light-gray breccia 73215: Introduction, subsample distribution data, and summary of results. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 2131-2143.

James O.B. and Hammarstrom J.G. (1977) Petrology of four clasts from consortium breccia 73215. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 2459-2494.

James O.B. and Hedenquist J.W. (1978a) Consortium breccia 73255: Petrology of aphanitic lithologies (abs). *Lunar Planet. Sci.* IX, 585-587. Lunar Planetary Institute, Houston

James O.B. and Hedenquist J.W. (1978b) Spinel-bearing troctolitic basalt 73215,170: Texture, mineralogy, and history (abs). *Lunar Planet. Sci.* IX, 588-590. Lunar Planetary Institute, Houston

James O.B. and Marti K. (1977) Consortium breccia 73255: Matrix petrography and exposure history (abs). *Lunar Sci.* VIII, 505-507. Lunar Planetary Institute, Houston

James O.B. and McGee J.J. (1979a) Consortium breccia 73255: Genesis and history of two coarse-grained "norite" clasts. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 713-743.

James O.B. and McGee J.J. (1979b) Consortium breccia 73255: Genesis and history of two coarse-grained "norite" clasts (abs). *Lunar Planet. Sci.* X, 616-618. Lunar Planetary Institute, Houston

James O.B. and McGee J.J. (1980a) Petrology of mare-type basalt clasts from consortium breccia 73255. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 67-86.

James O.B. and McGee J.J. (1980b) Petrology of ancient mare-type basalt clasts from breccia 73255 (abs). *Lunar Planet. Sci.* XI, 505 -507. Lunar Planetary Institute, Houston

James O.B. and McGee J.J. (1980c) Petrology of felsite clasts from Consortium breccia 73255 (abs). *Lunar Planet. Sci.* XI, 508-510. Lunar Planetary Institute, Houston

James O.B., Brecher A., Blanchard D.P., Jacobs J.W., Brannon J.C., Korotev R.L., Haskin L.A., Higuchi H., Morgan J.W., Anders E., Silver L.T., Marti K., Braddy D., Hutcheon I.D., Kirsten T., Kerridge J.F., Kaplan I.R., Pillinger C.T. and Gardiner L.R. (1975a) Consortium studies of matrix of light gray breccia 73215. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 547-577.

James O.B., Marti K., Braddy D., Hutcheon I.D., Brecher A., Silver L.T., Blanchard D.P., Jacobs J.W., Brannon J.C., Korotev R.L. and Haskin L.A. (1975b) Consortium studies of matrix of light gray breccia 73215 (abs). *Lunar Sci.* VI, 435-437. Lunar Planetary Institute, Houston

James O.B., Blanchard D.P., Jacobs J.W., Brannon J.C., Haskin L.A., Brecher A., Compston W., Marti K., Lugmair G.W., Gros J., Takahashi H. and Braddy D. (1976) Consortium studies of aphanitic lithologies and two anorthositic gabbro clasts in breccia 73215 (abs). *Lunar Sci.* VII, 423-525. Lunar Planetary Institute, Houston

James O.B., Hedenquist J.W., Blanchard D.P., Budahn J.R. and Compston W. (1978) Consortium breccia 73255: Petrology, major and trace element chemistry, and Rb-Sr systematics of aphanitic lithologies. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 789-819.

James O.B. and Flohr M.K. (1983) Subdivision of the Mg-suite noritic rocks into Mg-gabbronorites and Mg-norites. *Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res.*, A603-A614.

James O.B., Flohr M.K. and Lindstrom M.M. (1984) Petrology and geochemistry of lunar dimict breccia 61015. *Proc. 15<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res.* 89, C63-C86.

James O.B., Lindstrom M.M. and Flohr M.K. (1987) Petrology and geochemistry of alkali gabbronorites from lunar breccia 67975. *Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res.* E314-E330.

James O.B., Lindstrom M.M. and McGee J.J. (1991) Lunar ferroan anorthosite 60025: Petrology and chemistry of mafic lithologies. *Proc. 21<sup>st</sup> Lunar Planet. Sci. Conf.* 63-87. Lunar Planetary Institute, Houston

James O.B. and Lindstrom M.M. (1991) Apollo 16 dimict breccias: I. Sample 64425 (abs). *Lunar Planet. Sci.* VII, 635-636.

James O.B., Floss C. and McGee J.J. (2002) Rare earth element variations resulting from inversion of pigeonite and subsolidus reequilibration in ferroan anorthosites. *Geochim. Cosmochim. Acta* 65, 1269-1284.

James O.B., Ash R.D., McDonough W.F., Puchtel I.S. and Walker R.J. (2007) Fractionation and volatile redistribution of siderophile elements in metal grains from Lunar impact-melt breccia 76215 (abs). *Lunar Planet. Sci.* 38, #1094. Lunar Planetary Institute, Houston

Janghorbani M., Miller M.D., Ma M-S., Chyi L.L. and Ehmann W.D. (1973) Oxygen and other elemental abundance data for Apollo 14, 15, 16 and 17 samples. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1115-1126.

Jarosewich E. and Mason B. (1977) Compositions of lunar basalts 10069, 10071 and 12008. In *Lunar Sample Studies*. (ed. W. Phinney) NASA SP-418

Jeanloz R.F. and Ahrens T.J. (1976) Alkali mobility in shocked basalt (abs). *Lunar Sci.* VII, 428-430. Lunar Planetary Institute, Houston

Jerde E.A., Warren P.H., Morris R.V., Heiken G.H. and Vaniman D.T. (1987) A potpourri of regolith breccias: "New" samples from the Apollo 14, 16 and 17 landing sites. *Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res.* 92, E526-E536.

Jerde E.A., Snyder G.A., taylor L.A., Liu Y.-G. and Schmitt R.A. (1994) The origin and evolution of lunar high-Ti basalts: Periodic melting of a single source at Mare Tranquillitatis. *Geochim. Cosmochim. Acta* 58, 515-527.

Jerome D.Y., Philippot J.C. and Brichet E. (1972) Determination of 29 elements in Luna 16 soil by non-destructive activation analysis. *Earth Planet. Sci. Lett.* 13, 436-440.

- Jessberger E.K. (1979) Ancient pink-spinel-bearing troctolitic basalt in Apollo 17 breccia 73215 (abs). *Lunar Planet. Sci.* X, 625-627. Lunar Planetary Institute, Houston
- Jessberger E.K., Huneke J.C. and Wasserburg G.J. (1974) Evidence for a ~ 4.5 aeon age of plagioclase clasts in a lunar highland breccia. *Nature* 248, 199-202.
- Jessberger E.K., Horn P. and Kirsten T. (1975)  $^{39}\text{Ar}$ - $^{40}\text{Ar}$  dating of lunar rocks: A methodical investigation of mare basalt 75075 (abs). *Lunar Sci. VI*, 441-443. Lunar Planetary Institute, Houston
- Jessberger E.K., Kirsten T. and Standacher T. (1976a) Argon-argon ages of consortium breccia 73215. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 2201-2215.
- Jessberger E.K., Kirsten T. and Staudacher T. (1976b) Ages of plutonic clasts in consortium breccia 73215 (abs). *Lunar Sci. VII*, 431-433. Lunar Planetary Institute, Houston
- Jessberger E.K., Dominik B., Kirsten T. and Staudacher T. (1977a) New 40Ar-39Ar ages of Apollo 16 breccias and 4.42 AE old anorthosites (abs). *Lunar Sci. VIII*, 511-513. Lunar Planetary Institute, Houston
- Jessberger E.K., Kirsten T. and Staudacher T. (1977b) One rock and many ages - further K-Ar data on consortium breccia 73215. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 2567-2580.
- Jessberger E.K., Staudacher T., Dominik B. and Kirsten T. (1978) Argon-argon ages of aphanite samples from consortium breccia 73255. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 841-854.
- Jolliff B.L. (1991) Fragments of quartz-monazodiorite and felsite in Apollo 14 soil particles. *Proc. 21<sup>st</sup> Lunar Planet. Sci. Conf.* 101-118. Lunar Planetary Institute, Houston
- Jolliff B.L. (1999) Large scale separation of K-frac and REEP-frac in the source regions of Apollo impact-melt breccias, and a revised estimate of the KREEP composition. In Taylor Volume, GSA 135-154. Bellweather Press.
- Jolliff B.L., Korotev R.L. and Haskin L.A. (1991) Geochemistry of 2-4mm particles from Apollo 14 soil (14161) and implications regarding igneous components and soil forming processes. *Proc. 21<sup>st</sup> Lunar Planet. Sci. Conf.* 193-220. Lunar Planetary Institute, Houston
- Jolliff B.L., Haskin L.A., Colson R.O. and Wadhwa M. (1993) Partitioning in REE-saturating minerals: Theory, experiment, and modeling of whitlockite, apatite, and evolution of lunar residual magmas. *Geochim. Cosmochim. Acta* 57, 4069-4094.
- Jolliff B.L., Bishop K.M. and Haskin L.A. (1993) Possible petrogenetic associations among igneous components in North Massif Soils: Evidence in 2-4 mm soil particles from 76503. In Workshop on Geology of the Apollo 17 Landing Site. LPI Tech. Rpt. 92-09. Lunar Planetary Institute, Houston
- Jolliff B.L. and Haskin L.A. (1995) Cogenetic rock fragments from a lunar soil: evidence of a ferroan noritic-anorthosite pluton on the Moon. *Geochim. Cosmochim. Acta* 59, 2345-2374.
- Jolliff B.L., Rockow K.M., Korotev R.L. and Haskin L.A. (1996) Lithologic distributions and geologic history of the Apollo 17 site: The record in soils and small rock particles from the highlands massifs. *Meteoritics & Planet. Sci.* 31, 116-145.
- Jolliff B.L., Korotev R.L. and Rockow K.M. (1998) Geochemistry and petrology of lunar meteorite Queen Alexandra Range 94281, a mixed mare and highlands regolith breccia, with special emphasis on very-low-titanium mafic components. *Meteoritics & Planet. Sci.* 33, 581-601.

- Jolliff B.L., Gillis J.J., Haskin L.A., Korotev R.L. and Wieczorek M.A. (2000) Major lunar crustal terranes: Surface expressions and crust-mantle origins. *J. Geophys. Res.* 105, 4197-4216.
- Jolliff B.L., Korotev R.L., Zeigler R.A. and Floss C. (2003) Northwest Africa 773: Lunar mare breccia with a shallow-formed olivine-cumulate component, inferred very-lowTi (VLT) heritage, and a KREE connection. *Geochim. Cosmochim. Acta* 67, 4857-4879.
- Jolliff B.L., Hughes J.M., Freeman J.J. and Zeigler R.A. (2006) Crystal chemistry of lunar merrillite and composition of other meteoritic and planetary suites of whitlockite and merrillite. *Am. Mineral.* 91, 1583-1595.
- Jones J.H. and Drake M.J. (1993) Rubidium and cesium in the Earth and the Moon. *Geochim. Cosmochim. Acta* 57, 3785-3792.
- Jost D.T. and Marti K. (1982) Pu-Nd-Xe dating: Progress towards a "solar system" Pu/Nd ratio (abs). *Lunar Planet. Sci. XIII*, 371-372. Lunar Planetary Institute, Houston
- Jovanovic S., Jensen K. and Reed G.W. (1973a) The halogens, U, Li, Te and P<sub>2</sub>O<sub>5</sub> in five Apollo 17 soil samples. *EOS Trans. AGU* 54, 595-596.
- Jovanovic S. and Reed G.W. (1973b) Volatile trace elements and the characterization of the Cayley formation and the primitive lunar crust. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1313-1324.
- Jovanovic S. and Reed G.W. (1974a) Labile and nonlabile element relationships among Apollo 17 samples. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1685-1701. Lunar Planetary Institute, Houston
- Jovanovic S. and Reed G.W. (1974b) Labile trace elements in Apollo 17 samples (abs). *Lunar Sci. V*, 391-393. Lunar Planetary Institute, Houston
- Jovanovic S. and Reed G.W. (1975a) Cl and P<sub>2</sub>O<sub>5</sub> systematics: Clues to early lunar magmas. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1737-1751.
- Jovanovic S. and Reed G.W. (1975b) Soil breccia relationships and vapor deposits on the moon. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1753-1759.
- Jovanovic S. and Reed G.W. (1975c) History of Boulder 1 at Station 2, Apollo 17 based on trace element interrelationships. *The Moon* 14, 385-393.
- Jovanovic S. and Reed G.W. (1975d) Studies on regolith processes: Apollo 15 and 17 labile trace element implications (abs). *Lunar Sci. VI*, 451-453. Lunar Planetary Institute, Houston
- Jovanovic S. and Reed G.W. (1976a) Chemical fractionation of Ru and Os in the Moon. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 3437-3446.
- Jovanovic S. and Reed G.W. (1976b) Convection cells in the early lunar magma ocean: trace-element evidence. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 3447-3459.
- Jovanovic S. and Reed G.W. (1977) Trace element geochemistry and the early lunar differentiation. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 623-632.
- Jovanovic S. and Reed G.W. (1978) Trace element evidence for a laterally inhomogeneous Moon. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 59-80.
- Jovanovic S. and Reed G.W. (1979) Regolith layering processes based on studies of low-temperature volatile elements in Apollo core samples. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 1425-1435.

Jovanovic S. and Reed G.W. (1980a) Candidate samples for the earliest lunar crust. Proc. Conf. Lunar Highlands Crust, Geochim. Cosmochim. Acta, Suppl. 12. Pergamon Press. 101-111. Lunar Planetary Institute, Houston

Jovanovic S. and Reed G.W. (1980b)  $P_{205}$ , U and Br associated with mineral separates from a low and a high Ti mare basalt. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 125-134.

Jovanovic S. and Reed G.W. (1980c) Cl,  $P_{205}$ , Br and U partitioning among mineral separates from mare basalt 75055 (abs). Lunar Planet. Sci. XI, 517-519. Lunar Planetary Institute, Houston

Jovanovic S. and Reed G.W. (1981) Chlorine and phosphorus-bearing phases in lunar samples: The significance of C1/ $P_{205}$  ratios: A response (abs). Lunar Planet. Sci. XII, 516-519. Lunar Planetary Institute, Houston

Jovanovic S. and Reed G.W. (1983) The role of phosphorus in lunar samples - a chemical study. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. A705-A712.

Jovanovic S., Jensen K.J. and Reed G.W. (1976) Trace elements and the evolution of lunar rocks (abs). Lunar Sci. VII, 437-439. Lunar Planetary Institute, Houston

Jovanovic S., Jensen K.J. and Reed G.W. (1977) Further insights into the evolution of the early Moon: Convection cells, II. Ru-Os partitioning and mixing (abs). Lunar Sci. VIII, 516-518. Lunar Planetary Institute, Houston

Juan V.C., Chen J.C., Huang C.K., Chen P.Y. and Wang Lee C.M. (1972) Petrology and chemistry of some Apollo 14 lunar samples. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 687-705.

Jull A.J.T., Donahue D.J. and Reedy R.C. (1992)  $^{14}C$  depth profiles in lunar rock 68815 (abs). Lunar Planet. Sci. XXIII, 639-640. Lunar Planetary Institute, Houston

Jull A.J.T., Lal D. and Donahue D.J. (1995) Evidence for a non-cosmogenic implanted  $^{14}C$  component in lunar samples. Earth Planet. Sci. Lett. 136, 693-702.

Jull A.J.T., Cloudt S., Donahue D.J., Sisterson J.M., Reedy R.C. and Masarik J. (1998)  $^{14}C$  depth profiles in Apollo 15 and 17 cores and lunar rock 68815. Geochim. Cosmochim. Acta 62, 3025-3063.

Kaiser W.A. (1977) The excitation functions of Ba-Xe in the energy range 38-600 MeV; the use of cosmogenic xenon for estimating burial depths and real exposure ages. Phil. Trans. Roy. Soc. London A285, 337-362.

Karner J., Papike J.J. and Schearer C.K. (2003) Olivine from planetary basalts: Chemical signatures that indicate planetary parentage and those that record igneous setting and process. Am. Mineral. 88, 806-816.

Karner J., Papike J.J. and Schearer C.K. (2004) Plagioclase from planetary basalts: Chemical signatures that reflect planetary volatile budgets, oxygen fugacity, and styles of igneous differentiation. Am. Mineral. 89, 1101-1109.

Kaplan I.R. (1972) Distribution and isotopic abundance of biogenic elements in lunar samples. Space Life Sci. 3, 282-403.

Kaplan I.R. and Smith J.W. (1970) Carbon and sulfur concentration and isotopic composition in Apollo 11 luanr samples. Science 167, 541-543.

Keihm S.J. and Langseth M.G. (1973) Surface brightness temperatures at the Apollo 17 heat flow site: thermal conductivity of the upper 15 cm of regolith. Proc. 4<sup>th</sup> Lunar Sci. Conf. 2503-2513.

- Keil K., Dowty E. and Prinz M. (1974) Description, classification and inventory of 113 Apollo 17 rake samples from stations 1A, 2, 7 and 8. Curator's Catalog, pp. 149.
- Keil K., Warner R.D., Prinz M. and Dowty E. (1975) Rocks 60618 and 65785: Evidence for admixture of KREEP in lunar impact melts. *Geophys. Res. Lett.* 2, 369.
- Keith J.E., Clark R.S. and Richardson K.A. (1972) Gamma-ray measurements of Apollo 12, 14 and 15 lunar samples. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1671-1680.
- Keith J.E., Clark R.S. and Bennett L.J. (1974a) Determination of natural and cosmic ray induced radionuclides in Apollo 17 lunar samples. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 2121-2138.
- Keith J.E., Clark R.S. and Bennett L.J. (1974b) Determination of natural and cosmic ray induced radionuclides in Apollo 17 lunar samples (abs). *Lunar Sci. V*, 402-404. Lunar Planetary Institute, Houston
- Keller L.P. and McKay D.S. (1993) Discovery of vapor deposits in the lunar regolith. *Science* 261, 1305-1307.
- Kempa M.J., Papike J.J. and White C. (1980) The Apollo 16 regolith: A petrographically-constrained chemical mixing model. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 1341-1355.
- Kempa M.J. and Papike J.J. (1980) The Apollo 16 regolith: Comparative petrology of the >20 micron and 20-10 micron soil fractions, Lateral transport and differential volatilization. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 1635-1661.
- Kerridge J.F. (1975) Solar nitrogen: Evidence for a secular increase in the ratio of nitrogen-15 to nitrogen-14. *Science* 188, 162-164.
- Kerridge J.F., Kaplan I.R., Petrowski C. and Chang S. (1975) Light element geochemistry of Apollo 16 rocks and soils. *Geochim. Cosmochim. Acta* 39, 137-162.
- Kerridge J.F., Kim J.S., Kim Y. and Marti K. (1992) Evolution of isotopic signatures in lunar-regolith nitrogen: Noble gases and nitrogen in grain-size fractions from regolith breccia 79035. *Proc. 22<sup>nd</sup> Lunar Planet. Sci.* 215-224. Lunar Planetary Institute, Houston
- Kerridge J.F., Kim Y., Kim J. and Marti K. (1993) Nitrogen isotopic signatures in agglutinates from breccia 79035 (abs). *Lunar Planet. Sci. XXIV*, 795-796. Lunar Planetary Institute, Houston
- Kesson S.E. (1975a) Mare basalt petrogenesis. In Papers presented to the Conference on Origins of Mare Basalts and their Implications for Lunar Evolution (Lunar Science Institute, Houston), 81-85. Lunar Planetary Institute, Houston
- Kesson S.E. (1975b) Mare basalts: melting experiments and petrogenetic interpretations. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 921-944.
- Kesson S.E. (1975c) Melting experiments on synthetic mare basalts and their petrogenetic implications (abs). *Lunar Sci. VI*, 475-477. Lunar Planetary Institute, Houston
- Kesson S.E. (1975d) Experimental investigations of reaction coronas on olivine in Apollo 14 high-grade breccias. *Earth Planet. Sci. Lett.* 28, 65-68.
- Kesson S.E. (1977) Mare basalt petrogenesis. *Phil. Trans. Roy. Soc. London A285*, 159-168.
- Kesson S.E. and Lindsley D.H. (1976) Mare basalt petrogenesis – A review of experimental studies. *Rev. Geophys. Space Phys.* 14, 361-373.

Kesson S.E. and Ringwood A.E. (1976) Mare basalt petrogenesis in a dynamic Moon. *Earth Planet. Sci. Lett.* 30, 155-163.

Kimura K., Lewis R.S. and Anders E. (1974) Distribution of gold and rhenium between nickel-iron and silicate melts: Implications for the abundance of siderophile elements on the Earth and Moon. *Geochim. Cosmochim. Acta* 38, 683-701.

King E.A. (1977) The lunar regolith: physical characteristics and dynamics. *Phil. Trans. Roy. Soc. London A285*, 273-278.

King E.A., Butler J.C. and Carman M.F. (1972) Chondrules in Apollo 14 samples and size analyses of Apollo 14 and 15 fines. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 673-686.

Kirsten T. (1977) Rare gases implanted in lunar fines. *Phil. Trans. Roy. Soc. London A285*, 391-396.

Kirsten T., Horn P. and Kiko J. (1973) <sup>39</sup>Ar/<sup>40</sup>Ar dating and rare gas analysis of Apollo 16 rocks and soils. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1757-1784.

Kirsten T., Horn P. and Heymann D. (1973) Chronology of the Taurus-Littrow region. I Ages of two major rock types from the Apollo 17 site. *Earth Planet. Sci. Lett.* 20, 125-130.

Kirsten T. and Horn P. (1974a) Chronology of the Taurus-Littrow region III: ages of mare basalts and highland breccias and some remarks about the interpretation of lunar highland rock ages. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1451-1475.

Kirsten T. and Horn P. (1974b) <sup>39</sup>Ar-<sup>40</sup>Ar-chronology of the Taurus-Littrow region II: A 4.28 b.y. old troctolite and ages of basalts and highland breccias (abs). *Lunar Sci. V*, 419-421. Lunar Planetary Institute, Houston

Kirsten T., Horn P. and Heymann D. (1973a) Chronology of the Taurus-Littrow region I: Ages of two major rock types from the Apollo 17-site. *Earth Planet. Science Lett.* 20, 125-130.

Kirsten T., Horn P., Heymann D., Hubner W. and Storzer D. (1973b) Apollo 17 crystalline rocks and soils: Rare gases, ion tracks, and ages (abs). *EOS* 54, 595-597. AGU

Klein J., Middleton R., Fink D., Dietrich J.W., Aylmer D. and Herzog G.F. (1988) Beryllium- 10 and aluminum-26 contents of lunar rock 74275 (abs). *Lunar Planet. Sci. XIX*, 607-608. Lunar Planetary Institute, Houston

Klein L., Onorato P.I.K., Uhlmann D.R. and Hopper R.W. (1975a) Viscous flow, crystallization behaviour, and thermal histories of lunar breccias 70019 and 79155. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 579-593.

Klein L., Uhlmann D.R. and Hopper R.W. (1975b) Viscous flow, crystallization behaviour and thermal history of lunar breccias 70019 and 79155 (abs). *Lunar Sci. VI*, 481-483. Lunar Planetary Institute, Houston

Klein L.C. and Uhlmann D.R. (1976) The kinetics of lunar glass formation, revisited. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1113-1121.

Knoll H.-D. and Stöffler D. (1979) Characterization of the basic types of lunar highland breccias by quantitative textural analysis (abs). *Lunar Planet. Sci. X*, 673-675. Lunar Planetary Institute, Houston

Kohl C.P., Murell M.T., Russ G.P. III and Arnold J.R. (1978) Evidence for the constancy of the solar cosmic ray flux over the past ten million years: <sup>53</sup>Mn and <sup>26</sup>Al measurements. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 2299-2310.

- Korotev R.L. (1976) Geochemistry of grain-size fractions of soils from the Taurus-Littrow valley floor. Proc. 7<sup>th</sup> Lunar Planet. Sci. Conf. 695-726.
- Korotev R.L. (1981) Compositional trends in Apollo 16 soils. Proc. 12<sup>th</sup> Lunar Sci. Conf. 577-605.
- Korotev R.L. (1982) Apollo 16 soil compositions. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. A269-278.
- Korotev R.L. (1987) Mixing levels, the Apennine front soil component, and compositional trends in the Apollo 15 soils. Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 92, E411-E431.
- Korotev R.L. (1987) The meteorite component of Apollo 16 noritic impact melt breccias. Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. E491-E512.
- Korotev R.L. (1990) Cobalt and nickel concentrations in the “komatite component” of Apollo 16 polymict samples. Earth Planet. Sci. Lett. 96, 481-489.
- Korotev R.L. (1991) Geochemical stratigraphy of two regolith cores from the Central Highlands of the Moon. Proc. 21<sup>st</sup> Lunar Planet. Sci. Conf. 229-289. Lunar Planetary Institute, Houston
- Korotev R.L. (1993) The Apollo 17 regolith. In Workshop on Geology of the Apollo 17 Landing Site (abs). LPI Tech. Rpt. 92-09. 26-27. Lunar Planetary Institute, Houston
- Korotev R.L. (1994) Compositional variation in Apollo 16 impact-melt breccias and inferences for the geology and bombardment history of the Central Highlands of the Moon. Geochim. Cosmochim. Acta 58, 3931-3969.
- Korotev R.L. (1976a) Rare earths and other elements in two size fractions of soils from the Taurus-Littrow valley floor (abs). Lunar Sci. VII, 457-459. Lunar Planetary Institute, Houston
- Korotev R.L. (1976b) Geochemistry of grain-size fractions of soils from the Taurus-Littrow valley floor. Proc. 7<sup>th</sup> Lunar Sci. Conf. 695-726.
- Korotev R.L. (1982) Comparative geochemistry of Apollo 16 surface soils and samples from cores 64002 and 60002 thru 60007. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. A269-A278.
- Korotev R.L. (1996c) On the relationship between the Apollo 16 ancient regolith breccias and feldspathic fragmental breccias, and the composition of the prebasin crust in the Central Highlands of the Moon. Meteoritics & Planet. Sci. 31, 403-412.
- Korotev R.L. (1997) Some things we can infer about the Moon from the composition of the Apollo 16 regolith. Meteoritics & Planet. Sci. 32, 447-478.
- Korotev R.L. (1998) Concentrations of radioactive elements in lunar materials. J. Geophys. Res. 103, 1691-1701.
- Korotev R.L. (2000) The great lunar hot spot and the composition and origin of the Apollo mafic (“LKFM”) impact-melt breccias. J. Geophys. Res. 105, 4317-4345.
- Korotev R.L. and Haskin L.A. (1975) Inhomogeneity of trace element distributions from studies of the rare earths and other elements in size fractions of crushed basalt 70135. In Papers presented to the Conference on Origins of Mare Basalts and their Implications for Lunar Evolution (Lunar Science Institute, Houston), 86-90.
- Korotev R.L., Haskin L.A. and Lindstrom M.M. (1980) A synthesis of lunar highlands compositional data. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 395-429.

- Korotev R.L., Morris R.V. and Lauer H.V. (1984) Stratigraphy and geochemistry of the Stone Mountain Core (64001/2). Proc. 15<sup>th</sup> Lunar Planet. Sci. Conf. C143-160.
- Korotev R.L. and Haskin L.A. (1988) Europium mass balance in polymict samples and implications for plutonic rocks of the lunar crust. Geochim. Cosmochim. Acta 52, 1795-1813.
- Korotev R.L. and Kremser D. (1992) Compositional variations in Apollo 17 soils and their relationships to the geology of the Taurus-Littrow site. Proc. 22<sup>nd</sup> Lunar Planet. Sci. Conf. 275-301.
- Korotev R.L. and Morris R.V. (1993) Composition of Apollo 16 regolith core 60013/14. Geochim. Cosmochim. Acta 57, 4813-4826.
- Korotev R.L., Haskin L.A. and Jolliff B.L. (1995) A simulated geochemical rover mission to the Taurus-Littrow valley of the Moon. J. Geophys. Res. 100, 14403-14420.
- Korotev R.L., Jolliff B.L. and Rockow K.M. (1996) Lunar meteorite Queen Alexandra Range 93069 and the iron concentration of the lunar highlands surface. Meteoritics & Planet. Sci. 31, 909-924.
- Korotev R.L. and Gillis J.J. (2001) A new look at the Apollo 11 regolith and KREEP. J. Geophys. Res. 106, 12339-12353.
- Korotev R.L., Morris R.V., Jolliff B.L. and Schwarz C. (1997) Lithological variation with depth and decoupling of maturity parameters in Apollo 16 regolith core 68001/2. Geochim. Cosmochim. Acta 61, 2989-3002.
- Korotev R.L., Jolliff B.L., Zeigler R.A., Gillis J.J. and Haskin L.A. (2003) Feldspathic lunar meteorites and their implications for compositional remote sensing of the lunar surface and the composition of the lunar crust. Geochim. Cosmochim. Acta 67, 4895-4923.
- Kothari B.K. and Goel P.S. (1973) Nitrogen in Lunar Samples. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1587-1596.
- Krahenbuhl U., Ganapathy R., Morgan J.W. and Anders E. (1973a) Volatile elements in Apollo 16 samples: Possible evidence for outgassing of the Moon. Science 180, 858-861.
- Krahenbuhl U., Ganapathy R., Morgan J.W. and Anders E. (1973b) Volatile elements in Apollo 16 samples: Implications for highland volcanism and accretion history of the moon. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1325-1348.
- Krahenbuhl U. (1980) Distribution of volatile and non volatile elements in grain-size fractions of Apollo 17 drive tube 74001/2. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 1551-1564.
- Kratschmer W. and Gentner W. (1976) The long-term average of the galactic cosmic-ray iron group composition studied by the track method. Proc. 7<sup>th</sup> Lunar Sci. Conf. 501-511.
- Kramer F.E., Twedell D.B. and Walton W.J.A. (1977) Apollo 11 Lunar Sample Information Catalogue (revised). Curator's Office, JSC 12522
- Kreutzberger M.E., Drake M.J. and Jones J.H. (1986) Origin of the Earth's moon: Constraints from alkali volatile trace elements. Geochim. Cosmochim. Acta 50, 91-98.
- Kridelbaugh S.J. and Weill D.F. (1973) The mineralogy and petrology of ilmenite basalt 75055 (abs). EOS 54, 597-598. AGU
- Kridelbaugh S.J., McKay G.A. and Weill D.F. (1973) Breccias from the lunar highlands: Preliminary petrographic report on Apollo 16 samples 60017 and 63335. Science 179,

- Kring D.A. and Cohen B.A. (2002) Cataclysmic bombardment throughout the inner solar system 3.9 – 4.0 Ga. *J. Geophys. Res.* 107, E2
- Kurat G., Keil K., Prinz M. and Nehru C.E. (1972) Chondrules of lunar origin. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 707-721.
- Kurat G., Keil K. and Prinz M. (1974a) Petrology of some lithic fragments of alkalic high-alumina basalt composition from Apollo 12 coarse fines. *TMPM* 21, 179-195.
- Kurat G., Keil K., and Prinz M. (1974b) Rock 14318: A polymict lunar breccia with chondritic texture. *Geochim. Cosmochim. Acta* 38, 1133-1146.
- Kushiro I. and Haramura H. (1971) Major element variation and possible source materials of Apollo 12 crystalline rocks. *Science* 171, 1235-1237.
- Kushiro I., Ikeda Y. and Nakamura Y. (1972) Petrology of Apollo 14 high-alumina basalt. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 115-129.
- Labotka T.C., Vaniman D.T. and Papike J.J. (1979) The Apollo 17 drill core: Comparative modal petrology and phase chemistry of the >20 micron and <20 micron soil fractions. *Geophys. Res. Lett.* 6, 503-506.
- Labotka T.C., Kempa M.J., White C., Papike J.J. and Laul J.C. (1980) The lunar regolith: Comparative petrology of the Apollo sites. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 1285-1305.
- Lakatos S., Heymann D. and Yaniv A. (1973) Green spherules from Apollo 15: Inferences about their origin from inert gas measurements. *The Moon* 7, 132.
- Lal D. (1972) Hard rock cosmic ray archeology. *Space Sci. Rev.* 14, 3-102.
- Lal D. (1977) Irradiation and accretion of solids in space based on observations of lunar rocks and grains. *Phil. Trans. Roy. Soc. London* A285, 69-96.
- Lally J.S., Fischer R.M., Christie J.M., Griggs D.T., Heuer A.H., Nord G.L. and Radcliffe S.V. (1972) Electron petrography of Apollo 14 and 15 rocks. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 401-422.
- Lally J.S., Christie J.M., Nord G.L. and Heuer A.H. (1976a) Deformation, recovery, and recrystallization of lunar dunite 72417. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1845-1863.
- Lally J.S., Christie J.M., Heuer A.H. and Nord G.L. (1976b) Electron microscopy of lunar dunite 72417 (abs). *Lunar Sci. VII*, 468-470. Lunar Planetary Institute, Houston
- Lambert G., Le Rouelle J.C. and Bristeau P. (1977) Accumulation and circulation of gaseous radon between lunar fines. *Phil. Trans. Roy. Soc. London* A285, 331-336.
- Langevin T.C. and Naugle J.S. (1980) The depositional history of the Apollo deep drill core: A reappraisal. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 1415-1434.
- Langevin Y. and Arnold J.R. (1977) The evolution of the lunar regolith. *Ann. Rev. Earth Planet. Sci.* 5, 449-489.
- Laul J.C., Wakita H., Showalter D.L., Boyton W.V. and Schmitt R.A (1972) Bulk, rare earth, and other trace elements in Apollo 14 and 15 and Luna 16 samples. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1181-1200.
- Laul J.C. and Schmitt R.A. (1973) Chemical composition of Apollo 15, 16, and 17 samples. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1349-1367.

Laul J.C. and Schmitt R.A. (1974a) Chemical composition of boulder-2 rocks and soils, Apollo 17, Station 2. *Earth Planet. Sci. Lett.* 23, 206-219.

Laul J.C. and Schmitt R.A. (1974b) Chemical composition of Apollo 17 boulder-2 rocks and soils (abs). *Lunar Sci. V*, 438-440. Lunar Planetary Institute, Houston

Laul J.C. and Schmitt R.A. (1974c) Siderophile and volatile trace elements in Apollo 17 boulder-2 rocks and soils (abs). *Lunar Sci. V*, 441-443. Lunar Planetary Institute, Houston

Laul J.C., Hill D.W. and Schmitt R.A. (1974d) Chemical studies of Apollo 16 and 17 samples. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1047-1066.

Laul J.C. and Schmitt R.A. (1975a) Dunite 72417: A chemical study and interpretation. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1231-1254.

Laul J.C. and Schmitt R.A. (1975b) Dunite 72417: A chemical study (abs). *Lunar Sci. VI*, 495-497. Lunar Planetary Institute, Houston

Laul J.C. and Schmitt R.A. (1975c) Chemical composition of Apollo 17 samples: Boulder breccias (2), rake breccias (8), and others (abs). *Lunar Sci. VI*, 489-491. Lunar Planetary Institute, Houston

Laul J.C., Keys R.R., Ganapathy R. and Anders E. (1970) Abundance of 14 trace elements in lunar rock 12013,10. *Earth Planet. Sci. Lett.* 9, 211-215.

Laul J.C., Wakita H., Showalter D.L., Boynton W.V. and Schmitt R.A. (1972) Bulk, rare earth, and other trace elements in Apollo 14 and 15 and Luna 16 samples. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1181-1200.

Laul J.C., Hill D.W. and Schmitt R.A. (1974) Chemical studies of Apollo 16 and 17 samples. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1047-1066.

Laul J.C., Murali A.V., Schmitt R.A. and Wakita H. (1975a) Apollo 17 basalts and lunar evolution constraints. In Conference on Origins of Mare Basalts and their Implications for Lunar Evolution (Lunar Science Institute, Houston), 91-93.

Laul J.C., Schmitt R.A., Robyn M. and Goles G.G. (1975b) Chemical composition of 18 Apollo 17 rake basalts and one basalt-breccia (abs). *Lunar Sci. VI*, 492-494. Lunar Planetary Institute, Houston

Laul J.C., Vaniman D.T. and Papike J.J. (1978) Chemistry, mineralogy and petrology of seven >1mm fragments from mare Crisium. In Mare Crisium: The View from Luna 24. (ed. Merrill and Papike) 537-568. Lunar Planetary Institute, Houston

Laul J.C., Lepel E.A., Vaniman D.T. and Papike J.J. (1979) The Apollo 17 drill core: Chemical systematics of the grain size fractions. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 1269-1298.

Laul J.C. and Papike J.J. (1980) The lunar regolith: Comparative chemistry of the Apollo sites. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 1307-1340.

Laul J.C. and Papike J.J. (1980) The Apollo 17 drill core: Chemistry of size fractions and the nature of the fused soil component. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 1395-1413.

Laul J.C., Rode O.D., Simon S.B. and Papike J.J. (1987) The lunar regolith: Chemistry and petrology of Luna 24 ultra-fine gain size fractions. *Geochim. Cosmochim. Acta* 51, 661-673.

Lawrence S.J., Taylor G.J., Norman M.D. and Keil K. (2007) Trace element geochemistry of Apollo 17 mafic impact melt breccias (abs). *Lunar Planet. Sci.* 38, #1696. Lunar Planetary Institute, Houston

- Le Bas M.J. (2001) Report of the working party on the classification of the lunar igneous rocks. *Meteoritics & Planet. Sci.* 36, 1183-1188.
- Lee D-C., Halliday A.N., Snyder G.A. and Taylor L.A. (1997) Age and origin of the Moon. *Science* 278, 1098-1103.
- Lee D-C., Halliday A.N., Snyder G.A. and Taylor L.A. (2000) Lu-Hf systematics and evolution of the moon. (abs) *Lunar Planet. Sci. XXXI*, #1288 Lunar Planetary Institute, Houston
- Lee D.C., Halliday A.N., Leya I., Wieler R. and Weichert U. (2002) Cosmogenic tungsten and the origin and earliest differentiation of the Moon. *Earth Planet. Sci. Lett.* 198, 267-274.
- Leich D.A., Tombrello T.A. and Burnett D.S. (1973) The depth distribution of hydrogen and fluorine in lunar samples. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1597-1612.
- Leich D.A., Goldberg R.H., Burnett D.S. and Tombrello T.A. (1974) Hydrogen and fluorine in the surfaces of lunar samples. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1869-1884.
- Leich D.A., Kahl S.B., Kirschbaum A.R., Niemeyer S. and Phinney D. (1975a) Rare gas constraints on the history of Boulder 1, Station 2, Apollo 17. *The Moon* 14, 407-444.
- Leich D.A., Kahl S.B., Kirschbaum A.R., Niemeyer S. and Phinney D. (1975b) Rare gas studies on Boulder 1, Station 2, Apollo 17 (abs). *Lunar Sci. VI*, 501-503. Lunar Planetary Institute, Houston
- Leich D.A. and Niemeyer S. (1975) Trapped xenon in lunar anorthosite breccia 60015. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1953-1965.
- Levsky L.K., Verchovski A.B. and Choref A.N. (1981) Argon and xenon adsorption on mineral surfaces: Cosmochemical and geochemical consequences (abs). *Lunar Planet. Sci. XII*, 613-615. Lunar Planetary Institute, Houston
- Lindsay J.F. (1971) Mixing models and the recognition of end-member groups in Apollo 11 and 12 soils. *Earth Planet. Sci. Lett.* 12, 67-72.
- Lindsay J.F. (1972) Development of soil on the lunar surface. *J. Sediment. Petrol.* 42, 876-888.
- Lindsay J.F. (1976) **Lunar Stratigraphy and Sedimentology**. Elsevier, N.Y.
- Lindsley D.H., King H.E. and Turnock A.C. (1974) Composition of synthetic agugite and hypersthene coexisting at 810 deg C: Application to pyroxenes from the lunar highland rocks. *Geophys. Res. Lett.* 1, 134-136.
- Lindstrom D.J., Wentworth S.J., Martinez R. R. and McKay D.S. (1994) Trace element identification of three chemically distinct VLT basalt glasses from Apollo 17. *Geochim. Cosmochim. Acta* 58, 1367-1375.
- Lindstrom D.J., Wentworth S.J., Martinez R.R. and McKay D.S. (1993) Geochemistry of HASP, VLT and other glasses from the double drive tube 79001/2 (abs). In *Workshop on Geology of the Apollo 17 Landing Site. LPI Tech. Rpt. 92-09*. 27-28. Lunar Planetary Institute, Houston
- Lindstrom M.M. (1985) Compositional distinctions among lunar granulites (abs). *Lunar Planet. Sci. XVI*, 491-492. Lunar Planetary Institute, Houston
- Lindstrom M.M. (1986) Diversity of rock types in Apennine Front breccias (abs). *Lunar Planet. Sci. XVII*, 486-487. Lunar Planetary Institute, Houston

Lindstrom M.M., Duncan A.R., Fruchter J.S., McKay S.M., Stoeser J.W., Goles G.G. and Lindstrom D.J. (1972) Compositional characteristics of some Apollo 14 clastic materials. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1201-1214.

Lindstrom M.M. and Haskin L.A. (1978) Causes of compositional variations within mare basalt suites. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 465-486.

Lindstrom M.M., Knapp S.A., Shervais J.W. and Taylor L.A. (1984) Magnesian anorthosites and associated troctolites and dunite in Apollo 14 breccias. Proc. 15<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 89, C41-C49.

Lindstrom M.M. and Lindstrom D.J. (1986) Lunar granulites and their precursor anorthositic norites of the early lunar crust. Proc. 16<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 91, D263-D276.

Lindstrom M.M. and Marvin U.B. (1987) Geochemical and petrological studies of clasts in Apennine Front breccia 15459 (abs). Lunar Planet. Sci. XVIII, 554-555. Lunar Planetary Institute, Houston.

Lindstrom M.M., Marvin U.B., Vetter S.K. and Shervais J.W. (1988) Apennine front revisited: Diversity of Apollo 15 highland rock types. Proc. 18<sup>th</sup> Lunar Planet. Sci. Conf. 169-185. Lunar Planetary Institute, Houston.

Lindstrom M.M., Marvin U.B. and Mittlefehldt D.W. (1989a) Apollo 15 Mg- and Fe-norites: A redefinition of the Mg-suite differentiation trend. Proc. 19<sup>th</sup> Lunar Planet. Sci. Conf. 245-254. Lunar Planetary Institute, Houston

Lindstrom M.M., Marvin U.B., Holmberg B.B. and Mittlefehldt D.W. (1989b) Geochemistry and petrology of recrystallized gabbroic breccias from the Apollo 15 site (abs). Lunar Planet. Sci. XX, 576-577. Lunar Planetary Institute, Houston

Lindstrom M.M., Marvin U.B., Holmberg B.B. and Mittlefehldt D.W. (1990) Apollo 15 KREEP-poor impact melts. Proc. 20<sup>th</sup> Lunar Planet. Sci. Conf. 77-90. Lunar Planetary Institute, Houston.

Lindstrom M.M., Schwartz C., Score R. and Mason B. (1991) MacAlpine Hills 88104 and 88105 lunar highland meteorites: Geneeral description and consortium overview. Geochim. Cosmochim. Acta 55, 2999-3007.

Lingner S. (1989) Aufbau und Genese der oberen lunaren Kruste im Hochland und Fra Mauro (Apollo 14). Ph.D. dissertation. Munster

Lingner S., Bobe K.D., Palme H., Spettel B., Stöffler D. and Wanke H. (1989) Fra Mauro Formation, Apollo 14: I Composition and frequency distribution of igneous and metamorphic rocks. In Workshop on the Moon in Transition: Apollo 14, KREEP and evolved rocks. (eds. Taylor and Warren) LPI Tech Rpt. 89-03, 58-61. Lunar Planetary Institute, Houston.

Lingner S., Spettel B. and Stöffler D. (1989) Fra Mauro Formation, Apollo 14: II I Calculated composition of the primordial lunar crust in the Imbrium region. In Workshop on the Moon in Transition: Apollo 14, KREEP and evolved rocks. (eds. Taylor and Warren) LPI Tech Rpt. 89-03, 62-65. Lunar Planetary Institute, Houston.

Levine J., Becker T.A., Muller R.A. and Renne P.R. (2005) 40Ar/39Ar dating of Apollo 12 impact spherules. Geophys. Res. Lett. 32, L15201.

Lofgren G.E. (1971) Spherulitic textures in glassy and crystalline rocks. J. Geophys. Res. 76, 5635-5648.

Lofgren G.E. (1977) Dynamic crystallization experiments bearing on the origin of textures in impact-generated liquids. Proc. 8<sup>th</sup> Lunar Sci. Conf. 2079-2095.

- Lofgren G.E., Donaldson C.H., Williams R.J., Mullins O. and Usselman T.M. (1974) Experimentally reproduced textures of Apollo 15 basalts. Proc. 5<sup>th</sup> Lunar Sci. Conf. 549-567.
- Lofgren G.E. and Lofgren E.M. (1981) Catalog of Lunar Mare Basalts greater than 40 grams. LPI Cont. 438. Lunar Planetary Institute, Houston
- Longhi J. (1978) Pyroxene stability and the composition of the lunar magma ocean. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 285-306.
- Longhi J. (1981) Preliminary modeling of high pressure partial melting: Implications for early lunar differentiation. Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf. 1001-1018.
- Longhi J. (1982) Effects of fractional crystallization and cumulus processes on mineral composition trends of some lunar and terrestrial rock series. J. Geophys. Res. 87, A54-A64.
- Longhi J. (1987) On the connection between mare basalts and picritic volcanic glasses. Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 92, E349-E360.
- Longhi J. (1990) Silicate liquid immiscibility in isothermal crystallization experiments. Proc. 20<sup>th</sup> Lunar Planet. Sci. Conf. 13-24. Lunar Planetary Institute, Houston
- Longhi J. (1992) Origin of picritic green glass magmas by polybaric fractional fusion. Proc. 22<sup>nd</sup> Lunar Planet. Sci. Conf. 343-353. Lunar Planetary Institute, Houston
- Longhi J. (1992b) Experimental petrology and petrogenesis of mare volcanics. Geochim. Cosmochim. Acta 56, 2235-2251.
- Longhi J. (1995) Liquidus equilibria of some primary lunar and terrestrial melts in the garnet stability field. Geochim. Cosmochim. Acta 56, 2375-2386.
- Longhi J. (2003) A new view of lunar ferroan anorthosites: Postmagma ocean petrogenesis. J. Geophys. Res. 108(E8) 5083, doi:10.1029/2002JE001941
- Longhi J. (2006) Petrogenesis of picritic mare magmas: Constraints on the extent of early lunar differentiation. Geochim. Cosmochim. Acta 70, 5919-5934.
- Longhi J., Walker D. and Hays J.F. (1972) Petrology and crystallization history of basalts 14310 and 14072. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 131-139.
- Longhi J., Walker D., Grove T.L., Stolper E.M. and Hays J.F. (1974) The petrology of the Apollo 17 mare basalts. Proc. 5<sup>th</sup> Lunar Sci. Conf. 447-469.
- Longhi J., Walker D. and Hays J.F. (1976) Fe and Mg in plagioclase. Proc. 7<sup>th</sup> Lunar Sci. Conf. 1281-1300.
- Longhi J., Walker D. and Hays J.F. (1978) The distribution of Fe and Mg between olivine and lunar basaltic liquids. Geochim. Cosmochim. Acta 42, 1545-1558.
- Longhi J. and Boudreau A.E. (1979) Complex igneous processes and the formation of the primitive lunar crustal rocks. Proc. 10<sup>th</sup> Lunar Sci. Conf. 2085-2105.
- Longhi J. and Ashwal L.D. (1985) Two-stage models for lunar and terrestrial anorthosites: Petrogenesis without a magma ocean. Proc. 15<sup>th</sup> Lunar Planet. Sci. Conf., in J. Geophys. Res. 90, C571-C584.

- Lovering J.F., Wark D.A., Gleadow A.J.W. and Britten R. (1974) Lunar monazite: A late-stage (mesostasis) phase in mare basalt. *Earth Planet. Sci. Lett.* 21, 164-168.
- LSPET (1969) Preliminary examination of lunar samples from Apollo 11. *Science* 165, 1211-1227.
- LSPET (1970) Preliminary examination of lunar samples from Apollo 12. *Science* 167, 1325-1339.
- LSPET (1971) Preliminary examination of lunar samples from Apollo 14. *Science* 173, 681-693.
- 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.
- LSPET (1972c) Preliminary examination of lunar samples. *Apollo 16 Preliminary Science Report*. NASA SP-315, 7-1--7-58.
- LSPET (1973b) The Apollo 16 lunar samples: Petrographic and chemical description. *Science* 179, 23-34.
- LSPET (1973a) Apollo 17 lunar samples : Chemical and petrographic description. *Science* 182, 659-690.
- LSPET (1973c) Preliminary examination of lunar samples. *Apollo 17 Preliminary Science Report*. NASA SP-330, 7-1--7-46.
- Lu F., Taylor L.A. and Jin Y. (1989) Basalts and gabbros from Mare Crisium: Evidence for extreme fractional crystallization. *Proc. 19<sup>th</sup> Lunar Planet. Sci. Conf.* 199-207. Lunar Planetary Institute, Houston
- Lugmair G.W. (1975) Sm-Nd systematics of some Apollo 17 basalts. In *Papers presented to the Conference on Origins of Mare Basalts and their Implications for Lunar Evolution* (Lunar Science Institute, Houston), 107-110.
- Lugmair G.W. and Marti K. (1972) Exposure ages and neutron capture record in lunar samples from Fra Mauro. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1891-1897.
- Lugmair G.W. and Marti K. (1978) Lunar initial  $^{143}\text{Nd}/^{144}\text{Nd}$ : Differential evolution of the lunar crust. *Earth Planet. Sci. Lett.* 39, 349-357.
- Lugmair G.W., Scheinin N.B. and Marti K. (1975a) Sm-Nd age and history of Apollo 17 basalt 75075: Evidence for early differentiation of the lunar interior. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1419-1429.
- Lugmair G.W., Scheinin N.B. and Marti K. (1975b) Sm-Nd age of Apollo 17 basalt 75075: Two-stage igneous processes (abs). *Lunar Sci. VI*, 531-533. Lunar Planetary Institute, Houston
- Lugmair G.W., Marti K., Kurtz J.P. and Scheinin N.B. (1976a) History and genesis of lunar troctolite 76535 or: How old is old? *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 2009-2033.
- Lugmair G.W., Kurtz J.P., Marti K. and Scheinin N.B. (1976b) The low Sm/Nd region of the Moon: Evolution and history of a troctolite and a KREEP basalt (abs). *Lunar Sci. VII*, 509-511. Lunar Planetary Institute, Houston
- Lugmair G. and Marti K. (1977) Evolution of the lunar interior: Sm-Nd systematics of A15 green glass and the question of the lunar initial  $^{143}\text{Nd}/^{144}\text{Nd}$  (abs). *Lunar Sci. VIII*, 597-599. Lunar Planetary Institute, Houston
- Lugmair G. and Marti K. (1978) Lunar initial  $^{143}\text{Nd}/^{144}\text{Nd}$ : differential evolution of the lunar crust and mantle. *Earth Planet. Sci. Lett.* 39, 349-357.

Lugmair G.W. and Carlson R.W. (1978) The Sm-Nd history of KREEP. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 689-704.

Lunatic Asylum (1970) Mineralogic and isotopic investigations on lunar rock 12013. Earth Planet. Sci. Lett. 9, 137-163.

Lunatic Asylum (1978) Petrology, chemistry, age and irradiation history of Luna 24 samples. In Mare Crisium: The view from Luna 24. Geochim. Cosmochim. Acta Suppl. 9, 657-678.

Ma M-S., Schmitt R.A., Nielson R.L., Taylor G.J., Warner R.D. and Keil K. (1979) Pertogenes of Luna 16 aluminous mare basalt. Geophys. Res. Lett. 6, 909-912.

Ma M-S., Schmitt R.A., Warner R.D., Taylor G.J. and Keil K. (1979) Composition, petrography, and genesis of Apollo 17 high-Ti mare basalts (abs). Lunar Planet. Sci. X, 765-767. Lunar Planetary Institute, Houston

Ma M-S., Liu Y-G. and Schmitt R.A. (1981) A chemical study of individual green glasses and brown glasses from 15426: Implications for their petrogenesis. Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf. , 915-933.

MacDougall D., Rajan R.S., Hutcheon I.D. and Price P.B. (1973) Irradiation history and accretionary processes in lunar and meteoritic breccias. Proc. 4<sup>th</sup> Lunar Sci. Conf. 2319-2336.

MacDougall D., Hutcheon I.D. and Price P.B. (1974) Irradiation records in orange glass and two boulders from Apollo 17 (abs). Lunar Sci. V, 483-485. Lunar Planetary Institute, Houston

Mahmood A., Mitchell J.K. and Carrier W.D. (1974) Grain orientation in lunar soil. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2347-2354.

Mandeville J.-C. (1976) Microcraters on lunar rocks. Proc. 7<sup>th</sup> Lunar Sci. Conf. 1031-1038.

Mandeville J.-C. and Dollfus A. (1977) Optical properties of lunar and terrestrial rock samples submitted to micrometeoroid bombardment (abs). Lunar Sci. VIII, 616-618. Lunar Planetary Institute, Houston

Mao H.K., Virgo D. and Bell P.M. (1973a) Sample 74220: Analysis of the Apollo 17 orange soil from Shorty Crater. EOS Trans. AGU 54, 598.

Mao H.K., Virgo D. and Bell P.M. (1973b) Analytical and experimental study of iron and titanium in orange glass from Apollo 17 soil sample 74220. Proc. 4<sup>th</sup> Lunar Sci. Conf. 397-412.

Mao H.K., El Goresy A. and Bell P.M. (1974a) Evidence of extensive chemical reduction in lunar regolith samples from the Apollo 17 site. Proc. 5<sup>th</sup> Lunar Sci. Conf. 673-683.

Mao H.K., El Goresy A. and Bell P.M. (1974b) Orange glasses: Reaction of molten liquids with Apollo 17 soil breccia (70019) and gabbro (79155) (abs). Lunar Sci. V, 489-491. Lunar Planetary Institute, Houston

Mao H.K., Bell P.M. and Haggerty S.E. (1975) Chemical reduction of glasses in breccia 70019,93: The most reduced Apollo sample (abs). Lunar Sci. VI, 548-549. Lunar Planetary Institute, Houston

Mark R.K., Lee-Hu C.-N. and Wetherill G.W. (1974) Rb-Sr age of lunar igneous rocks 62295 and 14310. Geochim. Cosmochim. Acta 38, 1643-1648.

Mark R.K., Cliff R.A., Lee-Hu C. and Wetherill G.W. (1973) Rb-Sr studies of lunar breccias and soils. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1785-1795.

- Mark R.K., Lee-Hu C-N. and Wetherill G.W. (1974) Equilibration and ages: Rb-Sr studies of breccias 14321 and 15265. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1477-1485.
- Mark R.K., Lee-Hu C. and Wetherill G.W. (1975) More on Rb-Sr in lunar breccia 14321. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1501-1507.
- Marti K. (1983) Recoils: New opportunities to study and date early solar system processes (abs). Lunar Planet. Sci. XIV, 462-463. Lunar Planetary Institute, Houston
- Marti K., Aeschlimann U., Eberhardt P., Geiss J., Grogler N., Jost D.T., Laul J.C., Ma M.-S., Schmitt R.A. and Taylor G.J. (1983) Pieces of the ancient lunar crust: Ages and composition of clasts in consortium breccia 67915. Proc. Lunar Planet. Sci. Conf. 14<sup>th</sup> in J.Geophys. Res. 88, B165-B175.
- Martinez R. and Ryder G. (1989) A granite fragment from the Apennine Front – brother of QMD? (abs) Lunar Planet. Sci. XX, 620-621. Lunar Planetary Institute, Houston
- Marvin U.B. (1971) Lunar niobian rutile. Earth Planet. Sci. Lett. 11, 7-9.
- Marvin U.B. (1975) The Boulder. The Moon 14, 315-326.
- Marvin U.B. and Mosie A.B. (1980) Apollo 16 soil catalog 61220: Classification and description of 1-4 mm fines. JSC Curator Pub #53.
- Marvin U.B., Hohenberg B.B. and Lindstrom M.M. (1990) New pieces of the lunar granite-quartz monzodiorite puzzle (abs). Lunar Planet. Sci. XXI, 738-739. Lunar Planetary Institute, Houston
- Marvin U.B., Lindstrom M.M., Holmberg B.B. and Martinez R.R. (1991) New observations of quartz monozodiorite-granite suite. Proc. 21<sup>st</sup> Lunar Planet. Sci. Conf., 119-136.
- Mason B. (1972) Lunar Tridymite and Cristobalite. Am. Mineral. 57, 1530-1535.
- Mason B., Jarosowich E., Jacobson S. and Thompson G. (1977) Composition of eight Apollo 17 basalts. In Lunar Sample Studies. Pp41 JSC
- Masuda A., Nakamura N., Kurasawa H. and Tanaka T. (1972) Precise determination of rare-earth elements in the Apollo 14 and 15 samples. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1307-1313.
- Masuda A., Tanaka T., Nakamura N. and Kurasawa H. (1974) Possible REE anomalies of Apollo 17 REE patterns. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1247-1253.
- Mattinson J.M., Tilton G.R., Todt W. and Chen J.H. (1977) Lead isotope studies of mare basalt 70017. Proc. 8<sup>th</sup> Lunar Sci. Conf. 1473-1487.
- Marti K. (1967) Mass-spectrometric detection of cosmic-ray produced Kr<sup>81</sup> in meteorites and the possibility of Kr-Kr dating. Phys. Rev. Lett. 18, 264-266.
- Maurer P., Eberhardt P., Geiss J., Grogler N., Stettler A., Brown G.M., Peckett A. and Krahenbuhl U. (1978) Pre-Imbrium craters and basins: ages, compositions and excavation depths of Apollo 16 breccias. Geochim. Cosmochim. Acta 42, 1687-1720.
- Maxwell J.A. and Wiik H.B. (1971) Chemical composition of Apollo 12 lunar samples 12004, 12033, 12051, 12052 and 12065. Earth Planet. Sci. Lett. 10, 285.
- Mayeda T.K., Shearer J. and Clayton R.N. (1975) Oxygen isotope fractionation of Apollo 17 rocks. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1799-1802.

Mayne R.G. and Taylor L.A. (2003) New insights into the origin of 14053 – The only basaltic rock returned by Apollo 14. (abs) *Lunar Planet. Sci.* XXXIV #1604 Lunar Planetary Institute, Houston

McCallum I.S. (1983) Formation of Mg-rich pristine rocks by crustal metasomatism (abs). *Lunar Planet. Sci.* XIV, 473-474. Lunar Planetary Institute, Houston

McCallum I.S. and Charette M.P. (1977) Partitioning of Zr between crystals and coexisting high-Ti mare basalt melt (abs). *Lunar Sci.* VIII, 637-639. Lunar Planetary Institute, Houston

McCallum I.S. and Charette M.P. (1978) Zr and Nb distribution coefficients: Further constraints on the genesis of high-Ti mare basalts and KREEP (abs). *Lunar Planet. Sci.* IX, 711-713. Lunar Planetary Institute, Houston

McCallum I.S. and Mathez E.A. (1975) Petrology of noritic cumulates and a partial melting model for the genesis of Fra Mauro basalts. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 395-414.

McCallum I.S., Mathez E.A., Okamura F.P. and Ghose S. (1974a) Petrology and crystal chemistry of poikilitic anorthositic gabbro 77017. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 287-302.

McCallum I.S., Okamura F.P., Mathez E.A. and Ghose S. (1974b) Pyroxene relations in highland plutonic and high grade metamorphic rocks (abs). *Lunar Sci.* V, 472-474. Lunar Planetary Institute, Houston

McCallum I.S., Okamura F.P., Mathez E.A. and Ghose S. (1975) Petrology of noritic cumulates: Samples 78235 and 78238 (abs). *Lunar Sci.* VI, 534-536. Lunar Planetary Institute, Houston

McCallum I.S. and O'Brien H.E. (1996) Stratigraphy of the lunar highland crust: Depths of burial of lunar samples from cooling-rate studies. *Am. Mineral.* 81, 1166-1175.

McCallum I.S. and Schwartz J.M. (2000) JGR in review

FIND

McCallum I.S., Domeneghetti M.C., Schwartz J.M., Mullen E.K., Zema M., Camara F., McCammon C. and Ganguly J. (2006) Cooling history of lunar Mg-suite gabbronorite 76255, troctolite 76535 and Stillwater pyroxenite SC-936: The record in exsolution and ordering in pyroxenes. *Geochim. Cosmochim. Acta* 70, 6068-6078.

McDonnell J.A.M., Ashworth D.G., Flavill R.P., Carey W.C., Bateman D.C. and Jennison R.C. (1977) The characterization of lunar surface impact erosion and solar wind sputter processes on the lunar surface. *Phil. Trans. Roy. Soc. London A285*, 303-308.

McDonough W.F., Sun S.-S., Ringwood A.E., Jagoutz E. and Hofman A.W. (1992) Potassium, rubidium and cesium in the Earth and Moon and the evolution of the mantle of the Earth. *Geochim. Cosmochim. Acta* 56, 1001-1012.

McGee J.J. (1987) Petrology of brecciated ferroan noritic anorthosite 67215. *Proc. 18<sup>th</sup> Lunar Planet. Sci. Conf.* 21-31. Lunar Planetary Institute, Houston

McGee J.J. (1993) Lunar ferroan anorthosites: Mineralogy, compositional variations and petrogenesis. *J. Geophys. Res.* 98, 9089-9105.

McGee J.J., Bence A.E., Eichhorn G. and Schaeffer O.A. (1978a) Feldspathic granulite 79215: Limitations on T-fO<sub>2</sub> conditions and time of metamorphism. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 743-772.

McGee J.J., Bence A.E. and Schaeffer O.A. (1978b) Feldspathic granulite 79215: Conditions of metamorphism and age (abs). *Lunar Planet. Sci.* IX, 720-722. Lunar Planetary Institute, Houston

McGee J.J., Nord G.L. and Wandless M.-V. (1980a) Comparative thermal histories of matrix from Apollo 17 boulder 7 fragment-laden melt rocks: An analytical transmission electron microscopy study. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 611-627.

McGee J.J., Nord G.L., Jr. and Wandless M.-V. (1980b) Comparative thermal histories of matrix from Apollo 17 boulder 7 fragment-laden melt rocks (abs). Lunar Planet. Sci. XI, 700-702. Lunar Planetary Institute, Houston

McGee P.E., Warner J.L., Simonds C.E. and Phinney W.C. (1979) Introduction to the Apollo collections. Part 1: Lunar Igneous Rocks. Part II: Lunar Breccias. Curator's Office. JSC

McGetchin T.R., Settle M. and Head J.W. (1973) Radial thickness variations in impact crater ejecta: Implications for lunar basin deposits. Earth Planet. Sci. Lett. 20, 226-236.

McKay D.S. and Morrison D.A. (1971) Lunar breccias. J. Geophys. Res. 76, 5658-5669.

McKay D.S., Clanton U.S., Morrison D.A. and Ladle G.H. (1972) Vapor phase crystallization in Apollo 14 breccia. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 739-752.

McKay D.S., Clanton U.S. and Ladle G. (1973) Scanning electron microscope study of Apollo 15 green glass. Proc. 4<sup>th</sup> Lunar Sci. Conf. 225-238.

McKay D.S. and Heiken G.H. (1973) Petrology and scanning electron microscope study of Apollo 17 orange and black glass. EOS Trans. AGU 54, 599-600.

McKay D.S., Fruland R.M. and Heiken G.H. (1974) Grain size and the evolution of lunar soils. Proc. 5<sup>th</sup> Lunar Sci. Conf. 887-906.

McKay D.S., Heiken G.H. and Waits G. (1978) Core 74001/2: Grain size and petrology as a key to the rate of in-situ reworking and lateral transport on the lunar surface. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 1913-1932.

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., Johnson P. and Wentworth S.J. (1986) Apollo 16 regolith breccias: Characterization and evidence for early formation in the megaregolith. Proc. 16<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 91, D277-D303.

McKay D.S., Wentworth S.J. and Basu A. (1988) Core 79001/2: An example of extreme mixing in the lunar regolith (abs). Lunar Planet. Sci. XIX, 758-759. Lunar Planetary Institute, Houston

McKay D.S. and Wentworth S.J. (1993) Morphology and composition of condensates on Apollo 17 Orange and Black Glass. In Workshop on Geology of the Apollo 17 Landing Site (abs). LPI Tech. Rpt. 92-09. 31-33. Lunar Planetary Institute, Houston

McKay D.S., Heiken G., Basu A., Blanford G., Simon S., Reedy R., French B.M. and Papike J. (1991) The Lunar Regolith. In Lunar Sourcebook: a users guide to the moon. (eds. Heiken et al.) Cambridge Univ. Press

McKay G.A., Wiesmann H., Nyquist L.E., Wooden J.L. and Bansal B.M. (1978) Petrology, chemistry and chronology of 14078: Chemical constraints on the origin of KREEP. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 661-687.

McKay G.A., Wiesmann H. and Bansal B. (1979) The KREEP-magma ocean connection (abs). *Lunar Planet. Sci.* X, 804-806. Lunar Planetary Institute, Houston

McKinley J.P., Taylor G.J., Keil K., Ma M.-S. and Schmitt R.A. (1984) Apollo 16: Impact sheets, contrasting nature of the Cayley Plains and Descartes Mountains, and geologic history. *Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf.*, in *J. Geophys. Res.* 89, B513-B524.

Mehta S. and Goldstein J.I. (1980a) Metallic particles in the glassy constituents of three lunar highland samples 65315, 67435, and 78235. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 1713-1725.

Mehta S. and Goldstein J.I. (1980b) Metallic particles in the glass coatings of lunar highland samples 65315, 67435 and 78235 (abs). *Lunar Planet. Sci. XI*, 720-722. Lunar Planetary Institute, Houston

Megruer G.H. (1973) Distribution of gases within Apollo 15 samples: Implications for the incorporation of gases within solid bodies of the Solar System. *J. Geophys. Res.* 78, 4875-4883.

Megruer G.H. and Steinbrunn F. (1972) Classification and source of lunar soils: clastic rocks; and individual mineral, rock and glass fragments -- *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1899-1916.

Merlivat L., Lelu M., Nief G. and Roth E. (1974a) Deuterium, hydrogen, and water content of lunar material. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1885-1895.

Merlivat L., Lelu M., Nief G. and Roth E. (1974b) Deuterium content of lunar material (abs). *Lunar Sci. V*, 498-500. Lunar Planetary Institute, Houston

Merlivat L., Lelu M., Nief G. and Roth E. (1976) Spallation deuterium in rock 70215. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 649-658.

Meyer C. (1972) Mineral assemblages and the origin of non-mare lunar rock types (abs). *Lunar Sci. III*, 542-544. Lunar Planetary Institute, Houston

Meyer C. (1973) Apollo 17 Coarse Fines (4-10 mm) Sample Location, Classification and Photo Index. Curator Report. pp. 182.

Meyer C. (1977) Petrology, Mineralogy and Chemistry of KREEP basalt. In *Physics and Chemistry of the Earth* 10, 239-260. (Ahrens and Runcorn , eds)

Meyer C. (1978) Ion microprobe analyses of aluminous lunar glasses: A test of the "rock type" hypothesis. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 1551-1570.

Meyer C. (1979) Trace elements in plagioclase from the lunar highlands. In *Papers presented to the Conference on the Lunar Highlands Crust (abs)*. LPI Contr. 394, 111-113. Lunar Planetary Institute, Houston

Meyer C. (1987) The Lunar Petrographic Thin Section Set. Curatorial Branch Publication No. 76. JSC.

Meyer C. (1994) Catalog of Apollo 17 rocks: Volume 4. Curator's Office JSC 26088 pp. 644

Meyer C. and Hubbard N.J. (1970) High potassium and high phosphorous glass as an important rock type in the Apollo 12 soils (abs). *Meteoritics* 5, 210-211.

Meyer C., Brett R., Hubbard N.J., Morrison D.A., McKay D.S., Aitken F.K., Takeda H. and Schonfeld E. (1971) Mineralogy, chemistry and origin of the KREEP component in soils from the Ocean of Storms. *Proc. 2<sup>nd</sup> Lunar Sci. Conf.* 393-411.

Meyer C., Anderson D.H. and Bradley J.G. (1974) Ion microprobe mass analysis of plagioclase from "non-mare" lunar samples (abs). *Lunar Sci.* V, 506-508. Lunar Planetary Institute, Houston

Meyer C., Anderson D.H. and Bradley J.G. (1974) Ion microprobe mass analysis of plagioclase from "non-mare" lunar samples. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 685-706.

Meyer C., McKay D.S., Anderson D.H. and Butler P. (1975) The source of sublimes on the Apollo 15 green and Apollo 17 orange glass samples. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1673-1699.

Meyer C. and King C.D. (1979) Breccia Guidebook #114321. JSC 14753

Meyer C., Compston W. and Williams I.S. (1985) Lunar zircon and the closure age of the lunar crust (abs). *Lunar Planet. Sci. XVI*, 557-558. Lunar Planetary Institute, Houston

Meyer C. and Yang S.V. (1988) Tungsten-bearing yttrium-betaite in lunar granophyre. *Am. Mineral.* 73, 1420-1425.

Meyer C., Williams I.S. and Compston W. (1989)  $^{207}\text{Pb}/^{206}\text{Pb}$  ages of zircon-containing rock fragments indicate continuous magmatism in the lunar crust from 4350 to 3900 million years (abs). *Lunar Planet. Sci. XX*, 691-692.

Meyer C., Williams I.S. and Compston W. (1989) Zircon-containing rock fragments within Apollo 14 breccias indicate serial magmatism from 4350 to 4000 million years (abs). In *Workshop on Moon in Transition: Apollo 14, KREEP, and evolved lunar rocks*. LPI Tech Rpt. 89-03, 75-78. Lunar Planetary Institute, Houston

Meyer C., Williams I.S. and Compston W. (1996) Uranium-lead ages for lunar zircons: Evidence for a prolonged period of granophyre formation from 4.32 to 3.88 Ga. *Meteoritics & Planet. Sci.* 31, 370-387.

Meyer C.E. and Wilshire H.G. (1974) "Dunite" inclusion in lunar basal 74275 (abs). *Lunar Sci. V*, 503-505. Lunar Planetary Institute, Houston

Meyer H.O.A. and Boctor N.Z. (1974a) Opaque mineralogy: Apollo 17, rock 75035. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 707-716.

Meyer H.O.A. and Boctor N.Z. (1974b) Opaque minerals in basaltic rock 75035 (abs). *Lunar Sci. V*, 512-514. Lunar Planetary Institute, Houston

Meyer H.O.A. and Tsai H.M. (1975) Lunar glass compositions: Apollo 16 core sections 60002 and 60004. *Earth Planet. Sci. Lett.* 28, 2343-240.

Miller M.D., Pacer R.A., Ma M.-S., Hawke B.R., Lookhart G.L. and Ehmann W.D. (1974) Compositional studies of the lunar regolith at the Apollo 17 site. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1079-1086.

Minkin J.A., Thompson C.L. and Chao E.C.T. (1978) The Apollo 17 Station 7 boulder: Summary of study by the International Consortium. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 877-903.

Minkin J.A., Thompson C.L. and Chao E.C.T. (1987) Allocation of subsamples of Apollo 17 lunar rocks from the boulder at station 7, for study by the International Consortium. Open-file report 78-511. United States Geological Survey.

Misra K.C. and Taylor L.A. (1975) Characteristics of metal particles in Apollo 16 rocks. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 615-639.

Misra K.C., Walker B.M. and Taylor L.A. (1976a) Textures and compositions of metal particles in Apollo 17, Station 6 boulder samples. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 2251-2266.

- Misra K.C., Walker B.M. and Taylor L.A. (1976b) Native FeNi metal particles in Apollo 17 Station 6 boulder (abs). *Lunar Sci.* VII, 565-567. Lunar Planetary Institute, Houston
- Mitchell J.K., Bromwell L.G., Carrier W.D., Costes N.C., Houston W.N. and Scott R.F. (1972) 7. Soil-Mechanics Experiment. In Apollo 15 Preliminary Science Rpt. NASA SP-289. pages 7-17-28.
- Mitchell J.N., Snyder G.A. and Taylor L.A. (1999) Mineral-chemical and isotopic variations in Apollo 16 impact-melt breccias. In Taylor Volume, 173-192. GSA Bellweather Press
- Miura Y. (1982) A new indicator of formation process based on bulk An and Or contents of terrestrial and extraterrestrial plagioclases with or without exsolution (abs). *Lunar Planet. Sci.* XIII, 524-525. Lunar Planetary Institute, Houston
- Miura Y. (1988) Normal and anomalous compositions of lunar feldspars - I. Lunar plagioclases (abs). *Lunar Planet. Sci.* XIX, 794-795. Lunar Planetary Institute, Houston
- Mizutani H., Fujii N., Hamano Y. and Osako M. (1972) Elastic wave velocities and thermal diffusivities of Apollo 14 rocks. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 2557-2564.
- Mizutani H. and Osako M. (1974a) Elastic-wave velocities and thermal diffusivities of Apollo 17 rocks and their geophysical implications. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 2891-2901,
- Mizutani H. and Osako M. (1974b) Elastic wave velocities and thermal diffusivities of Apollo 17 rocks (abs). *Lunar Sci.* V, 518-519.
- Modzeleski J.E. and V.E., Nagy L.A. and B., Hamilton P.B., McEwan W.S. and Urey H.C. (1972) Carbon compounds in Apollo 15 lunar samples. In *The Apollo 15 Lunar Samples*, 311-315. Lunar Planetary Institute, Houston
- Moore C.B., Lewis C.F., Cripe J., Delles F.M., Kelly W.R. and Gibson E.K. (1972) Total carbon, nitrogen and sulfur in Apollo 14 lunar samples. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 2051-2058.
- Moore C.B., Lewis C.F. and Gibson E.K. (1973) Total carbon contents of Apollo 15 and 16 lunar samples. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1613-1923..
- Moore C.B., Lewis C.F. and Cripe J.D. (1974a) Total carbon and sulfur contents of Apollo 17 lunar samples. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1897-1906.
- Moore C.B., Lewis C.F., Cripe J.D. and Volk M. (1974b) Total carbon and sulfur contents of Apollo 17 lunar samples (abs). *Lunar Sci.* V, 520-522. Lunar Planetary Institute, Houston
- Moore C.B. and Lewis C.F. (1976) Total nitrogen contents of Apollo 15, 16 and 17 lunar rocks and breccias (abs). *Lunar Sci.* VII, 571-573. Lunar Planetary Institute, Houston
- Morgan J.W. and Ehmann W.D. (1970) Lunar rock 12013: O, Si, Al and Fe abundances. *Earth Planet. Sci. Lett.* 9, 164-176.
- Morgan J.W., Laul J.C., Ganapathy R. and Anders E. (1971) Glazed lunar rocks: Origin by impact. *Science* 172, 556-557.
- Morgan J.W., Laul J.C., Krahenbuhl U., Ganapathy R. and Anders E. (1972) Major impacts on the moon: Characterization from trace elements in Apollo 12 and 14 samples. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1377-1395.
- Morgan J.W. and Petrie R.K. (1979a) Breccias 73215 and 73255: Siderophile and volatile trace elements. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 789-801.

Morgan J.W. and Petrie R.K. (1979b) Siderophile and volatile trace elements in breccias 73215 and 73255 and in core 74001 (abs). *Lunar Planet. Sci. X*, 852-854. Lunar Planetary Institute, Houston

Morgan J.W. and Wandless G.A. (1979a) Terrestrial upper mantle: Siderophile and volatile trace element abundances (abs). *Lunar Planet. Sci. X*, 855-857. Lunar Planetary Institute, Houston

Morgan J.W. and Wandless G.A. (1979b) 74001 drive tube: Siderophile elements match IIB iron meteorite pattern. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 327-340.

Morgan J.W. and Wandless G.A. (1984) Surface-correlated trace elements in 15426 lunar glasses (abs). *Lunar Planet. Sci. XV*, 562-563. Lunar Planetary Institute, Houston

Morgan J.W. and Wandless G.A. (1988) Lunar dunite 72415-72417: Siderophile and volatile trace elements (abs). *Lunar Planet. Sci. XIX*, 804-805. Lunar Planetary Institute, Houston

Morgan J.W., Laul J.C., Krahenbuhl U., Ganapathy R. and Anders E. (1972) Major impacts on the moon: Characterization from trace elements in Apollo 12 and 14 samples. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1377-1395.

Morgan J.W., Ganapathy R., Higuchi H., Krahenbuhl U. and Anders E (1974a) Lunar basins: Tentative characterization of projectiles, from meteoritic dements in Apollo 17 boulders. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1703-1736.

Morgan J.W., Ganapathy R., Higuchi H., Krahenbuhl U. and Anders E. (1974b) Lunar basins: Tentative characterization of projectiles, from meteoritic elements in Apollo 17 boulders (abs). *Lunar Sci. V*, 526-528. Lunar Planetary Institute, Houston

Morgan J.W., Ganapathy R. and Krahenbuhl U. (1975a) Meteoritic trace elements in lunar rock 14321,184. *Geochim. Cosmochim. Acta* 39, 261-264.

Morgan J.W., Higuchi H. and Anders E. (1975b) Meteoritic material in a boulder from the Apollo 17 site: Implications for its origin. *The Moon* 14, 373-383.

Morgan J.W., Gros J., Takahashi H. and Hertogen J. (1976) Lunar breccia 73215: siderophile and volatile elements. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 2189-2199.

Morgan J.W., Ganapathy R., Higuchi H. and Anders E. (1977) Meteoritic material on the Moon. In *The Soviet-American Conference on Cosmochemistry of the Moon and Planets*. NASA SP-370. 659-689.

Morgan J.W., Hertogen J. and Anders E. (1978) The Moon: Composition determined by nebular processes. *The Moon and Planets* 18, 465-478.

Morgan J.W., Walker R.J., Brandon A.D. and Horan M.F. (2001) Siderophile elements in Earth's upper mantle and lunar breccias: Data synthesis suggests manifestations of the same late influx. *Meteoritics & Planet. Sci.* 36, 1257-1276.

Morgeli M., Eberhardt P., Eugster O., Geiss J., Grogler N. and Jungck M. (1977) The age of Shorty Crater (abs). *Lunar Sci. VIII*, 679-681. Lunar Planetary Institute, Houston

Mori H. and Takeda H. (1980) Thermal and deformational history of diogenites and a lunar norite, as determined by electron microscopy and crystallography (abs). *Lunar Planet. Sci. XI*, 743-745. Lunar Planetary Institute, Houston

Mori H., Takeda H. and Miyamoto M. (1982) Comparison of orthopyroxenes in lunar norites and diogenites (abs). *Lunar Planet. Sci. XIII*, 540-541. Lunar Planetary Institute, Houston

Morris R.V. (1976) Surface exposure indicies of lunar soils: A comparative FMR study. Proc. 7<sup>th</sup> Lunar Sci. Conf. 315-335.

Morris R.V. (1977) Origin and evolution on the grain-size dependence of the concentration of fine-grained metal in lunar soil: The maturation of lunar soils to a steady-state stage. Proc. 8<sup>th</sup> Lunar Sci. Conf. 3719-3747.

Morris R.V. (1978) The surface exposure (maturity) of lunar soils: Some concepts and Is/FeO compilation. Proc. 9<sup>th</sup> Lunar Sci. Conf. 2287-2297.

Morris R.V. (1980) Origins and size distribution of metallic iron particles in the lunar regolith. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 1697-1712.

Morris R.V. and Gose W.A. (1977) Depositional history of core section 74001: Depth profiles of maturity, FeO and metal. Proc. 8<sup>th</sup> Lunar Sci. Conf., 3113-3122.

Morris R.V., Gose W.A. and Lauer H.V. (1978) Depositional and surface history of the Shorty Crater core 74001/2: FMR and magnetic studies. Proc. 9<sup>th</sup> Lunar Planet. Sci., 2033-2048.

Morris R.V., Lauer H.V. and Gose W.A. (1979) Characterization and depositional and evolutionary history of the Apollo 17 deep drill core. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 1141-1157.

Morris R.V., Score R., Dardano C. and Heiken G. (1983) Handbook of Lunar Soils. Two Parts. JSC 19069. Curator's Office, Houston

Morris R.V., See T.H. and Horz F. (1986) Composition of the Cayley Formation at Apollo 16 as inferred from impact melt splashes. Proc. 16<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 90 E21-E42.

Morris R.W., Taylor G.J., Newsom H.E., Keil K. and Garcia S.R. (1990) Highly evolved and ultramafic lithologes from Apollo 14 soils. Proc. 20<sup>th</sup> Lunar Planet. Sci. Conf. 61-75. Lunar Planetary Institute, Houston

Morrison D.A., McKay D.S., Heiken G.H. and Moore H.J. (1972) Microcraters on lunar rocks. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 2767-2791.

Morrison D.A., McKay D.S., Fruland R.M.. and Moore H.J. (1973) Microcraters on Apollo 15 and 16 rocks. Proc. 4<sup>th</sup> Lunar Sci. Conf. 3235-3253.

Morrison D.A. and Zinner E. (1975) Studies of solar flares and impact craters in partially protected crystals. Proc. 6<sup>th</sup> Lunar Sci. Conf. 3373-3390.

Morrison D.A. and Zinner E. (1977a) 12054 and 76215: New measurements of interplanetary dust and solar flare fluxes. Proc. 8<sup>th</sup> Lunar Sci. Conf. 841-863.

Morrison D.A. and Zinner E. (1977b) Microcraters and solar cosmic ray tracks (abs). Lunar Sci. VIII, 691-693. Lunar Planetary Institute, Houston

Morrison D.A. and Zinner E. (1977c) Distribution and flux of micrometeoroids. Phil. Trans. Roy. Soc. London A285, 379-384.

Morrison D.A. and Clanton U.S. (1979) Properties of microcraters and cosmic dust of less than 1000 Å dimensions. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 1649-1663.

Morrison G.H., Nadkarni R.A., Jaworski J., Botto R.I. and Roth J.R. (1973) Elemental abundances of Apollo 16 samples. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1399-1405.

- Moynier F., Albarede F. and Herzog G.F. (2006) Isotopic composition of zinc, copper, and iron in lunar samples. *Geochim. Cosmochim. Acta* 70, 6103-6117.
- Muan A., Lofall T. and Ma C.-B. (1974) Liquid-solid equilibria in lunar rocks from Apollo 15, 16 and 17, and phase relations in parts of the system CaMgSi2O6-CaFeSi2O6-Fe2SiO4-CaAl2Si2O8 (abs). *Lunar Sci. V*, 529-530. Lunar Planetary Institute, Houston
- Muehlberger W.R. and many others (1973) Preliminary Geological Investigation of the Apollo 17 Landing Site. In *Apollo 17 Preliminary Science Report*. NASA SP-330.
- Muehlberger W.R., Horz F., Seiver J.R. and Ulrich G.E. (1980) Mission objectives for geological exploration of the Apollo 16 landing site. *Proc. Conf. on Lunar Highlands Crust*, 1-49 (eds. Papike and Merrill R.B.)
- Muhich T., Vaniman D. and Heiken G. (1990) Ilmenite in high-Ti Apollo 17 basalts: Variations in composition with degree of exsolution (abs). *Lunar Planet. Sci. XXI*, 817-819. Lunar Planetary Institute, Houston
- Muller H.W., Plieninger T., James O.B. and Schaeffer O.A. (1977a) Laser probe 39Ar-40Ar dating of materials from consortium breccia 73215. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 2551-2565.
- Muller H.W., Plieninger T., James O.B. and Schaeffer O.A. (1977b) Laser probe 40Ar-39Ar dating of materials from consortium breccia 73215 (abs). *Lunar Planet. Sci. XVIII*, 697-699. Lunar Planetary Institute, Houston
- Muller O. (1973) Chemically bond nitrogen contents of Apollo 16 and Apollo 15 Lunar fines. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1625-1634.
- Muller O. (1974a) Solar wind nitrogen and indigenous nitrogen in Apollo 17 lunar samples. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1907-1918.
- Muller O. (1974b) Solar wind and indigenous nitrogen in Apollo 17 lunar samples (abs). *Lunar Sci. V*, 534-536. Lunar Planetary Institute, Houston
- Muller O. (1975) Lithophile trace and major elements in Apollo 16 and 17 lunar samples. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1303-1312.
- Muller O., Grallath E. and Tolg G. (1976a) Nitrogen in lunar igneous rocks. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1615-1622.
- Muller O., Grallath E. and Tolg G. (1976b) Nitrogen in lunar igneous rocks (abs). *Lunar Sci. VII*, 580-582. Lunar Planetary Institute, Houston
- Murali A.V., Ma M-S. and Schmitt R.A. (1976) Mare basalt 60639. another easterly lunar basalt (abs). *Lunar Sci. VII*, 583-584.
- Murali A.V., Ma M.-S., Laul J.C. and Schmitt R.A. (1977a) Chemical composition of breccias, feldspathic basalt and anorthosites from Apollo 15 (15308, 15359, 15382, and 15362), Apollo 16 (60618 and 65785), Apollo 17 (72434, 72536, 72559, 72735, 72738, 78526, and 78527) and Luna 20 (22012 and 22013) (abs). *Lunar Sci. VIII*, 700-702. Lunar Planetary Institute, Houston
- Murali A.V., Ma M.-S., Schmitt R.A., Warner R.D., Keil K. and Taylor G.J. (1977b) Chemistry of 30 Apollo 17 rake basalts; 71597 a product of partial olivine accumulation (abs). *Lunar Sci. VIII*, 703-705. Lunar Planetary Institute, Houston

Murthy V.R. (1976) Rb-Sr studies of A-17 mare basalts and some general considerations early terrestrial and lunar evolution (abs). *Lunar Sci.* VII, 585-587. Lunar Planetary Institute, Houston

Murthy V.R. (1977) Lunar evolution: Is there a global radioactive crust on the Moon? *Phil. Trans. Roy. Soc. London* A285, 127-136.

Murthy V.R. (1978) Considerations of lunar initial strontium ratio (abs). *Lunar Planet. Sci.* IX, 778-780. Lunar Planetary Institute, Houston

Murthy V.R., Evensen N.M., Jahn B.-M. and Coscio M.R. (1971) Rb-Sr ages and elemental abundances of K, Rb, Sr and Ba in samples from the Ocean of Storms. *Geochim. Cosmochim. Acta* 35, 1139-1153.

Murthy V.R. and Coscio C. (1976) Rb-Sr ages and isotopic systematics of some Serenitatis mare basalts. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1529-1544.

Murthy V.R. and Coscio C. (1977) Rb-Sr isotopic systematics and initial Sr considerations for some lunar samples (abs). *Lunar Sci. VIII*, 706-708. Lunar Planetary Institute, Houston

Murrell M.T., Nishiizumi K. and Arnold J.R. (1979)  $^{53}\text{Mn}$  profile 74001/2: Comments on the recent history of the core (abs). *Lunar Planet. Sci.* X, 881-883.

Nagata T., Fisher R.M., Schwerer F.C., Fuller M.D. and Dunn J.R. (1972) Rock magnetism of Apollo 14 and 15 materials. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 2423-2447.

Nagata T., Fischer R.M., Schwerer F.C., Fuller M.D. and Dunn J.R. (1973) Magnetic properties and natural remanent magnetization of Apollo 15 and 16 lunar materials. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 3019-3043.

Nagata T., Sugiura N., Fisher R.M., Schwerer F.C., Fuller M.D. and Dunn J.R. (1974a) Magnetic properties of Apollo 11-17 lunar materials with special reference to effects of meteorite impact. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 2827-2839.

Nagata T., Sugiura N., Fisher R.M., Schwerer F.C., Fuller M.D. and Dunn J.R. (1974b) Magnetic properties and natural remanent magnetization of Apollo 16 and 17 lunar samples (abs). *Lunar Sci. V*, 540-542. Lunar Planetary Institute, Houston

Nagata T., Fisher R.M., Schwerer F.C., Fuller M.D. and Dunn J.R. (1975a) Effects of meteorite impact on magnetic properties of Apollo lunar materials. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 3111-3122.

Nagata T., Fisher R.M., Schwerer F.C., Fuller M.D. and Dunn J.R. (1975b) Basic magnetic properties of Apollo 17 basaltic and anorthositic lunar materials (abs). *Lunar Sci. VI*, 584-586. Lunar Planetary Institute, Houston

Nagel J.S. (1978) Drive tubes 74002/74001: Dissection and description. *Lunar Core Catalog*. NASA Johnson Space Center, Houston.

Nagle J.S. (1980) The detrital zone in the Shorty Crater cores. *The Moon* 18, 499-517.

Nagle J.S. (1981) Apollo 15 green glass: a mare margin deposit (abs). *Lunar Planet. Sci.* XII, 750-752. Lunar Planetary Institute, Houston

Nagle J.S. (1982) Evidence of subcrater lithification and hot ejecta deposition in lunar polymict regolith breccias and achondrites (abs). *Lunar Planet. Sci.* XIII, 568-569. Lunar Planetary Institute, Houston

Nagle J.S. and Walton W.J.A. (1977) Luna 24: Catalog and preliminary description. 1 May 1977 Curator's Office, NASA Johnson Space Center, Houston

Nakamura N. and Tatsumoto M. (1977) The history of the Apollo 17 Station 7 boulder. Proc. 8<sup>th</sup> Lunar Sci. Conf. 2301-2314.

Nakamura N., Tatsumoto M., Nunes P.D., Unruh D.M., Schwab A.P. and Wildeman T.R. (1976) 4.4 b.y.-old clast in Boulder 7, Apollo 17: A comprehensive chronological study by U-Pb, Rb-Sr, and Sm-Nd methods. Proc. 7<sup>th</sup> Lunar Sci. Conf. 2309-2333.

Nash W.P. and Haseiton J.D. (1975) Silica activity in lunar lavas. Proc. 6<sup>th</sup> Lunar Sci. Conf. 119-130.

Nautiyal C.M., Padia J.T., Rao M.N. and Venkatesan T.R. (1981a) Solar and galactic cosmic ray records of noble gases in lunar rock 79215 (abs). Lunar Planet. Sci. XII, 753-755. Lunar Planetary Institute, Houston

Nautiyal C.M., Padia J.T., Rao M.N, and Venkatesan T.R. (1981b) Solar flare neon: Clues from implanted noble gases in lunar soils and rocks. Proc. 12<sup>th</sup> Lunar Sci. Conf. 627-637.

Nava D.F. (1974a) Chemical compositions of some soils and rock types from the Apollo 15, 16, and 17 lunar sites. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1087-1096.

Nava D.F. (1974b) Chemistry of some rock types and soils from the Apollo 15, 16 and 17 lunar sites (abs). Lunar Sci. V, 547-549. Lunar Planetary Institute, Houston

Neal C.R. (2001) Interior of the moon: The presence of garnet in the primitive deep lunar mantle. J. Geophys. Res. 106, 27865-27885.

Neal C.R. (2007) Mining the literature for “new” data: expanding the Apollo 14 high-alumina basalt isotope database. (abs) Lunar Planet. Sci. XXXVIII, #2398. Lunar Planetary Institute, Houston

Neal C.R., Taylor L.A. and Lindstrom M.M. (1988a) Importance of lunar granite and KREEP in very high potassium (VHK) basalt petrogenesis. Proc. 18<sup>th</sup> Lunar Planet. Sci. Conf. 121-137. Lunar Planetary Institute, Houston

Neal C.R., Taylor L.A. and Lindstrom M.M. (1988b) Apollo 14 mare basalt petrogenesis: assimilation of KREEP-like components by a fractionating magma. Proc. 18<sup>th</sup> Lunar Planet. Sci. Conf. 139-153. Lunar Planetary Institute, Houston

Neal C.R. and Taylor L.A. (1989a) The nature of barium partitioning between immiscible melts: A comparison of experimental and natural systems with reference to lunar granite petrogenesis. Proc. 19<sup>th</sup> Lunar Planet. Sci. Conf. 209-218. Lunar Planetary Institute, Houston

Neal C.R. and Taylor L.A. (1989b) The barium problem in silicate liquid immiscibility: Influence of melt composition and structure on elemental partitioning (abs). Lunar Planet. Sci. XX, 770-771. Lunar Planetary Institute, Houston

Neal C.R. and Taylor L.A. (1989c) Metasomatism (?) products of the lunar magma ocean: The role of KREEP dissemination. Geochim. Cosmochim. Acta 53, 529-541.

Neal C.R., Taylor L.A., Schmitt R.A., Hughes S.S. and Lindstrom M.M. (1989d) High alumina (HA) and very high potassium (VHK) basalt clasts from Apollo 14 breccia, Part 1: Mineralogy and petrology: Evidence of crystallization from evolving magmas. Proc. 19<sup>th</sup> Lunar Planet. Sci. Conf. 137-145. Lunar Planetary Institute, Houston

Neal C.R., Taylor L.A., Schmitt R.A., Hughes S.S. and Lindstrom M.M. (1989d) High alumina (HA) and very high potassium (VHK) basalt clasts from Apollo 14 breccia, Part 2 – whole rock geochemistry:

Further evidence for combined assimilation and fractional crystallization within the lunar crust. Proc. 19<sup>th</sup> Lunar Planet. Sci. Conf. 147-161. Lunar Planetary Institute, Houston

Neal C.R., Taylor L.A., Patchen A.D., Hughes S.S. and Schmitt R.A. (1990a) The significance of fractional crystallization in the petrogenesis of Apollo 17 Type A and B high-Ti basalts. *Geochim. Cosmochim. Acta* 54, 1817-1833.

Neal C.R., Paces J.B., Taylor L.A. and Hughes S.S. (1990b) Two new Type C basalts: Petrogenetic implications for source evolution and magma genesis at the Apollo 17 site (abs). *Lunar Planet. Sci. XXI*, 855-856. Lunar Planetary Institute, Houston

Neal C.R., Taylor L.A., Hughes S.S. and Schmitt R.A. (1990c) The importance of fractional crystallization in the petrogenesis of Apollo 17 Type A and B high-Ti basalts (abs). *Lunar Planet. Sci. XXI*, 857-858. Lunar Planetary Institute, Houston

Neal C.R., Taylor L.A. and Patchen A.D. (1990d) An Apollo 17 safari: Exciting new clast from breccia "pull apart" efforts (abs). *Lunar Planet. Sci. XXI*, 859-860. Lunar Planetary Institute, Houston

Neal C.R., Taylor L.A. and Patchen A.D. (1990e) The dichotomy between primitive highland cumulates and evolved interstitial whitlockites: The process of "REEP-fraction" metasomatism (abs). *Lunar Planet. Sci. XXI*, 863-864. Lunar Planetary Institute, Houston

Neal C.R. and Taylor L.A. (1990f) Modeling of lunar basalt petrogenesis: Sr isotopic evidence from Apollo 14 high-alumina basalts. Proc. 20<sup>th</sup> Lunar Planet. Sci. Conf. 101-108. Lunar Planetary Institute, Houston

Neal C.R. and Taylor L.A. (1991) Evidence for metasomatism of the lunar highlands and the origin of whitlockite. *Geochim. Cosmochim. Acta* 55, 2965-2980.

Neal C.R. and Taylor L.A. (1992) Petrogenesis of mare basalts: A record of lunar volcanism. *Geochim. Cosmochim. Acta* 56, 2177-2211.

Neal C.R., Taylor L.A., Schmitt R.A. and Liu Y.-G. (1992) The recognition of monomict and polymict clasts from Apollo 17 breccias (abs). *Lunar Planet. Sci. XXIII*, 979-980. Lunar Planetary Institute, Houston

Neal C.R. and Taylor L.A. (1993) Catalog of Apollo 17 rocks, central valley. Volumes 2 and 3. Curators Office #26088

Neal C.R., Hacker M.D., Snyder G.A., Taylor L.A., Liu Y.-G. and Schmitt R.A. (1994a) Basalt generation at the Apollo 12 site, Part 1: New data, classification and re-evaluation. *Meteoritics* 29, 334-348.

Neal C.R., Hacker M.D., Snyder G.A., Taylor L.A., Liu Y.-G. and Schmitt R.A. (1994b) Basalt generation at the Apollo 12 site, Part 2: Source heterogeneity, multiple melts and crustal contamination. *Meteoritics* 29, 349-361.

Neal C.R. and Taylor L.A. (1998) Exploring the complexities of the Serenitatis basin: Breccia clasts from Apollo 17. *International Geology Review* 40, 945-962. (also in the Taylor Volume of GSA 155-172)

Neal C.R. and Kramer G.Y (2003) The composition of KREEP: A detailed study of KREEP basalt 15386. (abs) *Lunar Planet. Sci. XXXIV* #1665. Lunar Planetary Institute, Houston

Neal C.R., Shearer C.K. and Kramer G.Y. (2005) Are the Apollo 14 high-Al basalts really impact melts? (abs) *Lunar Planet. Sci. XXXVI* #2023. Lunar Planetary Institute, Houston

Neal C.R. and Kramer G.Y. (2006) The petrogenesis of the Apollo 14 high-Al mare basalts. *Am. Mineral.* 91, 1521-1535.

Neal C.R., Shih C-Y., Reese Y., Nyquist L.E. and Kramer G.Y. (2006) Derivation of Apollo 14 high-Al basalts from distinct source regions at discrete times: New constraints. (abs) *Lunar Planet. Sci. XXXVII* #2003 Lunar Planetary Institute, Houston

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.

Nehru C.E., Warner R.D., Keil K. and Taylor G.J. (1978) Metamorphism of brecciated ANT rocks: Anorthositic troctolite 72559 and norite 78527. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 773-788.

Nelen J., Noonan A. and Fredriksson K. (1972) Lunar glasses breccias and chondrules. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 723-737.

Nemchin A.A., Whitehouse M.J., Pidgeon R.T. and Meyer C. (2005) Isotopic composition of oxygen in lunar zircon. (abs#1274) *Lunar Planet. Sci. XXXVI*. Lunar Planetary Institute, Houston

Nemchin A.A., Whitehouse M.J., Pidgeon R.T. and Meyer C. (2006) Oxygen isotopic signature of 4.4 – 3.9 Ga zircons as a monitor of differentiation processes on the Moon. *Geochim. Cosmochim. Acta* 70, 1864-1872.

Nemchin A.A., Pidgeon R.T., Whitehouse M.J., Vaughan J.P. and Meyer C. (2008) SIMS study of zircons from Apollo 14 and 17 breccias: Implications for the evolution of lunar KREEP. *Geochim. Cosmochim. Acta* (accepted)

Neukum G., Horz F., Morrison D.A. and Hartung J.B. (1973) Crater populations on lunar rocks. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 3255-3276.

Newsom H.E. (1984) The abundance of molybdenum in lunar samples, new evidence for a lunar metal core (abs). *Lunar Planet. Sci. XV*, 605-606.

Niederer F., Wahlen M. and Geiss J. (1975) A search for energetic tritons in lunar samples. *Meteoritics* 10, 466-467.

Niederer F.R., Papanastassiou D.A. and Wasserburg G.J. (1980) Titanium abundances in terrestrial, lunar and meteoritic samples (abs). *Lunar Planet. Sci. XI*, 809-811.

Niedermann S. and Eugster O. (1992) Noble gases in lunar anorthositic rocks 60018 and 65315: Acquisition of terrestrial krypton and xenon indicating and irreversible adsorption process. *Geochim. Cosmochim. Acta* 56, 493-509.

Nielsen R.J. and Drake M.J. (1978) The case for at least three mare basalt magmas at the Luna 24 landing site. In: *Mare Crisium: The view from Luna 24*. (ed. Merrill and Papike) Pergamon 419-428.

Niemeyer S. (1977a) Exposure histories of lunar rocks 71135 and 71569. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 3083-3093.

Niemeyer S. (1977b) Exposure histories of lunar rocks 71135 and 71569 (abs). *Lunar Sci. VIII*, 729-731. Lunar Planetary Institute, Houston

Niemeyer S. and Leich D.A. (1976) Atmospheric rare gases in lunar rock 60015. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 587-597.

Nishiizumi K. and Imamura M. (1979) The extent of the lunar regolith mixing. *Earth Planet. Sci. Lett.* 44, 409-419.

Nishiizumi K., Kohl C.P., Arnold J.R., Finkel R.C., Chaffee M.W., Masarik J. and Reedy R.C. (1995) Final results of comogenic nuclides in lunar rock 64455 (abs). *Lunar Planet. Sci. XXVI*, 1055-1056. Lunar Planetary Institute, Houston

Nishiizumi K., Murrell M.T. and Arnold J.R. (1983)  $^{53}\text{Mn}$  profiles in four Apollo surface cores. *Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf.* in *J. Geophys. Res.* 88, B211-B219.

Nishiizumi K., Imamura M., Kohl C.P., Nagai H., Kobayashi K., Yoshida K., Yamashita H., Reedy R.C., Honda M. and Arnold J.R. (1988)  $^{10}\text{Be}$  profiles in lunar surface rock 68815. *Proc. 18<sup>th</sup> Lunar Planet. Sci. Conf.* 79-85. Lunar Planetary Institute, Houston

Noble S.K., Keller L.P. and Pieters C.M. (2005) Evidence of space weathering in regolith breccias I: Lunar regolith breccias. *Meteorit. & Planet. Sci.* 40, 397-408.

Nord G.L. (1976) 76535: Thermal history deduced from pyroxene precipitation in anorthite. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1875-1888.

Nord G.L. and James O.B. (1977) Aphanitic matrix, an ANT-suite clast and a felsite clast in consortium breccia 73215: An electron petrographic study. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 2495-2506.

Nord G.L. and James O.B. (1978a) Consortium breccia 73255: Thermal and deformational history of bulk breccia and clasts, as determined by electron petrography. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 821-839.

Nord G.L. and James O.B. (1978b) Consortium breccia 73255: Electron petrography of aphanitic lithologies and anorthite clasts (abs). *Lunar Planet. Sci. IX*, 814-816. Lunar Planetary Institute, Houston

Nord G.L. and McGee J.J. (1979a) Thermal and mechanical history of granulated norite and pyroxene anorthositic clasts in breccia 73255. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 817-832.

Nord G.L. and McGee J.J. (1979b) Thermal and mechanical history of granulated norite and pyroxene anorthositic clasts in breccia 73255 (abs). *Lunar Planet. Sci. X*, 919-921. Lunar Planetary Institute, Houston

Nord G.L., Lally J.S., Heuer A.H., Christie J.M., Radcliffe S.V., Fisher R.M. and Griggs D.T. (1974) A mineralogical study of rock 70017, an ilmenite-rich basalt, by high voltage electron microscopy (abs). *Lunar Sci. V*, 556-558. Lunar Planetary Institute, Houston

Nord G.L., Heuer A.H., Lally J.S. and Christie J.M. (1975) Substructures in lunar clinopyroxene as petrologic indicators (abs). *Lunar Sci. VI*, 601-603. Lunar Planetary Institute, Houston

Nord G.L., Ross M. and Huebner J.S. (1976) Lunar troctolite 76535: Mineralogical investigations (abs). *Lunar Sci. VII*, 628-630. Lunar Planetary Institute, Houston

Nord G.L., Heubner J.S. and Ross M. (1977) Structure, composition, and significance of "G-P" zones in 76535 orthopyroxene (abs). *Lunar Planet. Sci. VIII*, 732-734.

Nord G.L., Christie J.M., Lally J.S. and Heuer A.H. (1977) The thermal and deformational history of Apollo 15418. a partly shock-melted lunar breccia. *The Moon* 17, 217-231.

Norman M.D. (1981) Petrology of suevitic lunar breccia 67016. *Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf.* 235-252.

- Norman M.D. and Ryder G. (1979) A summary of the petrology and geochemistry of pristine highland rocks. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 531-559.
- Norman M.D. and Ryder G. (1980) Luna 24 ferrobasalts as a low-Mg primary melt. The Moon and Planets 23, 271-292.
- Norman M.D., Taylor G.J. and Keil K. (1991) New lunar rock types: Sodic anorthosites, and noritic, sulfur-rich kindred of ferroan anorthosites. Geophys. Res. Lett. 18, 2081-2084.
- Norman M.D. and Taylor S.R. (1992) Geochemistry of lunar crustal rocks from breccia 67016 and the composition of the Moon. Geochim. Cosmochim. Acta 56, 1013-1024.
- Norman M.D., Taylor G.L, Spudis P. and Ryder G. (1993) Lithologies contributing to the clast population in Apollo 17 LKFM basaltic impact melts. In Workshop on Geology of the Apollo 17 Landing Site. Lunar Planetary Institute, Houston Tech. Rpt. 92-09. 42-44.
- Norman M.D., Keil K., Griffin W.L. and Ryan C.G. (1995) Fragments of ancient lunar crust: Petrology and geochemistry of ferroan anorthosites from the Descartes region of the Moon. Geochim. Cosmochim. Acta 59, 831-847.
- Norman M.D., Borg L.E., Nyquist L.E. and Bogard D.D. (2003) Chronology, geochemistry, and petrology of a ferroan noritic anorthosite from Descartes breccia 67215: Clues to the age, origin, structure and impact history of the lunar crust. Meteoritics & Planet. Sci. 38, 645-661.
- Norman M.D., Duncan R.A. and Huard J.J. (2006) Identifying impact events within the lunar cataclysm from 40Ar-39Ar ages and compositions of Apollo 16 impact melt rocks. Geochim. Cosmochim. Acta 70, 6032-6049.
- Norman M.D., Shih C.-Y., Nyquist L.E., Bogard D.D. and Taylor L.A. (2007) Early impacts on the moon: Crystallization ages of Apollo 16 melt breccias. (abs) Lunar Planet. Sci. XXXVIII #1991 Lunar Planetary Institute, Houston
- Norris J.A., Keller L.P. and McKay D.S. (1993) Impact glasses from the <20um fraction of Apollo 17 soils 72501 and 78221. In Workshop on Geology of the Apollo 17 Landing Site. Lunar Planetary Institute, Houston Tech. Rpt. 92-09. 44-45.
- Norris S.J., Swart P.K., Wright I.P., Grady M.M. and Pillinger C.T. (1983) A search for a correlatable, isotopically light carbon and nitrogen components in lunar soils and breccias. Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf. B200-B210
- Nunes P.D. (1975) Pb loss from Apollo 17 glassy samples and Apollo 16 revisited. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1491-1499.
- Nunes P.D. and Tatsumoto M. (1973a) Excess lead in "Rusty Rock" 66095 and implications for an early lunar differentiation. Science 182, 916-920.
- Nunes P.D., Tatsumoto M., Knight R.J., Unruh D.M. and Doe B.R. (1973b) U-Th-Pb systematics of some Apollo 16 lunar samples. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1797-1822.
- Nunes P.D. and Tatsumoto M. (1975a) U-Th-Pb systematics of selected samples from Apollo 17, Boulder I, Station 2. The Moon 14, 463-471.
- Nunes P.D. and Tatsumoto M. (1975b) Pb loss from Apollo 17 glassy samples and Apollo 16 revisited (abs). Lunar Sci. VI, 604-606. Lunar Planetary Institute, Houston

Nunes P.D. and Tatsumoto M. (1975c) U-Th-Pb systematics of anorthositic gabbro 78155 (abs). *Lunar Sci.* VI, 607-609. Lunar Planetary Institute, Houston

Nunes P.D., Tatsumoto M. and Unruh D.M. (1974a) U-Th-Pb and Rb-Sr systematics of Apollo 17 Boulder 7 from the North Massif of the Taurus-Littrow valley. *Earth Planet. Sci. Lett.* 23, 445-452.

Nunes P.D., Tatsumoto M. and Unruh D.M. (1974b) U-Th-Pb systematics of some Apollo 17 lunar samples and implications for a lunar basin excavation chronology. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1487-1514.

Nunes P.D., Tasumoto M. and Unruh D.M. (1974c) U-Th-Pb systematics of some Apollo 17 samples (abs). *Lunar Sci.* V, 562-564. Lunar Planetary Institute, Houston

Nunes P.D., Tatsumoto M. and Unruh D.M. (1975a) U-Th-Pb systematics of anorthositic gabbros 78155 and 77017 - implications for early lunar evolution. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1431-1444.

Nunes P.D., Nakamura N. and Tatsumoto M. (1976) 4.4 b.y.-old cast in Boulder 7, Apollo 17 (abs). *Lunar Sci.* VII, 631-632. Lunar Planetary Institute, Houston

Nunes P.D., Unruh D.M. and Tatsumoto M. (1977) U-Th-Pb systematics of Apollo 16 samples 60018, 60025 and 64435; and the continuing problem of terrestrial Pb contamination of lunar samples. In *Lunar Sample Studies NASA SP-418*, 61.

Nyquist L.E. (1977) Lunar Rb-Sr chronology. *Phys. Chem. Earth* 10, 103-142.

Nyquist L.E., Hubbard N.J., Gast P.W., Church S.E., Bansal B.M. and Wiesmann H. (1972) Rb-Sr systematics for chemically defined Apollo 14 breccias. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1515-1530.

Nyquist L.E., Hubbard N.J., Gast P.W., Bansal B.M., Wiesmann H. and Jahn B.-M. (1973) Rb-Sr systematics for chemically defined Apollo 15 and 16 materials. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1823-1846.

Nyquist L.E., Bansal B.M., Wiesmann H. and Jahn B.-M. (1974a) Taurus-Littrow chronology: some constraints on early lunar crustal development. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1515-1539.

Nyquist L.E., Bansal B.M., Wiesmann H., and Jahn B.-M. (1974b) Taurus-Littrow chronology: Implications for early lunar crustal development (abs). *Lunar Sci.* V, 565-567. Lunar Planetary Institute, Houston

Nyquist L.E., Bansal B.M., and Wiesmann H. (1975a) Rb-Sr ages and initial  $^{87}\text{Sr}/^{86}\text{Sr}$  for Apollo 17 basalts and KREEP basalt 15386. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1445-1465.

Nyquist L.E., Bansal B.M., and Wiesmann H. (1975b) Rb-Sr ages and initial  $^{87}\text{Sr}/^{86}\text{Sr}$  for Apollo 17 basalts and KREEP basalt 15386 (abs). *Lunar Sci.* VI, 610-612. Lunar Planetary Institute, Houston

Nyquist L.E., Bansal B.M. and Wiesmann H. (1976) Rb-Sr systematics of agglutinate fractions from Apollo 16 soils. *Lunar Sci.* VII, 639-641. Lunar Planetary Institute, Houston

Nyquist L.E., Bansal B.M., and Wiesmann H. (1976a) Sr isotopic constraints on the petrogenesis of Apollo 17 mare basalts. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1507-1528.

Nyquist L.E., Bansal B.M. and Wiesmann H. (1976b) Sr isotopic constraints on the petrogenesis of Apollo 17 mare basalts (abs). *Lunar Sci.* VII, 636-638. Lunar Planetary Institute, Houston

Nyquist L.E., Bansal B.M., Wooden J. and Wiesmann H. (1977) Sr-isotopic constraints on the petrogenesis of Apollo 12 mare basalts. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 1383-1415.

Nyquist L.E., Wiesmann H., Bansal B., Wooden J. and McKay G. (1978) Chemical and Sr-isotopic characteristics of the Luna 24 samples. In Mare Crisium: The view from Luna 24 (Merrill and Papike eds.) p632-656. Pergamon Press. NY.

Nyquist L.E., Shih C.-Y., Wooden J.L., Bansal B.M. and Wiesmann H. (1979) The Sr and Nd isotopic record of Apollo 12 basalts: Implications for lunar geochemical evolution. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 77-114.

Nyquist L.E., Reimold W.U., Wooden J.L., Bansal B.M., Wiesmann H. and Shih C.-Y. (1981a) Sr and Nd cooling ages of cumulate norite 78236 (abs). Lunar Planet. Sci. XII, 782-784. Lunar Planetary Institute, Houston

Nyquist L.E., Reimold W.U., Bogard D.D., Wooden J.L., Bansal B.M., Wiesmann H. and Shih C.-Y. (1981b) A comparative Rb-Sr, Sm-Nd and K-Ar study of shocked norite 78236: Evidence of slow cooling in the lunar crust? Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf. 67-97.

Nyquist L.E., Wooden J.L., Shih C.-Y., Wiesmann H. and Bansal B.M. (1981c) Isotopic and REE studies of lunar basalt 12038: Implications for the petrogenesis of aluminous mare basalts. Earth Planet. Sci. Lett. 55, 335-355.

Nyquist L.E., Shih C.-Y., Bansal B., Wiesmann H. and Wooden J. (1983) Formation of a lunar granite 4.1 AE ago. (abs) Lunar Planet. Sci. XIV, 576-577. Lunar Planetary Institute, Houston

Nyquist L.E., Bogard D.D., Garrison D.H., Bansal B.M., Wiesmann H. and Shih C.-Y. (1991a) Thermal resetting of radiometric ages. I: Experimental Investigations (abs). Lunar Planet. Sci. XXII, 985-986. Lunar Planetary Institute, Houston

Nyquist L.E., Bogard D.D., Garrison D.H., Bansal B.M., Wiesmann H. and Shih C.-Y. (1991b) Thermal resetting of radiometric ages. II: Modeling and applications (abs). Lunar Planet. Sci. XXII, 987-988. Lunar Planetary Institute, Houston

Nyquist L.E. and Shih C.-Y. (1992) The isotopic record of lunar volcanism. Geochim. Cosmochim. Acta 56, 2213-2234.

Nyquist L.E., Shih C.-Y., Wiesmann H., and Bansal B.M. (1993) Formation interval for the lunar mantle and implications for lunar evolution (abs). Lunar Planet. Sci. XXIV, 1095-1096. Lunar Planetary Institute, Houston

Nyquist L.E., Wiesmann H., Bansal B., Shih C.-Y., Keith J.E. and Harper C.L. (1995)  $^{146}\text{Sm}$ - $^{142}\text{Nd}$  formation interval for the lunar mantle. Geochim. Cosmochim. Acta 59, 2817-2837.

Nyquist L.E., Bogard D.D. and Shih C.-Y. (2001) Radiometric chronology of the Moon and Mars. In The Century of Space Science, 1325-1376, Kluwer Acad. Press.

Oberli F., McCulloch M.T., Tera F., Papanastassiou D.A. and Wasserburg G.J. (1978) Early lunar differentiation constraints from U-Th-Pb, Sm-Nd and Rb-Sr model ages (abs). Lunar Planet. Sci. IX, 832-834. Lunar Planetary Institute, Houston

Oberli F., Hunkele J.C. and Wasserburg G.J. (1979) U-Pb and K-Ar systematics of cataclysm and precataclysm lunar impactites (abs). Lunar Planet. Sci. X, 940-942. Lunar Planetary Institute, Houston

O'Hara M.J. and Biggar G.M. (1972) A point of phase equilibrium interpretation in connection with lavas from Apollo 12 site. Earth Planet. Sci. Lett. 16, 388-390.

O'Hara M.J., Biggar G.M., Hill P.G., Jefferies B. and Humphries D.J. (1974) Plagioclase saturation in lunar high-Titanium basalt. Earth Planet. Sci. Lett. 21, 253-268.

O'Hara M.J., Biggar G.M., Humphries D.J. and Saha P. (1974b) Experimental petrology of high titanium basalt (abs). *Lunar Sci.* V, 571-573. Lunar Planetary Institute, Houston

O'Hara M.J. and Humphries D.J. (1975) Armalcolite crystallization, phenocryst assemblages, eruption conditions and origin of eleven high titanium basalts from Taurus Littrow (abs). *Lunar Sci.* VI, 619-621. Lunar Planetary Institute, Houston

O'Hara M.J. and Humphries D.J. (1977) Gravitational separation of quenching crystals: a cause of chemical differentiation in lunar basalts. *Phil. Trans. Roy. Soc. London A285*, 177-192.

O'Hara M.J. (2000) Flood basalts, basalt floods or topless bushvelds? *Lunar petrogenesis revisited. J. Petrogr.* 41, 1545-1651.

O'Kelley G.D., Eldridge J.S., Schonfeld E. and Bell P.R. (1971a) Abundances of the primordial radionuclides K, Th, and U in Apollo 12 luanr samples by nondestructive gamma-ray spectroscopy: implications for the origin of lunar soils. *Proc. Second Lunar Sci. Conf.* 1159-1168.

O'Kelley G.D., Eldridge J.S., Schonfeld E. and Bell P.R. (1971b) Cosmogenic radionuclide concentrations and exposure ages of lunar samples from Apollo 12. *Proc. Second Lunar Sci. Conf.* 1747-1755.

O'Kelley G.D., Eldridge J.S. and Northcutt K.J. (1973) Solar flare induced radionuclides and primordial radioelement concentrations in Apollo 17 rocks and frees preliminary results (abs). *Lunar Sci. IV*, 572-574. Lunar Planetary Institute, Houston

O'Kelley G.D., Eldridge J.S. and Northcutt K.J. (1974a) Cosmogenic radionuclides in samples from Taurus-Littrow: Effects of the solar flare of August 1972. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 2139-2147.

O'Kelley G.D., Eldridge J.S. and Northcutt K.J. (1974b) Concentrations of cosmogenic radionuclides in Apollo 17 samples: Effects of the solar flare of August, 1972 (abs). *Lunar Sci. V*, 577-579. Lunar Planetary Institute, Houston

Olhoeft G.R. and Strangway D.W. (1973) Electrical and magnetic properties of Apollo 17 soils. *EOS Trans. AGU* 54, 601.

Onorato P.I.K., Uhlmann D.R. and Simonds C.H. (1976) Heat flow in impact melts: Apollo 17 Station 6 Boulder and some applications to other breccias and xenolith laden melts. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 2449-2467.

Osborne M.D., Parkin K.M. and Bums R.G. (1978) Temperature-dependence of Fe-Ti spectra in the visible region: implications to mapping Ti concentrations of hot planetary surfaces. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 2949-2960.

Paces J.B., Nakai S., Neal C.R., Taylor L.A., Halliday A.N., Lee D.-C. and McKinney M.C. (1990a) Resolution of ages and Sm-Nd isotopic characteristics in Apollo 17 high-Ti basalts (abs). *Lunar Planet. Sci. XXI*, 924-925. Lunar Planetary Institute, Houston

Paces J.B., Neal C.R., Nakai S., Taylor L.A. and Halliday A.N. (1990b) Open- and closed-system magma evolution of Apollo 17 high-Ti basalts and origin of source heterogeneities at 4.1 Ga: Sr-Nd isotopic evidence (abs). *Lunar Planet. Sci. XXI*, 926-927. Lunar Planetary Institute, Houston

Paces J.B., Nakai S., Neal C.R., Taylor L.A., Halliday A.N. and Lee D.-C. (1991) A strontium and neodymium isotopic study of Apollo 17 high-Ti mare basalts: Resolution of ages, evolution of magmas, and origin of source heterogeneities. *Geochim. Cosmochim. Acta* 55, 2025-2043.

- Padawer G.M., Kamykowski E.A., Stanber M.C., D'Agostino M.D. and Brandt W. (1974) Concentration-versus-depth profiles of hydrogen, carbon, and fluorine in lunar rock surfaces. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1919-1937.
- Padia J.T., Rao M.N. and Venkatesan T.R. (1979) Cosmogenic and trapped rare gases in Luna 24 drill core samples. *The Moon* 20, 423-438.
- Palme H. (1977) On the age of KREEP. *Geochim. Cosmochim. Acta* 41, 1791-1801.
- Palme H. and Wanke H. (1977) Lunar differentiation processes as characterized by trace element abundances. *Phil. Trans. Roy. Soc. London A285*, 199-206.
- Palme H. and Wlotzka F. (1977) Trace element fractionation during crystallization of lunar rock 75035 (abs). *Lunar Sci. VIII*, 747-749. Lunar Planetary Institute, Houston
- Palme H., Baddenhausen H., Blum K., Cendales M., Dreibus G., Hofmeister H., Kmse H., Palme C., Spettel B., Vilcsek E. and Wanke H. (1978) New data on lunar samples and achondrites and a comparison of the least fractionated samples from the earth, the moon, and the eucrite parent body. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 25-57.
- Palme H., Spettel B., Wanke H., Bischoff A. and Stoffler D. (1984a) The evolution of the lunar magma ocean: Evidence from trace elements in plagioclase (abs). *Lunar Planet. Sci. XV*, 625-626.
- Palme H., Spettel B., Wanke H., Bischoff A. and Stoffler D. (1984b) Early differentiation of the Moon: Evidence from trace elements in plagioclase. Proc. 15<sup>th</sup> Lunar Planet. Sci. Conf. C3-C15.
- Papanastassiou D.A., Wasserburg G.J. and Burnett D.S. (1970a) Rb-Sr ages of lunar rocks from the Sea of Tranquility. *Earth Planet. Sci. Lett.* 8, 1
- Papanastassiou D.A. and Wasserburg G.J. (1970b) Rb-Sr ages from the Ocean of Storms. *Earth Planet. Sci. Lett.* 8, 269-278.
- Papanastassiou D.A. and Wasserburg G.J. (1971a) Lunar chronology and evolution from Rb-Sr studies of Apollo 11 and 12 samples. *Earth Planet. Sci. Lett.* 11, 37-62.
- Papanastassiou D.A. and Wasserburg G.J. (1971b) Rb-Sr ages of igneous rocks from the Apollo 14 mission and the age of the Fra Mauro Formation. *Earth Planet. Sci. Lett.* 12, 36-48.
- Papanastassiou D.A. and Wasserburg G.J. (1972a) Rb-Sr age of a Luna 16 basalt and the model age of lunar soils. *Earth Planet. Sci. Lett.* 13, 368-374.
- Papanastassiou D.A. and Wasserburg G.J. (1972b) Rb-Sr age of a crystalline rock from Apollo 16. *Earth Planet. Sci. Lett.* 16, 289-298.
- Papanastassiou D.A. and Wasserburg G.J. (1972c) Rb-Sr age of Luna 20 and Apollo 16 samples. *Earth Planet. Sci. Lett.* 17, 52-63.
- Papanastassiou D.A. and Wasserburg G.J. (1973) Rb-Sr ages and initial strontium in basalts from Apollo 15. *Earth Planet. Sci. Lett.* 17, 324-337.
- Papanastassiou D.A. and Wasserburg G.J. (1975a) Rb-Sr study of a lunar dunite and evidence for early lunar differentiates. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1467-1489.
- Papanastassiou D.A. and Wasserburg G.J. (1975b) A Rb-Sr study of Apollo 17 boulder 3: Dunite clast, microclasts, and matrix (abs). *Lunar Sci. VI*, 631-633. Lunar Planetary Institute, Houston

Papanastassiou D.A. and Wasserburg G.J. (1976a) Rb-Sr age of troctolite 76535. Proc. 7<sup>th</sup> Lunar Sci. Conf. 2035-2054.

Papanastassiou D.A. and Wasserburg G.J. (1976b) Early lunar differentiates and lunar initial  $^{87}\text{Sr}/^{86}\text{Sr}$  (abs). Lunar Sci. VII, 665-667. Lunar Planetary Institute, Houston

Papanastassiou D.A., DePaolo D.J. and Wasserburg G.J. (1977) Rb-Sr and Sm-Nd chronology and geneology of mare basalts from the Sea of Tranquillity. Proc. 8<sup>th</sup> Lunar Sci. Conf. 1639-1672.

Papike et al. (1971) Apollo 12 clinopyroxenes: Exsolution and epitaxy. Earth Planet. Sci. Lett. 10, 307-315.

Papike J.J. (1996) Pyroxene as a recorder of cumulate formational processes in asteroids, Moon, Mars and Earth: Reading the record with the ion microprobe. Am. Mineral. 81, 525-544.

Papike J.J. and Bence A.E. (1972) Apollo 14 inverted pigeonites: Possible samples of lunar plutonic rocks. Earth Planet. Sci. Lett. 14, 176-182.

Papike J.J., Bence A.E. and Lindsley D.H. (1974) Mare basalts from the Taurus-Littrow region of the moon. Proc. 5<sup>th</sup> Lunar Sci. Conf. 471-504.

Papike J.J., Hodges F.N., Bence A.E., Cameron M. and Rhodes J.M. (1976) Mare basalts: Crystal chemistry, mineralogy and petrology. Rev. Geophys. Space Phys. 14, 475-540.

Papike J.J. and Bence A.E. (1978) Lunar mare vs. terrestrial mid-ocean ridge basalts: Planetary constraints on basaltic volcanism. Geophys. Res. Lett. 5, 803-806.

Papike J.J. and Vaniman D.T. (1978) The lunar mare basalt suite. Geophys. Res. Lett. 5, 433-436.

Papike J.J. and Vaniman D.T. (1978) Luna 24 ferrobasalts and the mare basalt suite: Comparative chemistry, mineralogy and petrology. In Mare Crisium: The View from Luna 24. (eds. Merrill and Papike) Pergamon Press, 371-401.

Papike J.J., Simon S.B., White C. and Laul J.C. (1981) The relationship of the lunar regolith <10 micron fraction and agglutinates. Part I: A model for agglutinate formation and some indirect supportive evidence. Proc. 12<sup>th</sup> Lunar Planet. Sci. Lett. 409-420.

Papike J.J., Simon S.B. and Laul J.C. (1982) The lunar regolith: Chemistry, Mineralogy and Petrology. Rev. Geophys. Space Phys. 20, 761-826.

Papike J.J., Taylor L.A. and Simon S.B. (1991) Lunar Minerals. In Lunar Sourcebook: a users guide to the moon. (eds. Heiken et al.) Cambridge Univ. Press

Papike J.J., Fowler G.W. and Shearer C.K. (1994a) Orthopyroxene as a recorder of lunar Mg-suite norite petrogenesis: Preliminary ion microprobe studies of Apollo 17 fragments (abs). Lunar Planet. Sci. XXV, 1045-1046. Lunar Planetary Institute, Houston

Papike J.J., Fowler G.W. and Shearer C.K. (1994b) Orthopyroxene as a recorder of lunar crust evolution: An ion microprobe investigation of Mg-suite norites. Am. Mineral. 79, 796-800.

Papike J.J., Fowler G.W., Shearer C.K. and Layne G.D. (1996) Ion microprobe investigation of plagioclase and orthopyroxene from lunar Mg-suite norites: Implications for calculating parental melt REE concentrations and for assessing postcrystallization REE redistribution. Geochim. Cosmochim. Acta 60, 3967-3978.

Papike J.J., Fowler G.W. and Shearer C.K. (1997) Evolution of the lunar crust: SIMS study of plagioclase from ferroan anorthosites. *Geochim. Cosmochim. Acta* 61, 2343-2350.

Papike J.J., Ryder G. and Schaefer C.K. (1998) Lunar Samples. In *Planetary Materials*. (ed. Papike) *Reviews in Mineralogy*, vol 36. 5-01-5-189. Min. Soc. Am.

Papike J.J., Fowler G.W., Adcock C.T. and Schaefer C.K. (1999) Systematics of Ni and Co in olivine from planetary melt systems: Lunar mare basalts. *Am. Mineral.* 84, 392-399.

Papike J.J., Karner J.M. and Shearer C.K. (2003) Determination of planetary basalt parentage: A simple technique using the electron microprobe. *Letter to Am. Mineral.* 88, 469-472.

Patchen A.P. and Taylor L.A. (2004) The most reduced rock from the moon – Apollo 14 basalt 14053: Extreme reduction entirely from a re-heating event. (abs) *Lunar Planet. Sci.* XXXV, #1762 Lunar Planetary Institute, Houston

Pearce G.W. and Chou C.-L. (1976) Relationships between siderophile elements and metallic iron contents of Apollo 16 and 17 lunar soils. (abs) *Lunar Sci.* VII, 673-675. Lunar Planetary Institute, Houston

Pearce G.W. and Chou C.-L. (1977) On the origin of sample 70019 and its suitability for lunar magnetic field intensity studies. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 669-677.

Pearce G.W., Strangway D.W. and Gose W.A. (1972) Remanent magnetism of the lunar surface. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 2449-2464.

Pearce G.W., Gose W.A. and Strangway D.W. (1973) Magnetic studies on Apollo 15 and 16 lunar samples. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 3045-3076.

Pearce G.W. and Simonds C.H. (1974) Magnetic properties of Apollo 16 samples and implications for their mode of formation. *J. Geophys. Res.* 79, 2953-2959.

Pearce G.W., Strangway D.W. and Gose W.A. (1974a) Magnetic properties of Apollo samples and implications for regolith formation. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 2815-2826.

Pearce G.W., Gose W.A. and Strangway D.W. (1974b) Magnetism of the Apollo 17 samples (abs). *Lunar Sci.* V, 590-592. Lunar Planetary Institute, Houston

Pearce G.W., Hoye G.S., Strangway D.W., Walker B.M. and Taylor L.A. (1976) Some complexities in the determination of lunar paleointensities. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 3271-3297.

Pearce G.W., Chou C.-L. and Wu Y. (1977) Chemical compositions and magnetic properties in separated glass and breccia fractions of 70019 (abs). *Lunar Sci.* VIII, 759-761. Lunar Planetary Institute, Houston

Pearce T.H. and Timms C. (1992) Interference imaging of plagioclase in lunar materials (abs). *Lunar Planet. Sci.* XXIII, 1045. Lunar Planetary Institute, Houston

Peckett A. and Brown G.M. (1973) Plutonic or metamorphic equilibration in Apollo 16 lunar pyroxenes. *Nature* 242, 252-255.

Pepin R.O., Dragon J.C., Johnson N.L., Bates A., Coscio M.R. and Murthy V.R. (1975) Rare gases and Ca, Sr and Ba in Apollo 17 drill-core fines. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 2027-2056.

Perry C.H., Agrawal D.K., Anastassakis E., Lowndes R.P. and Tornberg N.E. (1972) Far infrared and Raman spectra A15. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 3077-3095.

Petrowski C., Kerridge J.F. and Kaplan I.R. (1974) Light element geochemistry of the Apollo 17 site. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1939-1948.

Philpotts J.A. and Schnetzler C.C. (1970a) Potassium, rubidium, strontium, barium and rare-earth concentrations in lunar rocks and separated phases. Science 167, 493-495.

Philpotts J.A. and Schnetzler C.C. (1970b) Apollo 11 lunar samples: K, Rb, Sr, Ba and rare-earth concentrations in some rocks and separated phases. Proc. Apollo 11 Lunar Science Conf. 1471-1486.

Philpotts J.A., Schnetzler C.C., Bottino M.L., Schumann S. and Thomas H.H. (1972) Luna 16: Some Li, K, Rb, Sr Ba, rare-earth, Zr and Hf concentrations. Earth Planet. Sci. Lett. 13, 429-435.

Philpotts J.A., Schuhmann S., Schnetzler C.C., Kouns C.W., Doan A.S., Wood F.M., Bickel A.L. and Lum R.K.L. (1973a) Apollo 17: Geochemical aspects of some soils, basalts, and breccia (abs). EOS 54, 603-604. Amer. Geophys. Union

Philpotts J.A., Schnetzler C.C., Nava D.F., Bottino M.L., Fullagar P.D., Thomas H.H., Schumann S. and Kouns C.W. (1972) Apollo 14: Some geochemical aspects. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1293-1305.

Philpotts J.A., Schumann S., Kouns C.W., Lum-Staab R.K.L. and Schnetzler C.C. (1973b) Apollo 16 returned lunar samples – lithophile trace-element abundances. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1427-1436.

Philpotts J.A., Schuhmann S., Kouns C.W., Lum R.K.L. and Winzer S. (1974a) Origin of Apollo 17 rocks and soils. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1255-1267.

Philpotts J.A., Schuhmann S., Kouns C.W. and Lum R.K.L. (1974b) Lithophile trace elements in Apollo 17 soils (abs). Lunar Sci. V, 599-601. Lunar Planetary Institute, Houston

Phinney D., Kahl S.B. and Reynolds J.H. (1975) 40Ar-39Ar dating of Apollo 16 and 17 rocks. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1593-1608.

Phinney W.C. (1981) Guidebook for the Boulders at Station 6, Apollo 17. Curatorial Branch Publication 55, JSC- 17243 pp. 125.

Phinney W.C. (1991) Lunar anorthosites, their equilibrium melts and the bulk moon. Proc. 21<sup>st</sup> Lunar Planet. Sci. Conf. 29-49. Lunar Planetary Institute, Houston

Phinney W.C. (1992) Partition coefficients for iron between plagioclase and basalt as a function of oxygen fugacity: Implications for Archean and lunar anorthosites. Geochim. Cosmochim. Acta 56, 1885-1895.

Phinney W.C., Consortium Leader (1974) Progress report: Apollo 17, station 6 boulder consortium (abs). LS V, Suppl. A. The Lunar Science Institute, Houston.

Phinney W. and Lofgren G. (1973) Description, classification and inventory of Apollo 16 rake samples from stations 1, 4 and 13. Curators Office.

Phinney W.C., Simonds C.H. and Warner J. (1974) Description, Classification and Inventory of Apollo 17 Rake Samples from Station 6. Curator's Catalog, pp. 46.

Phinney W.C., Simonds C.H. and Warner J. (1975) Description, Classification and Inventory of the Comprehensive sample from Apollo 14. Curator's Catalog, pp. 46.

Phinney W.C., McKay D.S., Simonds C.H. and Warner J.L. (1976a) Lithification of vitric- and elastic-matrix breccias: SEM photography. Proc. 7<sup>th</sup> Lunar Sci. Conf. 2469-2492.

Phinney W.C., McKay D.S., Warner J.L. and Simonds C.H. (1976b) Lithification of fragmental and vitric matrix breccias (abs). *Lunar Sci.* VII, 694-696. Lunar Planetary Institute, Houston

Phinney W.C., Warner J.L. and Simonds C.H. (1977) Petrologic evidence for formation and solidification of impact melts (abs). *Lunar Sci.* VIII, 770-772. Lunar Planetary Institute, Houston

Pidgeon R.T., Nemchin A.A. and Meyer C. (2005) A further investigation of the exceptional zircon aggregate in lunar thin section 73235,82. (abs#1275) *Lunar Planet. Sci.* XXXVI Lunar Planetary Institute, Houston

Pidgeon R.T., Nemchin A.A. and Meyer C. (2006) Complex histories of two lunar zircons as evidenced by their internal structures and U-Pb ages. (abs#1548) *Lunar Planet. Sci.* XXXVII Lunar Planetary Institute, Houston

Pidgeon R.T., Nemchin A.A., vanBronswijk W., Geisler T., Meyer C., Compston W. and Williams I.S. (2007) Complex history of a zircon aggregate from lunar breccia. *Geochim. Cosmochim Acta* (in press)

Pieters C.M., Hawke B.R., Butler P., Waltz S. and Nagle S. (1980) Multispectral imaging of the lunar regolith core samples: Preliminary results for 74002. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 1593-1608.

Pieters C.M. and Taylor G.J. (1989) Millimeter petrology and kilometer mineral exploration of the Moon. *Proc. 19<sup>th</sup> Lunar Planet. Sci. Conf.* 115-125. Lunar Planetary Institute, Houston

Pieters C.M. and Taylor L.A. (2003) Systematic global mixing and melting in lunar soil evolution. *Geophys. Res. Lett.* 30, doi:10.1029/2003GL019212

Pieters C.M., Pratt S.F. and Sunshine J.M. (1990) Petrology of the olivine mountains at Copernicus (abs). *Lunar Planet. Sci. XXI*, 962-963. Lunar Planetary Institute, Houston

Pieters C.M., Fischer E.M., Rode O. and Basu A. (1993) Optical effects of space weathering: The role of the finest fraction. *J. Geophys. Res.* 98, 20,817-20,824.

Pillinger C.T. and Eglinton G. (1977) The chemistry of carbon in the lunar regolith. *Phil. Trans. Roy. Soc. London A285*, 369-378.

Podosek F.A. and Huneke J.C. (1973) Argon in Apollo 15 green glass spherules (15426):  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  age and trapped argon. *Earth Planet. Sci. Lett.* 19, 413-421.

Podosek F.A., Huneke J.C., Gancarz A.J. and Wasserburg G. Jos. (1973) The age and petrology of two Luna 20 fragments and inferences for widespread lunar metamorphism. *Geochim. Cosmochim. Acta* 37, 887-904.

Poupeau G., Pellas P., Lorin J.C., Chetrit G.C. and Berdot J.L. (1972) Track analysis of rocks 15058, 15555, 15641 and 14307. The Apollo 15 Samples. 385-387. Lunar Planetary Institute, Houston

Poupeau G., Walker R.M., Zinner E. and Morrison D.A. (1975) Surface exposure history of individual crystals in the lunar regolith. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 3433-3448.

Pratt D.D., Moore C.B. and Parsons M.L. (1978) Apollo 17 Mare basalt regression and classification studies. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 487-494.

Premo W.R. (1991) Rb-Sr and Sm-Nd ages for lunar norite 78235/78236: Implications on the U-Pb isotopic systematics in this high-Mg rock (abs). *Lunar Planet. Sci.* XXII, 1089-1090. Lunar Planetary Institute, Houston

Premo W.R. (1993) U-Pb isotopic ages and characteristics of ancient (>4.0 Ga) lunar highland rocks (abs). *Lunar Planet. Sci.* XXIV, 1169-1170. Lunar Planetary Institute, Houston

Premo W.R. and Tatsumoto M. (1990) Pb isotopes in norite 78235 (abs). *Lunar Planet. Sci.* XXI, 977-978. Lunar Planetary Institute, Houston

Premo W.R. and Tatsumoto M. (1991a) Pb isotopes in troctolite 76535 (abs). *Lunar Planet. Sci.* XXII, 1093-1094. Lunar Planetary Institute, Houston

Premo W.R. and Tatsumoto M. (1991b) U-Th-Pb isotopic systematics of lunar norite 78235. *Proc. 21<sup>st</sup> Lunar Planet. Sci. Conf.* 89-100. Lunar Planetary Institute, Houston

Premo W.R. and Tatsumoto M. (1992a) U-Th-Pb, Rb-Sr, and Sm-Nd isotopic systematics of lunar troctolite cumulate 76535: Implications on the age and origin of this early lunar, deep-seated cumulate. *Proc. 22<sup>nd</sup> Lunar Planet. Sci. Conf.* 381-397. Lunar Planetary Institute, Houston

Premo W.R. and Tatsumoto M. (1992b) Acid leaching of apatite: Implications for U-Th-Pb systematics of lunar highland plutonic rocks (abs). *Lunar Planet. Sci. XXIII*, 1101-1102. Lunar Planetary Institute, Houston

Premo W.R. and Tatsumoto M. (1992c) U-Pb isotopes in dunite 72415 (abs). *Lunar Planet. Sci. XXIII*, 1103-1104. Lunar Planetary Institute, Houston

Premo W.R. and Tatsumoto M. (1993a) Isotopic ages and characteristics of ancient (pre-Serenitatis) crustal rocks at Apollo 17. In *Workshop on Geology of the Apollo 17 Landing Site*. LPI Tech. Rpt. 92-09. 45-48. Lunar Planetary Institute, Houston

Premo W.R. and Tatsumoto M. (1993b) U-Pb isotopic systematics of ferroan anorthosite 60025. (abs) *Lunar Planet. Sci. XXIV*, 1173-1174. Lunar Planetary Institute, Houston

Premo W.R., Tatsumoto M., Misawa K., Nakamura N. and Kita N.I. (1999) Pb-isotopic systematics of lunar highland rocks (>3.9 b.y.): Constraints on early lunar evolution. In *Taylor Volume 207-240*. GSA Bellweather Press (Snyder et al. eds.)

Premo W.R. and Tatsumoto M. (2000) Contrasting U-Th-Pb, Rb-Sr and Sm-Nd isotopic systematics of lunar ferroan anorthosite 60025 and 62237. Implications on the age and origin of the moon. In preparation or unpublished

Price P.B., Chan J.H., Hutcheon I.D., MacDougall D., Rajan R.S., Shirk E. and Sullivan J.D. (1973) Low energy heavy ions in the solar system. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 2347-2362.

Prinz M., Bunch T.E. and Keil K. (1971) Composition and origin of lithic fragments and glasses in Apollo 11 samples. *Cont. Mineral. Petrol.* 32, 211-230.

Prinz M., Dowty E., Keil K. and Bunch T.E. (1973a) Spinel troctolite and anorthosite in Apollo 16 samples. *Science* 179, 74-76.

Prinz M., Dowty E. and Keil K. (1973b) A model for the formation of orange and green glass and the filling of mare basins. *EOS Trans. AGU* 54, 605.

Prinz M., Dowty E., Keil K. and Bunch T.E. (1973c) Mineralogy, petrology and chemistry of lithic fragments from Luna 20 fines: Origin of the cumulate ANT suite and its relationship to high-alumina basalts. *Geochim. Cosmochim. Acta* 37, 979-1006.

Prinz M. and Keil K. (1977) Mineralogy, petrology and chemistry of ANT-suite rocks from the lunar highlands. *Phys. Chem. Earth* 10, 215-237.

- Puchtel I.S. et al. (2005) Lunar Planet. Sci. 34 #1707 Lunar Planetary Institute, Houston
- Puchtel I.S. et al. (2006) Lunar Planet. Sci. 37, #1428 Lunar Planetary Institute, Houston
- Puchtel I.S., Walker R.J., Kring D.A. and James O.B. (2007) Further study of 187Os/188Os and highly siderophile element systematics of lunar impact melt rocks. (abs) Lunar Planet. Sci. 38 #2040 Lunar Planetary Institute, Houston
- Quick J.E., Albee A.L., Ma M.-S., Murali A.V. and Schmitt R.A. (1977) Chemical compositions and possible immiscibility of two silicate melts in 12013. Proc. 8<sup>th</sup> Lunar Sci. Conf. 2153-2189.
- Quaide W. and Wrigley R. (1972) Mineralogy and origin of Fra Mauro fines and breccias. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 771-784.
- Radcliffe S.V., Christie J.M., Nord G.L., Lally J.S., Heuer A.H., Griggs D.T. and Fisher R.M. (1974) Electron petrographic evidence concerning the origin and lithification of the lunar breccias (abs). Lunar Sci. V, 613-615. Lunar Planetary Institute, Houston
- Rankenburg K., Brandon A.D. and Neal C.R. (2006) Neodymium isotope evidence for a chondritic composition of the Moon. Science 312, 1369-1372.
- 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. 3<sup>rd</sup> Lunar Sci. Conf. 1681-1691.
- Rancitelli L.A., Perkins R.W., Felix W.D. and Wogman N.A. (1973) Preliminary analysis of cosmogenic and primordial radionuclides in Apollo 17 samples (abs). Lunar Sci. IV, 612-614. Lunar Planetary Institute, Houston
- Rancitelli L.A., Perkins R.W., Felix W.D. and Wogman N.A. (1974a) Solar flare and lunar surface process characterization at the Apollo 17 site. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2185-2203.
- Rancitelli L.A., Perkins R.W., Felix W.D. and Wogman N.A. (1974b) Anisotropy of the August 4-7, 1972 solar flares at the Apollo 17 site (abs). Lunar Sci. V, 618-620. Lunar Planetary Institute, Houston
- Rao M.N and Venkatesan T.R. (1980) Solar-flare produced <sup>3</sup>He in lunar samples. Nature 286, 788-790.
- Rao M.N., Garrison D.H., Bogard D.D. and Reedy R.C. (1993) Solar-flare-implanted 4He/3He and solar-proton-produced Ne and Ar concentration profiles preserved in lunar rock 61016. J. Geophys. Res. 98, 7827-7835.
- Rao M.N., Garrison D.H., Bogard D.D. and Reedy R.C. (1994) Determination of the flux and energy distribution of energetic solar protons in the past 2 Myr using lunar rocks 68815. Geochim. Cosmochim. Acta 58, 4231-4245.
- Reed S.J.B. and Taylor S.R. (1974) Meteoritical metal in Apollo 16 samples. Meteoritics 9, 23-24.
- Reed G.W., Allen R.O. and Jovanovic S. (1977) Volatile metal deposits on lunar soils - relation to volcanism. Proc. 8<sup>th</sup> Lunar Sci. Conf. 3917-3930.
- Reedy R.C. and Arnold J.R. (1972) Interaction of solar and galactic cosmic ray particles with the moon. J. Geophys. Res. 77, 537-555.
- Reedy R.C. (1977) Solar flare fluxes since 1956. Proc. 8<sup>th</sup> Lunar Sci. Conf. , 825-839.

Reedy R.C. (1980) Lunar radionuclide records of average solar-cosmic-ray fluxes over the last ten million years. In Proc. Conf. Ancient Sun, Geochim Cosmochim. Acta Suppl. 13 (eds, Pepin et al. ) Lunar Planet. Institute

Reedy R.C. (1987) Nuclide production by primary cosmic-ray protons. Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf. E697-E702.

Reedy R.C. and Arnold J.R. (1977) Interaction of solar and galactic cosmic-ray particles with the Moon. J. Geophys. Res. 77, 537-555.

Rees C.E. and Thode H.G. (1974a) Sulfur concentrations and isotope ratios in Apollo 16 and 17 samples. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1963-1973.

Rees C.E. and Thode H.G. (1974b) Sulfur concentrations and isotope ratios in Apollo 16 and 17 samples (abs). Lunar Sci. V, 621-623. Lunar Planetary Institute, Houston

Reid A.M. (1974) Rock types present in lunar highland soils. The Moon 9, 141-146.

Reid A.M., Meyer C., Harmon R.S. and Brett R. (1970) Metal grains in Apollo 12 igneous rocks. Earth Planet. Sci. Lett. 9, 1-5.

Reid A.M., Warner J., Ridley W.I. and Brown R.W. (1972) Major element composition of glasses in three Apollo 15 soils. Meteoritics 7, 395-415.

Reid A.M., Lofgren G.E., Heiken G.H., Brown R.W. and Moreland G. (1973a) Apollo 17 orange glass, Apollo 15 green glass and Hawaiian lava fountain glass. EOS Trans. AGU 54, 606-607.

Reid A.M., Ridley W.I., Donaldson C. and Brown R.W. (1973b) Glass compositions in the orange and gray soils from Shorty Crater, Apollo 17. EOS Trans. AGU 54, 607-608.

Reid A.M., Duncan A.R. and Richardson S.H. (1977) In search of LKFM. Proc. 8<sup>th</sup> Lunar Sci. Conf. 2321-2338.

Reid J.B. (1971) Apollo 12 spinels as petrogenetic indicators. Earth Planet. Sci. Lett. 10, 351-356.

Reimold W.U. and Borchardt R. (1984) Subophitic lithologies in KREEP-rich poikilitic impact melt rocks from Caley Plains, Apollo 16 – remnants of a volcanic Highland curst? Earth Planet. Sci. Lett. 67, 9-18.

Reimold W.U. and Reimold J.N. (1984) The mineralogical, chemical and chronological characteristics of the crystalline Apollo 16 impact melt rocks. Forschr. Mineral. 62, 269-301.

Reimold W.U., Nyquist L.E., Bansal B.M., Wooden J.L., Shih C.-Y., Wiesmann H. and Mackinnon I.D.R. (1985) Isotope analysis of crystalline impact-melt rocks from Apollo 16 stations 11 and 13. North Ray Crater. Proc. 15<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 90, C597-C612.

Reynolds J.H., Alexander E.C., Davis P.K and Srinivasan B. (1974) Studies of K-Ar dating and xenon extinct radionuclides in breccia 14318: implications for early lunar history. Geochim. Cosmochim. Acta 38, 401-417.

Rhodes J.M. (1973) Major and trace element analyses of Apollo 17 samples (abs). EOS54, 609-610.

Rhodes J.M. (1977) Some compositional aspects of lunar regolith evolution. Phil. Trans. Roy. Soc. London A285, 293-303.

Rhodes J.M. and Blanchard D.P. (1980) Chemistry of Apollo 11 low-K mare basalts. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 49-66.

Rhodes J.M. and Blanchard D.P. (1981) Apollo 11 breccias and soils: Aluminous mare basalts or multi-component mixtures? Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf. 607-620.

Rhodes J.M. and Blanchard D.P. (1983) New analyses of mare basalts (abs). Lunar Planet. Sci. XIV, 640-641. Lunar Planetary Institute, Houston

Rhodes J.M. and Rodgers K.V. (1975) Major element chemistry, classification and fractionation of Apollo 17 mare basalts. In Papers presented to the Conference on Origins of Mare Basalts and their Implications for Lunar Evolution (Lunar Science Institute, Houston), 140-143.

Rhodes J.M., Rodgers K.V., Shih C., Bansal B.M., Nyquist L.E., Wiesmann H. and Hubbard N.J. (1974a) The relationships between geology and soil chemistry at the Apollo 17 landing site. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1097-1117.

Rhodes J.M., Rodgers K.V., Shih C., Bansal B.M., Nyquist L.E. Wiesmann H. (1974b) The relationship between geology and soil chemistry at the Apollo 17 landing site (abs). Lunar Sci. V, 630-632. Lunar Planetary Institute, Houston

Rhodes J.M., Adams J.B., Blanchard D.P., Charette M.P., Rodgers K.V., Jacobs J.W., Brannon J.C. and Haskin L.A. (1975) Chemistry of agglutinate fractions in lunar soils. Proc. 6<sup>th</sup> Lunar Sci. Conf. 2291-2308.

Rhodes J.M., Hubbard N.J., Wiesmann H., Rodgers K.V., Brannon J.C. and Bansal B.M. (1976a) Chemistry, classification, and petrogenesis of Apollo 17 mare basaits. Proc. 7<sup>th</sup> Lunar Sci. Conf. 1467-1489.

Rhodes J.M., Hubbard N.J., Wiesmann H., Rodgers K.V. and Bansal B.M. (1976b) Chemistry, classification and petrogenesis of Apollo 17 mare basalts (abs). Lunar Sci. VII, 730-732. Lunar Planetary Institute, Houston

Rhodes J.M. and Blanchard D.P. (1983) New analyses of Mare Basalts (abs). Lunar Planet. Sci. XIV, 640-641. Lunar Planetary Institute, Houston

Richter D., Simmons G., and Siegfried R. (1976a) Microcracks, micropores, and their petrologic interpretation for 72415 and 15418. Proc. 7<sup>th</sup> Lunar Sci. Conf. 1901-1923.

Richter D., Siegfried R., and Simmons G. (1976b) Unusual cracks and pores in breccia 15418 and lunar dunite 72415 (abs). Lunar Sci. VII, 736-738. Lunar Planetary Institute, Houston

Ridley W.I. (1973) Petrogenesis of basalt 70035: A multi-stage cooling history (abs). EOS 54, 611-612. AGU

Ridley W.I. (1975a) Petrology of Apollo 15 breccia 15459 (abs). Lunar Sci. VI, 671-673. Lunar Planetary Institute, Houston

Ridley W.I. (1975b) On high-alumina mare basalts. Proc. 6<sup>th</sup> Lunar Sci. Conf. 131-145.

Ridley W.I. (1977) Some petrologic aspects of Imbrium stratigraphy. Philos. Trans. R. Soc. Lond., A285, 105-114.

Ridley W.I., Reid A.M., Warner J.L. and Brown R.W. (1973a) Apollo 15 green glasses. Phys. Earth Planet. Interiors 7, 133-136.

Ridley W.I., Hubbard N.J., Rhodes J.M., Weismann H. and Bansal B. (1973b) The petrology of lunar breccia 15445 and petrogenetic implications. J. Geol. 81, 621-631.

- Ridley W.I., Reid A.M., Warner J.L., Brown R.W., Gooley R. and Donaldson C. (1973c) Glass compositions in Apollo 16 soils 60501 and 61221. Proc. 4<sup>th</sup> Lunar Sci. Conf. 309-321.
- Righter K. and Shearer C.K. (2003) Magmatic fractionation of Hf and W: Constraints on the timing of core formation and differentiation in the moon and Mars. Geochim. Cosmochim. Acta 67, 2497-2507.
- Ringwood A.E. (1970) Petrogenesis of Apollo 11 basalts and implications for a lunar origin. J. Geophys. Res. 75, 6453-6479.
- Ringwood A.E. (1975) Some aspects of the minor element chemistry of lunar mare basalts. The Moon 12, 127-157.
- Ringwood A.E. (1977a) Basaltic magmatism and the bulk composition of the moon. The Moon 16, 389-423.
- Ringwood A.E. (1977b) Mare basalt petrogenesis and the composition of the lunar interior. Phil. Trans. Roy. Soc. London A285, 577-586.
- Ringwood A.E. (1992) Volatile and siderophile element geochemistry of the moon. Earth Planet. Sci. Lett. 111, 537-555.
- Ringwood A.E and Essene E. (1970) Petrogenesis of Apollo 11 basalts, internal constitution and origin of the moon. Proc. Apollo 11 Lunar Sci. Conf. 769-799
- Ringwood A.E and Green D.H. (1972) Crystallization of plagioclase in lunar basalts and its significance. Earth Planet. Sci. Lett. 14, 14-18.
- Ringwood A.E and Kesson S.E. (1977a) A dynamic model for mare basalt petrogenesis. Proc. 7<sup>th</sup> Lunar Sci. Conf. 1697-1722.
- Ringwood A.E. and Kesson S.E. (1977b) Basaltic magmatism and the bulk composition of the Moon: II Siderophile and volatile elements in Moon, Earth and Chondrites: Implications for lunar origin. The Moon 16, 425-464.
- Ringwood A.E., Seifert S. and Wänke H. (1987) A komatiite composition in Apollo 16 highlands breccias; implications for the nickel-cobalt systematics and bulk composition of the Moon. Earth Planet. Sci. Lett. 81, 105-117.
- Ringwood A.E. and Wänke H. (1990) Cobalt and nickel concentration in the “komatiite” component of Apollo 16 polymict samples – reply to R.L. Korotev. Earth Planet. Sci. Lett. 96, 490-498.
- Roedder E. (1979a) Melt inclusions in 75075 and 78505 - the problem of anomalous low-K inclusions in ilmenite revisited. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 249-257.
- Roedder E. (1979b) Melt inclusions in 75075 - the problem of anomalous low-K inclusions in ilmenite revisited (abs). Lunar Planet. Sci. X, 1033-1035. Lunar Planetary Institute, Houston
- Roedder E. and Weiblen P.W. (1972a) Petrographic features and petrologic significance of melt inclusions in Apollo 14 and 15 rocks. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 251-279.
- Roedder E. and Weiblen P.W. (1972b) Occurrence of chromian, hercynitic spinel (Pleonaste) in Apollo 14 samples and its petrologic significance. Earth Planet. Sci. Lett. 15, 376-379.
- Roedder E. and Weiblen P.W. (1973a) Origin of orange glass spherules in Apollo 17 sample 74220. EOS Trans. AGU 54, 612-613.

- Roedder E. and Weiben P.W. (1973b) Apollo 17 “orange glass” and meteoritic impact on liquid lava. *Nature* 244, 210-212.
- Roedder E. and Weiben P.W. (1975a) Anomalous low-K silicate melt inclusions in ilmenite from Apollo 17 basalts. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 147-164.
- Roedder E. and Weiben P.W. (1975b) Anomalous low-K silicate melt inclusions in ilmenite from Apollo 17 basalts (abs). *Lunar Sci. VI*, 683-685. Lunar Planetary Institute, Houston
- Roedder E. and Weiben P.W. (1977a) Compositional variation in late-stage differentiates in mare lavas, as indicated by silicate melt inclusions. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 1767-1783.
- Roedder E. and Weiben P.W. (1977b) High-silica glass inclusions in olivine of Luna 24 samples. *Geophys. Res. Lett.* 10, 485-490.
- Rose H.J., Cuttitta F., Dwornik E.J., Carron M.K., Christian R.P., Lindsay J.R., Ligon D.T. and Larson R.R. (1970a) Semimicro chemical and X-ray fluorescence analysis of lunar samples. *Science* 167, 520-521.
- Rose H.J., Cuttitta F., Dwornik E.J., Carron M.K., Christian R.P., Lindsay J.R., Ligon D.T. and Larson R.R. (1970b) Semimicro X-ray fluorescence analysis of lunar samples. *Proc. Apollo 11 Luanr Sci. Conf.* 1493-1497.
- Rose H.J., Cuttitta F., Annell C.S., Carron M.K., Christian R.P., Dwornik E.J., Greenland L.P. and Ligon D.T. (1972) Compositional data for twenty-one Fra Mauro lunar materials. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1215-1229.
- Rose H.J., Cuttitta F., Berman S., Carron M.K., Christian R.P., Dwornik E.J., Greenland L.P. and Ligon D.T. (1973) Compositional data for twenty-two Apollo 16 samples. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1149-1158.
- Rose H.J., Cuttitta F., Berman S., Brown F.W., Carron M.K., Christian R.P., Dwornik E.J. and Greenland L.P. (1974a) Chemical composition of rocks and soils at Taurus-Littrow. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1119-1133.
- Rose H.J., Brown F.W., Carron M.K., Christian R.P., Cuttitta F., Dwornik E.J. and Ligon D.T. (1974b) Composition of some Apollo 17 samples (abs). *Lunar Sci. V*, 645-647.
- Rose H.J., Baedecker P.A., Berman S., Christian R.P., Dwornik E.J., Finkelman R.B. and Schnepfe M.M. (1975a) Chemical composition of rocks and soils returned by the Apollo 15, 16, and 17 missions. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1363-1373.
- Rose H.J., Christian R.P., Dwomik E.J. and Schnepfe M.M. (1975b) Major elemental analysis of some Apollo 15, 16, and 17 samples (abs). *Lunar Sci. VI*, 686-688. Lunar Planetary Institute, Houston
- Ross M., Huebner J.S. and Dowty E. (1973) Delineation of the one atmosphere augite-pigeonite miscibility gap for pyroxenes from lunar basalt 12021. *Am. Mineral.* 58, 619-635.
- Runcorn S.K., Collinson D.W., and Stephenson A. (1974) Magnetic properties of Apollo 16 and 17 rocks – interim report (abs). *Lunar Sci. V*, 653-654. Lunar Planetary Institute, Houston
- Russell W.A., Papanastassiou D.A., Tombrello T.A. and Epstein S. (1977a) Ca isotope fractionation on the Moon. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 3791-3805.

- Russell W.A., Papanasatassiou D.A., Tombrello T.A. and Epstein S. (1977b) Search for Ca isotopic fractionation and correlation of Ca and O effects (abs). *Lunar Sci.* VIII, 823-825. Lunar Planetary Institute, Houston
- Rutherford M.J. and Hess P.C. (1975) Origin of lunar granites as immiscible liquids (abs). *Lunar Sci.* VI, 696-698. Lunar Planetary Institute, Houston
- Rutherford M.J., Hess P.C. and Daniel G.H. (1974a) Experimental liquid line of descent and liquid immiscibility for basalt 70017. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 569-583.
- Rutherford M.J., Hess P.C. and Daniel G.H. (1974b) Liquid lines of descent and liquid immiscibility in high Ti lunar basalt (abs). *Lunar Sci.* V, 657-659. Lunar Planetary Institute, Houston
- Runcorn S.K., Collinson D.W., O'Reilly W., Stephenson A., Batty M.H., Manson A.J. and Readman P.W. (1971) Magnetic properties of Apollo 12 lunar samples. *Proc. Roy. Soc. London A*325, 157-174.
- Ruzicka A., Snyder G.A. and Taylor L.A. (2000) Crystal-bearing lunar spherules: Impact melting of the Moon's crust and implications for the origin of meteoritic chondrules. *Meteoritics & Planet. Sci.* 35, 173-192.
- Ryder and 27 authors (1976) Interdisciplinary studies by the Imbrium Consortium: Samples 14064, 14082, 14312, 14318, 15405, 15445 and 15455. 2 vol. Harvard U.
- Ryder G. (1976) Lunar sample 15405: Remnant of a KREEP basalt-granite differentiated pluton. *Earth Planet. Sci. Lett.* 29, 255-268.
- Ryder G. (1982a) Apollo 17 ol-plag vitrophyres, 76035, and the Serenitatis melt sheet: Another brick in the wall (abs). *Lunar Planet. Sci.* XIII, 669-670. Lunar Planetary Institute, Houston
- Ryder G. (1982b) Lunar anorthosite 60025, the petrogenesis of lunar anorthosites and the composition of the Moon. *Geochim. Cosmochim. Acta.* 46, 1591-1601.
- Ryder G. (1982c) Why lunar sample studies are not yet finished. *EOS* 63, Sept 21, 785-787.
- Ryder G. (1983) Nickel in olivines and parent magmas of lunar pristine rocks. In *Workshop on Pristine Highlands Rocks and the Early History of the Moon* (Longhi and Ryder, eds.) LPI Tech Rept. 83-02. The Lunar and Planetary Institute, Houston, 66-68.
- Ryder G. (1984a) Most olivine in the lunar highlands is of shallow origin (abs). *Lunar Planet. Sci.* XV, 707-708. Lunar Planetary Institute, Houston
- Ryder G. (1984b) Olivine in lunar dunite 72415, a rather shallow-origin cumulate (abs). *Lunar Planet. Sci.* XV, 709-710. Lunar Planetary Institute, Houston
- Ryder G. (1985) Catalog of Apollo 15 Rocks (three volumes). Curatorial Branch Pub. # 72, JSC#20787
- Ryder G. (1986) Analysis of Apollo 15 green glasses: Groupings and their spatial relationships (abs). *Lunar Planet. Sci.* XVII, 738-739. Lunar Planetary Institute, Houston
- Ryder G. (1987) Petrographic evidence for nonlinear cooling rates and a volcanic origin for Apollo 15 KREEP basalt. *Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf.* in *J. Geophys. Res.* 92, E331-E339.
- Ryder G. (1988) Quenching and disruption of lunar KREEP lava flows by impacts. *Nature* 336, 751-754.
- Ryder G. (1990a) Lunar samples, lunar accretion and the early bombardment of the moon. *EOS Trans. AGU* 71, 313-323.

- Ryder G. (1990b) A distant variant of high-titanium mare basalt from the Van Serg Core, Apollo 17 landing site. *Meteoritics* 25, 249-258.
- Ryder G. (1991) Lunar ferroan anorthosites and mare basalt sources: The mixed connection. *Geophys. Res. Lett.* 18, 2065-2068.
- Ryder G. (1992a) Chemical variation and zoning of olivine in lunar dunite 72415: Near-surface accumulation. *Proc. 22<sup>nd</sup> Lunar Planet. Sci. Conf.* 373-380. Lunar Planetary Institute, Houston
- Ryder G. (1992b) Lunar highlands totality from bits and pieces: A whole-rock-chemistry-free characterization of an evolved hypabyssal igneous gabbro schlieren from the Apollo 17 landing site (abs). *Lunar Planet. Sci. XXIII*, 1195-1196. Lunar Planetary Institute, Houston
- Ryder G. (1992c) A distinct poikilitic impact melt rock from the Apollo 17 landing site that is not from the Serenitatis melt sheet. (abs) *Meteoritics* 27, 284.
- Ryder G. (1993a) The Apollo 17 samples: The massifs and landslide. In *Workshop on Geology of the Apollo 17 Landing Site*. LPI Tech. Rpt. 92-09, 48-49. Lunar Planetary Institute, Houston
- Ryder G. (1993b) Impact melt breccias at the Apollo 17 landing site. In *Workshop on Geology of the Apollo 17 Landing Site*. LPI Tech. Rpt. 92-09, 49-50. Lunar Planetary Institute, Houston
- Ryder G. (1993c) Catalog of Apollo 17 rocks: Stations 2 and 3. Curators Office JSC#26088.
- Ryder G. (1993d) Lunar highlands totality from bits and pieces: A whole-rock-geochemistry-free characterization of an evolved hypabyssal igneous gabbro schlieren from the Apollo 17 landing site. (abs) *Lunar Planet. Sci. XXIII*, 1195-1196. Lunar Planetary Institute, Houston
- Ryder G. (1994) Coincidence in time of the Imbrium basin impact and Apollo 15 KREEP volcanic flows: The case for impact-induced melting. In *Large Meteorite Impacts*. GSA Special Paper 293. (eds. Dressler et al.) pp 11-18.
- Ryder G. (2000) Glass beads tell a tale of lunar bombardment. *Science* 287, 1768-1769.
- Ryder G. and Spudis P. (1980) Volcanic rocks in the lunar highlands. *Proc. Conf. Lunar Highlands Crust* 353-375. (eds. Papike and Merrill) Lunar Planetary Institute, Houston
- Ryder G., Stoeser D.B., Marvin U.B. and Bower J.F. (1975a) Lunar granites with unique ternary feldspars. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 435-449.
- Ryder G., Stoeser D.B., Marvin U.B., Bower J.F. and Wood J.A. (1975b) Boulder 1, Station 2, Apollo 17: Petrology and petrogenesis. *The Moon* 14, 327-357.
- Ryder G. and Bower J.F. (1976) Poikilitic KREEP impact melts in the Apollo 14 white rocks. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1925-1948.
- Ryder G. and Taylor G.J. (1976) Did mare-type volcanism commence early in lunar history? *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1741-1755.
- Ryder G. and Bower J.F. (1977) Petrology of Apollo 15 black-and-white rocks 15445 and 15455: Fragments of the Imbrium impact melt sheet? *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 1895-1923.
- Ryder G. and Wood J.A. (1977) Serenitatis and Imbrium impact melts: Implications for large-scale layering in the lunar crust. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 655-688.

- Ryder G., Stoeser D.B. and Wood J.A. (1977a) Apollo 17 KREEPy basalt: A rock type intermediate between mare and KREEP basalts. *Earth Planet. Sci. Lett.* 35, 1-13.
- Ryder G., McSween H.Y. and Marvin U.B. (1977b) Basalts from Mare Crisium. *The Moon* 17, 263-287.
- Ryder G. and Marvin U.B. (1978) On the origin of Luna 24 basalts and soils. In: *Mare Crisium: The view from Luna 24.* (ed. Merrill and Papike) Pergamon 339-355.
- Ryder G. and Norman M.D. (1979a) Catalog of pristine non-mare materials Part 1. Non-anorthosites, revised. NASA-JSC Curatorial Facility Publ. JSC 14565, Houston. 147 pp.
- Ryder G. and Norman M.D. (1979b) Catalog of pristine non-mare materials Part 2. Anorthosites. Revised. Curators Office JSC #14603
- Ryder G. and Norman M.D. (1980) Catalog of Apollo 16 rocks (3 vol.). Curator's Office pub. #52, JSC #16904
- Ryder G. and Spudis P. (1980) Volcanic rocks in the lunar highlands. *Proc. Conf. Lunar Highlands Crust,* 353-375. GCA 12, Lunar Planetary Institute, Houston.
- Ryder G., Norman M.D. and Score R.A. (1980a) The distinction of pristine from meteorite-contaminated highlands rocks using metal compositions. *Proc. 11th Lunar Planet. Sci. Conf.* 471-479.
- Ryder G., Norman M.D. and Score R.A. (1980b) Ni, Co content of metal grains for the identification of indigenous rocks (abs). *Lunar Planet. Sci. XI*, 968-970. Lunar Planetary Institute, Houston
- Ryder G. and Spudis P. (1987) Chemical composition and origin of Apollo 15 impact melts. *Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf.* in *J. Geophys. Res.* 92, E432-446.
- Ryder G. and Sherman S.B. (1989) The Apollo 15 Coarse Fines. Curators Office #81, JSC#24035
- Ryder G., Bogard D.D. and Garrison D. (1991) Probable age of Autolycus and calibration of lunar stratigraphy. *Geology* 19, 143-146.
- Ryder G., Delano J.W., Warren P.H., Kallymeyn G.W. and Dalrymple G.B. (1996) A glass spherule of questionable impact origin from the Apollo 15 landing site: Unique target basalt. *Geochim. Cosmochim. Acta* 60, 693-710.
- Ryder G. and Burling T.C. (1996) An Apollo 15 mare basalt fragment and lunar mare provinces. *Meteoritics & Planet. Sci.* 31, 50-59.
- Ryder G., Norman M.D. and Taylor G.J. (1997) The complex stratigraphy of the highland crust in the Serenitatis region of the Moon inferred from mineral fragment chemistry. *Geochim. Cosmochim. Acta* 61, 1083-1105.
- Ryder G. and Schuraytz B.C. (2001) Chemical variations of the large Apollo 15 olivine-normative mare basalt rock samples. *J. Geophys. Res.* 106, E1, 1435-1451.
- Saal A.E., Hauri E.H., Rutherford M.J. and Cooper R.F. (2007) The volatile contents (CO<sub>2</sub>, H<sub>2</sub>O, F, S, Cl) of the lunar picritic glasses. (abs) *Lunar Planet. Sci. XXXVIII*, #2148. Lunar Planetary Institute, Houston
- Salpas P.A. and Taylor L.A. (1985) Basalt clasts in breccia 72275: Examples of pre-mare volcanism (abs). *Lunar Planet. Sci. XVI*, 728-729. Lunar Planetary Institute, Houston
- Salpas P.A., Willis K.J. and Taylor L.A. (1985) Breccia Guidebook No. 8, 72275. Curatorial Branch Publication 71, JSC 20416 pp. 43.

- Salpas P.A., Taylor L.A. and Lindstrom M.M. (1986a) Apollo 17 KREEPy basalts: Pristine basaltic breccias (abs). *Lunar Planet. Sci.* XVII, 748-749. Lunar Planetary Institute, Houston
- Salpas P.A., Taylor L.A. and Lindstrom M.M. (1986b) The first Apollo 17 ferroan anorthosite: Its significance relative to Mg-suite highland clasts (abs). *Lunar Planet. Sci.* XVII, 752-753. Lunar Planetary Institute, Houston
- Salpas P.A., Lindstrom M.M. and Taylor L.A. (1987) Highland materials at Apollo 17: Contributions from 72275. *Proc. 18<sup>th</sup> Lunar Planet. Sci. Conf.* 11-19. Lunar Planetary Institute, Houston
- Salpas P.A., Taylor L.A. and Lindstrom M.M. (1987) Apollo 17 KREEPy basalts: Evidence for Nonuniformity of KREEP. *Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res.* 89 E340-E348.
- Sanchez A.G. (1981) Geology of Stone Mountain. In *Geology of Apollo 16*. (eds. Ulrich et al.) U.S.G.S. Prof. Paper 1048
- Sanford R.F. and Huebner J.S. (1979) Reexamination of diffusion processes in 77115 and 77215 (abs). *Lunar Planet. Sci. X*, 1052-1054. Lunar Planetary Institute, Houston
- Sanford R.F. and Heubner J.S. (1980) Model thermal history of 77115 and implications for the origin of fragment-laden basalts. In *Proc. Conf. Lunar Highlands Crust*, 253-269. Lunar Planetary Institute, Houston
- Sato M. (1976a) Oxygen fugacity and other thermochemical parameters of Apollo 17 high-Ti basalts and their implications on the reduction mechanism. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1323-1344.
- Sato M. (1976b) Oxygen fugacity values of some Apollo 16 and 17 rocks (abs). *Lunar Sci. VII*, 758-760. Lunar Planetary Institute, Houston
- Sato M. (1979) The driving mechanism of lunar pyroclastic eruptions inferred from the oxygen fugacity behavior of Apollo 17 orange glass. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 311-325.
- Sato M., Hicklin N.L. and McLane J.E. (1973) Oxygen fugacity values of lunar samples. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1061-1079.
- Saito K. and Alexander E.C. (1979)  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  studies of lunar soil 74001 (abs). *Lunar Sci. X*, 1049. Lunar Planetary Institute, Houston
- Scarlett B., Buxton R.E. and Faulkner R.G. (1977) Formation of glass spheres on the lunar surface. *Phil. Trans. Roy. Soc. London A285*, 279-284.
- Schaal R.B., Horz F. and Gibbons R.V. (1976) Shock metamorphic effects in lunar microcraters. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1039-1054.
- Schaal R.B. and Hörz F. (1977a) Shock metamorphism of lunar and terrestrial basalts. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 1697-1729.
- Schaal R.B. and Hörz F. (1977b) Shock effects in some lunar basalts (abs). *Lunar Planet. Sci. VIII*, 832-834. Lunar Planetary Institute, Houston
- Schaal R.B., Hörz F. and Bauer J.F. (1978) Shock experiments on particulate lunar basalt - a regolith analogue (abs). *Lunar Planet. Sci. IX*, 999-1001. Lunar Planetary Institute, Houston
- Schaal R.B., Hörz F., Thompson T.D. and Bauer J.F. (1979a) Shock metamorphism of granulated lunar basalt. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 2547-2571.

- Schaal R.B., Thompson T.D., Hörz F. and Bauer J.F. (1979b) Experimentally shocked lunar basalt: Massive and particulate (abs). *Lunar Planet. Sci.* X, 1055-1057. Lunar Planetary Institute, Houston
- Schaeffer J. (1974) An electron microprobe analysis of Apollo 16 breccia 60255,78. B.A. Thesis, Princeton Univ.
- Schaeffer J. and Hollister L.S. (1974) The petrology of two coarse-grained clasts in breccia sample 60255 (abs). In *Lunar Sci.* VI, 705-706. Lunar Planetary Inst. Houston.
- Schaeffer O.A. (1977) Lunar chronology as determined from the radiometric ages of returned lunar samples. *Phil. Trans. Roy. Soc. London* A285, 137-144.
- Schaeffer O.A., Funkhouser J.G., Bogard D.D. and Zahringer J. (1970) Potassium-argon ages of lunar rocks from Mare Tranquillitatis and Oceanus Procellarum. *Science* 161-162.
- Schaeffer O.A. and Husain L. (1973) Isotopic ages of Apollo 17 lunar material (abs). *EOS Trans. AGU* 54, 614.
- Schaeffer O.A. and Husain L. (1974) Chronology of lunar basin formation. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1541-1555.
- Schaeffer G.A. and Schaeffer O.A. (1977a)  $^{39}\text{Ar}/^{40}\text{Ar}$  ages of lunar rocks. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 2253-2300.
- Schaeffer G.A. and Schaeffer O.A. (1977b)  $^{39}\text{Ar}/^{40}\text{Ar}$  ages of lunar rocks (abs). *Lunar Sci. VIII*, 840-842. Lunar Planetary Institute, Houston
- Schaeffer O.A., Bence A.E., Eichhorn G., Papike J.J. and Vaniman D.T. (1978) 39Ar-40Ar and petrologic study of Mare Crisium: Age and petrology of Luna 24 samples 24007 (abs). *Lunar Planet. Sci. IX*, 1007-1009. Lunar Planetary Institute, Houston
- Schaeffer O.A., Warasila R. and Labotka T.C. (1982a) Ages of Serenitatis breccias: Lunar breccias and soils and their meteoritic analogs . *LPI Tech. Rept.* 82-02, 123-125. Lunar Planetary Institute, Houston
- Schaeffer O.A., Warasila R. and Labotka T.C. (1982b) Ages of Serenitatis breccias (abs). *Lunar Planet. Sci. XIII*, 685-686. Lunar Planetary Institute, Houston
- Schaeffer O.A., Muller H.W. and Grove T.L. (1977a) Laser 39Ar-40Ar study of Apollo 17 basalts. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 1489-1499.
- Schaeffer O.A., Muller H.W. and Grove T.L. (1977b) Laser  $^{39}\text{Ar}/^{40}\text{Ar}$  study of Apollo 17 basalts (abs). *Lunar Planet. Sci. VIII*, 837-839. Lunar Planetary Institute, Houston
- Schearer C.K. and Papike J.J. (1999) Magmatic evolution of the moon. *Am. Mineral.* 84, 1469-1494.
- Schmitt H.H. (1973) Apollo 17 Report on the Valley of Taurus-Littrow. *Science* 182, 681-690.
- Schmitt H.H. (1975) Geological model for Boulder 1 at Station 2, South Massif, Valley of Taurus-Littrow. *The Moon* 14, 491-504.
- Schmitt H.H. (2005) Return to the Moon. *a new book about 3He economy*
- Schmitt H.H. and Cernan E.A. (1973) A geological investigation of the Taurus-Littrow Valley. In *Apollo 17 Preliminary Science Report*. NASA SP-330.

- Schnabel C., Xue S., Ma P., Herzog G.F., Figiel K., Cresswell R.G., Tada M.L., Hauslaned P. and Reedy R.C. (2000) Nickel-59 in surface layers of lunar basalt 74275: Implications for the solar alpha particle flux (abs). *Lunar Planat. Sci.* XXXI, #1778, Lunar Planetary Institute, Houston.
- Schnare D.W., Norman M.D. and Day J.M.D and Taylor L.A. (2005) LAP 02-224 (abs). *Lunar Planet. Sci.* XXXVI, #2212. Lunar Planetary Institute, Houston
- Schnare D.W., Taylor L.A., Norman M.D. and Day J.M.D. (2007) Single source origin for Apollo 15 olivine- and quartz- normative basalts (abs). *Lunar Planet. Sci.* XXXVIII, #1379. Lunar Planetary Institute, Houston
- Schnare D.W., Taylor L.A., Day J.M.D. and Norman M.D. (2007?) GCA in preparation
- Schneider E. and Hörz F. (1974) Microcrater populations on Apollo 17 rocks. *Icarus* 22, 459-473.
- Schnetzler C.C., Philpotts J.A. and Bottino M.L. (1970) Li, K, Rb, Sr, Ba and rare-earth concentrations and Rb-Sr age of lunar rock 12013. *Earth Planet. Sci. Lett.* 9, 185-192.
- Schnetzler C.C. and Nava D.F. (1971) Chemical composition of Apollo 14 soils 14163 and 14259. *Earth Planet. Sci. Lett.* 11, 345.
- Schonfeld E. (1973) Determination by non-destructive gamma-ray counting of radionuclides produced by the August 1972 solar flare (abs). *Lunar Sci.* IV, 659. Lunar Planetary Institute, Houston
- Schonfeld E. (1974) The contamination of lunar highland rocks by KREEP: Interpretations by mixing models. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1269-1286.
- Schonfeld E. (1975) Component abundances in Apollo 15 soils and breccias by the mixing model technique (abs). *Lunar Sci.* VI, 712-714. Lunar Planetary Institute, Houston
- Schonfeld E. (1974) The contamination of Lunar highlands rocks by KREEP: Interpretation by mixing models. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1269-1286.
- Schonfeld E. and Meyer C. (1972) The abundances of components of the lunar soils by a least-squares mixing model and the formation age of KREEP. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1397-1420.
- Schreiber E. (1977) The Moon and Q. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 1201-1208.
- Schultz P.H. and Spudis P.D. (1983) Beginning and end of lunar mare volcanism. *Nature* 302, 233-236.
- Schwaller H. Eberhardt P., Geiss J., Graf H. and Grogler N. (1971) The  $^{78}\text{Kr}/^{83}\text{Kr}$  –  $^{131}\text{Xe}/^{126}\text{Xe}$  correlation in Apollo 12 rocks. *Earth Planet. Sci. Lett.* 12, 167-169.
- Schwartz J.M. and McCallum I.S. (1999) Inferred depths of formation of spinel cataclasites and troctolitic granulite, 76535 using new thermodynamic data for Cr-spinel (abs). *Lunar Planet. Sci.* XXX CD-ROM # 1308 Lunar Planetary Institute, Houston
- Schwerer F.C., Huffman G.P., Fisher R.M. and Nagata T. (1972) Electrical conductivity and Mossbauer study of Apollo lunar samples. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 3173-3185.
- Schwerer F.C. and Nagata T. (1976) Ferromagnetic-superparamagnetic granulometry of lunar surface materials. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 759-778.
- Scalar C.B. and Bauer J.F. (1975a) Shock-induced subsolidus reduction-decomposition of orthopyroxene and shock-induced melting of norite 78235. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 799-820.

Sclar C.B. and Bauer J.F. (1975b) Shock-induced subsolidus reduction-decomposition of orthopyroxene and shock-induced melting in norite 78235 (abs). *Lunar Sci. VI*, 730-731. Lunar Planetary Institute, Houston

Sclar C.B. and Bauer J.F. (1976a) Subsolidus reduction phenomena in lunar norite 78235: Observations and interpretations. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 2493-2508.

Sclar C.B. and Bauer J.F. (1976b) Redox reactions involving nonvolatile ionic species as a mechanism of shock-induced subsolidus reduction of Fe +2 in plagioclase and orthopyroxene: Indications from lunar norite 78235 (abs). *Lunar Sci. VII*, 791-793. Lunar Planetary Institute, Houston

Scoon J.H. (1972) Chemical analysis of lunar samples 14003, 14311 and 14321. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1335-1336.

Scoon J.H. (1974) Chemical analysis of lunar samples from the Apollo 16 and 17 collections (abs). *Lunar Sci. V*, 690-692.

See T.H., Horz F. and Morris R.V. (1986) Apollo 16 impact-melt splashes: Petrography and major-element composition. *Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf.* in *J. Geophys. Res.* 91, E3-E20.

Sha L.-K. (2000) Whitlockite solubility in silicate melts: Some insights into lunar and planetary evolution. *Geochim. Cosmochim. Acta* 64, 3217-3236.

Shaw D.M. and Middleton T.A. (1987) Lunar boron: A preliminary study (abs). *Lunar Planet. Sci. XVIII*, 912-913. Lunar Planetary Institute, Houston

Shaffer E., Brophy J.G. and Basu A. (1990) La/Sm ratios in mare basalts as a consequence of mafic cumulate fractionation from an initial lunar magma (abs). *Lunar Planet. Sci. XXI*, 1130-1131. Lunar Planetary Institute, Houston

Shearer C.K., Papike J.J., Simon S.B. and Shimizu N. (1989) An ion microprobe study of the intra-crystalline behavior of REE and selected trace elements in pyroxene from mare basalts with different cooling and crystallization histories. *Geochim. Cosmochim. Acta* 53, 1041-1054.

Shearer C.K., Papike J.J., Galbreath K.C., Wentworth S.J. and Shimizu N. (1990) A SIMS study of lunar "komatiitic glasses". Trace element characteristics and possible origin. *Geochim. Cosmochim. Acta* 54, 1851-1857.

Shearer C.K., Papike J.J., Galbreath K.C. and Shimizu N. (1991) Exploring the lunar mantle with secondary ion mass spectrometry: A comparison of lunar picritic glass beads from the Apollo 14 and Apollo 17 sites. *Earth Planet. Sci. Lett.* 102, 134-147.

Shearer C.K. and Papike J.J. (1993) Basaltic magmatism on the Moon: A perspective from volcanic picritic glass beads. *Geochim. Cosmochim. Acta* 57, 4785-4812.

Shearer C.K., Layne G.D. and Papike J.J. (1994) The systematics of light lithophile elements (Li, Be, and B) in lunar picritic glasses: Implications for basaltic magmatism on the Moon and the origin of the Moon. *Geochim. Cosmochim. Acta* 58, 5349-5362.

Shearer C.K., Papike J.J. and Layne G.D. (1996a) Deciphering basaltic magmatism on the Moon from the compositional variations in Apollo 15 very low-Ti picritic magmas. *Geochim. Cosmochim. Acta* 60, 509-528.

Shearer C.K., Papike J.J. and Layne G.D. (1996b) The role of ilmenite in the source region for mare basalts: Evidence from niobium, zirconium and cerium in picritic glasses. *Geochim. Cosmochim. Acta* 60, 3521-3530.

- Shearer C.K. and Papike J.J. (1999) Magmatic evolution of the Moon. *Am. Mineral.* 84, 1469-1494.
- Shearer C.K. and Newsom H.E. (2000) W-Hf isotope abundances and the early origin and evolution of the Earth-Moon system. *Geochim. Cosmochim. Acta* 64, 3599-3613.
- Shearer C.K. and Papike J.J. (2005) Early crustal building processes on the moon: Models for the petrogenesis of the magnesian suite. *Geochim. Cosmochim. Acta* 69, 3445-3461.
- Shervais J.W. (1994) Ion microprobe studies of lunar highland cumulate rocks: Preliminary results (abs). *Lunar Planet. Sci. XXV*, 1265-1266. Lunar Planetary Institute, Houston
- Shervais J.W. (1999) Surfing the Fra Mauro shoreline: Highlands crust at the Apollo 14 site. In Taylor Volume pp. 194-206. GSA Bellweather Publishing
- Shervais J.W., Taylor L.A. and Laul J.C. (1983) Ancient crustal components in the Fra Mauro breccias. *Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf.* in *J. Geophys. Res.* 88, 77-92.
- Shervais J.W., Knapp S. and Taylor L.A. (1984) Breccia Guidebook No.7 14321. JSC 19492.
- Shervais J.W., Taylor L.A. and Lindstrom M.M. (1985) Apollo 14 mare basalts: petrology and geochemistry of clasts from consortium breccia 14321. *Proc. 15<sup>th</sup> Lunar Planet. Sci. Conf.* in *J. Geophys. Res.* 89, C375-395.
- Shervais J.W., Taylor L.A., Laul J.C., Shih C.-Y. and Nyquist L.E. (1985) Very high potassium (VHK) basalt: Complications in lunar mare petrogenesis. *Proc. 16<sup>th</sup> Lunar Planet. Sci. Conf.* in *J. Geophys. Res.* 90, D3-D18.
- Shervais J.W., Taylor L.A. and Lindstrom M.M. (1988) Olivine vitrophyres: A nonpristine high-Mg component in Lunar breccia 14321. *Proc. 18<sup>th</sup> Lunar Planet. Sci. Conf.* 45-57. Lunar Planetary Institute, Houston
- Shervais J.W., Vetter S.K. and Lindstrom M.M. (1990) Chemical differences between small subsamples of Apollo 15 olivine-normative basalts. *Proc. 20<sup>th</sup> Lunar Planet. Sci. Conf.* 109-126. Lunar Planetary Institute, Houston
- Shervais J.W. and Stuart J.B. (1995) Ion microprobe studies of lunar highland cumulate rocks: New results (abs). *Lunar Planet. Sci. XXVI*, 1285-1286. Lunar Planetary Institute, Houston
- Shervais J.W. and McGee J.J. (1997) KREEP in the western lunar highlands: An ion microprobe study of alkali and Mg suite cumulates from the Apollo 12 and 14 sites. (abs) *Lunar Planet. Sci. XXVIII*, 1301-1302. Lunar Planetary Institute, Houston
- Shervais J.W. and McGee J.J. (1998a) KREEP in the western lunar highlands: ion and electron microprobe study of alkali suite anorthosites and norites from Apollo 12 and 14. *Am. Min.* (say what?)
- Shervais J.W. and McGee J.J. (1998b) Ion and electron microprobe study of trctolites, norites and anorthosites from Apollo 14: Evidence for urKREEP assimilation during petrogenesis of Apollo 14 Mg-suite rocks. *Geochim. Cosmochim. Acta* 62, 3009-3023.
- Shih C.-Y. (1977) Origins of KREEP basalts. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 2375-2401.
- Shih C.-Y., Nyquist L.E., Bogard D.D. and Wiesmann H. (1973) K-Ca and Rb-Sr dating of two lunar granites: Relative chronometer resetting. *Geochim. Cosmochim. Acta* 58, 3101-3116.

- Shih C.-Y., Haskin L.A., Wiesmann H., Bansal B.M. and Brannon J.C. (1975a) On the origin of high-Ti mare basalts. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1255-1285.
- Shih C.-Y., Wiesmann H. and Haskin L.A. (1975b) On the origin of high-Ti mare basalts (abs). Lunar Sci. VI, 735-737. Lunar Planetary Institute, Houston
- Shih C.-Y., Nyquist L.E., Bogard D.D., Wooden J.L., Bansal B.M. and Wiesmann H. (1985) Chronology and petrogenesis of a 1.8 g lunar granite clast: 14321,1062. Geochim. Cosmochim. Acta 49, 411-426.
- Shih C.-Y., Nyquist L.E., Bogard D.D., Bansal B.M., Wiesmann H., Johnson P., Shervais J.W. and Taylor L.A. (1986) Geochronology and petrogenesis of Apollo 14 very high potassium mare basalts. Proc. Lunar Planet. Sci. Conf. 16<sup>th</sup>, J. Geophys. Res. 91, D214-D228.
- Shih C.-Y., Nyquist L.E., Bogard D.D., Dash E.J., Bansal B.M. and Wiesmann H. (1987) Geochronology of high-K aluminoius mare basalt clasts from Apollo 14 breccia 14304. Geochim. Cosmochim. Acta 51, 3255-3271.
- Shih C.-Y., Nyquist L.E., Dasch E.J., Bansal B.M. and Wiesmann H. (1989) Ages of pristine lunar plutonic rocks and their petrogenetic implications (abs). Lunar Planet. Sci. XX, 1004-1005. Lunar Planetary Institute, Houston
- Shih C.-Y., Bansal B.M., Wiesmann H. and Nyquist L.E. (1990a) Rb-Sr and Sm-Nd isotopic studies of an Apollo 17 KREEPy basalt (abs). Lunar Planet. Sci. XXI, 1148-1149. Lunar Planetary Institute, Houston
- Shih C.-Y., Nyquist L.E., Bansal B.M. and Wiesmann H. (1992) Rb-Sr and Sm-Nd chronology of an Apollo 17 KREEP basalt. Earth Planet. Sci. Lett. 108, 203-215.
- Shih C.-Y., Nyquist L.E., Dash E.J., Bogard D.D., Bansal B.M. and Wiesmann H. (1993) Ages of pristine noritic clasts from lunar breccias 15445 and 15455. Geochim. Cosmochim. Acta 57, 915-931.
- Shih C.-Y., Nyquist L.E. and Wiesmann H. (1993) K-Ca chronology of lunar granites. Geochim. Cosmochim. Acta 57, 4827-4841.
- Shih C.-Y., Nyquist L.E., Bogard D.D., Reese Y., Wiesmann H. and Garrison D. (1999) Rb-Sr, Sm-Nd and 40Ar-39Ar isotopic studies of an Apollo 11 group D basalt (abs). Lunar Planet. Sci. XXX, #1787. Lunar Planetary Institute, Houston
- Shih C.-Y., Nyquist L.E., Reese Y., Wiesmann H. and Schwandt C. (2001) Rb-Sr and Sm-Nd isotopic constraints on the genesis of lunar green and orange glasses (abs). Lunar Planet. Sci. XXXII, #1401. Lunar Planetary Institute, Houston
- Shirley D.N. (1983) A partially molten magma ocean model. J. Geophys. Res. 88, A519-27.
- Short N.M. and Forman M.L. (1972) Impact crater ejecta on the lunar surface. Modern Geol. 3, 69-91.
- Signer P., Baur H., Derksen Uwe, Etique P., Funk H., Horn P. and Wieler R. (1977) He, Ne and Ar records of lunar soil evolution. Proc. 8<sup>th</sup> Lunar Sci. Conf. 3657-3683.
- Signer P., Baur H., Etique P., Frick U. and Funk H. (1977) On the question of the 40Ar excess in lunar soils. Phil. Trans. Roy. Soc. London A285, 385-390.
- Sill G.T., Nagy B., Nagy L.A., Hamilton P.B., McEwan W.S. and Urey H.C. (1974) Carbon compounds in Apollo 17 lunar samples: Indications of cometary contribution to breccia 78155? (abs) Lunar Sci. V, 703-705. Lunar Planetary Institute, Houston

- Silver L.T. (1971) U-Th-Pb isotope systems in Apollo 11 and 12 regolith materials and a possible age for the Copernican impact (abs). EOS Trans. AGU 52, 534.
- Silver L.T. (1972) U-Th-Pb abundances and isotopic characteristics in some Apollo 14 rocks and soils (abs). Lunar Sci. III, 704-706. Lunar Planetary Institute, Houston
- Silver L.T. (1973) Uranium-Thorium-Lead isotopic characteristics in some regolithic materials from the Descartes Region (abs). Lunar Sci. IV, 672. Lunar Planetary Institute, Houston
- Silver L.T. (1974a) Patterns for U, Th, Pb distributions and isotopic relationships in Apollo 17 soils (abs). Lunar Sci. V, 706-708. Lunar Planetary Institute, Houston
- Silver L.T. (1974b) Implications of volatile leads in orange, grey, and green lunar soils for an Earth-like Moon (abs). EOS Trans. AGU, 55, 681.
- Simkin T., Noonan A.F., Switzer G.S., Mason B., Nelen J.A. and Thomson G. (1973) Composition of Apollo 16 fines 60061, 60052, 64811, 64812, 67711, 6712, 68821 and 68822. Proc. 4<sup>th</sup> Lunar Sci. Conf. 279-289.
- Simmons G., Siegfried R. and Richter D. (1975a) Characteristics of microcracks in lunar samples. Proc. 6<sup>th</sup> Lunar Sci. Conf. 3227-3254.
- Simmons G., Richter D. and Siegfried R. (1975b) Characterization of microcracks in lunar igneous rocks (abs). Lunar Sci. VI, 741-743. Lunar Planetary Institute, Houston
- Simon S.B., Papike J.J. and Laul J.C. (1981) The lunar regolith: Comparative studies of the Apollo and Luna sites. Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf. 371-388.
- Simon S.B., Papike J.J., Shearer C.K. and Laul J.C. (1983) Petrology of the Apollo 11 highland component. Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 88, B103-138.
- Simon S.B., Papike J.J. and Shearer C.K. (1984) Petrology of Apollo 11 regolith breccias. Proc. 15<sup>th</sup> Lunar Planet. Sci. Conf., in J. Geophys. Res. 89, C109-132.
- Simon S.B., Papike J.J. and Grosselin D.C. (1986) Petrology of the Apollo 15 regolith breccias. Geochim. Cosmochim. Acta 50, 2675-2691.
- Simon S.B., Papike J.J., Laul J.C., Hughes S.S. and Schmitt R.A. (1988) Apollo 16 regolith breccias and soils: Recorders of exotic component addition to the Descartes region of the moon. Earth Planet. Sci. Lett. 89, 147-162.
- Simon S.B., Papike J.J., Laul J.C., Hughes S.S. and Schmitt R. A. (1989) Comparative petrology and chemistry of Apollo 17 regolith breccias and soils (abs). Lunar Planet. Sci. XX, 1014-1015. Lunar Planetary Institute, Houston
- Simon S.B., Papike J.J., Gosselin D.C., Laul J.C., Hughes S.S. and Schmitt R.A. (1990) Petrology and chemistry of Apollo 17 regolith breccias: A history of mixing of highland and mare regolith. Proc. 20<sup>th</sup> Lunar Planet. Sci. 219-230. Lunar Planetary Institute, Houston
- Simoneit B.R., Christiansen P.C. and Burlingame A.L. (1973) Volatile element chemistry of selected lunar, meteoritic and terrestrial samples. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1635-1650.
- Simonds C.H. (1973) Sintering and hot pressing of Fra Mauro composition glass and the lithification of lunar breccias. Am. J. Sci. 273, 428-439.

- Simonds C.H. (1975) Thermal regimes in impact melts and the petrology of the Apollo 17 Station 6 boulder. Proc. 6<sup>th</sup> Lunar Sci. Conf. 641-672.
- Simonds C.H. and Warner J.L. (1981) Petrochemistry of Apollo 16 and 17 samples (abs). Lunar Planet. Sci. XII, 993-995. Lunar Planetary Institute, Houston
- Simonds C.H., Warner J.L. and Phinney W.C. (1973) Petrology of Apollo 16 poikilitic rocks. Proc. 4<sup>th</sup> Lunar Sci. Conf. 613-632.
- Simonds C.H., Phinney W.C. and Warner J.L. (1974) Petrography and classification of Apollo 17 non-mare rocks with emphasis on samples from the Station 6 boulder. Proc. 5<sup>th</sup> Lunar Sci. Conf. 337-353.
- Simonds C.H., Phinney W.C., Warner J.L. and Heiken G.H. (1975) Thermal regimes in crater debris as deduced from the petrology of the Apollo 17 Station 6 boulder and rake samples (abs). Lunar Sci. VI, 747-749. Lunar Planetary Institute, Houston
- Simonds C.H., Warner J.L. and Phinney W.C. (1976a) Thermal regimes in cratered terrain with emphasis on the role of impact melt. Am. Mineral. 61, 569-577.
- Simonds C.H., Warner J.L. Phinney W.C. and McGee P.E. (1976) Thermal model for impact breccia lithification: Manicouagan and the moon. Proc. 7<sup>th</sup> Lunar Sci. Conf. 2509-2528.
- Simonds C.H., Warner J.L. and Phinney W.C. (1976c) Clast-melt interactions in lunar and terrestrial impact melts (abs). Lunar Sci. VII, 812-814. Lunar Planetary Institute, Houston
- Simonds C.H., Phinney W.C., Warner J.L., McGee P.E., Geeslin J., Brown R.W. and Rhodes M.J. (1977) Apollo 14 revisited, or breccias aren't so bad after all. Proc. 8<sup>th</sup> Lunar Sci. Conf. 1869-1893.
- Smith J.M., Meyer C., Compston W. and Williams I.S. (1986) 73235,82 (pomegranate): An assemblage of lunar zircon with unique overgrowth (abs). Lunar Planet. Sci. XVII, 805-806. Lunar Planetary Institute, Houston
- Smith J.V. (1974) Lunar mineralogy: A heavenly detective story. Pres. Address. Am. Mineral. 59, 231-243.
- Smith J.V., Anderson A.T., Newton R.C., Olsen E.J. and Wyllie P.J. (1970) A petrologic model for the moon based on petrogenesis, experimental petrology and physical properties. J. Geol. 78, 381-405.
- Smith J.V., Anderson A.T., Newton R.C., Olsen E.J., Wyllie P.J., Crewe A.V., Isaacson M.S. and Johnson D. (1970) Petrologic history of the moon inferred from protogrpahy, mineralogy and petrogenesis of Apollo 11 rocks. Proc. Apollo 11 Lunar Sci. Conf. 897-925.
- Smith J.V. and Steele I.M. (1974) Intergrowths in lunar and terrestrial anorthosites with implications for lunar differentiates. Am. Mineral. 59, 673-680.
- Smith J.V. and Steele I.M. (1976) Lunar mineralogy. Am. Mineral. 61, 1059-1116.
- Smith J.V., Hansen E.C. and Steele I.M. (1980) Lunar highland rocks: Element partitioning among minerals II: Electron microprobe analyses of Al, P, Ca, Ti, Cr, Mn and Fe in olivine. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 555-569.
- Smyth J.R. (1974) The crystal structure of armalcolites from Apollo 17. Earth Planet. Sci. Lett. 24, 262-270.
- Smyth J.R. (1975) Intracrystalline cation order in a lunar crustal troctolite. Proc. 6<sup>th</sup> Lunar Sci. Conf. 821-832.

Smyth J.R. (1986) Crystal structure refinement of a lunar anorthite, An<sub>94</sub>. Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 91, E91-97.

Snee L.W. and Ahrens T.J. (1975a) Shock-induced deformation features in terrestrial peridot and lunar dunite. Proc. 6<sup>th</sup> Lunar Sci. Conf. 833-842.

Snee L.W. and Ahrens T.J. (1975b) Shock-induced deformation features in terrestrial olivine and lunar dunite (abs). Lunar Sci. VI, 759-761. Lunar Planetary Institute, Houston

Snyder G.A., Taylor L.A. and Neal C.R. (1992) A chemical model for generating the sources of mare basalts: Combined equilibrium and fractional crystallization of the lunar magmasphere. Geochim. Cosmochim. Acta 56, 3809-3823.

Snyder G.A., Taylor L.A. and Crozaz G. (1993) Rare earth element selenochemistry of immisible liquids and zircon at Apollo 14: An ion probe study of evolved rocks on the moon. Geochim. Cosmochim. Acta 57, 1143-1149.

Snyder G.A., Lee D-C., Taylor L.A., Halliday A.N. and Jerde E.A. (1994) Evolution of the upper mantle of the Earth's moon: Neodymium and strontium isotopic constraints from high-Ti mare basalts. Geochim. Cosmochim. Acta 58, 4795-4808.

Snyder G.A., Taylor L.A. and Halliday A.N. (1995a) Chronology and petrogenesis of the lunar highlands alkali suite: Cumulates from KREEP basalt crystallization. Geochim. Cosmochim. Acta 59, 1185-1203.

Snyder G.A., Neal C.R., Taylor L.A. and Halliday A.N. (1995b) Processes involved in the formation of magnesian-suite plutonic rocks from the highlands of the Earth's moon. J. Geophys. Res. 100, 9365-9388.

Snyder G.A., Hall C.M., Lee D.C., Taylor L.A. and Halliday A.N. (1996) Earliest high-Ti volcanism on the Moon: 40Ar-39Ar, Sm-Nd and Rb-Sr isotopic studies of group D basalts from the Apollo 11 landing site. Meteoritics & Planet. Sci. 31, 328-334.

Snyder G.A., Neal C.R., Taylor L.A. and Halliday A.N. (1997a) Anataxis of lunar cumulate mantle in time and space: Clues from trace-element, strontium and neodymium isotopic chemistry of parental Apollo 12 basalts. Geochim. Cosmochim. Acta 61, 2731-2747.

Snyder G.A., Borg L.E., Lee D.C., Taylor L.A., Nyquist L.E. and Halliday A.N. (1997b) Nd-Sr-Hf isotopic and geochronologic studies of Apollo 15 basalts. (abs) Lunar Planet. Sci. XXVII, 1347-1348. Lunar Planetary Institute, Houston

Snyder G.A., Borg L.E., Taylor L.A., Nyquist L.E. and Halliday A.N. (1998) Volcanism in the Hadley-Apennine region of the Moon: Geochronology, Nd-Sr isotopic systematics and depths of melting. (abs) Lunar Planet. Sci. XXIX (CD-ROM) Lunar Planetary Institute, Houston

Snyder G.A., Borg L.E., Lee D.C., Nyquist L.E., Taylor L.A. and Halliday A.N. (1999a) Volcanism in the Hadley-Apennine region of the Moon: Chronology, Nd-Sr-Hf isotopic systematics and petrogenesis of Apollo 15 mare basalts. Geochim. Cosmochim. Acta (say what?)

Snyder G.A., Lee D.C., Taylor L.A. and Halliday A.N. (1999b) Earliest lunar volcanism: An alternative interpretation of the Apollo 14 high-Al basalts from Nd-Sr-Hf isotopic studies. Meteoritics & Planet. Sci. (say what?)

Snyder G.A., Borg L.E., Nyquist L.E. and Taylor L.A. (2000) Chronology and isotopic constraints on lunar evolution. In Origin of the Earth and Moon. 361-396. (ed. Canup and Righter) U. Arizona Press.

Snyder G.A. and Taylor L.A. (2001) (abs) 64<sup>th</sup> met Soc (say what?)

Snyder G.A., Lee D-C., Ruzicka A., Prinz M., Halliday A.N., and Taylor L.A., (2001) Hf-W, Sm-Nd, and Rb-Sr isotopic evidence of late impact fractionation and mixing of silicates on iron meteorite parent bodies. *Earth Planet. Sci. Lett.* 186, 311-324

Soloman S.C. and Longhi J. (1977) Magma oceanography: Thermal evolution. *Proc. 8<sup>th</sup> Lunar Planet. Sci. Conf.* 583-599.

Spangler R.R., Warasila R. and Delano J.W. (1984) 39Ar-40Ar ages for the Apollo 15 green and yellow volcanic glasses. *Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf.* in *J. Geophys. Res.*, 89, B487-497.

Spera F.J. (1992) Lunar magma transport phenomena. *Geochim. Cosmochim. Acta* 56, 2253-2265.

Spudis P.D. (1978) Composition and origin of the Apennine Bench Formation. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 3379-3394.

Spudis P.D. (1993) The Geology of Multi-Ring Impact Basins: The Moon and Other Planets. Cambridge Univ. Press, pp. 263.

Spudis P.D. and Ryder G. (1981) Apollo 17 impact melts and their relation to the Serenitatis basin. In *Proc. of the Conf. on Multi-Ring Basins. Proc. Lunar Planet. Sci. 12A - Geochim. Cosmochim. Acta*, Suppl. 15. Pergamon Press. 133-148.

Spudis P.D. and Ryder G. (1985) Geology and petrology of the Apollo 15 landing site: Past, present, and future understanding. (abs) *EOS* 66, 721-726.

Spudis P.D. and Davis P.A. (1986) A chemical and petrological model of the lunar crust and implications for lunar crustal origin. *Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf.* in *J. Geophys. Res.* 91, E84-E90.

Srinivasan B. (1973) Variation in the isotopic composition of trapped rare gases in lunar sample 14318. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 2049-2064.

Srinivasan B. (1974) Lunar breccia 14066: 81-83Kr exposure age, evidence for fissionogenic xenon from 244Pu and rate of production of spallogenic 126Xe. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 2033-2044.

Stadermann F.J., Heusser E., Jessberger E.K., Lingner S. and Stoffler D. (1991) The case for a younger Imbrium basin: New 40Ar-39Ar ages of Apollo 14 rocks. *Geochim. Cosmochim. Acta* 55, 2339-2349.

Stanin F.T. and Taylor L.A. (1979a) Armalcolite/ilmenite: Mineral chemistry, paragenesis, and origin of textures. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 383-405.

Stanin F.T. and Taylor L.A. (1979b) Ilmenite/armalcolite: Effects of rock composition, oxygen fugacity, and cooling rate (abs). *Lunar Planet. Sci. X*, 1160-1162. Lunar Planetary Institute, Houston

Stanin F.T. and Taylor L.A. (1980a) Armalcolite: an oxygen fugacity indicator. *Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf.* 117-124.

Stanin F.T. and Taylor L.A. (1980b) An oxygen geobarometer for lunar high-titanium basalts (abs). *Lunar Planet. Sci. XI*, 1079-1081. Lunar Planetary Institute, Houston

Staudacher T., Jessberger E.K. and Kirsten T. (1977) 40Ar-39Ar age systematics of consortium breccia 73215 (abs). *Lunar Sci. VIII*, 896-898.

Staudacher T., Dominik B., Jessberger E.K. and Kirsten T. (1978) Consortium breccia 73255: 40Ar-39Ar dating (abs). *Lunar Planet. Sci. IX*, 1098-1100. Lunar Planetary Institute, Houston

Staudacher T., Jessberger E.K., Flohs I. and Kirsten T. (1979a) 40Ar/39Ar age systematics of consortium breccia 73255. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 745-762.

Staudacher T., Dominik B., Flohs I., Jessberger E.K. and Kirsten T. (1979b) New 40Ar-39Ar ages for aphanites and clasts of consortium breccia 73255 (abs). Lunar Planet. Sci. X, 1163-1165. Lunar Planetary Institute, Houston

Steiger R.H. and Jaeger E. (1977) Subcommission on geochronology: Convention on the use of decay constants in geo- and cosmochronology. Earth Planet. Sci. Lett. 36, 359-362.

Steele A.M. (1992) Apollo 15 green glass: Relationships between texture and composition. Proc. 22<sup>nd</sup> Lunar Planet. Sci. Conf. 329-341. Lunar Planetary Institute, Houston

Steele A.M., Colson R.O., Korotev R.L. and Haskin L.A. (1992) Apollo 15 green glass: Compositional distributions and petrogenesis. Geochim. Cosmochim. Acta 56, 4075-4090.

Steele I.M. (1972) Chromian spinels from Apollo 14 rocks. Earth Planet. Sci. Lett. 14, 190-194.

Steele I.M. (1974) Ilmenite and armalcolite in Apollo 17 breccias. Am. Mineral. 59, 681-689.

Steele I.M. (1975) Mineralogy of lunar norite 78235: Second lunar occurrence of P21ca pyroxenes from Apollo 17 soils. Am. Mineral. 60, 1086-1091.

Steele I.M. and Smith J.V. (1971a) Mineralogy of Apollo 15415 "Genesis Rock": Source of anorthosite on the moon. Nature 234, 138-140.

Steele I.M. and Smith J.V. (1971b) Mineral and bulk compositions of three fragments from Luna 16. Earth Planet. Sci. Lett. 13, 323-327.

Steele I.M. and Smith J.V. (1972) Ultrabasic lunar samples. Nature 240, 5-6.

Steele I.M., Smith J.V. and Grossman L. (1972) Mineralogy and petrology of Apollo 15 rake samples: II. Breccias. In The Apollo 15 Lunar Samples 161-164. Lunar Planetary Institute, Houston

Steele I.M. and Smith J.V. (1974) Mineralogy and petrology of some Apollo 16 rocks and fines: General petrologic model of the moon. Proc. 4<sup>th</sup> Lunar Sci. Conf. 519-536.

Steele I.M. and Smith J.V. (1975) Minor elements in lunar olivine as a petrologic indicator. Proc. 6<sup>th</sup> Lunar Sci. Conf. 451-467.

Steele I.M. and Smith J.V. (1976) Mineralogy and petrology of complex breccia 14063. Proc. 7<sup>th</sup> Lunar Sci. Conf. 1949-1964.

Steele I.M. and Smith J.V. (1980) Ion-probe determination of Li, Na, Mg, Ti, Sr and Ba in lunar plagioclase (abs). Lunar Planet. Sci. XI, 1085-1087. Lunar Planetary Institute, Houston

Steele I.M., Hutcheon I.D. and Smith J.V. (1980) Ion microprobe analysis and petrogenetic interpretations of Li, Mg, Ti, K, Sr, Ba in lunar plagioclase. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 571-590.

Stephenson A., Collinson D.W. and Runcorn S.K. (1974) Lunar magnetic field paleointensity determinations on Apollo 11, 16, and 17 rocks. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2859-2871.

Stephenson A., Runcorn S.K. and Collinson D.W. (1975) On changes in intensity of the ancient lunar magnetic field. Proc. 6<sup>th</sup> Lunar Sci. Conf. 3049-3062.

- Stephenson A., Runcorn S.K. and Collinson D.W. (1977) Paleointensity estimates from lunar samples 10017 and 10020. Proc. 8<sup>th</sup> Lunar Sci. Conf. 679-687.
- Stettler A., Eberhardt P., Geiss J., Grogler N. and Maurer P. (1973) Ar39-Ar40 ages and Ar37-Ar38 exposure ages of lunar rocks. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1865-1888.
- Stettler A., Eberhardt P., Geiss J. and Grogler N. (1974) 39Ar-40Ar ages of samples from the Apollo 17 Station 7 boulder and implications for its formation. Earth Planet. Sci. Lett. 23, 453-461.
- Stettler A., Eberhardt P., Geiss J., Grogler N. and Guggisberg S. (1975) Age sequence in the Apollo 17 Station 7 boulder (abs). Lunar Sci. VI, 771-773. Lunar Planetary Institute, Houston
- Stettler A. and Albarede F. (1977) Ar39-Ar40 pattern and light noble gas suystematics of two mm-sized rock fragments from Mare Crisium (abs). Conf. on Luna 24. 175-178. Lunar Planetary Institute, Houston
- Stettler A., Eberhardt P., Geiss J., Grogler N. and Guggisberg S. (1978) Chronology of the Apollo 17 Station 7 Boulder and the South Serenitatis impact (abs). Lunar Planet. Sci. IX, 1113-1115. Lunar Planetary Institute, Houston
- Stewart D.B. (1975) Apollonian metamorphic rocks--The products of prolonged subsolidus equilibration (abs). Lunar Sci. VI, 774-776. Lunar Planetary Institute, Houston
- Stoenner R.W., Davis R., Norton E. and Bauer M. (1974) Radioactive rare gases, tritium, hydrogen and helium in the sample return container and in the Apollo 16 and 17 drill stems. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2211-2230.
- Stoeser D.B., Marvin U.B., Wood J.A., Wolfe R.W. and Bower J.F. (1974a) Petrology of a stratified boulder from South Massif, Taurus-Littrow. Proc. 5<sup>th</sup> Lunar Sci. Conf. 355-377.
- Stoeser D.B., Wolfe R.W., Marvin U.B., Wood J.A. and Bower J.F. (1974b) Petrographic studies of a boulder from the South Massif (abs). Lunar Sci. V, 743-745. Lunar Planetary Institute, Houston
- Stoeser D.B., Wolfe R.W., Wood J.A. and Bower J.F. (1974c) Petrology and petrogenesis of boulder 1. In Interdisciplinary Studies of Samples from Boulder 1, Station 2, Apollo 17. Volume 1, Consortium Indomitable. Smithsonian Astrophysical Observatory. Also Lunar Science Institute Cont. no. 210D, 35-109.
- Stoeser D.B., Marvin U.B. and Bower J.F. (1974d) Petrology and petrogenesis of boulder 1. In Interdisciplinary Studies of Samples from Boulder 1, Station 2, Apollo 17. Volume 2, Consortium Indomitable. Smithsonian Astrophysical Observatory. Also Lunar Science Institute Cont. no. 21 ID, 1-59.
- Stoeser D.B., Ryder G. and Marvin U.B. (1975) Lunar granite clasts with unique ternary feldspars (abs). Lunar Sci. VI, 780-782. Lunar Planetary Institute, Houston
- Stöffler D. (1989) Brecciated nature of the Apollo 14 lunar samples: A review. In Workshop on the Moon in Transition: Apollo 14, KREEP and evolved rocks. (eds. Taylor and Warren) LPI Tech Rpt. 89-03, 138-144. Lunar Planetary Institute, Houston.
- Stöffler D., Dence M.R., Graup G. and Abadian M. (1974) Interpretation of ejecta formations at the Apollo 14 and 16 sites by a comparative analysis of experimental, terrestrial and lunar craters. Proc. 5<sup>th</sup> Lunar Sci. Conf. 137-150.
- Stöffler D., Schelien S. and Ostertag R. (1975) Rock 61016: Multiphase shock and crystallization history of a polymict troctolite-anorthositic breccia. Proc. 6<sup>th</sup> Lunar Sci. Conf. 673-692.

Stöffler D., Knoll H-D., Reimold W. and Schulien S. (1976) Grain size statistics, composition and provenance of fragmetal particles in some Apollo 14 breccias. Proc. 7<sup>th</sup> Lunar Sci. Conf. 1965-1985.

Stöffler D. and Knoll H-D. (1977) Composition and origin of plagioclase, pyroxene and olivine clasts of lunar breccias 14006, 14063, 14066, 14311, 14320 and 14321. Proc. 8<sup>th</sup> Lunar Sci. Conf. 1849-1867.

Stöffler D., Knoll H.-D. and Maerz U. (1979) Terrestrial and lunar irnpact breccias and the classification of lunar rocks. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 639-675.

Stöffler D., Knoll H.-D., Marvin U.B., Simonds C.H. and Warren P.H. (1980) Recommended classification and nomenclature of lunar highland rocks - a committee report. In Proc. of the Conf. on The Lunar Highlands Crust. (Merrill and Papike eds.) Geochim. Cosmochim. Acta, Suppl. 12, 51-70. Pergamon Press

Stöffler D., Bischoff A., Borchardt R., Burghel A., Deutsch A., Ostertag R., Palme H., Spettel B., Reimhold W.U., Wacker K. and Wanke H. (1985) Composition and evolution of the lunar crust in the Decartes highlands. Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 90, C449-C506.

Stöffler D., Bode K.D., Jessberger E.K., Lingner S., Palme H., Spettle B., Stadermann F.J. and Wanke H. (1989) Fra Mauro Formation, Apollo 14: IV Synopsis and Synthesis of Consortium Studies. In Workshop on the Moon in Transition: Apollo 14, KREEP and evolved rocks. (eds. Taylor and Warren) LPI Tech Rpt. 89-03, 145-148. Lunar Planetary Institute, Houston.

Stöffler D. and Ryder G. (2001) Stratigraphy and isotopic ages of lunar geologic units: Chronological standard for the inner solar system. Space Science Rev. 96, 9-54.

Stolper E.M. (1974) Lunar ultramafic glasses. A.B. thesis. Harvard Univ.

Stolper E.M., Walker D., Longhi J. and Hayes J.F. (1974) Compositional variation in lunar ultramafic glasses (abs). Lunar Sci. V, 749-751. Lunar Planetary Institute, Houston

Stone C.D., Taylor L.A., McKay D.S. and Morris R.V. (1982) Ferromagnetic resonance intensity: A rapid method for determining lunar glass bead origin. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 87, A182-A196.

Storey W.C., Humphries D.J. and O'Hara M.J. (1974) Experimental petrology of sample 77135. Earth Planet. Sci. Lett. 23, 435-438.

Storzer D., Poupeau G. and Kratschmer W. (1973) Track-exposure and formation ages of some lunar samples. Proc. 4<sup>th</sup> Lunar Sci. Conf. 2363-2377.

Strangway D.W., Pearce G.W., Gose W.A. and Timme R.W. (1971) Remanent magnetization of lunar samples. Earth Planet. Sci. Lett. 13, 43-52.

Strangway D.W. and Olhoeft G.R. (1977) Electrical properties of planetary surfaces. Phil. Trans. Roy. Soc. London A285, 441-450.

Stasheim A., Jackson P.F.S., Coetzee J.H.J., Streleow F.W.E., Wybenga F.T., Gricius A.J., Kokot M.L. and Scott R.H. (1972) Analysis of lunar samples 14163, 14259 and 14321 wqith isotopic data for  $^{7}\text{Li}/^{6}\text{Li}$ . Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1337-1342.

Spangler R.R. and Delano J.W. (1984) History of the Apollo 15 yellow impact glass and samples 15426 and 15427. Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 89, B478-B486.

Spangler R.R., Warasila R. and Delano J.W. (1984)  $^{39}\text{Ar}/^{40}\text{Ar}$  ages for the Apollo 15 green and yellow volcanic glasses. Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 89, B487-B497.

Spudis P.D., Ryder G., Taylor G.J., McCormick K.A., Keil K., Grieve R.A.F. (1991) Sources of mineral fragments in impact melts, 15445 and 15455: Toward the origin of low-K Fra mauro basalt. Proc. 21<sup>st</sup> Lunar Planet. Sci. Conf. 151-165. Lunar Planetary Institute, Houston

Sugiura N. and Strangway D.W. (1980a) Comparisons of magnetic paleointensity methods using a lunar sample. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 1801-1813.

Sugiura N. and Strangway D.W. (1980b) Thellier paleointensity: Studies of lunar samples (abs). Lunar Planet. Sci. XI, 1111-1113. Lunar Planetary Institute, Houston

Sugiura N., Strangway D.W. and Pearce G.W. (1978) Heating experiments and paleointensity determinations. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 3151-3163.

Sugiura N., Wu Y.M., Strangway D.W., Pearce G.W. and Taylor L.A. (1979a) A new magnetic paleointensity value for a "young lunar glass." Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 2189-2197.

Sugiura N., Wu Y.M., Strangway D.W., Pearce G.W. and Taylor L.A. (1979b) Paleointensity studies on 70019, a young glass sample from Apollo 17 (abs). Lunar Planet. Sci. X, 1195-1197. Lunar Planetary Institute, Houston.

Sugiura N. and Strangway D.W. (1980) Comparison of magnetic paleointensity methods using a lunar sample. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 1801-1813.

Sung C.-M., Abu-Eid R.M. and Burns R.G. (1974a)  $Ti^{3+}/Ti^{4+}$  ratios in lunar pyroxenes: implications to depth of origin of mare basalt magma. Proc. 5<sup>th</sup> Lunar Sci. Conf. 717-726.

Sung C.-M., Abu-Eid R.M. and Burns R.G. (1974b) A search for trivalent titanium in Apollo 17 pyroxenes (abs). Lunar Sci. V, 758-760. Lunar Planetary Institute, Houston

Sutton R.L. (1981) Documentation of Apollo 16 samples. In Geology of the Apollo 16 area, central lunar highlands. (Ulrich et al. ) U.S.G.S. Prof. Paper 1048.

Sutton R.L., Batson R.M., Larson K.B., Schafer J.P., Eggleton R.E. and Swann G.A. (1971) Documentation of the Apollo 14 samples. U.S. Geological Survey, Rpt. 32.

Sutton R.L. and Schaber G.G. (1971) Lunar locations and orientations of rock samples from Apollo missions 11 and 12. Proc. 2<sup>nd</sup> Lunar Sci. Conf. 17-26.

Sutton R.L., Hait M.H. and Swann G.A. (1972) Geology of the Apollo 14 landing site. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 27-38.

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

Sutton S.R. and others (1992) Reduced chromium in olivine grains from lunar basalt 15555: X-ray absorption near edge structure (XANES). Geochim. Cosmochim. Acta 57, 461-468.

Swann G.A., Trask N.J., Hait M.H. and Sutton R.L. (1971a) Geologic setting of the Apollo 14 samples. Science 173, 716-719.

Swann G.A., Bailey N.G., Batson R.M., Eggleton R.E., Hait M.H., Holt H.E., Larson K.B., Reed V.S., Schaber G.G., Sutton R.L., Trask N.J., Ulrich G.E. and Wilshire H.G. (1977) Geology of the Apollo 14 landing site in the Fra Mauro Highlands. U.S.G.S. Prof. Paper 880.

Swann G.A., Bailey N.G., Batson R.M., Eggleton R.E., Hait M.H., Holt H.E., Larson K.B., McEwen M.C., Mitchell E.D., Schaber G.G., Schafer J.P., Shepard A.B., Sutton R.L., Trask N.J., Ulrich G.E., Wilshire H.G. and Wolfe E.W. (1972) 3. Preliminary Geologic Investigation of the Apollo 14 landing site. In Apollo 14 Preliminary Science Rpt. NASA SP-272. pages 39-85.

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 5-112.

Swindle T.D., Caffee M.W., Hohenberg C.M., Hudson G.B., Laul J.C., Simon S.B. and Papike J.J. (1985) Noble gas component organization in Apollo 14 breccia 14318: 129I and 244Pu regolith chronology. Proc. 15<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 89, C517-C539.

Swindle T.D., Spudis P.D., Taylor G.J., Korotev R.L., Nichols R.H. and Olinger C.T. (1991) Searching for Crisium basin ejecta: Chemistry and ages of Luna 20 impact melts. Proc. 21<sup>st</sup> Lunar Planet. Sci. 167-181. Lunar Planetary Institute, Houston

Switkowski Z.E., Haff P.K., Tombrello T.A. and Burnett D.S. (1977) Mass fractionation of the lunar surface by solar wind sputtering. J. Geophys. Res. 82, 3797-3804.

Takeda H. (1972) Structural studies of rim augite and core pigeonite from lunar rock 12052. Earth Planet. Sci. Lett. 15, 65-71.

Takeda H. and Ishii T. (1975) Typical processes of exsolution, decomposition and inversion of pyroxenes and its bearing on thermal history of lunar rocks (abs). Lunar Sci. VI, 795-797. Lunar Planetary Institute, Houston

Takeda H. and Miyamoto M. (1976) Characterization of crust formation on a parent body of achondrites and the Moon by pyroxene crystallography and chemistry (abs). Lunar Sci. VII, 846-848. Lunar Planetary Institute, Houston

Takeda H. and Miyamoto M. (1977a) Inverted pigeonites from lunar breccia 76255 and pyroxene-crystallization trends in lunar and achondritic crusts. Proc. 8<sup>th</sup> Lunar Sci. Conf. 2617-2626.

Takeda H. and Miyamoto M. (1977b) Inverted pigeonites from lunar breccia 76255 and pyroxene-crystallization trends in lunar and achondritic crusts (abs). Lunar Sci. VIII, 922-924. Lunar Planetary Institute, Houston

Takeda H., Miyamoto M., Ishii T. and Reid A.M. (1976) Characterization of crust formation on a parent body of achondrites and the Moon by pyroxene crystallography and chemistry. Proc. 7<sup>th</sup> Lunar Sci. Conf. 3535-3548.

Takeda H., Miyamoto M. and Ishii T. (1979) Pyroxenes in the early crustal cumulates found in achondrites and lunar highland rocks. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 1095-1107.

Takeda H., Miyamoto M. and Ishii T. (1980) Composition of basaltic clasts in lunar and eucrite polymict breccias. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 135-147.

- Takeda H., Mori H. and Miyamoto M. (1982) Comparison of thermal history of orthopyroxenes between lunar norites 78236, 72255, and diogenites. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 87 A124-A130.
- Takeda H., Miyamoto M. and Ishii T. (1983) Mineralogical comparison of lunar and chondritic vesicular melt breccias (abs). Lunar Planet. Sci. XIV, 771-772. Lunar Planetary Institute, Houston
- Tanaka S., Sakamoto K. and Komura K. (1972) Aluminum 26 and manganese 53 produced by solar-flare particles in lunar rock and cosmic dust. J. Geophys. Res. 77, 4281-4288.
- Tanaka T., Kurasawa H., Nakamura N. and Masuda A. (1973) Rare earth elements in fines 74220. (abs) EOS Trans. AGU 54, 614.
- Tanaka T., Masuda A., Kurasawa H. and Nakamura N. (1974) Determination of REE and Ba in five Apollo 17 samples (abs). Lunar Sci. V, 772-774. Lunar Planetary Institute, Houston
- Tanimizu M. and Tanaka T. (2002) Coupled Ce-Nd isotopic systematics and rare earth elements differentiation of the moon. Geochim. Cosmochim. Acta 66, 4007-4014.
- Tarasov L.S., Nazarov M.A., Shevareevsky I.D., Kudryashova A.F., Gaverdovskaya A.S. and Korina M.I. (1977) Mineralogy and petrography of lunar rocks from Mare Crisium. Proc. 8<sup>th</sup> Lunar Sci. Conf. 3333-3356.
- Tatsumoto M. (1970) U-Th-Pb age of Apollo 12 rock 12013. Earth Planet. Sci. Lett. 9, 193-200.
- Tatsumoto M., Hedge C.E., Doe B.R. and Unruh D.M. (1972a) U-Th-Pb and Rb-Sr measurements on some Apollo 14 lunar samples. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1531-1555.
- Tatsumoto M., Hedge C.E., Knight R.J., Unruh D.M. and Doe Bruce R. (1972b) U-Th-Pb, Rb-Sr and K measurements on some Apollo 15 and Apollo 16 samples. In The Apollo 15 Samples (Chamberlain and Watkins eds) 391-395. Lunar Planetary Institute, Houston
- Tatsumoto M., Nunes P.D., Knight R.J., Hedge C.E. and Unruh D.M. (1973) U-Th-Pb, Rb-Sr, and K measurements of two Apollo 17 samples (abs). EOS 54, 614-615.
- Tatsumoto M., Nunes P.D., Knight R.J. and Unruh D.M. (1974) Rb-Sr and U-Th-Pb systematics of boulders 1 and 7, Apollo 17 (abs). Lunar Sci. V, 774-776. Lunar Planetary Institute, Houston
- Tatsumoto M. and Unruh D.M. (1976) KREEP basalt age: Grain by grain U-Th-Pb systematic study of the quartz monozodiorite clast 15405,88. Proc. 7<sup>th</sup> Lunar Sci. Conf. 2107-2129.
- Tatsumoto M., Premo W. and Unruh D.M. (1987) Origin of lead from green glass of Apollo 15426: A search for primitive lunar lead. Proc. Lunar Planet. Sci. Conf. 17<sup>th</sup>, in J. Geophys. Res. 92, E361-E371.
- Taylor D.J., McKeegan K.D., Harrison T.M. and McCulloch M. (2007) 176Lu/176Hf in lunar zircons: Identification of an early enriched reservoir on the moon. (abs) Lunar Planet. Sci. XXXVIII, #2130 Lunar Planetary Institute, Houston
- Taylor D.J., McKeegan K.D., Harrison T.M. and McCulloch M. (2007) 176Lu-176Hf in Lunar Zircon: Identification of an early enriched reservoir on the Moon. (abs) Lunar Planet. Sci. XXXVIII, #1338
- Taylor D.J., McKeegan K.D. and Harrison T.M. (2007) Correlated study of Lu-Hf and REE in lunar zircons, with implication for the differentiation age of KREEP. (abs) Meterotical Soc. Tucson
- Taylor G.J. (1994) Legacy of Apollo. Sci. Amer. 271, 40-47.

- Taylor G.J. and Marvin U.B. (1971) A dunite-norite lunar microbreccia. *Meteoritics* 6, 173-180.
- Taylor G.J., Drake M.J., Wood J.A. and Marvin U.B. (1973) The Luna 20 lithic fragments and the composition and origin of the lunar highlands. *Geochim. Cosmochim. Acta* 37, 1087-1106.
- Taylor G.J., Keil K. and Warner R.D. (1977) Very low-Ti basalts. *Geophys. Res. Lett.* 4, 207-210.
- Taylor G.J., Keil K. and Warner R.D. (1977) Petrology of Apollo 17 deep drill core. I: Depositional history based on modal analysis of 70007, 70008 and 70009. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 3195-3222.
- Taylor G.J., Wentworth S. and Warner R.D. (1978) Petrology of Apollo 17 deep drill core. II: Agglutinates as recorders of fossil soil compositions. *Proc. 9<sup>th</sup> Lunar Planet Sci. Conf.* 1959-1968.
- Taylor G.J., Warner R.D. and Keil K. (1978) VLT mare basalts: Impact mixing, parent magma types, and petrogenesis. In *Mare Crisium: The View from Luna 24.* (ed. Merrill R.B. and Papike J.J.) *Geochim. Cosmochim. Acta Suppl.* 9, 357-370.
- Taylor G.J., Warner R.D. and Keil K. (1979) Stratigraphy and depositional history of the Apollo 17 drill core. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 1159-1184.
- Taylor G.J., Warner R.D., Keil K., Ma M.-S. and Schmitt R.A. (1980) Silicate liquid immiscibility, evolved lunar rocks, and the formation of KREEP. In *Proc. Conf. Lunar Highlands Crust,* *Geochim. Cosmochim. Acta Suppl.* 12. Pergamon Press. 339-352. Lunar Planetary Institute, Houston
- Taylor G.J., Warren P., Ryder G., Delano J., Pieters C. and Lofgren G. (1991) *Lunar Rocks.* In *Lunar Sourcebook: a users guide to the moon.* (eds. Heiken et al. ) Cambridge Univ. Press
- Taylor H.P. and Epstein S. (1970) Oxygen and silicon isotopic ratios of lunar rock 12013. *Earth Planet. Sci. Lett.* 9, 208-210.
- Taylor H.P. and Epstein S. (1975) O<sup>18</sup>/O<sup>16</sup> and Si<sup>30</sup>/Si<sup>28</sup> studies of some Apollo 15, 16 and 17 samples. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1657-1679.
- Taylor J.H.C. and Carter J.L. (1974) Apollo 17: Comparative chemistry of olivines, pyroxenes, and plagioclase from regolith samples, 74002, 74241 and 75081. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 925-933.
- Taylor L.A. (1979) Paleointensity determinations at elevated temperatures: Sample preparation technique. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 2183-2187.
- Taylor L.A., Williams R.J. and McCallister R.H. (1972) Stability of ilmenite and ulvöspinel in the Fe-Ti-O system and applications of these data to lunar mineral assemblages. *Earth Planet. Sci. Lett.* 16, 282-298.
- Taylor L.A. and McCallister R.H. (1972) An experimental investigation of the significance of zirconium partitioning in lunar ilmenite and ulvöspinel. *Earth Planet. Sci. Lett.* 17, 105-109.
- Taylor L.A., Mao H.K. and Bell P.M. (1973a) "Rust" in the Apollo 16 rocks. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 829-839.
- Taylor L.A., Williams K.L. and Sardi O. (1973b) Selected Apollo 17 soils: Mineralogy and geochemistry of opaque and non-opaque phases. *Earth Planet. Sci. Lett.* 21, 6-12.
- Taylor L.A. and Williams K.L. (1974a) Formational history of lunar rocks: applications of experimental geochemistry of the opaque minerals. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 585-596.
- Taylor L.A. and Williams K.L. (1974b) Formational history of lunar rocks: applications of experimental geochemistry of the opaque minerals (abs). *Lunar Sci. V*, 783-785. Lunar Planetary Institute, Houston

Taylor L.A., Mao H.K. and Bell P.M. (1974c) Identification of the hydrated iron oxide mineral akaganeite in Apollo 16 lunar rocks. *Geology* 2, 429-432.

Taylor L.A. and Misra K.C. (1975a) Pyroxene-phyric basalt 15075: Petrography and petrogenesis. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 165-179.

Taylor L.A., Uhlmann D.R., Hopper R.W. and Misra K.C. (1975b) Absolute cooling rates of lunar rocks: Theory and application. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 181-191.

Taylor L.A., Shervais J.W., Hunter R.H., Shih C.-Y., Nyquist L.E., Bansal B.M., Wooden J. and Laul J.C. (1983) Pre-4.2 AE mare-basalt volcanism in the lunar highlands. *Earth Planet. Sci. Lett.* 66, 33-47.

Taylor L.A., McKay D.S., Patchen A., Wentworth S., Oder R. and Jerde E. (1992) Magnetic beneficiation of high-Ti mare basalts: Petrographic analyses (abs). *Lunar Planet. Sci. XXIII*, 1415-1416. Lunar Planetary Institute, Houston

Taylor S.R. (1973) Geochemistry of the lunar highlands. *The Moon* 7, 181-195.

Taylor S.R. (1975) *Lunar Science: A Post-Apollo View*. Pergamon Press, pp. 372.

Taylor S.R. (1982) *Planetary Science: A Lunar Perspective*. Lunar Planetary Institute, pp. 481.

Taylor S.R. (1993) *Solar System Evolution: A New Perspective*. Cambridge Univ. Press, pp. 307.

Taylor S.R. and Jakes P. (1974) The geochemical evolution of the Moon. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1287-1305.

Taylor S.R. and Bence A.E. (1975) Trace element characteristics of the mare basalt source region: Implications of the cumulate versus primitive source model. In *Origins of Mare Basalts and their Implications for Lunar Evolution* (Lunar Science Institute, Houston), 159-163.

Taylor S.R., Muir P. and Kaye M. (1971) Trace element chemistry of Apollo 14 lunar soils from Fra Mauro. *Geochim. Cosmochim. Acta* 35, 975-981.

Taylor S.R., Kaye M., Muir P., Nance W., Rudowski R. and Ware N. (1972) Composition of the lunar uplands: Chemistry of Apollo 14 samples from Fra Mauro. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1231-1249.

Taylor S.R., Gorton M.P., Muir P., Nance W.B., Rudowski R. and Ware N. (1973a) Composition of the Descartes region, lunar highlands. *Geochim. Cosmochim. Acta* 37, 2665-2683.

Taylor S.R., Gorton M.P., Muir P., Nance W., Rudowski R. and Ware N. (1973b) Lunar highlands composition: Apennine Front. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1445-1459.

Taylor S.R., Gorton M., Muir P., Nance W., Rudowski R. and Ware N. (1974) Lunar highland composition (abs). *Lunar Sci. V*, 789-791. Lunar Planetary Institute, Houston

Taylor S.R., Taylor G.J. and Taylor L.A. (2006) The Moon: A Taylor perspective. *Geochim. Cosmochim. Acta* 70, 5904-5918.

Tera F. and Wasserburg G.J. (1972a) U-Th-Pb systematics in three Apollo 14 basalts and the problem of initial Pb in lunar rocks. *Earth Planet. Sci. Lett.* 14, 281-304.

Tera F. and Wasserburg G.J. (1972b) U-Th-Pb systematics in the lunar highland samples from the Luna 20 and Apollo 16 missions. *Earth Planet. Sci. Lett.* 17, 36-51

- Tera F. and Wasserburg G.J. (1974) U-Th-Pb systematics on lunar rock: and inferences about lunar evolution and the age of the Moon. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1571-1599.
- Tera F. and Wasserburg G.J. (1975) The evolution and history of mare basalts as inferred from U-Th-Pb systematics (abs). Lunar Sci. VI, 807-809. Lunar Planetary Institute, Houston
- Tera F. and Wasserburg G.J. (1976) Lunar ball games and other sports (abs). Lunar Sci. VII, 858-860. Lunar Planetary Institute, Houston
- Tera Fouad, Ray L.A. and Wasserburg G.J. (1972) Distribution of Pb-U-Th in lunar anorthosite 15415 and inferences about its age. In The Apollo 15 Lunar Samples (Chamberlain and Watkins eds) p. 396-401. Lunar Planetary Institute, Houston
- Tera F., Papanastassiou D.A. and Wasserburg G.J. (1973) A lunar cataclysm at 3.95 AE and the structure of the lunar crust (abs). Lunar Sci. IV, 723-725 Lunar Planetary Institute, Houston
- Tera F., Papanastassiou D.A. and Wasserburg G.J. (1974a) Isotopic evidence for a terminal lunar cataclysm. Earth Planet. Sci. Lett. 22, 1-21.
- Tera F., Papanastassiou D.A. and Wasserburg G.J. (1974b) The lunar time scale and a summary of isotopic evidence for a terminal lunar cataclysm (abs). Lunar Sci. V, 792-794. Lunar Planetary Institute, Houston
- Thiemens M.H. and Clayton R.N. (1980) Solar and cosmogenic nitrogen in the Apollo 17 deep drill core. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 1435-1451.
- Thiemens M.H. and Clayton R.N. (1980) Ancient solar wind in lunar microbreccias. Earth Planet. Sci. Lett. 47, 34-42.
- Thode H.G. and Reese C.E. (1971) Measurement of sulphur concentrations and the isotopic ratios  $^{33}\text{S}/^{32}\text{S}$ ,  $^{34}\text{S}/^{32}\text{S}$  and  $^{36}\text{S}/^{32}\text{S}$  in Apollo 12 samples. Earth Planet. Sci. Lett. 12, 434-438.
- Thode H.G. and Rees C.E. (1976) Sulfur isotopes in grain size fractions of lunar soils. Proc. 7<sup>th</sup> Lunar Sci. Conf. 459-468.
- Thornber C.R. and Huebner J.S. (1980) An experimental study of the thermal history of fragment-laden "basalt" 77115. In Proc. Conf. Lunar Highlands Crust. Geochim. Cosmochim. Acta, Suppl. 12. Pergamon Press. 233-252.
- Tilton G.R. and Chen J.H. (1979) Lead isotope systematics of three Apollo 17 mare basalts. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 259-274.
- Tittmann B.R., Curnow J.M. and Housley R.M. (1975a) Internal friction quality factor Q>3100 achieved in lunar rock 70215,85. Proc. 6<sup>th</sup> Lunar Sci. Conf. 3217-3226.
- Tittmann B.R., Housley R.M. and Abdel-Gawad M. (1975b) Internal friction quality factor > 3100 achieved in lunar rock 70215,85 (abs). Lunar Sci. VI, 812-814. Lunar Planetary Institute, Houston
- Tittmann B.R., Ahlberg L. and Cumow J. (1976) Internal friction and velocity measurements. Proc. 7<sup>th</sup> Lunar Sci. Conf. 3123-3132.
- Tittmann B.R., Ahlberg H., Nadler H., Curnow J., Smith T. and Cohen E.R. (1977) Internal friction quality-factor Q under confining pressure. Proc. 8<sup>th</sup> Lunar Sci. Conf. 1209-1224.
- Tittmann B.R., Nadler H., Richardson J.M. and Ahlberg L. (1978) Laboratory measurements of p-wave seismic Q on lunar and analog rocks. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 3627-3635.

Touboul M., Kleine T., Bourdon B. and Plame H. (2007) The duration of magma ocean crystallization on the moon – evidence from new W isotope data for metals from high- and low-Ti mare basalts. (abs) Lunar Planet. Sci. XXXVIII #2385. Lunar Planetary Institute, Houston

Trice R., Warren N. and Anderson O.L. (1974) Rock elastic properties and near-surface structure of Taurus-Littrow. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2903-2911.

Turner G. (1970) 40Ar-39Ar age determination of lunar rock 12013. Earth Planet. Sci. Lett. 9, 177-180.

Turner G. (1971) 40Ar-39Ar ages from the lunar maria. Earth Planet. Sci. Lett. 11, 169-191.

Turner G. (1972) 40Ar-39Ar age and cosmic ray irradiation history of Apollo 15 anorthosite 15415. Earth Planet. Sci. Lett. 14, 169-175.

Turner G. (1977a) Potassium-argon chronology of the moon. Phys. Chem. Earth 10, 145-195.

Turner G. (1977b) The early chronology of the Moon: Evidence for the early collisional history of the solar system. Phil. Trans. Roy. Soc. London A285, 97-104.

Turner G., Hunke J.C., Podosek F.A. and Wasserburg G.J. (1971) 40Ar-39Ar ages and cosmic ray exposure ages of Apollo 14 samples. Earth Planet. Sci. Lett. 12, 19-35.

Turner G., Hunke J.C., Podosek F.A. and Wasserburg G.J. (1972) Ar40-39 systematics in rocks and separated minerals from Apollo 14. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1589-1612.

Turner G., Cadogan P.H. and Yonge C.J. (1973a) Argon selenochronology. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1889-1914.

Turner G., Cadogan P.H. and Yonge C.J. (1973b) Apollo 17 age determinations. Nature 242, 513-515.

Turner G. and Cadogan P.H. (1974) Possible effects of 39Ar recoil in 40Ar-39Ar dating. Proc. 5<sup>th</sup> Lunar Sci. Conf. 1601-1615.

Turner G. and Cadogan P.H. (1975a) The history of lunar bombardment inferred from 40Ar-39Ar dating of highland rocks. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1509-1538.

Turner G. and Cadogan P.H. (1975b) The history of lunar basin formation inferred from 40Ar-39Ar dating of highland rocks (abs). Lunar Sci. VI, 826-828. Lunar Planetary Institute, Houston

Twedell D., Feight S., Carlson I. and Meyer C. (1978) Lithologic maps of selected Apollo 14 breccia samples. Curators Office. JSC 13842

Uhlmann D.R., Cukierman M., Scherer G. and Hopper R.W. (1973) Viscous flow, crystallization behavior and thermal history of orange soil material (abs). EOS Trans. AGU 54, 617-618.

Uhlmann D.R. and Onorato P.I.K. (1979) A simplified model for glass formation (abs). Lunar Planet. Sci. X, 1250-1252. Lunar Planetary Institute, Houston

Uhlmann D.R. and Yannon H. (1981) Simplified model evaluation of cooling rates for glass-containing lunar compositions (abs). Lunar Planet. Sci. XII, 1103-1105. Lunar Planetary Institute, Houston

Uhlmann D.R., Klein L., Onorato P.I.K. and Hopper R.W. (1975) The formation of lunar breccias: sintering and crystallization kinetics. Proc. 6<sup>th</sup> Lunar Sci. Conf. 693-705.

Uhlmann D.R., Onorato P.I.K. and Scherer G.W. (1979) A simplified model for glass formation. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 375-381.

- Uhlmann D.R., Yannon H. and Fang C.-Y. (1981) Simplified model evaluation of cooling rates for glass-containing lunar compositions. Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf. 281-288.
- Ulrich M.C. (1970) Chemical individuality of lunar, meteoritic and terrestrial silicate rocks. Science 168, 1375-1376.
- Ulrich G.E. (1981) Geology of North Ray Crater. In U.S. Geol. Survey Prof. Paper 1048, 45-81.
- Ulrich G.E., Hodges C.A. and Muehlberger W.R. (1981) Geology of the Apollo 16 Area, Central Lunar Highlands. U.S. Geol. Survey Prof. Paper 1048
- Unruh D.M. and Tatsumoto M. (1977) Evolution of mare basalts: The complexity of the U-Th-Pb system. Proc. 8<sup>th</sup> Lunar Sci. Conf. 1673-1696.
- Unruh D.M. and Tatsumoto M. (1978) Implications from Luna 24 sample 24170 to U-Pb evolution in the lunar mantle. In Mare Crisium: a view from Luna 24 (eds, Merrill and Papike) 679-694.
- Unruh D.M., Stille P., Patchett P.J. and Tatsumoto M. (1984) Lu-Hf and Sm-Nd evolution in lunar mare basalts. Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 88, B459-B477.
- Usselman T.M. (1975) Ilmenite chemistry in mare basalts, an experimental study. In Origins of Mare Basalts and their Implications for Lunar Evolution (Lunar Science Institute, Houston), 164-168.
- Usselman T.M. and Lofgren G.E. (1976a) The phase relations, textures, and mineral chemistries of high-titanium mare basalts as a function of oxygen fugacity and cooling rate. Proc. 7<sup>th</sup> Lunar Sci. Conf. 1345-1363.
- Usselman T.M. and Lofgren G.E. (1976b) Phase relations of high-titanium mare basalts as a function of oxygen fugacity (abs). Lunar Sci. VII, 888-890. Lunar Planetary Institute, Houston
- Usselman T.M., Lofgren G.E., Donaldson C.H. and Williams R.J. (1975) Experimentally reproduced textures and mineral chemistries of high-titanium mare basalts. Proc. 6<sup>th</sup> Lunar Sci. Conf. 997-1020.
- Vaniman D.T. (1990) Glass variants and multiple HASP trends in Apollo 14 regolith breccias. Proc. 20<sup>th</sup> Lunar Planet. Sci. Conf. 209-217. Lunar Planetary Institute, Houston
- Vaniman D.T. and Papike J.J. (1977a) VLT basalts: A new mare rock type from the Apollo 17 drill core. Proc. 8<sup>th</sup> Lunar Planet. Sci. Conf. 1443-1471.
- Vaniman D.T. and Papike J.J. (1977b) Ferrobasalts from Mare Crisium: Luna 24. Geophys. Res. Lett. 4, 497-500.
- Vaniman D.T. and Papike J.J. (1978) The lunar highland melt-rock suite. Geophys. Res. Lett. 5, 429-432.
- Vaniman D.T., Labotka T.C., Papike J.J., Simon S.B. and Laul J.C. (1979) The Apollo 17 drill core: Petrologic systematics and the identification of a possible Tyco component. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 1185-1227.
- Vaniman D.T. and Papike J.J. (1980) Lunar highland melt rocks: Chemistry, petrology, and silicate mineralogy. In Proc. Conf. Lunar Highlands Crust, Geochim. Cosmochim. Acta, Supp. 12. Pergamon Press. 271-337. Lunar Planetary Institute, Houston
- Vaughan D.J. and Burns R.G. (1973) Low oxidation states of Fe and Ti in the Apollo 17 orange soil (abs). EOS Trans. AGU 54, 618-619.

Vaughan D.J. and Burns R.G. (1977) Electronic absorption spectra of lunar minerals. Phil. Trans. Roy. Soc. London A285, 249-258.

Vaughan J.P., Nemchin A.A., Pidgeon R.T. and Meyer C. (2006) U-Pb ages of lunar apatites (abs#1606). Lunar Planet. Sci. XXXVII Lunar Planetary Institute, Houston

Venkatesan T.R., Nautiyal C.M., Padia J.T. and Rao M.N. (1981) Compositional characteristics of solar wind and solar flare neon in the past using lunar soils and rocks (abs). Lunar Planet. Sci. XII, 1112-1114. Lunar Planetary Institute, Houston

Venkatesan T.R., Nautiyal C.M., Padia J.T. and Rao M.N. (1982) SCR-proton produced xenon isotopes in lunar rocks (abs). Lunar Planet. Sci. XIII, 821-822. Lunar Planetary Institute, Houston

Vetter S.K., Shervais J.W. and Lindstrom M.M. (1988) Petrology and geochemistry of olivine-normative and quartz-normative basalts from regolith breccia 15498: New diversity in Apollo 15 mare basalts. Proc. 18<sup>th</sup> Lunar Planet. Sci. Conf. 255-271. Lunar Planetary Institute, Houston

Vickers D.G. and Bastin J.A. (1977) The interaction of lunar rock and far infrared radiation. Phil. Trans. Roy. Soc. London A285, 319-324.

Vinogradov A.P. (1971) Preliminary data on lunar ground brought to Earth by Automatic Probe "Luna 16". Proc. 2<sup>nd</sup> Lunar Sci. Conf. 1-16.

Vinogradov A.P. (1973) Preliminary data on lunar soil collected by the Luna 20 unmanned spacecraft. Geochim. Cosmochim. Acta 37, 721-729.

von Engelhardt W. (1979) Ilmenite in the crystallization sequence of lunar rocks. Proc. 10<sup>th</sup> Lunar Sci. Conf. 677-694.

von Engelhardt W., Arndt J., Stoffler D. and Schneider H. (1972) Apollo 14 regolith and fragmental rocks, their compositions and origins by impacts. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 753-770.

von Guten H.R., Wegmuller F. and Krahenbuhl U. (1982) Low temperature volatilization on the Moon. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 87, A279-A282.

Wahlen M., Honda M., Imamura M., Fruchter J.S., Finkel R.C., Kohl C.P., Arnold J.R. and Reedy R.C. (1972) Cosmogenic nuclides in football-sized rocks. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1719-1732.

Wakita H. and Schmitt R.A. (1970) Elemental abundances in seven fragments from lunar rock 12013. Earth Planet. Sci. Lett. 9, 177-180.

Walker D. (1983) Lunar and terrestrial crust formation. Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 88, 17-25.

Walker D., Longhi J. and Hays J.F. (1972) Experimental petrology and origin of Fra Mauro rocks and soil. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 797-817.

Walker D., Grove T.L., Longhi J., Stöpler E.M. and Hays J.F. (1973) Origin of lunar feldspathic rocks. Earth Planet. Sci. Lett. 20, 325-336.

Walker D., Longhi J., Stöpler E., Grove T. and Hays J.F. (1974) Experimental petrology and origin of titaniferous lunar basalts (abs). Lunar Sci. V, 814-816. Lunar Planetary Institute, Houston

Walker D., Longhi J. and Hays J.F. (1975a) Heterogeneity in titaniferous lunar basalts. In Conference on Origins of Mare Basalts and their Implications for Lunar Evolution, 169-173. Lunar Science Institute, Houston

- Walker D., Longhi J., Stolper E.M., Grove T.L. and Hays J.F. (1975b) Origin of titaniferous lunar basalts. *Geochim. Cosmochim. Acta* 39, 1219-1235.
- Walker D., Longhi J. and Hays J.F. (1976a) Heterogeneity in titaniferous lunar basalts. *Earth Planet. Sci. Lett.* 30, 27-36.
- Walker D., Kirkpatrick R.J., Longhi J. and Hays J.F. (1976) Crystallization history of lunar picritic basalt sample 12002: Phase-equilibria and cooling-rate studies. *Geol. Soc. Am. Bull.* 87, 646-656.
- Walker D. and Hays J.F. (1977) Plagioclase floatation and lunar crust formation. *Geology* 5, 425-428.
- Walker R.M. (1975) Interactions of energetic nuclear particles in space with the lunar surface. *Ann. Rev. Earth Planet. Sci.* 3, 99-128.
- Walker R.J. and Papike J.J. (1981) The Apollo 15 regolith. *Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf.* 485-508.
- Walker R.J., Horan M.F., Shearer C.K. and Papike J.J. (2004) Low abundances of highly siderophile elements in the lunar mantle: evidence for prolonged late accretion. *Earth Planet. Sci. Lett.* 224, 399-413.
- Walker R.J., Morgan J.W., Shearer C.K. and Papike J.J. (1998) Rhenium-osmium isotopic systematics of lunar orange glass(abs). *Lunar Planet. Sci. XXIV #1271* Lunar Planetary Institute, Houston
- Walton J.R., Lakatos S. and Heymann D. (1973) Distribution of inert gases in fines from the Cayley-Descartes region. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 2079-2096.
- Wanke H., Baddehausen H., Balaceanu A., Teschke F., Spettel B., Dreibus G., Palme H., Quijano-Rico M., Kruse H., Wlotzka F. and Begemann F. (1973) Multielement analysis of lunar samples and some implications of the results. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1251-1268.
- Wanke H., Baddehausen H., Dreibus G., Jagoutz E., Kruse H., Palme H., Spettel B. and Teschke F. (1973) Multielement analysis of Apollo 15, 16 and 17 samples and the bulk composition of the moon. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1461-1481.
- Wanke H., Palme H., Baddehausen H., Dreibus G., Jagoutz E., Kruse H., Spettel B., Teschke F. and Thacker R. (1974) Chemistry of Apollo 16 and 17 samples: bulk composition, late-stage accumulation and early differentiation of the Moon. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 1307-1335.
- Wanke H., Palme H., Baddehausen H., Dreibus G., Jagoutz E., Kruse H., Palme C., Spettel B., Teschke F. and Thacker R. (1975a) New data on the chemistry of lunar samples: Primary matter in the lunar highlands and the bulk composition of the moon. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1313-1340.
- Wanke H., Palme H., Baddehausen H., Dreibus G., Jagoutz E., Kruse H., Spettel B., Teschke F. and Thacker R. (1975b) New data on the chemistry of lunar samples and about the major element composition of KREEP (abs). *Lunar Sci. VI*, 844-846. Lunar Planetary Institute, Houston
- Wanke H., Palme H., Kruse H., Baddehausen H., Cendales M., Dreibus G., Hofmeister H., Jagoutz E., Palme C., Spettel B. and Thacker R. (1976) Chemistry of lunar highland rocks: a refined evaluation of the composition of the primary matter. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 3479-3499.
- Wanke H., Baddehausen H., Blum K., Cendales M., Dreibus G., Hofmeister H., Kruse H., Jagoutz E., Palme C., Spettel B., Thacker R. and Vilcsek E. (1977) On the chemistry of lunar samples and achondrites. Primary matter in the lunar highlands: A re-evaluation. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 2191-2213.
- Wanke H., Palme H., Baddehausen H., Dreibus G., Kruse H. and Spettel B. (1977) Element correlations and the bulk composition of the Moon. *Phil. Trans. Roy. Soc. London A285*, 41-48.

- Wanke H., Dreibus G. and Palme H. (1978) Primary matter in the Lunar Highlands: The case of the siderophile elements. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 83-110.
- Ware N.G. and Green D.H. (1977) Troctolitic and basaltic clasts from a Fra Mauro breccia. In Lunar Sample Studies. NASA SP-418, 49. JSC
- Warner J. (1970) Apollo 12 Lunar-Sample Information. NASA TR R-353. JSC
- Warner J.L. (1971) Lunar crystalline rocks: Petrology and geology. Proc. 2<sup>nd</sup> Lunar Sci. Conf. 469-480.
- Warner J.L. (1972) Metamorphism of Apollo 14 breccias. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 623-643.
- Warner J.L. (1975) Mineralogy, petrology and geochemistry of the lunar samples. Rev. Geophys. Space Phys. 13, 107-168.
- Warner J.L., Ridley W.I., Reid A.M. and Brown R.W. (1972) Apollo 15 glasses and the distribution of non-mare crystal rock types. In The Apollo 15 Lunar Samples 179-182. Lunar Planetary Institute, Houston
- Warner J.L., Simonds C.H., Phinney W.C. and Gooley R. (1973a) Petrology and genesis of two "igneous" rocks from Apollo 17 (76055 and 77135) (abs). EOS 54, 620-621. AGU
- Warner J.L., Simonds C.H. and Phinney W.C. (1973b) Apollo 16 rocks: Classification and petrogenetic model. Proc. 4<sup>th</sup> Lunar Sci. Conf. 481-504.
- Warner J.L., Simonds C.H. and Phinney W.C. (1976a) Apollo 17, Station 6 boulder sample 76255: Absolute petrology of breccia matrix and igneous clasts. Proc. 7<sup>th</sup> Lunar Sci. Conf. 21233-2250.
- Warner J.L., Simonds C.H. and Phinney W.C. (1976b) Genetic distinction between anorthosites and Mg-rich plutonic rocks (abs). Lunar Sci. VII, 915-917. Lunar Planetary Institute, Houston
- Warner J.L., Phinney W.C., Bickel C.E. and Simonds C.H. (1977) Feldspathic granulitic impactites and pre-final bombardment lunar evolution. Proc. 8<sup>th</sup> Lunar Sci. Conf. 2051-2066.
- Warner J.L. and Bickel C.E. (1978) Lunar plutonic rocks: a suite of materials depleted in trace siderophile elements. Am. Mineral. 63, 1010-1015.
- Warner R.D., Keil K., Murali A.V. and Schmitt R.A. (1975a) Petrogenetic relationships among Apollo-17 basalts. In Papers presented to the Conference on Origins of Mare Basalts and their Implications for Lunar Evolution (Lunar Science Institute, Houston), 179-183.
- Warner R.D., Keil K., Prinz M., Laul J.C., Murali A.V. and Schmitt R.A. (1975b) Mineralogy, petrology, and chemistry of mare basalts from Apollo 17 rake samples. Proc. 6<sup>th</sup> Lunar Sci. Conf. 193-220.
- Warner R.D., Prinz M. and Keil K. (1975c) Mineralogy and petrology of mare basalts from Apollo 17 rake samples (abs). Lunar Sci. VI, 850-852. Lunar Planetary Institute, Houston
- Warner R.D., Warren R.G., Mansker W.L., Berkley J.L. and Keil K. (1976a) Electron microprobe analyses of olivine, pyroxene and plagioclase from Apollo 17 rake sample mare basalts. Spec. Publ. # 15, UNM Institute of Meteoritics, Albuquerque. 158 pp.
- Warner R.D., Berkley J.L., Mansker W.L., Warren R.G. and Keil K. (1976b) Electron microprobe analyses of spinel, Fe-Ti oxides and metal from Apollo 17 rake sample mare basalts. Spec. Publ. #16, UNM Institute of Meteoritics, Albuquerque. 114 pp.

Warner R.D., Dowty E., Prinz M., Conrad G.H., Nehru C.E. and Keil K. (1976c) Catalog of Apollo 16 rake samples from the LM area and station 5. Spec. Publ. #13, UNM Institute of Meteoritics, Albuquerque. 87 pp.

Warner R.D., Keil K. and Taylor G.J. (1977a) Coarse-grained basalt 71597: A product of partial olivine accumulation. Proc. 8<sup>th</sup> Lunar Sci. Conf. 1429-1442.

Warner R.D., Taylor G.J. and Keil K. (1977b) Petrology of crystalline matrix breccias from Apollo 17 rake samples. Proc. 8<sup>th</sup> Lunar Sci. Conf. 1987-2006.

Warner R.D., Taylor G.J. and Keil K. (1977c) Petrology of breccias from Apollo 17 rake samples (abs). Lunar Sci. VIII, 985 -987. Lunar Planetary Institute, Houston

Warner R.D., Taylor G.J., Keil K., Planner H.N., Nehru C.E., Ma M.-S. and Schmitt R.A. (1978a) Green glass vitrophyre 78526: an impact melt of very low-Ti mare basalt composition. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 547-563.

Warner R.D., Taylor G.J., Mansker W.L. and Keil K. (1978b) Clast assemblages of possible deep-seated (77517) and immiscible melt (77538) origins in Apollo 17 breccias. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 941-958.

Warner R.D., Keil K., Taylor G.J. and Nehru C.E. (1978C) Petrology of recrystallized ANT rocks from Apollo 17 rake samples: 72558 (anorthositic troctolite) and 78527 (norite) (abs). Lunar Planet. Sci. IX, 1220-1222. Lunar Planetary Institute, Houston

Warner R.D., Taylor G.J. and Keil K. (1978d) Clasts in breccias 77517 and 77538: Evidence for deep-seated and immiscible melt origins (abs). Lunar Planet. Sci. IX, 1222-1224. Lunar Planetary Institute, Houston

Warner R.D., Taylor G.J., Keil K. and Nehru C.E. (1978e) Green glassy rock 78526: An impact melt rock of very low- Ti mare basalt? (abs) Lunar Planet. Sci. IX, 1225-1227. Lunar Planetary Institute, Houston

Warner R.D., Keil K., Nehru C.E. and Taylor G.J. (1978) Catalogue of Apollo 17 rake samples from Stations 1a, 2, 7, and 8. Spec. Publ. #18, UNM Institute of Meteoritics, Albuquerque. 88 pp.

Warner R.D., Nehru C.E. and Keil K. (1978g) Opaque oxide mineral crystallization in lunar high-titanium basalts. Submitted to Am. Mineral.

Warner R.D., Taylor G.J., Conrad G.H., Northrop H.R., Barker S., Keil K., Ma M.-S. and Schmitt R. (1979a) Apollo 17 high-Ti mare basalts: New bulk compositional data, magma types, and petrogenesis. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 225-247.

Warner R.D., Taylor G.J. and Keil K. (1979b) Composition of glasses in Apollo 17 samples and their relation to known lunar rock types. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 1437-1456.

Warner R.D., Taylor G.J. and Keil K. (1979c) Composition of glasses in Apollo 17 soil breccias (abs). Lunar Planet. Sci. X, 1298-1300. Lunar Planetary Institute, Houston

Warner R.D., Taylor G.J., Wentworth S.J., Huss G.R., Mansker W.L., Planner H.N., Sayeed U.A. and Keil K. (1979d) Electron microprobe analyses of glasses from Apollo 17 rake sample breccias and Apollo 17 drill core. UNM Spec. Publ. #20, Albuquerque, 20 pp.

Warner R.D., Taylor G.J., Keil K., Ma M.-S. and Schmitt R. (1980a) Aluminous mare basalts: New data from Apollo 14 coarse-fines. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 87-104.

Warner R.D., Taylor G.J. and Keil K. (1980b) Petrology of 60035: Evolution of a polymict ANT breccia. Proc. Conf. Lunar Highlands Crust, (eds. Papike and Merrill) 377-394. Lunar Planetary Institute, Houston

Warren N., Trice R. and Stephens J. (1974) Ultrasonic attenuation: Q measurements on 70215,29. Proc. 5<sup>th</sup> Lunar Sci. Conf. 2927-2938.

Warren P.H. (1979) The quest for pristine nonmare rocks: A new crop of Toisons d'Or (abs). Lunar Planet. Sci. X, 1301-1303. Lunar Planetary Institute, Houston

Warren P.H. (1985) The magma ocean concept and lunar evolution. Annu. Rev. Earth Planet. Sci. 13, 201-240.

Warren P.H. (1988) The origin of pristine KREEP: Effects of mixing between urKREEP and the magmas parental to the Mg-rich cumulates. Proc. 18<sup>th</sup> Lunar Planet. Sci. Conf. 233-241. Lunar Planetary Institute, Houston

Warren P.H. (1990) Lunar anorthosites and the magma ocean hypothesis: Importance of FeO enrichment in the parent magma. Am. Mineral. 75, 46-58.

Warren P.H. (1992) Inheritance of silicate differentiation during lunar origin by giant impact. Earth Planet. Sci. Lett. 112, 101-116.

Warren P.H. (1993) A concise compilation of petrologic information on possibly pristine nonmare Moon rocks. Am. Mineral. 78, 360-376.

Warren P.H. (2001) Porosities of lunar meteorites: Strength, porosity, and petrologic screening during the meteorite delivery process. J. Geophys. Res. 106, 10,101-10,111.

Warren P.H. (2003) 1.21 The Moon. In Treatise on Geochemistry. Vol. 1, pages 559-599. Elsevier Ltd.

Warren P.H., Mittlefehldt D.W., Boynton W.V. and Wasson J.T. (1977) In quest of primary highlands rocks (abs). Lunar Planet. Sci. VIII, 988-990. Lunar Planetary Institute, Houston

Warren P.H. and Wasson J.T. (1977) Pristine nonmare rocks and the nature of the lunar crust. Proc. 8<sup>th</sup> Lunar Sci. Conf. 2215-2235.

Warren P.H. and Wasson J.T. (1978) Compositional-petrographic investigation of pristine nonmare rocks. Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf. 185-217.

Warren P.H., McEwing C.E., Afiaitalab F. and Wasson J.T. (1978) The quest for pristine non-mare rocks: Nine nonmare samples free of meteoritic siderophiles (abs). Lunar Planet. Sci. IX, 1228-1230. Lunar Planetary Institute, Houston

Warren P.H. and Wasson J.T. (1979a) The compositional-petrographic search for pristine nonmare rocks: Third foray. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 583-610.

Warren P.H. and Wasson J.T. (1979b) The origin of KREEP. Rev. Geophys. Space Phys. 17, 73-88.

Warren P.H. and Wasson J.T. (1980a) Further foraging of pristine nonmare rocks: Correlations between geochemistry and longitude. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 431-470.

Warren P.H. and Wasson J.T. (1980b) Early lunar petrogenesis, oceanic and extraoceanic. Proc. Conf. Lunar Highlands Crust, Geochim. Cosmochim. Acta, Suppl. 12. Pergamon Press. 81-99. Lunar Planetary Institute, Houston

- Warren P.H., Taylor G.J., Keil K., Marshall C. and Wasson J.T. (1981) Foraging westward for pristine nonmare rocks: Complications for petrogenetic models. Proc. 12<sup>th</sup> Lunar Planet. Sci. Conf. 21-40.
- Warren P.H., Taylor G.J., Keil K., Kallemeyn G.W., Rosener P.S. and Wasson J.T. (1982) Foraging for pristine nonmare rocks: Four more from the west (abs). Lunar Planet. Sci. XIII, 841-842. Lunar Planetary Institute, Houston
- Warren P.H., Taylor G.J. and Keil K. (1983a) Regolith breccia Allan Hills A81005: Evidence of lunar origin and petrography of pristine and nonpristine clasts. Geophys. Res. Lett. 10, 779-782.
- Warren P.H., Taylor G.J., Keil K., Shirley D.N. and Wasson J.T. (1983b) Petrology and chemistry of two large granite clasts from the Moon. Earth Planet. Sci. Lett. 64, 175-185.
- Warren P.H., Taylor G.J., Keil K., Kallemeyn G.W., Rosener P.S. and Wasson J.T. (1983c) Sixth foray for pristine nonmare rocks and an assessment of the diversity of lunar anorthosites. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. , in J. Geophys. Res. 88, A615-A630.
- Warren P.H., Taylor G.J., Keil K., Kallemeyn G.W., Shirley D. and Wasson J.T. (1983d) Seventh foray: Whitlockite-rich lithologies, a diopside-bearing troctolitic anorthosite, ferroan anorthosite and KREEP. Proc. 14<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 88, B151-B164.
- Warren P.H. and Kallemeyn G.W. (1984) Pristine rocks (8th foray): Plagiophile element ratios, crustal genesis, and the bulk composition of the Moon. Proc. 15<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 89, C16-C24.
- Warren P.H., Kallemeyn G.W. and Wasson J.T. (1984) Pristine rocks (8th foray): Genetic distinctions using Eu/Al and Sr/Al ratios (abs). Lunar Planet. Sci. XV, 894-895. Lunar Planetary Institute, Houston
- Warren P.H., Shirley D.N. and Kallemeyn G.W. (1986) A potpourri of pristine moon rocks, including a VHK mare basalt and a unique, augite-rich Apollo 17 anorthosite. Proc. 16<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 89, D319-D330.
- Warren P.H., Jerde E.A. and Kallemeyn G.W. (1987) Pristine moon rocks: A large felsite and a metal-rich ferroan anorthosite. Proc. 17<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. 90, E303-E313.
- Warren P.H., Jerde E.A. and Kallemeyn G.W. (1989) Lunar meteorites: Siderophile element contents and implications for the composition and origin of the Moon. Earth Planet. Sci. Lett. 91, 245-260.
- Warren P.H., Jerde E.A. and Kallemeyn G.W. (1990) Pristine moon rocks: An alkali anorthosite with coarse augite exsolution from plagioclase, a magnesian harzburgite and other oddities. Proc. 20<sup>th</sup> Lunar Planet. Sci. Conf. 31-59. Lunar Planetary Institute, Houston
- Warren P.H., Jerde E.H. and Kallemeyn G.W. (1991a) Pristine moon rocks: Apollo 17 anorthosites. Proc. 21<sup>st</sup> Lunar Planet. Sci. Conf. 51-61. Lunar Planetary Institute, Houston
- Warren P.H. and Kallemeyn G.W. (1991b) The MacAlpine Hills lunar meteorite and implications of the lunar meteorites collectively for the composition and origin of the Moon. Geochim. Cosmochim. Acta 55, 3123-3138.
- Warren P.H., Haack H. and Rasmussen K.L. (1991c) Megaregolith insulation and the duration of cooling to isotopic closure within differentiated asteroids and the moon. J. Geophys. Res. 96, 5909-5923.
- Warren P.H. and Kallemeyn G.W. (1993a) The ferroan-anorthosite suite, the extent of primordial lunar melting, and the bulk composition of the Moon. J. Geophys. Res. 98, 5445-5455.

Warren P.H. and Klemme G.W. (1993b) Troctolitic anorthosite from 77115: A magnesian member of the alkalic suite. In Workshop on Geology of the Apollo 17 Landing Site. LPI Tech. Rpt. 92-09. 61. Lunar Planetary Institute, Houston

Warren P.H., Klemme G.W. and Kyte F.T. (1997) Siderophile element evidence indicates that Apollo 14 high-Al mare basalts are not impact melts (abs). *Lunar Planet. Sci.* XXVIII, 1501-1502. Lunar Planetary Institute, Houston

Warren P.H., Tonui E., Young E.D. and Newman W.L. (2007) Lunar Rock-rain: Diverse silicate impact-vapor condensation in an Apollo 14 regolith breccia (abs). *Lunar Planet. Sci.* XXXVIII, #2406. Lunar Planetary Institute, Houston

Wasserburg G.J. and Papanastassiou D.A. (1971) Age of an Apollo 15 mare basalt: lunar crust and mantle evolution. *Earth Planet. Sci. Lett.* 13, 97-104.

Wasserburg G.J., Papanastassiou D.A., Tera F. and Huneke J.C. (1977) The accumulation and bulk composition of the moon: Outline of a lunar chronology. *Phil. Trans. Roy. Soc. Lond.* 285, 7-22.

Wasserburg and 8 others (1978) Petrology, chemistry, age and irradiation history of Luna 24 samples. In *Mare Crisium: The view from Luna 24*. (Merrill and Papike eds) pp. 657-678. Pergamon Press

Wasson J.T., Chou C.L., Robinson K.L. and Baedecker P.A. (1975) Siderophiles and volatiles in Apollo 16 rocks and soils. *Geochim. Cosmochim. Acta* 39, 1475-1485.

Wasson J.T., Boynton W.V., Klemme G.W., Sundberg L.L. and Wai C.M. (1976) Volatile compounds released during lunar lava fountaining. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1583-1595.

Wasson J.T., Warren P.H., Klemme G.W., McEwing C.E., Mittefleldt D.W. and Boynton W.V. (1977) SCCRV, a major component of highlands rocks. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 2237-2252.

Watson D.E., Larson E.E. and Reynolds R.L. (1974) Microscopic and thermomagnetic analysis of Apollo 17 breccia and basalt: feasibility of obtaining meaningful paleointensities of the lunar magnetic field (abs). *Lunar Sci. V*, 827-829. Lunar Planetary Institute, Houston

Wechsler B.A., Prewitt C.T. and Papike J.J. (1976) Chemistry and structure of lunar and synthetic armalcolite. *Earth Planet. Sci. Lett.* 29, 91-103.

Weiben P.W. (1977) Examination of the liquid line of descent of mare basalts in the light of data from melt inclusions in olivine. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 1751-1765.

Weiben P.W. and Roedder E. (1976) Compositional interrelationships of mare basalts from bulk chemical and meltinclusions. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 1449-1466.

Weigand P.W. (1973) Petrology of a coarse-grained Apollo 17 ilmenite basalt (abs). *EOS* 54, 621-622.

Weigand P.W. and Hollister L.S. (1973) Basaltic vitrophyre 15597: An undifferentiated melt sample. *Earth Planet. Sci. Lett.* 19, 61-74.

Weiler R. and Heber V.S. (2003) Noble gas isotopes on the Moon. *Space Sci. Rev.* 106, 197-210.

Wenk H.R. and Wilde W.R. (1973) Chemical anomalies of lunar plagioclase, described by substitution vectors and their relation to optical and structural properties. *Contrib. Mineral. Petrol.* 41, 89-104.

Wentworth S.J. et al. (1979) The unique nature of Apollo 17 VLT mare basalts. *Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf.* 207-223.

Wentworth Susan J and McKay David (1988) Glasses in ancient and young Apollo 16 regolith breccias: Populations and ultra-Mg glass. Proc. 18<sup>th</sup> Lunar Planet. Sci. Conf. 67-77. Lunar Planetary Institute, Houston

Wentworth S.J and McKay D. (1991) Apollo 14 glasses and the origin of lunar soils. Proc. 21<sup>st</sup> Lunar Planet. Sci. Conf. 185-192. Lunar Planetary Institute, Houston

Wentworth S.J et al. (1994) Apollo 12 ropy glasses revisited. Meteoritics 29, 323-333.

Wentworth S.J., Keller L.P., McKay D.S. and Morris R.V. (1999) Space weathering on the Moon: Patina on Apollo 17 samples 75075 and 76015. Meteoritics & Planet. Sci. 34, 593-603.

Wetherill G.W. (1971) Of time and the moon. Science 173, 383-392

Wider R., Etique P., Signer P. and Poupean G. (1983) Decrease of the solar flare/solar wind flux ratio in the past several aeons deduced from solar neon and tracks in lunar soil plagioclases. Proc. 13<sup>th</sup> Lunar Planet. Sci. Conf. in J. Geophys. Res. A713 -A724.

Wider R., Baur H. and Signer P. (1993) A long-term change of the Ar/Kr/Xe fractionation in the solar corpuscular radiation (abs). Lunar Planet. Sci. XXIV, 1519-1520. Lunar Planetary Institute, Houston

Wieler R., Etique Ph., Signer P. and Poupeau G. (1980) Record of the solar corpuscular radiation in minerals from lunar soils: A comparative study of noble gases and tracks. Proc. 11<sup>th</sup> Lunar Planet. Sci. Conf. 1369-1393.

Wieler R., Baur H. and Signer P. (1986) Noble gases from solar energetic particles revealed by closed system step wise etching of lunar soil minerals. Geochim. Cosmichim. Acta 50, 1997-2017.

Wiens R.C., Burnett D.S., Neugebauer M. and Pepin R.O. (1991) A comparison of solar wind and solar system xenon abundances (abs). Lunar Planet. Sci. XXII, 1503-1504. Lunar Planetary Institute, Houston

Wiens R.C., Burnett D.S., Neugebauer M. and Pepin R.O. (1992) A comparison of solar wind and estimated solar system xenon abundances: A test for solid/gas fractionation in the solar nebula. Proc. 22<sup>nd</sup> Lunar Planet. Sci. 153-159. Lunar Planetary Institute, Houston

Wiesmann H. and Hubbard N.J. (1975) A compilation of the Lunar Sample Data Generated by the Gast, Nyquist and Hubbard Lunar Sample PI-Ships. Unpublished. JSC

Wieczorek M.A. and Phillips R.J. (2000) The Procellarum KREEP Terrane: Implications for mare volcanism and lunar evolution. J. Geophys. Res. - Planets 105, 20417-20430.

Wiik H.B., Maxwell J.A. and Bouvier J.-L. (1973) Chemical composition of some Apollo 14 lunar samples. Earth Planet. Sci. Lett. 17, 365-368.

Wilhelms D.E. (1987) Geologic History of the Moon. US Geol. Survey Prof. Paper 1348. pp302

Williams K.L. and Taylor L.A. (1974) Optical properties and chemical compositions of Apollo 17 armalcolites. Geology 2, 5-8.

Williams R.J. (1972) The lithification of metamorphism of lunar breccias. Earth Planet. Sci. Lett. 16, 250-256.

Willis K.J. (1985) Three lithologic units of 72275 (abs). Lunar Planet. Sci. XVI, 910-911. Lunar Planetary Institute, Houston

Willis J.P., Erlank A.J., Gurney J.J., Theil R.H. and Ahrens L.H. (1972) Major, minor, and trace element data for some Apollo 11, 12, 14 and 15 samples. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1269-1273.

Wilshire H.G. and Jackson E.D. (1972a) Lunar "dunite," "pyroxenite," and "anorthosite." Earth Planet. Sci. Lett. 16, 396-400.

Wilshire H.G. and Jackson E.D. (1972b) Petrology and stratigraphy of the Fra Mauro Formation at the Apollo 14 site. US Geol. Survey Prof. Paper 785

Wilshire H.G., Schaber G.C.G., Silver L.T., Phinney W.C. and Jackson E.D. (1972) Geological setting and petrology of Apollo 15 anorthosite (15415). Geol. Soc. Am. Bull. 83, 1083-1092.

Wilshire H.G., Stuart-Alexander D.E. and Jackson E.D. (1973) Apollo 16 rocks – Petrology and classification. J. Geophys. Res. 78, 2379-2391.

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

Winzer S.R., Nava D.F., Schuhmann S., Kouns C.W., Lum R.K.L. and Philpotts J.A. (1974) Major, minor and trace element abundances in samples from the Apollo 17 Station 7 boulder: Implications for the origin of early lunar crustal rocks. Earth Planet. Sci. Lett. 23, 439-444.

Winzer S.R., Nava D.F., Schuhmann S., Lum R.K.L. and Philpotts J.A. (1975a) Origin of the Station 7 boulder: A note. Proc. 6<sup>th</sup> Lunar Sci. Conf. 707-710.

Winzer S.R., Nava D.F., Lum R.K.L., Schuhmann S., Schuhmann P. and Philpotts J.A. (1975b) Origin of 78235, a lunar norite cumulate. Proc. 6<sup>th</sup> Lunar Sci. Conf. 1219-1229.

Winzer S.R., Lum R.K.L., Seuhmann S. and Philpotts J.A. (1975c) Large ion lithophile trace element abundances in phases from 78235,34, a lunar norite cumulate (abs). Lunar Sci. VI, 872-873. Lunar Planetary Institute, Houston

Winzer S.R., Nava D.F., Schuhmarm P.J., Schuhmann S., Lindstrom M.M., Lum R.K.L., Lindstrom D.J. and Philpotts J.A. (1976) Origin of melts, breccias and rocks from the Apollo 17 landing site (abs). Lunar Sci. VII, 941-943. Lunar Planetary Institute, Houston

Winzer S.R., Nava D.F., Meyerhoff M., Lindstrom D.J., Lum R.K.L., Lindstrom M.M., Schuhmann P., Schumann S. and Philpotts J.A. (1977a) The petrology and geochemistry of impact melts, granulites and hornfelses from consortium breccia 61175. Proc. 8<sup>th</sup> Lunar Sci. Conf. 1943-1966.

Winzer S.R., Nava D.F., Schuhmann PJ., Lum R.K.L., Schuhmann S., Lindstrom M.M., Lindstrom D.J. and Philpous J.A. (1977b) The Apollo 17 "melt sheet": Chemistry, age, and Rb/Sr systematics. Earth Planet. Sci. Lett. 33, 389-400.

Wlotzka F., Jagoutz E., Spettel B., Baddehausen H., Balacecu A. and Wanke H. (1972) On lunar metallic particles and their contribution to the trace element content of Apollo 14 and 15 soils. Proc. 3<sup>rd</sup> Lunar Sci. Conf. 1077-1084.

Wlotzka F., Spettel B. and Wanke H. (1973) On the compositon of metal from Apollo 16 fines and the meteoritic component. Proc. 4<sup>th</sup> Lunar Sci. Conf. 1483-1491.

Wolf R., Woodrow A. and Anders E. (1979) Lunar basalts and pristine highland rocks: Comparison of siderophile and volatile elements. Proc. 10<sup>th</sup> Lunar Planet. Sci. Conf. 2107-2130.

Wolf R. and Anders E. (1980) Moon and Earth: Compositional differences inferred from siderophiles, volatiles and alkalis in basalts. Geochim. Cosmochim. Acta 44, 2111-2124.

Wolfe E.W., Bailey N.G., Lucchitta B.K., Muehlberger W.R., Scott D.H., Sutton R.L and Wilshire H.G. (1981) The geologic investigation of the Taurus-Littrow Valley: Apollo 17 Landing Site. US Geol. Survey Prof. Paper, 1080, pp. 280.

Wood J.A. (1970) Petrology of the lunar soil and geophysical implications. *J. Geophys. Res.* 75, 6497-6513.

Wood J.A. (1972a) Thermal history and early magmatism in the Moon. *Icarus* 16, 229-240.

Wood J.A. (1972b) Fragments of Terra rock in the Apollo 12 soil samples and a structural model of the moon. *Icarus* 16, 462-501.

Wood J.A. (1975) Lunar petrogenesis in a well-stirred magma ocean. *Proc. 6<sup>th</sup> Lunar Sci. Conf.* 1087-1102.

Wood J.A. (1975) The nature and origin of Boulder 1, Station 2, Apollo 17. *The Moon* 14, 505-517.

Wood J.A., Dickey J.S., Marvin U.B. and Powell B.N. (1970a) Lunar anorthosites. *Science* 167, 602-604.

Wood J.A., Dickey J.S., Marvin U.B. and Powell B.N. (1970b) Lunar anorthosites and a geophysical model of the Moon. *Proc. Apollo 11 Lunar Sci. Conf.* 965-988.

Wood J.A. and Ryder G. (1977) The Apollo 15 green glass enigma (abs). *Lunar Sci. VIII*, 1026-1028. Lunar Planetary Institute, Houston

Woodcock M.R. and Pillinger C.T. (1978) Major element chemistry of agglutinate size fractions. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* 2195-2214.

Wosinski J.F., Williams J.P., Korda E.J., Kane W.T., Carrier G.B. and Schreurs J.W.H. (1972) Inclusions and interface relationships between glass and breccia in lunar sample 14306,50. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 853-864.

Wrigley R.C. (1973) Radionuclides at Descartes in the central highlands. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 2203-2208.

Wszołek P.C., Jackson R.F. and Burlingame A.L. (1972) Carbon chemistry of a glass-rich sample related to the uniformity of the regolith and lunar surface processes. In *The Apollo 15 Lunar Samples*, 324-328. Lunar Planetary Institute, Houston

Wszołek P.C., Simonett B.R. and Burlingame A.L. (1973) Studies of magnetic fines and volatile-rich soils: Possible meteoritic and volcanic contributions to lunar carbon and light element chemistry. *Proc. 4<sup>th</sup> Lunar Sci. Conf.* 1693-1706.

Yaniv A. and Marti K. (1981) Detection of stopped solar flare helium in lunar rock 68815. *Astrophys. J. Lett.* 247, L143-146.

Yokoyama Y., Reyss J.L. and Guichard F. (1974)  $^{22}\text{Na}$ - $^{26}\text{Al}$  chronology of lunar surface processes. *Proc. 5<sup>th</sup> Lunar Sci. Conf.* 2231-2247.

York D., Kenyon W.J. and Doyle R.J. (1972)  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  ages of Apollo 14 and 15 samples. *Proc. 3<sup>rd</sup> Lunar Sci. Conf.* 1613-1622.

Zeigler R.A., Korotev R.L., Haskin L.A., Jolliff B.L. and Gillis J.J. (2006) Petrology and geochemistry of five Apollo 16 mare basalts and evidence for post-basin deposition of basaltic material at the site. *Meteoritics & Planet. Sci.* 41, 263-284.

Zeigler R.A., Korotev R.L., Jolliff B.L., Haskin L.A. and Floss C. (2006) The geochemistry and provenance of Apollo 16 mafic glasses. *Geochim. Cosmochim. Acta* 70, 6050-6067.

Zellner N.E.B., Spudis P.D., Delano J.W. and Whittet D.C.B. (2002) Impact glasses from the Apollo 14 landing site and implications for regional geology. *J. Geophys. Res.* 107, E11

Zellner N.E.B., Delano J.W. , Swindle T.D. and Whittet D.C.B. (2007) Geochemistry and impact history at the Apollo 17 landing site. (abs) *Lunar Planet. Sci. XXXVIII #1007*. Lunar Planetary Institute, Houston

Zinner E. (1980) On the constancy of solar particle fluxes from track, thermoluminescence and solar wind measurements in lunar rocks. In Proc. Conf. Ancient Sun (eds, Pepin et al.) *Geochim. Cosmochim. Acta Suppl.* 13, 201-226. Lunar Planetary Institute, Houston

Zinner E. and Morrison D.A. (1976) Comment on micrometeorites and solar flare particles in and out of the ecliptic. *J. of Geophys. Res.* 81, 6364-6366.

Zinner E., Walker R.M., Chaumont J. and Dran J.C. (1976a) Ion probe analysis of artificially implanted ions in terrestrial samples and surface enhanced ions in lunar sample 76215,77. *Proc. 7<sup>th</sup> Lunar Sci. Conf.* 953-984.

Zinner E., Walker R.M., Chaumont J. and Dran J.C. (1976b) Ion probe analysis of artificially implanted ions in terrestrial samples and solar wind implanted ions in lunar surface samples (abs). *Lunar Sci. VII*, 965-967. Lunar Planetary Institute, Houston

Zinner E., Walker R.M., Chaumont J. and Dran J.C. (1977a) Ion microprobe surface concentration measurements of Mg and Fe and microcraters in crystals from lunar rock and soil samples. *Proc. 8<sup>th</sup> Lunar Sci. Conf.* 3859-3883.

Zinner E., Walker R.M., Chaumont J. and Dran J.C. (1977b) Surface enhanced elements and microcraters in lunar rock 76215 (abs). *Lunar Planet. Sci. VIII*, 1044-1046. Lunar Planetary Institute, Houston

Zook H.A. (1978) Dust, impact pits, and accrete on lunar rock 12054. *Proc. 9<sup>th</sup> Lunar Planet. Sci. Conf.* , 2469-2484.

Zook H.A., Hartung J.B. and Storzer D. (1977) Solar flare activity: Evidence for large-scale changes in the past. *Icarus* 32, 106-126.

Zook H.A. (1980) On lunar evidence for a possible large increase in solar flare activity  $\sim 2 \times 10^4$  years ago. In Proc. Conf. Ancient Sun, (ed. Pepin) *Geochim. Cosmochim. Acta Suppl.* 13, 245-266. Lunar Planetary Institute, Houston