Table 2. *Compositions and norms of rock mixes used in the experimental work*

	1. High-alumina olivine tholeiite	2. High-alumina quartz tholeiite	3. Basaltic andesite	4. Andesite	5. Dacite	6. Rhyodacite I (adamellite)
SiO_2	50.3[a]	52.9	56.4	62.2[a]	65.0[a]	69.6
TiO_2	1.7[a]	1.5	1.4	1.1[a]	0.7[a]	0.6
Al_2O_3	17.0[a]	16.9	16.6	17.3[a]	16.1[a]	14.7
Fe_2O_3	1.5[b]	0.3[b]	3.0[b]	0.3[b]	1.4[b]	1.7[b]
FeO	7.6[b]	7.9[b]	5.7[b]	5.9[b]	3.5[b]	1.8[b]
MnO	0.16	0.2	0.1	0.1	0.1	0.1
MgO	7.8[a]	7.0	4.3	2.4[a]	1.8[a]	1.0
CaO	11.4[a]	10.0	8.5	5.2[a]	5.0[a]	2.5
Na_2O	2.8[a]	2.7	3.0	3.3[a]	3.6[a]	3.4
K_2O	0.18[a]	0.6	1.0	2.3[a]	2.1[a]	4.6
	100.4	100.0	100.0	100.1	99.3	100.0
MOL. PROP. $\frac{100\,MgO}{MgO + FeO_{Total}}$	60.7	60.4	47.7	41.0	40.3	36.0
CIPW NORMS						
Qz	—	1.3	10.7	15.5	21.7	25.3
Or	1.1	3.5	5.9	13.6	13.0	27.2
Ab	23.7	22.8	25.4	27.9	30.5	28.8
An	33.3	32.2	28.9	25.7	21.5	11.2
Diop	18.9	14.2	10.8	0.2	2.3	0.9
Hyp	11.9	22.6	11.3	14.8	7.7	3.0
Ol	6.2	—	—	—	—	—
Mt	2.2	0.4	4.3	0.4	2.0	2.5
Ilm	3.2	2.8	2.7	2.1	1.3	1.1

[a] Denotes content determined by electron probe analysis of a glass fragment.

[b] Denotes chemically determined content (E. Kiss, A. N. U., analyst).

wet conditions during the experiment, with P_{H_2O} undoubtedly less than P_{LOAD}. With practice consistent and reproducible results could be obtained following this method. Wet runs were carried out on high-alumina quartz tholeiite, basaltic andesite and andesite compositions in order to experimentally test the model suggesting that the calc-alkaline series may be derived by fractional melting of basalt under conditions of $P_{H_2O} < P_{LOAD}$ at 30—40 kms depth. The experimental method is not ideal because of some iron loss in the long experiments, and the uncertainty of the P_{H_2O} on the sample, but with the type of apparatus used this method was the best that could be achieved.

Analytical

The analytical procedures followed involved electron microprobe determination of the compositions of clinopyroxene, orthopyroxene, garnet, plagioclase and amphibole crystals in polished sections of the products of the high pressure experimental runs. Direct calibration has been carried out between the phases analyzed and prepared standard synthetic orthopyroxene, "clinopyroxene" and "feldspar" glasses and natural, analyzed garnet standards of overall similar composition to the experimental crystal phases. Because of this similarity in composition no correction procedures have been followed, and the method of counting for fixed specimen currents has been adopted. Using these methods accuracy of analysis is estimated to be of the order of 5% of the amount present for analyses of SiO_2, TiO_2, Al_2O_3, FeO, MgO, MnO, CaO and K_2O and about 10% for Na_2O. Thus when the analyses for these major elements are totalled, figures in the range from 95—105% are considered to be reasonable. This is sufficiently accurate for the purpose of indicating fractionation trends of the major elements in certain magmas at high pressure, the main aim of this experimental project.

However if the analyzed phases total outside a range of, for example 99—101% and these unchanged analyses are used to calculate derivative liquids by extracting estimated amounts of crystals of these compositions from the starting composition, then the totals for the residual liquids or crystal aggregates will be correspondingly poor, and may be misleading (e.g. in calculation of normative compositions). These totals should not arbitrarily be corrected back to 100% because the errors in the original analyses may not have been proportionately distributed between the components. If the probe analyses total outside the range 99—101% or where the calculated liquid fractionate compositions fall outside this range, the procedure adopted to reduce these discrepancies is as follows: The electron microprobe analyses obtained are used as the basis for the calculation of the composition of the phase so that this totals 100% and fits the stoichiometry of the phase concerned. The calculated compositions are then used in the determination of the fractionation trends. In subsequent tables where this has been done the liquid fractionates or crystal residua are marked.

Because fractionation trends involving iron are important in the calc-alkali series, iron losses from the samples to the platinum capsules during a run may result in errors in the calculation of fractionation trends. Chemical analysis for ferrous and ferric iron in some of the higher temperature (above liquidus) runs has been carried out (E. KISS, A.N.U. analyst) in order to place approximate upper limits on the likely iron loss. These analyses are given in Table 3. Also to reduce this iron loss effect, run times above 1300° C have been shortened and also only crystals away from the edge of the sample have been analysed. Iron loss is minimal in the central areas of the samples. As an additional check on the iron loss effects in the experiments conducted under wet conditions in platinum capsules, a few wet runs have been carried out in graphite capsules and the compositions of the phases crystallized in the two different types of capsules have been compared.

Table 3. *Changes in iron content and oxidation state during experimental runs (Analyses by* E. KISS, *A. N. U.)*

Composition	Conditions of run			FeO		Fe_2O_3		Total Fe as FeO	
	Temp. (°C)	Pressure (kb)	Time (Hrs)	Initial	Final	Initial	Final	Initial	Final
High-alumina olivine tholeiite	1,360	18	1	7.6	3.5	1.5	0.9	9.0	4.3
	1,440	27	$^1/_2$	7.6	4.1	1.5	0.06	9.0	4.15
High-alumina quartz tholeiite	1,360	18	$^2/_3$	7.9	4.1	0.3	0.5	8.2	4.6
	880	10	8 (wet)	7.9	5.9	0.3	0.2	8.2	6.1
	1,020	10	4 (wet)	7.9	5.6	0.3	0.1	8.2	5.7
Basaltic andesite	1,400	27	$^1/_2$	5.7	6.2	3.0	0.1	8.4	6.3
Dacite	1,320	18	$^5/_6$	3.5	2.7	1.4	0.1	4.8	2.8
	1,280	27	$^5/_6$ (wet)	3.5	2.2	1.4	0.3	4.8	2.5
	1,220	27	$^2/_3$ (wet)	3.5	2.2	1.4	0.1	4.8	2.3

I. Experimental Investigation under Dry Conditions

Results

The results of the phase equilibria in the partial melting fields of the various compositions under dry conditions for the pressure range 18—36 kb are the main concern of this section. The details of the dry experimental runs are recorded in Tables 4—9 and are summarized in Figs. 1—6. In consulting these tables and