

Appendix

THERMOCALC reactions

Endmember abbreviations from Holland and Powell (1998)

P-T estimates (Table 3)

QL1A

cores

••INCOMPLETE•• independent set of reactions

- 1)  $3\mu + 6di = 3cel + py + 2gr$
- 2)  $3\mu + 3di + 2coe = 3cel + gr + 2ky$
- 3)  $cz + acm = ep + jd$
- 4)  $\mu + 4fep + di + 8jd = cel + 3gr + 8acm + 2H_2O + 4ky$

T = 545°C, sd = 107,

P = 33.4 kbars, sd = 6.6, cor = 0.782

rims

Independent set of reactions

- 1)  $3\mu + 6di = 3cel + py + 2gr$
- 2)  $3\mu + 3di + 2coe = 3cel + gr + 2ky$
- 3)  $cz + 2acm = fep + 2jd$
- 4)  $ep + acm = fep + jd$
- 5)  $\mu + 8ep + di = cel + 3gr + 4fep + 2H_2O + 4ky$

T = 533°C, sd = 66,

P = 32.5 kbars, sd = 4.4, cor = 0.666

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QL6B

core

Independent set of reactions

- 1)  $py + 3hed = alm + 3di$
- 2)  $3\mu + 6di = py + 2gr + 3cel$
- 3)  $2py + 6hed + 3gl = 2alm + 6jd + 3tr$
- 4)  $5gr + 33hed + 12tr + 6parg = 11alm + 84di + 6jd + 18H_2O$

T = 591°C, sd = 93,

P = 32.6 kbars, sd = 2.6, cor = -0.451

rim

Independent set of reactions

- 1)  $5py + 3fact = 5alm + 3tr$
- 2)  $3mu + 6di = py + 2gr + 3cel$
- 3)  $py + 3mu + 6hed = 2gr + 2alm + 3cel$
- 4)  $5alm + 6di + 3gl = 5py + 6jd + 3fact$
- 5)  $17mu + 8tr + 4parg = 13py + 8gr + 17cel + 4jd + 12H_2O$

T = 660°C, sd = 74,

P = 27.3 kbars, sd = 2.1, cor = -0.382

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QL22A

cores-Grt 1

Independent set of reactions

- 1)  $gr + alm + 2coe = 3hed + 2ky$
- 2)  $py + 3mu + 4coe = 3cel + 4ky$
- 3)  $py + 3hed = alm + 3di$

T = 612°C, sd = 106,

P = 27.9 kbars, sd = 5.6, cor = 0.755

cores-Grt 2

Independent set of reactions

- 1)  $gr + alm + 2coe = 3hed + 2ky$
- 2)  $py + 3mu + 4coe = 3cel + 4ky$
- 3)  $py + 2gr + 3cel = 6di + 3mu$
- 4)  $gr + 2acm = andr + 2jd$

T = 706°C, sd = 115,

P = 30.3 kbars, sd = 5.8, cor = 0.745

core-Grt 3

••INCOMPLETE•• independent set of reactions

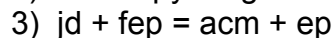
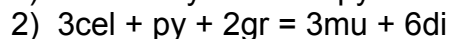
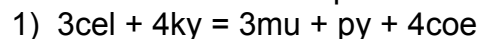
- 1)  $3cel + py + 2gr = 3mu + 6di$
- 2)  $3cel + gr + 2ky = 3mu + 3di + 2coe$
- 3)  $2jd + fep = 2acm + cz$
- 4)  $jd + fep = acm + ep$

T = 606°C, sd = 60,

P = 31.2 kbars, sd = 3.6, cor = 0.708

rims-Grt 3

••INCOMPLETE•• independent set of reactions



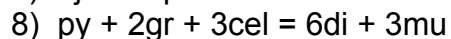
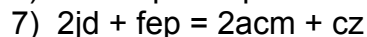
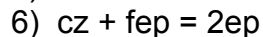
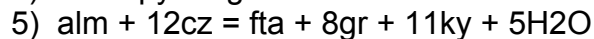
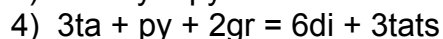
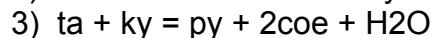
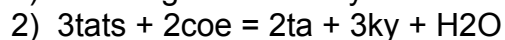
T = 683°C, sd = 77,

P = 31.6 kbars, sd = 4.1, cor = 0.680

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QL32

core-Grt 1

Independent set of reactions

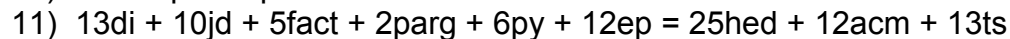
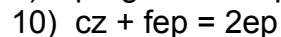
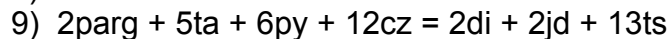
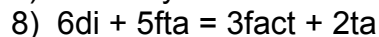
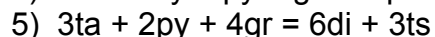
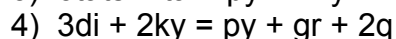
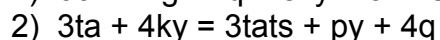
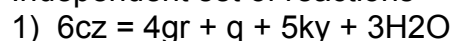


T = 591°C, sd = 28,

P = 32.6 kbars, sd = 2.5, cor = -0.347

rim-Grt 1

Independent set of reactions



T = 671°C, sd = 20,

P = 20.8 kbars, sd = 1.3, cor = 0.137

## rim-Grt 2

### Independent set of reactions

- 1)  $6cz = 4gr + q + 5ky + 3H_2O$
- 2)  $3ta + 4ky = 3tats + py + 4q$
- 3)  $3tats = ta + py + 2ky + 2H_2O$
- 4)  $3di + 2ky = py + gr + 2q$
- 5)  $3ta + 2py + 4gr = 6di + 3ts$
- 6)  $6hed + 3fact + 16ky = 7alm + 6cz + 13q$
- 7)  $13fact + 6cz = 38hed + 9alm + 19q + 16H_2O$
- 8)  $6hed + 3fact + 6fep + 16ky = 7alm + 12ep + 13q$
- 9)  $6hed + 6acm + 3fact + 16ky = 6jd + 7alm + 6ep + 13q$
- 10)  $13di + 5fact + 2parg + 6py + 12cz = 25hed + 2jd + 13ts$

T = 659°C, sd = 20,

P = 20.1 kbars, sd = 1.4, cor = 0.166

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Calculated reactions plotted in Fig. 12

activities (calculated from QL32 rim compositions using  
the a-X program of Holland and Powell 1998):

di     0.41  
py     0.141  
gr     0.0179  
ta     0.75  
tr     0.097

$ta + ky = py + 2q + H_2O$

P	5	15	20.4	25	28.2
T	682	682	672	661	654

$ta + ky = py + 2coe + H_2O$

P	28.2	31.1	35	45	50
T	654	634	609	546	516

$2ta + gr = 3di + py + 2coe + 2H_2O$

P	31.1	35	45	50
T	634	622	591	577

$gr + py + 2coe = 3di + 2ky$

P	28.4	31.1
T	694	634

ta + gr = 3di + ky + H2O

P	5	15	19.3	23.1	25	31.1
T	575	607	614	621	624	634

gr + py + 2q = 3di + 2ky

P	5	15	19.3	25	28.4
T	944	840	791	729	694

2di + ta = tr

T	400	600	800	1000
P	25.3	26.7	28.1	29.6

Ab = Jd + Qtz calculated from symplectite of sample QL1A (Holland 1980):

no Fe3 recalc

T	400	500	600	700	800	950		
P	9.374	10.269		11.164		12.059	12.954	14.297

Fe3 recalc

T	400	500	600	700	800	950		
P	8.443	9.081	9.719	10.357		10.996	11.953	

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Calculated reactions plotted in Fig. 13a

12ep = 8gr + 4alm + 3O2 + 6H2O

QL1A:

	gr	alm	ep
activity	0.0193	0.0820	0.470

log fO2	-15	-14.5	-14	-13.5	-13	-12.5	-12	-11.5	-11	-10.5	-10
T	512	526	539	553	568	583	598	614	631	648	666

QL22A:

	gr	alm	ep
activity	0.0227	0.0410	0.410

log fO2	-15	-14.5	-14	-13.5	-13	-12.5	-12	-11.5	-11	-10.5	-10
T	513	526	540	554	568	583	599	615	632	649	667

QL32:

	gr	alm	ep
activity	0.0179	0.040	0.48

log fO2	-14.5	-14	-13.5	-13	-12.5	-12	-11.5	-11	-10.5	-10
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T	511	524	538	552	567	582	597	613	630	647
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