SYNTHESIS OF PIGEONITE CRYSTALS FOR SPECTROSCOPIC AND SPACE WEATHERING STUDIES

D. H. Lindsley[1], H. Nekvasil[1], and Tim Glotch[1], [1]Stony Brook University, Dept. of Geosciences, Earth and Space Sciences Building, Stony Brook, NY 11794. donald.lindsley@stonybrook.edu.

Introduction: We have succeeded in synthesizing a range of pigeonites to be used as standards for remote sensing, mainly following the methods of [1]. Samples were grown in Fe capsules, and contain minor amounts of unreacted SiO_2 as well as Fe∘. The following compositions (Fig. 1; Table 1) are available and should be requested from Glotch (timothy.glotch @stonybrook,edu). In your request be sure to indicate: a) the target composition; b) the sample letter; c) the optimum and minimum amounts needed; d) the purpose for which you need it.

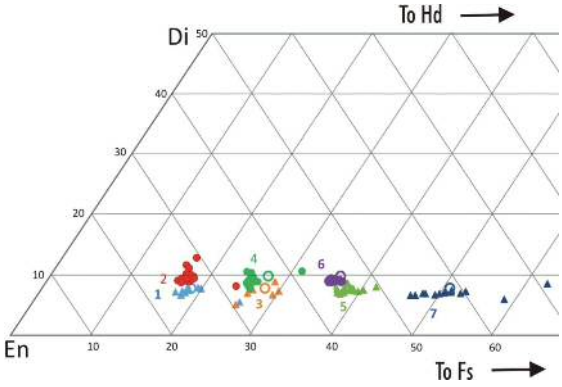

Fig. 1. Electron microprobe analyses of successful pigeonite syntheses. Open circles denote target compositions, closed symbols show individual microprobe analyses. Numbers 1-7 refer to Table 1 below. Mol percent.

# Fig.1	Target Comp.	Samp. Ltr.	Synth. T, °C	~gms Avail.
1	Wo_8 X=20	G	1225	2
2	Wo_{10} X=20	F	1225	4
3	Wo_8 X=30	F	1225	1.6
4	Wo_{10} X=30	I	1225	3.5
5	Wo_8 X=40	E	1185	5.1
6	Wo_{10} X=40	K	1186	2.6
7	Wo_8 X=55	D	1075	1.3

Table 1. Pigeonite samples and approximate quantities available for distribution. Wo = 100Ca/(Ca+Mg+Fe); X = 100Fe/(Mg+Fe) atomic.

Grain size available: Grain sizes of the pigeonites range from ~10 to ~60 microns, with the majority near 25-30 microns. The samples are not sieved.

Coarser grain sizes: We continue our efforts to grow pigeonites of 100 microns or larger. We use two methods, both of which involve crystallization from melt.

Melts within the pyroxene system. The first approach uses melts within the pyroxene quadrilateral, which has the advantage of not introducing unwanted phases or components. Unfortunately though, both the liquidus and solidus curves are very steep [2], so it is not practical to melt a pigeonite composition completely and then grow large crystals through slow cooling. Thus our attempts must involve only partial melting, followed by slow cooling. This process does increase average grain size, but also induces zoning in both Wo and X values. It is therefore necessary to include a long "soak" at just below the solidus in an attempt to homogenize the resulting crystals. We are currently determining the optimum conditions for this approach, with the hope that it will succeed.

Synthesis from a flux. The second approach will involve use of a flux. We will use RbBr (melting point 693∘C), since neither element should enter significantly into the pigeonite, and we hope that following synthesis the flux can be removed by washing in water (although that remains to be seen). We do not know the solubility of pyroxene components in RbBr melt, so the optimum proportion of flux to pigeonite as well as the optimum temperature range and cooling rate remain to be determined experimentally. Very likely this method will also produce zoned pigeonites, which would them require long "soaks" to homogenize them. Since diffusion rates are strongly temperature-dependent, it may well be necessary to use a two-stage approach: slow cooling to grow the crystals, followed by removal of the flux and then homogenization at a temperature well within the pigeonite stability range for the appropriate X value [3].

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Reference: [1] Turnock, A., Lindsley, D.H., and Grover, J.E. (1973) Am. Min. **58**, 50. [2] Huebner, J.S. & Turnock, A. (1980) Am. Min. **65**, 225. [3] Davidson, P.M and Lindsley, D.H. (1985) Contr. Min. Pet. **91**, 390.