

## **Larry A. Haskin Publications**

The list of publications has been divided into topical areas for the convenience of anyone wanting to search for papers in any of those areas. These areas, listed alphabetically, are the Basaltic Volcanism Study, Electron Paramagnetic Resonance, Geochemical Analysis, Geochemical Modeling, Geochemistry and Geophysics of Impact Cratering, Lunar Analog Studies, Lunar Geochemistry, Lunar Meteorites, Lunar Terrane Studies, Mars, Miscellaneous, Nuclear Chemistry, Planetary Raman Spectroscopy, REE Studies, Resources of Space and Moonbase, Sedimentary and Metamorphic Rock Studies, Silicate Electrochemistry and Electrolysis, and Trace-Element Partitioning Experiments.

The main thrusts of the work have been to further precise, accurate geochemical analysis; gain quantitative understanding of trace element behavior through rock analysis and geochemical modeling, with experimental work to provide modeling parameters and better understanding; and introduction to the application of some methods of physical chemistry to geochemical work (neutron activation analysis, electron paramagnetic resonance, silicate electrochemistry, planetary Raman spectroscopy).

At the bottom of the list are shown several studies that are in draft form and some that for one reason or another are moribund. Also shown are a few other materials that have been published.

### **Basaltic Volcanism Study:**

Bence A., Lindstrom M., and Haskin L. (1981) Oceanic intraplate volcanism. In *Basaltic Volcanism on the Terrestrial Planets*, Basaltic Volcanism Study Project, Pergamon, NY, 161-190.

Dungan M., Lipman P., Lindstrom M., and Haskin L. (1981) Continental rift volcanism. In *Basaltic Volcanism on the Terrestrial Planets*, Basaltic Volcanism Study Project, Pergamon, NY, 78-105.

Green J., Brannon J., and Haskin L. (1981) Pre tertiary continental flood basalts. In *Basaltic Volcanism on the Terrestrial Planets*, Basaltic Volcanism Study Project, Pergamon, NY, 30-74.

Haggerty S., Lindstrom M., and Haskin L. (1981) Tertiary continental flood basalts. In *Basaltic Volcanism on the Terrestrial Planets*, Basaltic Volcanism Study Project, Pergamon, NY, 78-105.

Haskin L. and Dungan M. (1981) Processes that affect basaltic magma composition. In *Basaltic Volcanism on the Terrestrial Planets*, Basaltic Volcanism Study Project, Pergamon, NY, 399-407.

Naldrett A., Lindstrom M., and Haskin L. (1981) Mafic and ultramafic volcanism during the archaean. In *Basaltic Volcanism on the Terrestrial Planets*, Basaltic Volcanism Study Project, Pergamon, NY, 5-28.

Dungan M. A., Muehlberger W. B., Leininger L., Peterson C., McMillan N. J., Gunn G., Lindstrom M., and Haskin L. (1984) Volcanic and sedimentary stratigraphy of the Rio Grande Gorge, and the late cenozoic geologic evolution of the Southern San Luis Valley. In *Rio Grande Rift: Northern New Mexico*, New Mexico Geological Society Guidebook No. 27, 157-170.

Dungan M. A., Lindstrom M. M., McMillan N. J., Hoefs J., Moorbath S., and Haskin L. A. (1986) Open system magmatic evolution of the Taos Plateau Volcanic field, Northern New Mexico - I: The petrology and geochemistry of the Servillita basalts. *J. Geophys. Res.* **91**, 5999-6028.

### **Electron Paramagnetic Resonance:**

Morris R. V. and Haskin L. A. (1974) EPR measurement of the effect of glass composition on the oxidation states of europium. *Geochim. Cosmochim. Acta* **38**, 1435-1445.

Morris R. V., Haskin L. A., Biggar G. M., and O'Hara M. J. (1974) Measurement of the effects of temperature and partial pressure of oxygen on the oxidation states of europium in silicate glasses. *Geochim. Cosmochim. Acta* **38**, 1447-1459.

### **Geochemical Analysis:**

Haskin L. A., Fearing H. W., and Rowland F. S. (1961) Neutron activation analysis for U, especially in limestones, by measurement of Xe. *Anal. Chem.* **33**, 1298-1301.

DeGrazia A. R. and Haskin L. (1964) On the gold contents of rocks. *Geochim. Cosmochim. Acta* **28**, 559-564.

Haskin L. A. (1968) Analisis de rocas y meteoritos por medio de la activacion por neutrones.

Haskin L. A., Wildeman T. R., and Haskin M. A. (1968) An accurate procedure for the determination of the rare earths by neutron activation. *J. Radioanal. Chem.* **1**, 337-348.

Allen R. O., Haskin L. A., Anderson M. R., and Muller O. (1970) Neutron activation analysis for 39 elements in small or precious geologic samples. *J. Radioanal. Chem.* **6**, 115-138.

Denechaud E. B., Helmke P. A., and Haskin L. A. (1970) Analysis for the rare earth elements by neutron activation and Ge(Li) spectrometry. *J. Radioanal. Chem.* **6**, 97-113.

Haskin L. A., Helmke P. A., Paster T. P., and Allen R. O. (1971) Rare earths in meteoritic, terrestrial, and lunar matter. In *Activation Analysis in Geochemistry and Cosmochemistry*, (A. Brunfelt and E. Steinnes, eds.) Universitetsforlaget Oslo, pp. 201-218.

Haskin L. A. and Ziege K. E. (1971) Neutron activation: Techniques and possible uses in soil and plant analysis. In *Instrumental Methods for Analysis of Soils and Plant Tissue* (L. M. Walsh, ed.), Soil Science Society of America, pp. 185-208.

Haskin L. A. and Korotev R. L. (1973) Determination of rare earths in geological samples and raw materials. In *Analysis and Application of Rare Earth Materials* (O. Michelsen, ed.) Universitetsforlaget Oslo. pp. 183-211.

Henzler T. E., Korda R. J., Helmke P. A., Anderson M. R., Jimenez M. M., and Haskin L. A. (1974) An accurate procedure for multielement neutron activation analysis of trace elements in biological materials. *J. Radioanal. Chem.* **20**, 649-663.

Kosiewicz S. R., Schomberg P. J., and Haskin L. A. (1974) Rare earth analysis of USGS rocks SCo-1 and STM-1: Evaluation of standards for homogeneity and of the precision and accuracy of a procedure for neutron activation analysis. *J. Radioanal. Chem.* **20**, 619-626.

Jacobs J. W., Korotev R. L., Blanchard D. P., and Haskin L. A. (1977) A well tested procedure for instrumental neutron activation analysis of silicate rocks and minerals. *J. Radioanal. Chem.* **40**, 93-114.

Haskin L. A. (1980) An overview of neutron activation analysis in geochemistry. Chapter 1 in *Short Course in Neutron Activation Analysis in the Geosciences*, (G. K. Muecke, ed.) Mineralogical Assoc. of Canada, 1-19.

Gromet L. P., Dymek R. F., Haskin L. A., and Korotev R. L. (1984) The North American shale composite: Compilation, major and trace element characteristics. *Geochim. Cosmochim. Acta* **48**, 2469-2482.

### **Geochemical Modeling:**

Paster T. P., Schauwecker D. S., and Haskin L. A. (1974) The behavior of some trace elements during solidification of the Skaergaard layered series. *Geochim. Cosmochim. Acta* **38**, 1549-1577.

Haskin L. A. and Korotev R. L. (1977) Test of a model for trace element partition during closed-system solidification of a silicate liquid. *Geochim. Cosmochim. Acta* **41**, 921-939.

Lindstrom M. M. and Haskin L. A. (1981) Compositional inhomogenities in a single Icelandic tholeiite flow. *Geochim. Cosmochim. Acta* **45**, 15-31.

Haskin L. A. and Korotev R. L. (1981) On compositional modeling of lunar highlands soils, including applications to the orbiting gamma-ray experimental data. *Proc. 12th Lunar Planet. Sci. Conf.*, 791-808.

Haskin L. A. (1983) Petrogenetic Modelling - Use of rare earth elements. In *Rare Earth Element Geochemistry*, (P. Henderson, ed.), Elsevier, 115-152.

Haskin L. A. and Lindstrom D. J. (1988) On identifying parent plutonic rocks from lunar breccia and soil fragments. *Proc. 18th Lunar Planet. Sci. Conf.*, Cambridge University Press, pp. 1-9.

Haskin L. A. (1990) PREEconceptions pREEvent pREEcise pREEditions. (Presidential lecture) *Geochim. Cosmochim. Acta* **54**, 2353-2361.

Haas J. R., and Haskin L. A. (1991) Compositional variations among whole-rock fragments of the L6 chondrite Bruderheim. *Meteoritics* **26**, 13-26.

Jolliff B. L., Haskin L. A., Colson R. O., and Wadhwa M. (1993) Partitioning in REE-saturating minerals: Theory, experiment, and modelling of whitlockite, apatite, and evolution of lunar magmas. *Geochim. Cosmochim. Acta*, **57** 4069-4094.

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.

Korotev R. L., Jolliff B. L., Haskin L. A., and Rockow K. M. (1995) A simulated geochemical rover mission to the Taurus-Littrow Valley of the Moon. *J. Geophys. Res.* **100**, 14,403-14,420.

### **Geochemistry and Geophysics of Impact Cratering:**

Korotev R. L., Rockow K. M., Jolliff B. L., Haskin L. A., McCarville P., and Crossey L. J. (1996) Geochemical comparison of four cores from the Manson impact structure, GSA Special Paper 302, *The Manson Impact Structure, Iowa: Anatomy of an Impact Crater*, 275-315.

Rockow, K.M., Haskin L. A., Jolliff B. L., and Fountain D. M. (1997) Constraints on element mobility associated with the conversion of granulite to eclogite along fractures in an anorthositic complex on Holsnøy, Norway. *J. Metamorph. Geol.* 15, 401-418.

Haskin L. A. (1998) The Imbrium impact event and the thorium distribution at the lunar highlands surface. *J. Geophys. Res.* 103,1679-1689.

Haskin L. A., Korotev R. L., Rockow K. M., and Jolliff B. L. (1998) On the significance of Th-rich mafic impact melt breccias and their possible Imbrium origin. *Meteor. Planet. Sci.* 33, 959-975.

Haskin L. A., Moss B. E., and McKinnon W. (2003) On estimating ejecta deposit thicknesses and proportions of materials from distant basins at lunar highland sites. *Meteor. Planet. Sci.* 38, 13-33.

### **Lunar Analog Studies:**

(See also Geochemical Modeling and Sediment and Metamorphic Rock Studies)

Hermann A. G., Blanchard D. P., Haskin L. A., Jacobs J. W., Knake D., Korotev R. L., and Brannon J. C. (1976) Major, minor and trace element compositions of peridotitic and basaltic komatiites from the Precambrian Crust of Southern Africa. *Contr. Min. Petrol.* 59, 1-12.

Haskin L. A., Salpas P. A., and McCallum I. S. (1983) Stillwater anorthosites: A lunar analog? *Proc. 14th Lun. Planet Sci. Conf., J. Geophys. Res.* 88, Suppl., B27-B39.

Haskin L. A. and Salpas P. A. (1992) Genesis of compositional characteristics of Stillwater AN-I and AN-II anorthosite units. *Geochim. Cosmochim. Acta* 56, 1187-1212.

### **Lunar Geochemistry:**

(See also Geochemical Modeling and Lunar Analog Studies)

Haskin L. A., Helmke P. A., and Allen R. O. (1970) Rare-earth elements in returned lunar samples. *Science* 167, 487-490.

Haskin L. A., Allen R. O., Helmke P. A., Paster T. P., Anderson M. R., Korotev R. L., and Zwiefel K. A. (1970) Rare earths and other trace elements in Apollo 11 lunar samples. *Proc. Apollo 11 Lunar Science Conf., Geochim. Cosmochim. Acta*, Suppl. 1, 1213-1231.

Haskin L. A., Helmke P. A., Allen R. O., Anderson M. R., Korotev R. L., and Zwifel K. A. (1971) Rare-earth elements in Apollo 12 lunar materials. *Proc. 2nd Lunar Sci. Conf., Geochim. Cosmochim. Acta*, Suppl. 2, 1307-1317.

Helmke P. A. and Haskin L. A. (1972) Rare earths and other trace elements in Apollo 15 samples. In *The Apollo 15 Lunar Samples*, 217-220. The Lunar Science Institute, Houston, Texas.

Helmke P. A. and Haskin L. A. (1972) Rare earths and other trace elements in Luna 16 soil. *Earth and Planet. Sci. Lett.* 13, 441-443.

- 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. 3rd Lunar Sci. Conf., Geochim. Cosmochim. Acta*, Suppl. 3, 1275-1292.
- Haskin L. A., Helmke P. A., Blanchard D. P., Jacobs J. W., and Telander K. (1973) Major and trace elements abundances in samples from the lunar highlands. *Proc. 4th Lunar Sci. Conf., Geochim. Cosmochim.*, Suppl. 4, 1275-1296.
- 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.
- Helmke P. A., Blanchard D. P., Jacobs J. W., and Haskin L. A. (1973) Rare earths, other trace elements and iron in Luna 20 samples. *Geochim. Cosmochim. Acta* **37**, 869-874.
- Helmke P. A., Telander K. M., Weiss C. K., and Haskin L. A. (1973) Trace elements in fines from the Apollo 15 Deep Drill. *Geochim. Cosmochim. Acta* **37**, 706-708.
- Blanchard D. P., Haskin L. A., Jacobs J. W., Brannon J. C., and Korotev R. L. (1975) Major and trace elements chemistry of Boulder 1 at Station 2, Apollo 17. *The Moon* **14**, 359-371.
- Blanchard D. P., Korotev R. L., Brannon J. C., Jacobs J. W., Haskin L. A., Reid A. M., Donaldson C. H., and Brown R. W. (1975) A geochemical and petrographic study of 1-2mm fines from Apollo 17. *Proc. 6th Lunar Sci. Conf., Geochim. Cosmochim. Acta*, Suppl. 6, 2321-2341.
- 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. (1975) Consortium studies of matrix of light gray breccia 73215. *Proc. 6th Lunar Sci. Conf., Geochim. Cosmochim. Acta*, Suppl. 6, 547-577.
- 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. 6th Lunar Sci. Conf., Geochim. Cosmochim. Acta*, Suppl. 6, 2291-2307.
- Shih C-Y, Haskin L. A., Wiesmann, H., Bansal B. M., and Brannon J. C. (1975) On the origin of High-Ti mare basalts. *Proc. 6th Lunar Sci. Conf., Geochim. Cosmochim. Acta*, Suppl. 6, 1255-1285.
- 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. 7th Lunar Sci. Conf., Geochim. Cosmochim. Acta*, Suppl. 7, 2179-2187.
- Haskin L. A., Jacobs J. W., Brannon J. C., and Haskin M. A. (1977) Compositional dispersions in lunar and terrestrial basalts. *Proc. 8th Lunar Sci. Conf.*, 1731-1750.
- Haskin L. A. (1978) Trace element composition of Luna 24 Crisium VLT basalt. In *Mare Crisium: The View from Luna 24* (R. B. Merrill and J. J. Papike, eds.), 593-611.
- Lindstrom M. M. and Haskin L. A. (1978) Causes of compositional variations within mare basalt suites. *Proc. 9th Lunar Sci. Conf.*, 465-486.

- Korotev R. L., Haskin L. A., and Lindstrom M. M. (1980) A synthesis of lunar highlands compositional data. *Proc. 11th Lunar Planet. Sci. Conf.*, 395-429.
- Haskin L. A., Lindstrom M. M., Salpas P. A., and Lindstrom D. J. (1981) On compositional variations among lunar anorthosites. *Proc. 12th Lunar Planet. Sci. Conf.*, 41-66.
- Korotev R. L. and Haskin L. A. (1988) Europium mass balance in polymict lunar samples and implications for plutonic rocks of the lunar crust. *Geochim. Cosmochim. Acta* **52**, 1795-1813.
- Jolliff B. L., Korotev R. L., and Haskin L. A. (1991) Geochemistry of 2-4 mm particles from Apollo 14 soil (14161) and implications regarding igneous components and soil-forming processes. *Proc. Lunar Planet. Sci. Conf. 21st*, 192-219.
- Haskin L. A. and Warren P. H. (1991) Lunar Chemistry. In *Lunar Sourcebook*, G. Heiken, D. Vaniman, and B. French, eds. pp. 357-474.
- Steele, A. M., Korotev R. L., and Haskin L. A. (1992) Apollo 15 green glass: New insight from combined major- and trace-element studies. *Geochim. Cosmochim. Acta* **56**, 4075-4090.
- Jolliff B. L., Rockow K. M., Korotev R. L., and Haskin L. A. (1996) Lithologic distribution and geologic history of the Apollo 17 site: The record in soils and small rock particles from the highland massifs. *Meteorit. and Planet. Sci.* **31**, 116-145.

#### **Lunar Meteorites:**

- Korotev R. L., Lindstrom M. M., Lindstrom D. J., and Haskin L. A. (1983) Antarctic meteorite ALHA 81005 - Not just another lunar anorthositic norite. *Geophys. Res. Lett.* **10**, 829-832.
- Lindstrom M. M., Lindstrom D. J., Korotev R. L., and Haskin L. A. (1986) Lunar meteorite Yamato-791197: A polymict anorthositic norite breccia. *Proc. 10th Symp. Antarctic Meteorites*, National Institute of Polar Research, Japan, 58-75.
- Jolliff B. L., Korotev R. L., and Haskin L. A. (1991) A ferroan region of the lunar highlands as recorded in meteorites MAC88104 and MAC88105. *Geochim. Cosmochim. Acta* **55**, 3051-3071.
- Fagan, T. J., G. J. Taylor, K. Keil, T. E. Bunch, J. H. Wittke, R. L. Korotev, B. L. Jolliff, J. J. Gillis, L. A. Haskin, E. Jarosewich, R. N. Clayton, T. K. Mayeda, V. A. Fernandes, R. Burgess, G. Turner, O. Eugster, and S. Lorenzetti (2002) Northwest Africa 032: Product of lunar volcanism. *Met. Planet. Sci.* **37**, 371 – 394.
- Korotev, R. L., Jolliff, B. L., Zeigler, R. A., and Haskin, L. A. (2003) Compositional constraints on the launch pairing of three brecciated lunar meteorites of basaltic composition, *National Institute of Polar Research, Japan* 16,152-175.
- Korotev, R. L. B. L. Jolliff , R. A. Zeigler, J. J. Gillis, and L. A. Haskin (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.

#### **Lunar Terrane Studies:**

Jolliff B. L., Gillis J. J., Haskin, L. A., Korotev R. L., and Wieczorek M. A. (1999) Major lunar crustal terranes: Surface expressions and crust-mantle origins, *J. Geophys. Res.*, 105,4197-4216.

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 analyses, *J. Geophys. Res.*, 105, 20,403 – 20,415.

### **Mars:**

McSween, H. Y., R. E. Arvidson, J. F. Bell III, D. Blaney, N. A. Cabrol, P. R. Christensen, B. C. Clark, J. A. Crisp, L. S. Crumpler, D. J. Des Marais, J. D. Farmer, R. Gellert, A. Ghosh, S. Gorevan, T. Graff, J. Grant, L. A. Haskin, K. E. Herkenhoff, J. R. Johnson, B. L. Jolliff, G. Klingelhöfer, A. T. Knudson, S. McLennan, K. A. Milam, J. E. Moersch, R. V. Morris, R. Rieder, S. W. Ruff, P. A. de Souza Jr., S. W. Squyres, H. Wänke, A. Wang, M. B. Wyatt, A. Yen, and J. Zipfel (2004) Basaltic rocks at the Spirit Landing Site in Gusev Crater. *Science*, 305, 794-799.

Squyres et al. (2004) The Spirit Rover's Athena Science Investigation at Gusev Crater, Mars. *Science*, 305, 794-799.

Squyres et al. (2004) The Opportunity Rover's Athena Science Investigation At Meridiani Planum, Mars. *Science*, (submitted).

### **Miscellaneous:**

Wagner P., Driesner A. R., and Haskin L. A. (1959) High-temperature properties of graphite. II. Creep in tension. *J. Applied Phys.* **30**, 152-154.

Haskin L. A. (1960) Analysis for uranium by neutron activation and reactions of energetic recoil tritium with solvent mixtures. Ph.D. dissertation, University of Kansas, Lawrence. 72 pp.

Sokolowska A., Haskin L. A., and Rowland F. S. (1962) Competitive reactions of recoil tritium atoms in liquid mixtures. *J. Amer. Chem. Soc.* **84**, 2469-2474.

West R. and Haskin L. (1963) The possibility of compound formation by helium. *Science* **139**, 672-673.

Francis C. W., Chesters G., and Haskin L. A. (1970) Determination of Pb mean residence time in the atmosphere. *Environ. Sci. Technol.* **4**, 586-589.

Haskin L. A. (1972) *The Atomic Nucleus and Chemistry*. D. C. Heath and Company, Lexington, Massachusetts. 138 pp.

Korda R. J., Henzler T. E., Helmke P. A., Jimenez M. M., Haskin L. A., and Larsen E. M. (1977) Trace elements in samples of fish, sediment and taconite from Lake Superior. *J. Great Lakes Res.* **3**, 148-154.

### **Nuclear Chemistry:**

Haskin L. and Vandenbosch R. (1961) New yttrium isomers of masses 86 and 90. *The Physical Review* **123**, 184-185.

Vandenbosch R., Haskin L., and Norman J. C. (1965) Isomer ratios for  $Y^{87/87m}$  and the spin dependence of the nuclear level density. *Phys. Rev.* **137**, B1134-B1144.

Keedy C. R., Haskin L., Wing J., and Huizenga J. R. (1966) Isomer ratios for the  $^{41}K(\_,n)^{44,44m}Sc$  and  $^{55}Mn(\_,n)^{58,58m}Co$  reactions. *Nuclear Physics* **82**, 1-15.

### **Planetary Raman Spectroscopy:**

Wang A., Jolliff B. L., and Haskin, L. A (1995) Raman spectroscopy as a method for mineral identification on lunar robotic exploration missions. *J. Geophys. Res.* **100**, 21,189 - 21,199.

Haskin L. A., Wang A., Rockow K. M., Jolliff B. L., Korotev R. L., and Viskupic K. M. (1997) Raman spectroscopy for mineral identification and quantification for in-situ planetary surface analysis: A point-count method, *J. Geophys. Res.* **102**, 19,293-19,306.

Wang A., Haskin L. A., and Cortez, E. (1998) A Raman sensor for *in situ* mineral characterization on planetary surfaces, *Appl. Spec.* **52**, 477-487.

Wang, A., Jolliff, B. L., and Haskin, L. A. (1999) Raman spectroscopic characterization of a Martian SNC meteorite – Zagami, *J. Geophys. Res.* **104**, 8509-8519.

Wang, A., Jolliff B. L., and Haskin L. A. (1999) Raman spectroscopic characterization of a highly weathered basalt – igneous mineralogy, alteration products, and a micro-organism, *J. Geophys. Res.*, **27**,067 – 27,077.

Wang, A., Jolliff, B. L., Haskin, L. A., Kuebler, K. E., and Viskupic, K. M. (2001) Characterization and comparison of structural and compositional features of planetary quadrilateral pyroxenes by Raman spectroscopy. *Amer. Mineralogist*, **86**, 790-806.

Wang A., Haskin L. A., Lane, A. L., Wdowiak, T. J., Squyres S. W., Robert J. Wilson, Larry E. Hovland, Ken S. Manatt, Nasrat Raouf, and Christopher D. Smith (2003) Development of the Mars Microbeam Raman Spectrometer (MMRS), *J. Geophys. Res.* **108**, NO. E1, 5005,doi:10.1029/2002JE001902, 2003.

Wang A., K. E. Kuebler, B. L. Jolliff, and L. A. Haskin (2004) Raman spectroscopy of Fe-Ti-Cr-oxides, case study: martian meteorite EETA79001, *Amer. Mineral.* **89**, 665-680.

Wang, A., Kuebler K., Jolliff, B., and Haskin, L. A. (2004) Mineralogy of a Martian meteorite as determined by Raman spectroscopy, *J. Raman Spectr.* **35**, 504-514.

### **REE Studies:**

Haskin L. A. and Gehl M. A. (1962) The rare-earth distribution in sediments. *J. Geophys. Res.* **67**, 2537-2541.

Haskin L. and Gehl M. A. (1963) The rare-earth contents of standard rocks G-1 and W-1 and their comparison with other rare-earth distribution patterns. *J. Geophys. Res.* **68**, 2037-2043.

Haskin L. and Gehl M. A. (1963) Rare-Earth elements in tektites. *Science* **139**, 1056-1058.

- Schmitt R. A., Smith R. H., and Haskin L. A. (1964) Abundances of the fourteen rare-earth elements, scandium and yttrium in the solar system (meteoritic, terrestrial, and solar matter. Rare Earth Research II, K. Vorhees, ed. Proc. 3<sup>rd</sup> Conf. Rare Earth Research, Gordon and Breach, NY.
- Schofield A. and Haskin L. A. (1964) Rare-earth distribution patterns in eight terrestrial materials. *Geochim. Cosmochim. Acta* 28, 437-446.
- Frey F. A. and Haskin L. A. (1964) Rare Earths in Oceanic Basalts. *J. Geophys. Res.* 69, 775-780.
- Wildeman T. R. and Haskin L. (1965) Rare-earth elements in ocean sediments. *J. Geophys. Res.* **70**, 2905-2910.
- Haskin L. A. and Frey, F. A. (1966) Discussion of paper by J. W. Morgan and J. F. Lovering, 'Uranium and Thorium Abundances in the Basalt Cored in Mohole Project (Guadalupe Site).' *J. Geophys. Res.* **71**, 688-689.
- Haskin L. A. and Frey F. A. (1966) Dispersed and non-so-rare earths. *Science* **152**, 299-314.
- Haskin L. A., Frey F. A., Schmitt R. A., and Smith R. H. (1966) Meteoritic, solar and terrestrial rare-earth distributions. In *Physics and Chemistry of the Earth*, Pergamon Press, New York, 167-321.
- Haskin L. A., Wildeman T. R., Frey F. A., Collins K. A., Keedy C. R., and Haskin M. A. (1966) Rare earths in sediments. *J. Geophys. Res.* **71**, 6091-6105.
- Haskin M. A. and Haskin L. A. (1966) Rare earths in European shales: A redetermination. *Science* **154**, 507-509.
- Norman J. C. and Haskin L. A. (1968) The geochemistry of Sc: A comparison to the rare earths and Fe. *Geochim. Cosmochim. Acta* 32, 93-108.
- Frey F. A., Haskin M. A., Poetz J. A., and Haskin L. A. (1968) Rare earth abundances in some basic rocks. *J. Geophys. Res.* **73**, 6085-6098.
- Haskin L. A. and Haskin M. A. (1968) Rare-earth elements in the Skaergaard intrusion. *Geochim. Cosmochim. Acta* **32**, 433-447.
- Haskin L. A., Haskin M. A., Frey F. A., and Wildeman T. R. (1968) Relative and absolute terrestrial abundances of the rare earths. In *Origin and Distribution of the Elements*, Pergamon Press, New York, 889-912.
- Frey F. A., Haskin L. A., and Haskin M. A. (1971) Rare-earth abundances in some ultramafic rocks. *J. Geophys. Res.* **76**, 2057-2070.
- Helmke P. A. and Haskin L. A. (1973) Rare-earth elements, Co, Sc and Hf in the Steens Mountain basalts. *Geochim. Cosmochim. Acta* **37**, 1513-1529.
- Wildeman T. R. and Haskin L. A. (1973) Rare earths in Precambrian sediments. *Geochim. Cosmochim. Acta* **37**, 419-438.

Haskin L. A., Shih C-Y, Bansal B. M., Rhodes J. M., Wiesmann H., and Nyquist L. E. (1974) Chemical evidence for the origin of 76535 as a cumulate. *Proc. 5th Lunar Sci. Conf., Geochim. Cosmochim. Acta*, Suppl. 5, 1213-1225.

Haskin L. A. and Paster T. P. (1979) Geochemistry and mineralogy of the Rare Earths. In *Handbook on the Physics and Chemistry of the Rare Earths*. (K. A. Gschneider, Jr. and C. Eyring, eds.) North Holland Pub., 1-80.

Haskin L. A. (1979) On rare-earth element behavior in igneous rocks. in *Proc. 2nd Int. Conf. Origin and Distribution of the Elements*. (L. H. Ahrens, ed.) Pergamon, pp. 175-189.

Haskin, L. A. (1989) Rare-earth elements in lunar materials. *Revs. Mineral.* **21**, 227-258.

### **Resources of Space; Moonbase:**

(See also Silicate Electrochemistry and Electrolysis)

Haskin L. A. (1984) The resources of space. *The Planetary Report* **4**, #2, 16-17.

Haskin L. A., Korotev R. L., Lindstrom D. J., and Lindstrom M. M. (1985) Geochemical and petrological sampling and studies at a Moon base. in *Lunar Bases and Space Activities of the 21st Century*, (W. Mendell, ed.) Lunar and Planetary Institute. pp. 199-210.

Haskin L. A. (1985) Toward a Spartan scenario for use of lunar materials, in *Lunar Bases and Space Activities of the 21st Century*, (W. Mendell, ed.) Lunar and Planetary Institute, pp. 435-443.

Haskin L. A. and Colson R. O. (1989) Lunar resources -- Toward living off the lunar land. In *Proc. First UA/NASA Annual Invitational Sympos. on Space Mining and Manufacturing*, J. Lewis and T. Triffet, eds. p I-11-19.

Haskin L. A. (1992) Water and cheese from the lunar desert. in *Lunar Bases and Space Activities of the 21st Century II*, (W. Mendell, ed.) NASA Conf. Publ. 3166, vol.2, 393-396.

Haskin L. A., Colson R. O., Vaniman D. T., and Gillett, S. L. (1993) A geochemical assessment of possible lunar ore formation. In *Near-Earth Space Resources*, J. S. Lewis, M. S. Matthews, and M. L. Guerrieri, eds. U. of AZ Press, pp. 17-50.

Haskin L. A. (1993) By-products of lunar helium-3 mining. In *Proceedings of the 2nd Wisconsin Symposium on <sup>3</sup>He and Fusion Power*, J. Sarantius, ed. pp. 75-80.

### **Sedimentary and Metamorphic Rock Studies:**

Moss B. E., Haskin L. A., Dymek R. F., and Shaw, D. (1995) Redetermination and reevaluation of compositional variations in metamorphosed sediments of the Littleton Formation, New Hampshire. *Am J. Sci.*, 295, 988-1019.

Moss B. E., Haskin L. A., and Dymek R. F. (1996) Compositional variations in metamorphosed sediments of the Littleton Formation, New Hampshire, and the equivalent Carabassett Formation, Maine, at hand specimen, outcrop, and regional scales. *Am. J. Sci.* 296, 473-505.

### **Silicate Electrochemistry and Electrolysis:**

- Lindstrom D. J. and Haskin L. A. (1979) Electrochemistry of lunar rocks. in *Space Manufacturing III*. (J Grey and C. Krop. eds.) American Institute of Aeronautics and Astronautics, pp. 129-134.
- Semkow K. W., Rizzo R. A., Haskin L. A., and Lindstrom D. J. (1982) An electrochemical study of  $\text{Ni}^{2+}$ ,  $\text{Co}^{2+}$ , and  $\text{Zn}^{2+}$  ions in melts of composition  $\text{CaMgSi}_2\text{O}_6$ . *Geochim. Cosmochim. Acta* **46**, 1879-1889.
- Semkow K. W. and Haskin L. A. (1985) Concentrations and behavior of oxygen and oxide ion in melts of composition  $\text{CaO}\cdot\text{MgO}\cdot x\text{SiO}_2$ . *Geochim. Cosmochim. Acta* **49**, 1897-1908.
- Colson R. O. and Haskin L. A. (1990) Lunar oxygen and metal for use in near-Earth space: Magma electrolysis. In *Proceedings of Space 90, Engineering, Construction, and Operations in Space II*, S. Johnson and J. Wetzel, eds. AIAA-ASCE, 187-196.
- Colson R. O., Haskin L. A., and Crane, D. (1990) Electrochemistry of cations in diopsidic melt: Determining diffusion rates and redox potentials from voltammetric curves. *Geochim. Cosmochim. Acta* **54**, 3353-3367.
- Colson R. O., Keedy C. R., and Haskin L. A. (1991) Reinterpretation of reduction potentials derived by linear sweep voltammetry with emphasis on whether metal reduction products are dissolved in silicate melt or in Pt electrodes. *Geochim. Cosmochim. Acta* **55**, 2831-2838.
- Haskin L. A. and Colson R. O. (1992) Steady state composition with low  $\text{Fe}^{2+}$  concentrations for efficient  $\text{O}_2$  production by "magma" electrolysis of lunar soils. In *Engineering, Construction, and Operations in Space III*, W. Sadeh, S. Sture, and R. Miller, eds. ASCE, pp. 651-665.
- Haskin L. A., Colson R. O., Lindstrom D. J., Lewis R. H., and Semkow K. W. (1992) Electrolytic smelting of lunar rock for oxygen and iron. in *Lunar Bases and Space Activities of the 21st Century II*, (W. Mendell, ed.) NASA Conf. Publ. 3166, vol.2, 411-422.
- Colson R. O. and Haskin L. A. (1992) Oxygen from the lunar soil by molten silicate electrolysis. NASA SP-509 *Space Resources*, M. F. McKay, D. S. McKay, and M. B. Duke, eds., Vol. 3 Materials, pp. 195-209.
- Colson R. O. and Haskin L. A. (1993) Producing oxygen by silicate melt electrolysis, in *Near-Earth Space Resources*, J. S. Lewis, M. S. Matthews, and M. L. Guerrieri, eds. U. of AZ Press, pp. 109-127.
- Colson R. O., Keedy C. R., and Haskin L.A. (1995) Diffusion and activity of NiO in  $\text{CaO}\cdot\text{MgO}\cdot\text{Al}_2\text{O}_3\cdot\text{SiO}_2$  melts considering effects of  $a_{\text{O}^{2-}}$  and  $\gamma_{\text{Ni}^{2+}}$ . *Geochim. Cosmochim. Acta* **59**, 909-925.

#### **Trace Element Partitioning Experiments:**

- Schreiber H. D. and Haskin L. A. (1976) Chromium in Basalts: Experimental determination of Redox States and partitioning among synthetic silicate phases. *Proc. 7th Lunar Sci. Conf.*, 1221-1259.
- Cullers R. L., Medaris L. G., Jr., and Haskin L. A. (1970) Gadolinium: Distribution between aqueous and silicate phases. *Science* **169**, 580-583.

Cullers R. L., Medaris L. G., and Haskin L. A. (1973) Experimental studies of the distribution of rare earths as trace elements among silicate minerals and liquids and water. *Geochim. Cosmochim. Acta* **37**, 1499-1512.

---

**Drafted:**

Haskin L. A. et al. (2004) Water Alteration of Rocks and Soils from the Spirit Rover Site, Gusev Crater, Mars. *Nature* (advanced draft)

Zeigler, R., Korotev, R. L., Jolliff B. L., and Haskin L.A. (2004) Petrology and geochemistry of the LaPaz Icefield suite of basaltic lunar meteorites, which are likely source-crater paired with NWA 032, *Met. Planet. Sci.* (advanced draft)

Zeigler, R. A., Haskin, L. A., Jolliff, B. L., Korotev, R. L., and Gillis J. J. (2004) The Apollo 16 Mare Component: Petrography, Geochemistry, and Provenance. *Met. Planet. Sci.* (advanced draft).

Haskin, L. A., Benner, L. M., and McKinnon, W. B. (2002) Lunar Rotational Effects on Imbrium Ejecta at the Antipode

Haskin, L. A., Korotev, R. L., Gillis, J. J., Jolliff, B. L. and Zeigler R. A., (2002) Basin Ejecta Stratigraphies of Apollo and Luna highland Landing Sites, *Meteor. Planet. Sci.* (rejected, will be revised and resubmitted)

Haskin L. A., Dymek R. F., Cullers R. O., Moss B. E., and Rockow K. L. (2001) Compositional variations and their causes in Kansas Permian shales.

**Moribund:**

Salpas P. A., Haskin L. A., McCallum I. S., and Gitlin E. C. (2001) A formational model for Stillwater anorthosites; further information from a detailed sampling and analysis of a small AN-II boulder. (Draft sent to McCallum and Salpas) (draft to McCallum, inactive for years)

Haas J. R., Haskin L. A., Luhr J. F. and Rasskazov, S. (2001) Quaternary hawaiites and mugearites from the Bartoy Volcanic Field, Baikal Rift, Siberia; Evidence for an evolved, deep-seated source region and for compositional control by assimilation of megacrysts during ascent. *Geochim. Cosmochim. Acta*, (inactive for years, even though accepted subject to revision).

Gardner, J. E., Haskin L. A., Oestrike R., Brannon, J. C., and Couture, R. (2001) Use of quantitative geochemical modelling to determine the origins of stratifications of the Endion Sill, Duluth, Minnesota from crystal fractionation, multiple intrusion, magma mixing, and fluid transport. (manuscript with Gardner long ago; inactive for years)

Salpas P. A. and Haskin L. A. (2001) Genesis of compositional characteristics of Stillwater AN-I and AN-II anorthosites: Hydrous fluids. *Geochim. Cosmochim. Acta* **59**, (manuscript nearly complete, but inactive for years).

**Not Peer Reviewed:**

**Editorials:**

Haskin L. A. (1989) Twenty years after Apollo -- shouldn't we be back on the Moon? (Various newspapers and other publications)

Haskin L. A. (1990) Our national scientific meetings. *Geochim. Cosmochim. Acta* 54, 1-2.

Haskin L. A. (1990) Geochemists, organize! *Geochim. Cosmochim. Acta* 54, 265-266.

**McDonnell Center Reports:**

Haskin L. A., Lindstrom D. J., Semkow K. W., and Lewis R. H. (1986) Lunar soil and rock as a source for propellant and constructional materials in space, McDonnell Center for the Space Sciences Report No. TEL – 107.

Semkow K. W., Haskin L. A., and Lindstrom D. J. (1986) Observations on oxide film formation on platinum electrodes during silicate melt electrolysis, McDonnell Center for the Space Sciences Report No. TEL – 108.

Colson R. O. and Haskin L. A. (1993) Oxygen and iron production by electrolytic smelting of lunar soil, Final report to U of Az\_NASA Space Engineering Center for the Utilization of Local Planetary Resources, July, 1993.

**Other:**

Haskin L. A. (1993) Lunox production by magma electrolysis. *Space Resource News* 2, N0. 10, pp. 3,4.

Haskin, L. A. (1995) Memorial of Carl Tolman. *Amer. Mineral.* 80, 1336-1337.