A suite of planetary crystallization programs (MAGFOX, MAGPOX, and FXMOTR): A programming conundrum

Jesse D. Davenport,[1] John Longhi,[2] Clive R. Neal[1], Diogo Bolster[1]

[1] *Civil and Environmental Engineering and Earth Sciences, University of Notre Dame, Notre Dame, IN 46556, USA*
[2] *Lamont-Doherty Earth Observatory, Palisades, NY 10964, USA*
davenport.26@nd.edu

Coupling the capabilities of modern technology with geological investigations can give scientists an unparalleled view into the ways in which geologic systems work, evolve, and effect the human race. This is certainly the case with the suite of igneous crystallization programs MAGFOX[1], MAGPOX[2], and FXMOTR[3], which were originally developed by John Longhi through experimental work on liquidus phase boundaries in varying pseudo-ternary systems. This experimental work was coupled with a number of different expressions and algorithms to simulate fractional crystallization of major elements in MAGFOX, equilibrium crystallization at high pressures of major elements in MAGPOX, and a combination of fractional and equilibrium processes to simulate the crystallization of major and trace elements of magma oceans in FXMOTR (a modified version of BATCH[4]). The original experimental and programming work can be found in Longhi (1977[5], 1980[7], 1987[8], 1991[9], 1992[10]), Longhi et al. (1978)[6] and Longhi and Pan (1988)[11].

The original programs were coded in the acceptable FORTRAN programming language. However, various programming techniques and syntax used in FORTRAN have gone out of fashion. This work aims to translate the original FORTRAN code into the MATLAB programming environment, a much more user-friendly and effective scientific modeling language. Furthermore, in an attempt to make these programs more widely distributed to researchers who do not have extensive programming experience, graphical user interfaces (GUIs) have been developed for each of the programs. This will allow users to input the parameters required for each model and receive the output data of the model without ever viewing the MATLAB code.

MAGFOX and MAGPOX have long been used by a multitude of scientists studying planetary bodies such as the Earth, Moon, Mercury, Mars, asteroids, and other planetary bodies. Here, I will present the models in their new form as well as applications to lunar rocks and magma oceans to show the usefulness of not only the code but of the translation and new GUIs.

[1] J. Davenport, J. Longhi, C. R. Neal, and D. Bolster, *Computers and Geosciences*, (in prep), [2]J. Davenport, J. Longhi, C. R. Neal, and D. Bolster, *Computers and Geosciences*, (in prep), [3] J. Davenport, J. Longhi, C. R. Neal, and D. Bolster *Computers and Geosciences*, (in prep), [4]J. Longhi, *G^3*, 3 (2002), [5]J. Longhi, *Proc. Lunar Sci. Conf. 8th* (1977), [6]J. Longhi, D. Walker, F. Hayes, *GCA*, 42 (1978), [7]J. Longhi, *Proc. Lunar Sci. Conf. 11th* (1980), [8]J. Longhi, *Proc. Lunar Sci. Conf. 17th* (1987), [9]J. Longhi, *Am. Mineralogist*, 76 (1991), [10]J. Longhi, *Proc. Lunar Sci. Conf. 22th* (1992), [11]J. Longhi, V. Pan, *J. Petrology*, 29 (1988).