

```
> ##### GLOSS
#####
```

Gloss

if sulfur present assume as pyrite, in which case reduce O2 by S2/2, i.e., FeO -> FeS2

~100 g

```
> H2O := 0.405;# 21.69 7.37
> CO2 := 0.068;# 3.67 3.04
> FeO := 0.073;# 3.89 5.27
> MgO := 0.062;# 3.30 2.51
> CaO := 0.106;# 5.69 6.02
> Na2O := 0.039;# 2.10 2.46
> K2O := 0.022;# 1.16 2.06
> Al2O3 := 0.117;# 6.26 12.04
> SiO2 := 0.975;# 52.25 59.23
> S2 := 0.0;
> O2 := H2O/2 + CO2 + FeO/2 + MgO/2 + CaO/2 + Na2O/2 + K2O/2 + 3*
Al2O3/2 + SiO2 - S2/2;
> Al := 2*Al2O3;
> Na := 2*Na2O;
> K := 2*K2O;
> C := CO2 + 0.00;
```

raw Gloss 0

```
> H2O,C,SiO2,Al,FeO,MgO,CaO,Na,K,O2,S2;
H2O := 0.405
CO2 := 0.068
FeO := 0.073
MgO := 0.062
CaO := 0.106
Na2O := 0.039
K2O := 0.022
Al2O3 := 0.117
SiO2 := 0.975
S2 := 0.
O2 := 1.572000000
Al := 0.234
Na := 0.078
```

(1)

$K := 0.044$

$C := 0.068$

0.405, 0.068, 0.975, 0.234, 0.073, 0.062, 0.106, 0.078, 0.044, 1.572000000, 0.

> $S2 := 0.00;$

> $O2 := H2O/2 + CO2 + FeO/2 + MgO/2 + CaO/2 + Na2O/2 + K2O/2 + 3*Al2O3/2 + SiO2 - S2/2;$

> $Al := 2*Al2O3;$

> $Na := 2*Na2O;$

> $K := 2*K2O;$

> $C := CO2 + 0.00;$

Gloss 0 + 0.001 C

> $H2O, C, SiO2, Al, FeO, MgO, CaO, Na, K, O2, S2;$

$S2 := 0.$

(2)

$O2 := 1.572000000$

$Al := 0.234$

$Na := 0.078$

$K := 0.044$

$C := 0.068$

0.405, 0.068, 0.975, 0.234, 0.073, 0.062, 0.106, 0.078, 0.044, 1.572000000, 0.

> $S2 := 0.01;$

> $O2 := H2O/2 + CO2 + FeO/2 + MgO/2 + CaO/2 + Na2O/2 + K2O/2 + 3*Al2O3/2 + SiO2 - S2/2;$

> $Al := 2*Al2O3;$

> $Na := 2*Na2O;$

> $K := 2*K2O;$

> $C := CO2 + 0.00;$

Gloss 0 + Sulfur + 0.001 C

> $H2O, C, SiO2, Al, FeO, MgO, CaO, Na, K, O2, S2;$

$S2 := 0.01$

(3)

$O2 := 1.567000000$

$Al := 0.234$

$Na := 0.078$

$K := 0.044$

$C := 0.068$

0.405, 0.068, 0.975, 0.234, 0.073, 0.062, 0.106, 0.078, 0.044, 1.567000000, 0.01

```
> ##### STAUDIGEL
#####
```

Staudigel

if sulfur present assume as pyrrhotite, in which case reduce O2 by S2, i.e., FeO -> FeS

~101.9 g

staudigel basalt 0.1528 0.069 0.7839 0.157 0.1434 0.167 0.2365 0.0345 0.0063 0.

```
> H2O := 0.1528;
> CO2 := 0.069;
> SiO2 := 0.7839;
> Al2O3 := 0.157 ;
> FeO := 0.1434 ;
> MgO := 0.167 ;
> CaO := 0.2365 ;
> Na2O := 0.0345 ;
> K2O := 0.0063;
> S2 := 0.0;
> O2 := H2O/2 + CO2 + FeO/2 + MgO/2 + CaO/2 + Na2O/2 + K2O/2 + 3*
  Al2O3/2 + SiO2 - S2;
> Al := 2*Al2O3;
> Na := 2*Na2O;
> K := 2*K2O;
> C := CO2 + 0.00;
```

raw Stau

```
> H2O,C,SiO2,Al,FeO,MgO,CaO,Na,K,O2,S2;
      H2O := 0.1528
      CO2 := 0.069
      SiO2 := 0.7839
      Al2O3 := 0.157
      FeO := 0.1434
      MgO := 0.167
      CaO := 0.2365
      Na2O := 0.0345
      K2O := 0.0063
      S2 := 0.
      O2 := 1.458650000
      Al := 0.314
```

(4)

$Na := 0.0690$

$K := 0.0126$

$C := 0.069$

0.1528, 0.069, 0.7839, 0.314, 0.1434, 0.167, 0.2365, 0.0690, 0.0126, 1.458650000, 0.

```
> S2 := 0.;
> O2 := H2O/2 + CO2 + FeO/2 + MgO/2 + CaO/2 + Na2O/2 + K2O/2 + 3*
  Al2O3/2 + SiO2 - S2;
> Al := 2*Al2O3;
> Na := 2*Na2O;
> K := 2*K2O;
> C := CO2 + 0.001;
```

Stau+ 0.001 C

```
> H2O,C,SiO2,Al,FeO,MgO,CaO,Na,K,O2,S2;
```

$S2 := 0.$

$O2 := 1.458650000$

$Al := 0.314$

$Na := 0.0690$

$K := 0.0126$

$C := 0.070$

0.1528, 0.070, 0.7839, 0.314, 0.1434, 0.167, 0.2365, 0.0690, 0.0126, 1.458650000, 0.

(5)

```
> S2 := 0.02;
> O2 := H2O/2 + CO2 + FeO/2 + MgO/2 + CaO/2 + Na2O/2 + K2O/2 + 3*
  Al2O3/2 + SiO2 - S2;
> Al := 2*Al2O3;
> Na := 2*Na2O;
> K := 2*K2O;
> C := CO2 + 0.001;
```

Stau+ Sulfur + 0.001 C

```
> H2O,C,SiO2,Al,FeO,MgO,CaO,Na,K,O2,S2;
```

$S2 := 0.02$

$O2 := 1.438650000$

$Al := 0.314$

$Na := 0.0690$

$K := 0.0126$

$C := 0.070$

(6)

0.1528, 0.070, 0.7839, 0.314, 0.1434, 0.167, 0.2365, 0.0690, 0.0126, 1.438650000, 0.02

```
> ##### BEHN  
#####
```

BEHN

if sulfur present assume as pyrrhotite, in which case reduce O2 by S2, i.e., FeO -> FeS

~101.5 g (1.5 wt%h2o)

```
> H2O := 0.083;  
> CO2 := 0.;  
> SiO2 := 0.903;  
> Al2O3 := 0.140 ;  
> FeO := 0.097 ;  
> MgO := 0.304 ;  
> CaO := 0.194 ;  
> Na2O := 0.020 ;  
> K2O := 0.001;  
> S2 := 0.0;  
> O2 := H2O/2 + CO2 + FeO/2 + MgO/2 + CaO/2 + Na2O/2 + K2O/2 + 3*  
Al2O3/2 + SiO2 - S2;  
> Al := 2*Al2O3;  
> Na := 2*Na2O;  
> K := 2*K2O;  
> C := CO2 + 0.00;
```

raw behn + C + S2

```
> H2O,C,SiO2,Al,FeO,MgO,CaO,Na,K,O2,S2;  
H2O := 0.083  
CO2 := 0.  
SiO2 := 0.903  
Al2O3 := 0.140  
FeO := 0.097  
MgO := 0.304  
CaO := 0.194  
Na2O := 0.020  
K2O := 0.001  
S2 := 0.  
O2 := 1.462500000  
Al := 0.280
```

(7)

$Na := 0.040$

$K := 0.002$

$C := 0.$

0.083, 0., 0.903, 0.280, 0.097, 0.304, 0.194, 0.040, 0.002, 1.462500000, 0.

> $S2 := 0.0;$

> $O2 := H2O/2 + CO2 + FeO/2 + MgO/2 + CaO/2 + Na2O/2 + K2O/2 + 3*Al2O3/2 + SiO2 - S2;$

> $Al := 2*Al2O3;$

> $Na := 2*Na2O;$

> $K := 2*K2O;$

> $C := CO2 + 0.001;$

behn + 0.001 C

> $H2O, C, SiO2, Al, FeO, MgO, CaO, Na, K, O2, S2;$

$S2 := 0.$

$O2 := 1.462500000$

$Al := 0.280$

$Na := 0.040$

$K := 0.002$

$C := 0.001$

0.083, 0.001, 0.903, 0.280, 0.097, 0.304, 0.194, 0.040, 0.002, 1.462500000, 0.

(8)

> $S2 := 0.02;$

> $O2 := H2O/2 + CO2 + FeO/2 + MgO/2 + CaO/2 + Na2O/2 + K2O/2 + 3*Al2O3/2 + SiO2 - S2;$

> $Al := 2*Al2O3;$

> $Na := 2*Na2O;$

> $K := 2*K2O;$

> $C := CO2 + 0.001;$

behn + Sulfur + 0.001 C

> $H2O, C, SiO2, Al, FeO, MgO, CaO, Na, K, O2, S2;$

$S2 := 0.02$

$O2 := 1.442500000$

$Al := 0.280$

$Na := 0.040$

$K := 0.002$

$C := 0.001$

(9)

0.083, 0.001, 0.903, 0.280, 0.097, 0.304, 0.194, 0.040, 0.002, 1.442500000, 0.02

```
> ##### LOSIMAG  
#####
```

LOSIMAG

if sulfur present assume as pyrrhotite, in which case reduce O2 by S2, i.e., FeO -> FeS

~95 g (4 wt%h2o)

```
> H2O := .21090;  
> CO2 := 0.0*H2O;  
> SiO2 := 0.7075 ;  
> Al2O3 := 0.037 ;  
> FeO := 0.09711 ;  
> MgO := 0.8666 ;  
> CaO := 0.0527 ;  
> Na2O := 0.0046 ;  
> K2O := 0.00046;  
> S2 := 0.0;  
> O2 := H2O/2 + CO2 + FeO/2 + MgO/2 + CaO/2 + Na2O/2 + K2O/2 + 3*  
Al2O3/2 + SiO2 - S2;  
> Al := 2*Al2O3;  
> Na := 2*Na2O;  
> K := 2*K2O;  
> C := CO2 + 0.00;
```

raw LOSIMAG

```
> H2O,C,SiO2,Al,FeO,MgO,CaO,Na,K,O2,S2;  
H2O := 0.21090  
CO2 := 0.  
SiO2 := 0.7075  
Al2O3 := 0.037  
FeO := 0.09711  
MgO := 0.8666  
CaO := 0.0527  
Na2O := 0.0046  
K2O := 0.00046  
S2 := 0.  
O2 := 1.379185000
```

(10)

$Al := 0.074$
 $Na := 0.0092$
 $K := 0.00092$
 $C := 0.$

0.21090, 0., 0.7075, 0.074, 0.09711, 0.8666, 0.0527, 0.0092, 0.00092, 1.379185000, 0.

```
> S2 := 0.0;  
> O2 := H2O/2 + CO2 + FeO/2 + MgO/2 + CaO/2 + Na2O/2 + K2O/2 + 3*  
  Al2O3/2 + SiO2 - S2;  
> Al := 2*Al2O3;  
> Na := 2*Na2O;  
> K := 2*K2O;  
> C := CO2 + 0.001;
```

LOSIMAG + 0.001 C

```
> H2O,C,SiO2,Al,FeO,MgO,CaO,Na,K,O2,S2;  
  S2 := 0.  
O2 := 1.379185000  
  Al := 0.074  
  Na := 0.0092  
  K := 0.00092  
  C := 0.001
```

0.21090, 0.001, 0.7075, 0.074, 0.09711, 0.8666, 0.0527, 0.0092, 0.00092, 1.379185000, 0.

```
> S2 := 0.002;  
> O2 := H2O/2 + CO2 + FeO/2 + MgO/2 + CaO/2 + Na2O/2 + K2O/2 + 3*  
  Al2O3/2 + SiO2 - S2;  
> Al := 2*Al2O3;  
> Na := 2*Na2O;  
> K := 2*K2O;  
> C := CO2 + 0.001;
```

LOSIMAG + 0.001 C + S

```
> H2O,C,SiO2,Al,FeO,MgO,CaO,Na,K,O2,S2;  
  S2 := 0.002  
O2 := 1.377185000  
  Al := 0.074  
  Na := 0.0092  
  K := 0.00092
```

(11)

(12)

$C := 0.001$

0.21090, 0.001, 0.7075, 0.074, 0.09711, 0.8666, 0.0527, 0.0092, 0.00092, 1.377185000, 0.002

```
> t0_deep := -2.059655E-10*z0^6 + 2.323113E-07*z0^5 - 1.076535E-04*  
z0^4 + 2.625959E-02*z0^3 - 3.566382E+00*z0^2 + 2.582593E+02*z0 -  
7.189476E+03; # z0 > 75.0 km
```

```
> t0_shallow := 1.255734E-06*z0^5 - 2.000554E-04*z0^4 +  
1.180485E-02*z0^3 - 3.163565E-01*z0^2 + 6.026698E+00*z0 +  
2.300000E+00 +.735544;
```

```
> z0 := p0/0.35;
```

```
t0_deep := -2.059655 10-10 z06 + 2.323113 10-7 z05 - 0.0001076535 z04 + 0.02625959 z03  
- 3.566382 z02 + 258.2593 z0 - 7189.476 (13)
```

```
t0_shallow := 0.000001255734 z05 - 0.0002000554 z04 + 0.01180485 z03 - 0.3163565 z02  
+ 6.026698 z0 + 3.035544
```

$z0 := 2.857142857 p0$

```
> p := 10;
```

```
> subs(p0,t0_deep + 273);
```

```
> subs(p0=p,t0_shallow + 273);
```

$p := 10$

-1903.930548

355.9025519

(14)

```
> fsolve(t0_deep=t0_shallow,p0);
```

-1769.175064, -59.23176593, 26.17936336, 26.25000234

(15)

```
> p0 := pbar/1000;
```

$p0 := \frac{pbar}{1000}$

(16)

```
> subs(pbar=26.1793e3, {t0_deep,t0_shallow});
```

{301.97012, 301.9701589}

(17)

```
> t0_shallow;
```

```
2.390878086 10-19 pbar5 - 1.333147188 10-14 pbar4 + 2.753317784 10-10 pbar3  
- 0.000002582502040 pbar2 + 0.01721913714 pbar + 3.035544
```

(18)

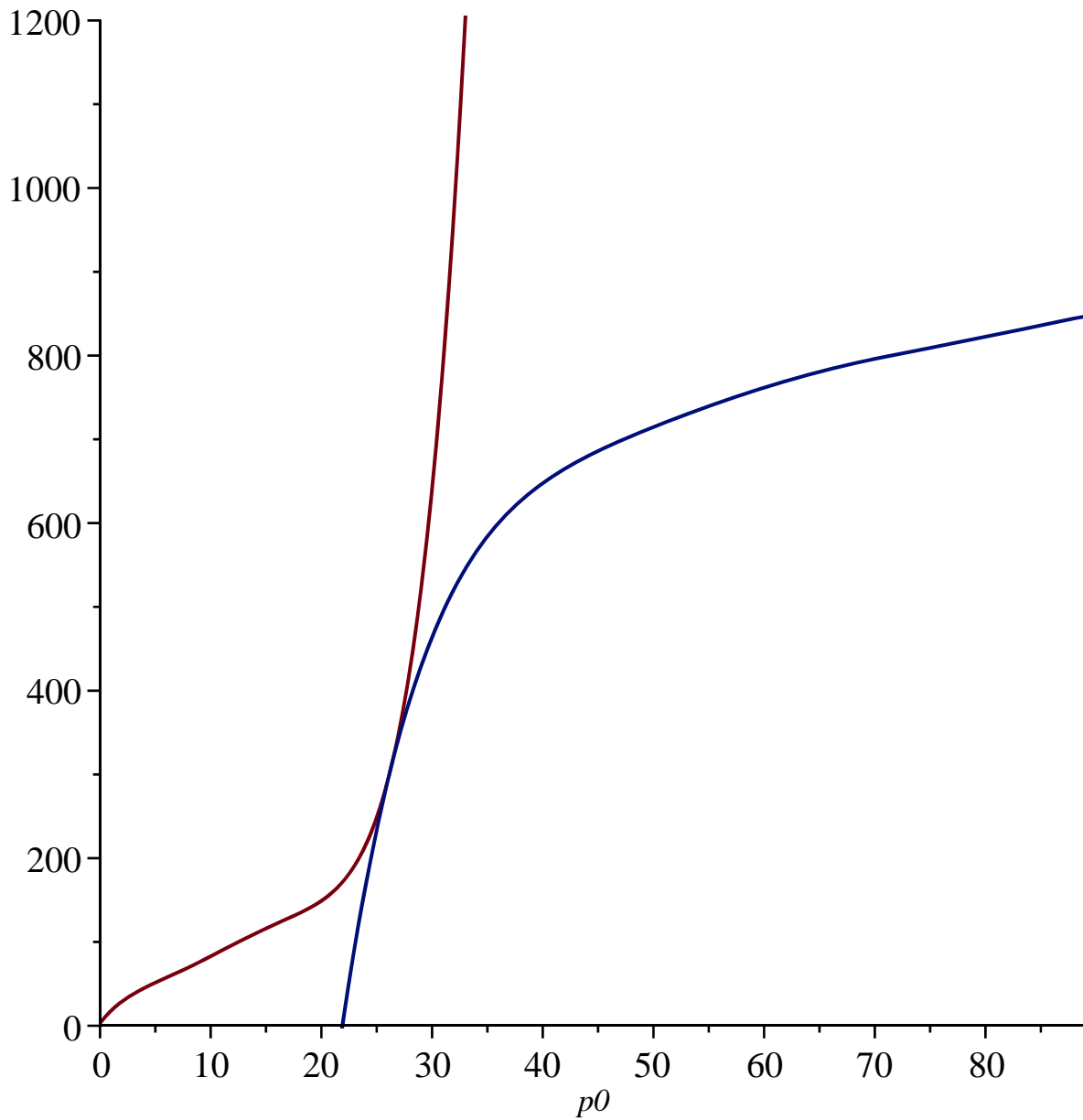
```
> subs(pbar=A1,t0_deep);
```

```
-1.120433833 10-25 A16 + 4.423134169 10-20 A15 - 7.173910869 10-15 A14
```

```
+ 6.124685714 10-10 A13 - 0.00002911332244 A12 + 0.7378837142 A1 - 7189.476
```

(19)

```
> plot({t0_deep,t0_shallow},p0=0..255*.35,0..1200);
```



```
> eq1 := t1 = dtdp*p1 + int;
      eq1 := t1 = dtdp p1 + int (20)
```

```
> eq2 := t2 = dtdp*p2 + int;
      eq2 := t2 = dtdp p2 + int (21)
```

```
> solve(subs(t1=1473,p1=2.5e4,t2=973,p2=4.5e4,{eq1,eq2}},{dtdp,int}
);
      {dtdp = -0.025000000000, int = 2098.} (22)
```

```
> 1.353*18;
      24.354 (23)
```

```
> 45000.*0.05 + 223;
      2473.00 (24)
```

```
[> c0 + var*(c1 + var*(c2 + var*(c3 + var*c4)))
```

```
[> exox := 2*(1.585-1.572);                                exox := 0.026                                (25)
```

```
[> feox := 2*exox;                                        feox := 0.052                                (26)
```

```
[> fred := 0.073 - feox;                                  fred := 0.021                                (27)
```

```
[> feox/fred;                                             2.476190476                                (28)
```