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Jennings, Eleanor S. and Holland, T.J.B. (2015) A simple thermodynamic model for melting of Peridotite in the system NCFMASOCr. *Journal of Petrology* 56 (5), pp. 869-892. ISSN Print ISSN 0022-3530 - Online ISSN 1460-2415.

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## Supplementary information: Details of alphaMELTS calculations

In all cases, calculations are performed using the pMELTS model in alphaMELTS (1.3.1). The new garnet model is used and  $fO_2$  is not imposed. Input files are documented below:

### 1) KLB1-solidus

Calculations for fig. 1, fig. 5a, fig. 6 and fig. 8, and to determine the garnet-in pressure on the solidus.

These calculations are performed on a 'nominal' solidus ( $F=0.005$ ). The KLB-1 bulk composition of Davis et al. (2009) is used, with  $Fe_2O_3$  set to 0.3 wt.%. Components considered are those in the system NCFMASOCrTi, i.e. the components used in our model plus  $TiO_2$ . Input files are documented below:

#### MELTS file

Title: KLB-1, majors Davis et al., 2009  
Initial Composition: SiO2 44.84  
Initial Composition: Al2O3 3.51  
Initial Composition: FeO 7.93  
Initial Composition: Fe2O3 0.3  
Initial Composition: MgO 39.52  
Initial Composition: CaO 3.07  
Initial Composition: Na2O 0.3  
Initial Composition: TiO2 0.11  
Initial Composition: Cr2O3 0.32  
Initial Temperature: 1500.0  
Initial Pressure: 40000.00  
Final Pressure: 1  
Increment Pressure: -500

#### Settings file

*n.b. != line not read i.e. variable set to FALSE*  
ALPHAMEELTS\_VERSION pMELTS  
!ALPHAMEELTS\_OLD\_GARNET true  
!ALPHAMEELTS\_ALTERNATIVE\_FO2 true  
!ALPHAMEELTS\_IMPOSE\_FO2 true  
ALPHAMEELTS\_MODE isentropic  
ALPHAMEELTS\_DELTAP -500  
ALPHAMEELTS\_DELTAT 0  
ALPHAMEELTS\_MAXP 40000  
ALPHAMEELTS\_MINP 1  
ALPHAMEELTS\_MAXT 2400  
ALPHAMEELTS\_MINT 500

#### Batch file

1 # select MELTS file  
KLB1.melts  
10 # phase diagram mode  
1 # on  
4 # execute  
1 # superliquidus initial guess  
liquid # boundary to track  
1 # track melt fraction by mass  
0.005 # F = 0.005  
0 # quick search

0

Calculations for table 1 are performed with this KLB-1 bulk composition at a given pressure and melt fraction by mass. The settings file used is as above.

## 2) MM-3 Isobaric calculation

Calculations for fig. 10b

These isobaric calculations are performed on the bulk composition MM-3, Falloon et al. (2008) with Fe<sub>2</sub>O<sub>3</sub> set to 0.3 wt.%. Components considered are those in the system NCFMASOCrTi, i.e. the components used in our model plus TiO<sub>2</sub>. Input files are documented below:

### **MELTS file**

Title: MM-3, Falloon 2008  
Initial Composition: SiO<sub>2</sub> 45.50  
Initial Composition: Al<sub>2</sub>O<sub>3</sub> 3.98  
Initial Composition: Fe<sub>2</sub>O<sub>3</sub> 0.30  
Initial Composition: FeO 6.85  
Initial Composition: MgO 38.30  
Initial Composition: CaO 3.57  
Initial Composition: Na<sub>2</sub>O 0.31  
Initial Composition: Cr<sub>2</sub>O<sub>3</sub> 0.68  
Initial Composition: TiO<sub>2</sub> 0.11  
Initial Temperature: 2000.0  
Final Temperature: 1300  
Initial Pressure: 15000  
Final Pressure: 15000  
Increment Temperature: -10  
Increment Pressure: 0

### **Settings file**

```
ALPHAMEELTS_VERSION pMELTS
!ALPHAMEELTS_OLD_GARNET true
ALPHAMEELTS_MODE isobaric
!ALPHAMEELTS_ALTERNATIVE_FO2 true
!ALPHAMEELTS_IMPOSE_FO2 true
!ALPHAMEELTS_FRACTIONATE_SOLIDS true
ALPHAMEELTS_DELTAP 0
ALPHAMEELTS_DELTAT -10
ALPHAMEELTS_MAXP 40000
ALPHAMEELTS_MINP 1
ALPHAMEELTS_MAXT 2400
ALPHAMEELTS_MINT500
```

Isobaric melt productivity (fig. 5b) was calculated at 15 kbar using the bulk composition of KLB-1 from section 1) and the settings file from section 2).