

TABLE 2  
Results of experimental runs on the diorite composition at 900 °C

Pressure (kb)	Temperature (°C)	Time (hrs)	Type of sample capsule	Phases present*				Comments
{ 27	900	48	Au	px	plag	qtz	—	Well crystallized; uncommon laths of orthopyroxene distinguishable; plag ≫ px > qtz
then 4	900	67						
{ 27	900	48	Au	px	plag	qtz	—	Medium grainsize; plag ≫ px > qtz
then 6.5	900	64						
{ 27	900	48	Au	px	plag	qtz	<u>ga</u>	Medium grainsize; laths of orthopyroxene distinguishable; plag ≫ px > qtz > ga
then 9	900	62						
	900	24	Au	px	plag	qtz	—	Fine grained; no evidence for garnet; plag ≫ px > qtz
	900	24	Au	px	plag	qtz	—	Medium grainsize; no evidence for garnet; plag ≫ px > qtz
{ 18	1100	6	Ag-Pd	px	plag	qtz	<u>ga</u>	Medium grainsize; plag ≫ px > qtz > ga
then 11.3	900	50						
	900	6	Ag-Pd	px	plag	qtz	—	Fine grained; no garnet evident; plag ≫ px > qtz
	900	20	Ag-Pd	px	plag	qtz	<u>ga</u> ?	Fine grained; uncertain, rare garnet; plag ≫ px > qtz
	900	48	Au	px	plag	qtz	<u>ga</u>	Medium grainsize; plag ≫ px > qtz > ga
	900 ± 50	48	Au	px	plag	qtz	<u>ga</u>	Medium grainsize; plag > px > qtz > ga
{ 27	900	48	Au	px	plag	qtz	ga	Medium grainsize; px ≫ qtz > plag, ga; definite growth of plag compared with 27 kb 900 °C run
then 22.1	900	64						
	900	48	Au	px	plag	qtz	ga	Medium grainsize; px ≫ qtz, plag > ga
{ 22.5	1000	16	Au	px	plag	qtz	ga	Medium grainsize; px ≫ plag, qtz > ga; slightly more garnet than 22.5 kb 900 °C run
then 22.5	900	71						
	900	48	Au	px	felds	qtz	ga	Medium grainsize; px ≫ qtz > ga > felds; trace of feldspar, probably K-feldspar not plag
	900	48	Au	px	felds	qtz	ga	Fine grained; px ≫ qtz > ga > felds
	900	48	Au	px	felds	qtz	ga	Fine grained; px ≫ qtz > ga > felds

\* Underlines denote phase identified by optical means alone.

px = pyroxene; plag = plagioclase; qtz = quartz; ga = garnet; felds = feldspar (K-rich).

were substituted. Runs at 1100 °C were conducted in silver-palladium capsules and at 1200 °C platinum capsules were used, with reduced experiment time to minimize iron loss from the sample to the platinum capsule. At this higher temperature equilibrium was reached in much shorter times. The pressure cell components were not dried, except for runs on the andesite composition at 1100 °C in the lower pressure range where a dried pyrophyllite spacer was used, in order to prevent excessive melting resulting from access of water to the sample. No boron nitride sleeve was used in the pressure cell. This procedure allowed minor access of water to the sample to promote reaction, but the amount present did not result in observable crystallization of hydrous phases.

Even with runs of 48 hours duration, difficulty in nucleating garnet was experienced in both compositions at 900 °C. Accordingly the incoming of garnet with increasing pressure was determined by two-stage runs. In the first stage the charge was taken into the garnet field and held under conditions where it was known from previous runs that garnet formed in the allowed time, then the *P-T* conditions were changed to those desired for the particular run and held for 2-3 days. Finally the charge was removed and examined to determine whether garnet remained stable or had reacted away. This procedure was, in effect, a type of reversal of reaction by a two stage experiment. The final disappearance of plagioclase was studied in a similar manner.

TABLE 3  
Results of experimental runs on the diorite composition at 1000–1200 °C

Pressure (kb)	Temperature (°C)	Time (hrs)	Type of sample capsule	Phases present †	Comments
18	1000	24	Ag-Pd	px plag qtz — —	Well crystallized; uncommon orthopyroxene laths distinguishable; plag ≳ px > qtz
then 9.3	1000	70	Ag-Pd	px plag qtz ga —	Medium grainsize; plag ≳ px > qtz > ga
11	1000	31	Ag-Pd	px plag qtz ga —	Medium grainsize; px > plag > qtz > ga
22.5	1000	16	Au	px plag qtz ga —	Medium grainsize; px ≳ qtz > ga > felds; possible trace of plag remaining
25	1000	10	Au	px felds qtz ga —	Medium grainsize; px ≳ qtz > ga > felds; possible trace of plag remaining
25	1000	48	Au	px felds qtz ga —	Medium grainsize; px ≳ qtz > ga > felds; possible trace of plag remaining
36	1000	17½	Au	px felds coes ga —	Medium grainsize; px ≳ coes > ga > felds
12.2	1100	4	Ag-Pd	px plag qtz — <u>glass</u>	Well crystallized; minor glass; plag ≳ px ≳ qtz
12.2	1100	24	Ag-Pd	px plag qtz — <u>glass</u>	Well crystallized; common glass; plag ≳ px > qtz
13.5	1100	4	Pt	px plag qtz <u>ga?</u> —	Medium grainsize; plag ≳ px > qtz; uncertain, rare garnet
14	1100	4	Ag-Pd	px plag qtz <u>ga</u> —	Fine grained; plag ≳ px > qtz > ga
14	1100	12	Ag-Pd	px plag qtz <u>ga</u> <u>glass</u>	Well crystallized, very minor melting; plag ≳ px > qtz > ga
15.8	1100	5	Ag-Pd	px plag qtz <u>ga</u> <u>glass</u>	Medium grainsize; minor melting; plag ≳ px > qtz > ga
18	1100	6	Ag-Pd	px plag qtz ga <u>glass</u>	Medium grainsize; minor melting; px > plag > qtz > ga
22.5	1100	10	Ag-Pd	px plag qtz ga —	Fine grained; px > plag > qtz > ga
24.8	1100	10½	Ag-Pd	px plag qtz ga —	Fine grained; px > plag, qtz > ga
27	1100 ± 30	24	Ag-Pd	px felds qtz ga —	Fine grained; px ≳ qtz > ga > felds
31.5	1100	24	Ag-Pd	px felds qtz ga —	Fine grained; px ≳ qtz, ga > felds
36	1100	4½	Ag-Pd	px felds qtz ga —	Fine grained; px ≳ coes, ga > felds
36	1200	4	Pt	px felds coes/ qtz ga —	Medium grainsize; px ≳ coes, qtz > ga > felds
36	1200	11½	Pt	px felds coes ga —	Medium grainsize; px ≳ coes > ga > felds

† Underlines denote phases identified by optical means alone.

px = pyroxene; plag = plagioclase; qtz = quartz; ga = garnet; felds = feldspar (K-rich); coes = coesite.

### 3. Results

#### 3.1. Diorite

The detailed experimental results for this composition are given in tables 2 and 3 and are summarized in fig. 1.

At 900 °C garnet first appeared stable at 6.5 kb after a two-stage run, but was not obtained in a single stage run until 13.5 kb (48 hour run), pointing to the difficulty in nucleating garnet in this composition at 900 °C. Garnet, quartz and clinopyroxene increased in amount with increasing pressure, while plagioclase decreased, until at 24.8 kb only a trace of feldspar remained. This amount of feldspar remained unchanged with further increase in pressure and was probably potash feldspar.

At 1000 °C garnet first appeared at 11 kb in a single stage run and was unstable in a two-stage run at 9.3 kb. In a similar fashion to the 900 °C series of runs, garnet, quartz and pyroxene increased in amount with increasing pressure while plagioclase decreased, until at 25 kb only a trace of feldspar (K-rich) remained. In the experiments at 1100 °C minor glass occurred in the lower pressure runs. Garnet first appeared at 14 kb and plagioclase disappeared by 27 kb. Kyanite was not observed in any of the runs.

#### 3.2. Gabbroic anorthosite

The detailed experimental results for this composition are given in table 4 and are summarized in fig. 2.

In a series of two-stage runs at 900 °C garnet was