

1. GRAIN-SIZE, MORPHOLOGICAL, AND COMPOSITIONAL VARIATIONS IN IGNEOUS SILICATES IN MEDIUM-GRAINED DIABASE FROM HOLE 504B¹

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ABSTRACT

Samples recovered from Hole 504B during Leg 140 include a number of medium-grained, holocrystalline diabases that appear to represent the cores of thick dikes. The plagioclase and pyroxene in these samples occur in a variety of crystal morphologies. Plagioclase occurs as phenocrysts, microphenocrysts, elongate crystals, skeletal crystals, and branching radial clusters. Pyroxene occurs as phenocrysts, microphenocrysts, ophitic crystals, and poikilitic crystals. Plagioclase compositions became progressively poorer in anorthite and MgO and progressively richer in FeO as crystallization proceeded, while the average grain volume decreased and the aspect ratio of individual grains increased. Pyroxene compositions are largely independent of crystal morphology.

The diabase dikes recovered from Hole 504B during Leg 140 appear to have crystallized *in situ*. Crystal compositions and morphologies are consistent with a rapid cooling rate and solidification times for individual dikes on the order of hours or days. The crystallization rate and nucleation rate of plagioclase lagged behind the cooling rate so that the degree of undercooling progressively increased as crystallization proceeded. Plagioclase crystal morphologies indicate much greater degrees of supersaturation than do pyroxene or olivine crystal morphologies. The 504B diabase magmas appear to have been emplaced with abundant preexisting pyroxene and olivine nuclei, but with few preexisting plagioclase nuclei. The suppression of plagioclase nucleation and crystallization relative to that of pyroxene and olivine could provide a mechanism by which the actual fractionation assemblage is more pyroxene-rich and plagioclase-poor than that predicted from thermodynamic models, or that observed in isothermal crystallization experiments.

INTRODUCTION

Samples recovered from Hole 504B during Legs 137 and 140 range from aphanitic dike margins to medium-grained diabase presumably from the centers of dikes. Within these samples, plagioclase and pyroxene are the dominant minerals, with lesser amounts of olivine, oxides, quartz, apatite, and alteration minerals. Plagioclase and pyroxene in the coarsest diabase samples have a variety of crystal morphologies and textures. Plagioclase occurs as: phenocrysts; microphenocrysts; elongate laths; skeletal crystals; and branching radial clusters of crystals. Pyroxene occurs as: phenocrysts; microphenocrysts; ophitic crystals; and large poikilitic crystals. Olivine in these samples occurs primarily as altered phenocrysts, but in some samples from the lower part of the section, unaltered olivine cores are preserved. This report will examine the relationship among grain size, crystal morphology, and composition of plagioclase, pyroxene, and olivine in the medium-grained diabase samples recovered from Hole 504B during Legs 137 and 140.

TEXTURAL RELATIONSHIPS

Plagioclase makes up 55% to 60% of the medium-grained diabase samples examined in this study. Plagioclase phenocrysts are the largest, but least abundant, crystal type. They make up 5% to 10% of the total plagioclase. Phenocrysts are commonly complexly zoned with abundant crystal and melt inclusions. They range from 1 to 5 mm in length and are typically lath-shaped with aspect ratios between 1 and 3 (Table 1). In contrast, microphenocrysts, which make up 20% to 25% of the total plagioclase, range from 0.5 to 1 mm in length with aspect ratios between 2 and 4. Plagioclase microphenocrysts are typically subhedral to euhedral with simple zoning patterns. Acicular crystals 0.8 to 1.5 mm in length with aspect ratios between 5 and 20 make up 50% to 60% of the total plagioclase. They range in morphol-

ogy from euhedral elongate crystals to curved and skeletal crystals. They are listed separately in the tables as either elongate crystals, those that tend toward euhedral outlines, or skeletal crystals, those that tend toward curved, incipient-branching, or cellular outlines. An extreme example of branching crystals occurs as large radial clusters of plagioclase laths that radiate in bundles from a central point as fan-shaped or, in some cases, bow tie-shaped splays (Fig. 1). These plagioclase radial clusters typically make up 10% to 15% of the total plagioclase but were not observed in all of the medium-grained diabase samples examined. Individual laths within these radial clusters vary from euhedral to skeletal in shape, and are 1 to 2 mm in length with aspect ratios between 15 and 30. Most crystals within radial clusters are narrow at the base of the cluster and become progressively wider toward their tips. Many radial clusters are enclosed within a single poikilitic pyroxene that appears to have precipitated simultaneously with the plagioclase radial cluster.

Augite makes up 35% to 40% of the medium-grained diabase samples examined in this study, but in many samples it has been partially altered, so its original modal abundance is hard to determine. Subhedral phenocrysts 1 to 3 mm across make up 2% to 3% of the total pyroxene. They are typically equidimensional with aspect ratios between 1 and 1.5 in most sections. A few crystals, however, are elongate with aspect ratios up to 6. Some phenocrysts have abundant inclusions, but most have relatively inclusion-free cores with ophitic rims. Some of the pyroxene phenocrysts have sector-zoned and oscillatory-zoned cores (Fig. 2). The zoning is most pronounced in terms of the distribution of Al_2O_3 and Cr_2O_3 . Small variations in CaO and TiO_2 follow those of Al_2O_3 , whereas minor variations in MgO are antithetic to those of Al_2O_3 . Subhedral microphenocryst laths 0.5 to 1.0 mm in length with aspect ratios between 1 and 2 make up 5% to 10% of the total pyroxene. In most samples, 90% to 95% of the pyroxene occurs as ophitic to poikilitic crystals in the groundmass. Individual oikocrysts may be up to 4 mm across. Although these samples are distinctly porphyritic, there is a continuous variation in grain size between pyroxene phenocrysts on one extreme and groundmass poikilitic pyroxene on the other extreme (i.e., they are seriate porphyritic). The outer margins of pyroxene phenocrysts and microphenocrysts are typically ophitic or poikilitic with respect to the surrounding groundmass. Some of the

¹ Erzinger, J., Becker, K., Dick, H.J.B., and Stokking, L.B. (Eds.), 1995. *Proc. ODP Sci. Results*, 137/140: College Station, TX (Ocean Drilling Program).

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Table 1. Average grain sizes.

	Length (mm)	Width (mm)	Aspect ratio
Plagioclase			
Phenocryst	1.84	0.87	2.29
Microphenocryst	0.68	0.28	2.49
Elongate	1.09	0.10	12.27
Skeletal	1.16	0.13	11.17
Radial	1.06	0.07	21.11
Pyroxene			
Phenocryst	1.94	1.57	1.27
Microphenocryst	0.82	0.52	1.67
Ophitic	1.06	0.84	1.29
Poikilitic	2.59	1.52	1.95
Olivine			
Phenocryst	1.32	1.12	1.20



Figure 1. Distribution of Al_2O_3 in a branching radial cluster of plagioclase crystals surrounded by poikilitic pyroxene from Sample 140-504B-200R-1, 18–24 cm. Image is an X-ray map generated using a JEOL 8900 electron microprobe in scan mode with 300,000 pixels and a dwell time of 50 ms per pixel. Black = low Al (surrounding pyroxene); gray = intermediate Al; white = highest Al. Field of view is 0.89 mm wide.

more inclusion-rich phenocrysts are texturally similar to the larger poikilitic groundmass pyroxenes. In most of the samples examined, olivine occurs only as pseudomorphs replaced by alteration minerals. In a few samples, unaltered olivine cores are preserved. Olivine crystals range from 0.5 to 1.5 mm in diameter with low aspect ratios. Owing to the alteration present in the groundmass of almost all samples, the former existence of groundmass olivine would be hard to determine.

COMPOSITIONAL VARIATIONS

Plagioclase crystals in three samples (137-504B-181M-1, 115–124 cm; 140-504B-200R-1, 18–24 cm; and 140-504B-226R-1, 8–12 cm) were analyzed using electron microprobe techniques (Tables 2–6). (Analyses were done on the JEOL 8900 at the Department of Geological Sciences, State University of New York at Binghamton, using

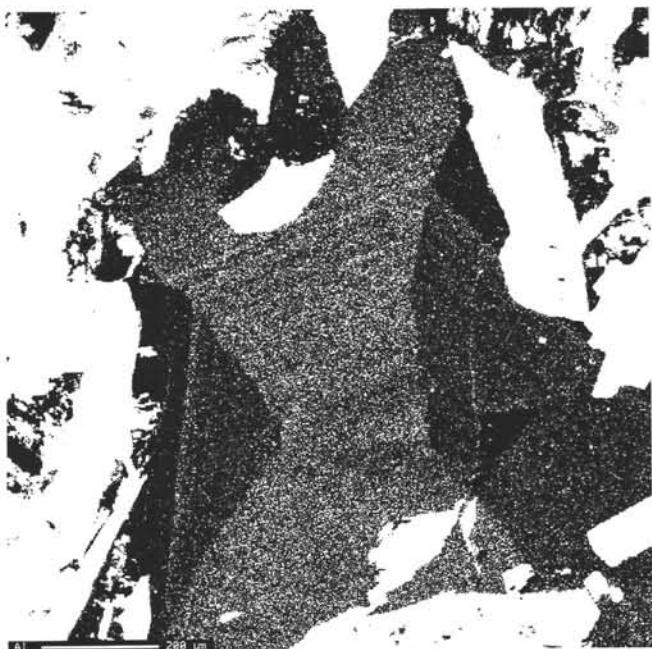


Figure 2. Distribution of Al_2O_3 in a sector-zoned and oscillatory-zoned pyroxene phenocryst core from Sample 140-504B-193R-1, 28–31 cm. Image is an X-ray map generated using a JEOL 8900 electron microprobe in scan mode with 300,000 pixels and a dwell time of 50 ms per pixel. Black = low Al; gray = moderate Al; white = highest Al (surrounding plagioclase crystals). Field of view is 1.11 mm wide.

wavelength dispersive spectrometers. Counting times were 30 s on peaks and 10 s on backgrounds, with a spot size of <1 micron, an accelerating voltage of 15 kv, and a sample current of 10 na. A ZAF correction scheme was used with oxide standards.) Data are divided into phenocrysts, microphenocrysts, elongate crystals, skeletal crystals, and plagioclase radial clusters. For most of the analyzed grains, traverses were made from margin to margin, and the data are separated into cores and rims. In the case of the plagioclase crystals within radial clusters, which do not have typical rims, the analyses are separated into those from the main mass of the crystal and those from the tips of the crystals. Figure 3 shows typical zoning patterns for traverses across the width of phenocrysts (Fig. 3A), microphenocrysts (Fig. 3B), and elongate crystals (Fig. 3C), and along the length of individual crystals within plagioclase radial clusters (Fig. 3D). The bulk of most crystals is composed of a relatively anorthite-rich core with a thin rim (or in the case of radial clusters, a small tip) of more anorthite-poor plagioclase. All groups show a systematic increase in Fe_2O_3 and decrease in MgO with decreasing anorthite content as has been observed in plagioclases from Hole 504B basalts (Sato, 1989). All five of the textural types analyzed fall on the same $\text{An}\%$ ($\text{Ca}/(\text{Ca} + \text{Na} + \text{K})$) vs. $\text{Mg}\#$ ($\text{Mg}/(\text{Mg} + \text{Fe})$) curve (Fig. 4A). There is, however, a progressive decrease in $\text{An}\%$ and $\text{Mg}\#$ with increasing aspect ratio. Although there are a few stragglers, the cores of phenocrysts are generally between 80 and 90 $\text{An}\%$, the cores of microphenocrysts are generally between 75 and 90 $\text{An}\%$, the cores of elongate and skeletal crystals are generally between 70 and 80 $\text{An}\%$, and the cores of crystals within radial clusters are generally between 65 and 75 $\text{An}\%$ (Fig. 4B). The few core compositions plotted near 50 $\text{An}\%$ may be the result of analyses of points that appear to be cores in thin section, but may be rims in a three-dimensional view. As is typical of other analyzed oceanic plagioclase (Bollinger and Semet, 1980; Thompson and Humphris, 1980), the plagioclases tend to be deficient in Al_2O_3 relative to CaO such that the anorthite content calculated by $\text{Ca}/(\text{Ca} + \text{Na} + \text{K})$ is 5% to 10% higher than that calculated by $(\text{Al} - 1)/(\text{Si} + \text{Al} - 3)$.

Table 2. Plagioclase phenocrysts.

Sample	Grain	Weight percent								Cations per 8 oxygens									
		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O	Total	Si	Al	Fe	Ca	Mg	Na	K	Total	An%	Mg#
Plagioclase phenocryst cores																			
137-504B-																			
181M-1, 115-124 cm	PH-1	47.29	31.71	0.401	17.23	0.269	1.20	0.004	98.10	2.211	1.748	0.014	0.863	0.019	0.108	0.000	4.963	88.8	57.1
181M-1, 115-124 cm	PH-1	48.16	32.20	0.440	17.26	0.280	1.31	0.007	99.65	2.215	1.746	0.015	0.851	0.019	0.117	0.000	4.963	87.9	55.8
181M-1, 115-124 cm	PH-1	47.68	32.68	0.519	17.18	0.245	1.40	0.004	99.71	2.194	1.773	0.018	0.847	0.017	0.125	0.000	4.974	87.1	48.3
181M-1, 115-124 cm	PH-2	49.34	29.77	0.519	15.71	0.312	2.21	0.000	97.86	2.304	1.639	0.018	0.786	0.022	0.200	0.000	4.968	79.7	54.3
181M-1, 115-124 cm	PH-2	47.30	30.80	0.427	17.00	0.263	1.44	0.007	97.23	2.232	1.713	0.015	0.860	0.019	0.131	0.000	4.970	86.7	55.0
181M-1, 115-124 cm	PH-2	48.84	30.65	0.413	16.16	0.306	1.97	0.000	98.34	2.271	1.680	0.015	0.805	0.021	0.178	0.000	4.970	81.9	59.5
181M-1, 115-124 cm	PH-3	49.07	32.59	0.573	16.61	0.298	1.58	0.011	100.73	2.228	1.744	0.020	0.808	0.020	0.139	0.001	4.960	85.2	50.7
181M-1, 115-124 cm	PH-3	47.20	33.04	0.509	17.57	0.224	1.12	0.000	99.67	2.174	1.795	0.018	0.867	0.015	0.100	0.000	4.970	89.6	46.6
181M-1, 115-124 cm	PH-3	47.40	33.54	0.545	17.59	0.204	1.07	0.014	100.36	2.168	1.808	0.019	0.862	0.014	0.095	0.001	4.967	90.0	42.6
181M-1, 115-124 cm	PH-3	47.75	33.07	0.456	17.51	0.215	1.10	0.000	100.10	2.187	1.786	0.016	0.859	0.015	0.098	0.000	4.961	89.8	48.3
181M-1, 115-124 cm	PH-4	47.95	32.69	0.548	17.31	0.252	1.20	0.011	99.96	2.199	1.767	0.019	0.851	0.017	0.107	0.001	4.961	88.8	47.7
181M-1, 115-124 cm	PH-4	48.50	32.30	0.504	16.66	0.314	1.55	0.008	99.83	2.223	1.746	0.017	0.818	0.022	0.137	0.001	4.964	85.6	55.2
181M-1, 115-124 cm	PH-4	48.82	32.17	0.455	16.56	0.342	1.62	0.003	99.96	2.234	1.735	0.016	0.812	0.023	0.143	0.000	4.963	85.0	59.8
181M-1, 115-124 cm	PH-4	48.69	32.18	0.467	16.70	0.294	1.60	0.003	99.93	2.230	1.737	0.016	0.819	0.020	0.142	0.000	4.965	85.2	55.5
140-504B-																			
200R-1, 18-24 cm	PH-1	47.47	33.93	0.475	17.59	0.192	1.36	0.012	101.04	2.159	1.819	0.016	0.857	0.013	0.120	0.001	4.984	87.6	44.5
200R-1, 18-24 cm	PH-1	47.47	32.86	0.486	17.20	0.231	1.38	0.000	99.62	2.187	1.784	0.017	0.849	0.016	0.123	0.000	4.975	87.3	48.5
200R-1, 18-24 cm	PH-1	47.68	32.38	0.487	17.26	0.197	1.36	0.007	99.38	2.201	1.762	0.017	0.854	0.014	0.122	0.000	4.970	87.4	44.5
200R-1, 18-24 cm	PH-2	48.64	31.42	0.441	16.44	0.252	1.90	0.001	99.10	2.247	1.711	0.015	0.814	0.017	0.170	0.000	4.975	82.7	53.1
200R-1, 18-24 cm	PH-2	48.86	30.67	0.480	16.47	0.265	1.86	0.005	98.61	2.268	1.678	0.017	0.819	0.018	0.167	0.000	4.968	83.0	52.2
200R-1, 18-24 cm	PH-2	49.87	31.69	0.491	16.33	0.301	2.17	0.000	100.85	2.262	1.694	0.017	0.794	0.020	0.191	0.000	4.978	80.6	54.8
200R-1, 18-24 cm	PH-2	48.60	32.76	0.448	17.14	0.216	1.52	0.003	100.67	2.212	1.757	0.015	0.836	0.015	0.134	0.000	4.969	86.2	48.9
200R-1, 18-24 cm	PH-2	49.64	31.11	0.428	16.33	0.261	1.98	0.012	99.75	2.275	1.681	0.015	0.802	0.018	0.175	0.001	4.966	82.0	54.7
200R-1, 18-24 cm	PH-2	47.77	31.94	0.443	17.19	0.215	1.52	0.004	99.08	2.213	1.744	0.015	0.853	0.015	0.136	0.000	4.976	86.2	49.0
200R-1, 18-24 cm	PH-2	49.37	32.03	0.510	16.06	0.272	1.97	0.005	100.21	2.251	1.721	0.018	0.784	0.018	0.174	0.000	4.967	81.8	51.4
200R-1, 18-24 cm	PH-2	49.46	31.19	0.512	16.13	0.306	1.97	0.000	99.57	2.270	1.688	0.018	0.793	0.021	0.175	0.000	4.965	81.9	54.2
200R-1, 18-24 cm	PH-2	49.56	29.72	0.439	16.03	0.282	2.02	0.000	98.04	2.309	1.632	0.015	0.800	0.020	0.183	0.000	4.959	81.4	56.0
200R-1, 18-24 cm	PH-2	49.81	30.94	0.451	16.38	0.301	2.02	0.012	99.90	2.280	1.669	0.016	0.803	0.021	0.179	0.001	4.968	81.7	56.9
200R-1, 18-24 cm	PH-2	49.46	31.84	0.433	16.16	0.282	1.97	0.013	100.15	2.256	1.712	0.015	0.790	0.019	0.174	0.001	4.967	81.9	56.3
200R-1, 18-24 cm	PH-2	48.50	32.51	0.391	17.06	0.239	1.56	0.000	100.25	2.216	1.751	0.013	0.835	0.016	0.138	0.000	4.970	85.8	54.8
200R-1, 18-24 cm	PH-2	48.19	29.94	0.499	16.74	0.260	1.66	0.019	97.31	2.270	1.662	0.018	0.845	0.018	0.152	0.001	4.966	84.7	50.8
200R-1, 18-24 cm	PH-2	48.29	32.23	0.508	16.93	0.269	1.59	0.011	99.81	2.218	1.744	0.018	0.833	0.018	0.141	0.001	4.973	85.4	51.2
200R-1, 18-24 cm	PH-2	48.45	33.25	0.491	17.04	0.198	1.57	0.007	101.01	2.198	1.778	0.017	0.828	0.013	0.138	0.000	4.973	85.7	44.4
200R-1, 18-24 cm	PH-2	47.98	32.40	0.543	17.06	0.161	1.59	0.005	99.74	2.207	1.757	0.019	0.841	0.011	0.142	0.000	4.976	85.5	37.0
200R-1, 18-24 cm	PH-2	48.22	31.59	0.478	16.83	0.213	1.64	0.000	98.97	2.233	1.724	0.017	0.835	0.015	0.147	0.000	4.970	85.0	46.9
200R-1, 18-24 cm	PH-2	49.73	29.64	0.553	15.00	0.271	2.46	0.006	97.66	2.322	1.631	0.019	0.751	0.019	0.222	0.000	4.964	77.1	49.2
200R-1, 18-24 cm	PH-3	48.12	31.07	0.542	16.63	0.254	1.85	0.008	98.47	2.241	1.706	0.019	0.830	0.018	0.167	0.000	4.981	83.2	48.1
200R-1, 18-24 cm	PH-3	47.21	31.46	0.456	16.98	0.195	1.48	0.013	97.79	2.215	1.740	0.016	0.854	0.014	0.135	0.001	4.974	86.3	45.9
200R-1, 18-24 cm	PH-3	48.92	31.33	0.732	16.17	0.169	2.07	0.000	99.39	2.254	1.702	0.025	0.798	0.012	0.185	0.000	4.975	81.2	31.4
200R-1, 18-24 cm	PH-3	49.03	31.74	0.598	16.32	0.229	1.87	0.005	99.80	2.248	1.715	0.021	0.802	0.016	0.166	0.000	4.968	82.8	43.1
200R-1, 18-24 cm	PH-3	48.07	31.53	0.456	16.70	0.210	1.70	0.000	98.66	2.232	1.726	0.016	0.831	0.015	0.153	0.000	4.973	84.4	47.7
200R-1, 18-24 cm	PH-3	47.75	30.55	0.488	16.54	0.259	1.82	0.011	97.41	2.248	1.695	0.017	0.834	0.018	0.166	0.001	4.979	83.3	51.2
200R-1, 18-24 cm	PH-4	46.89	32.31	0.493	16.34	0.223	2.03	0.000	98.29	2.190	1.779	0.017	0.818	0.016	0.184	0.000	5.004	81.6	47.3
200R-1, 18-24 cm	PH-4	46.87	32.18	0.556	16.54	0.246	1.85	0.005	98.24	2.191	1.773	0.020	0.828	0.017	0.168	0.000	4.997	83.1	46.7
200R-1, 18-24 cm	PH-5	46.02	33.02	0.461	16.97	0.190	1.48	0.011	98.15	2.155	1.823	0.016	0.851	0.013	0.134	0.001	4.993	86.3	44.9
200R-1, 18-24 cm	PH-5	45.97	32.88	0.463	17.15	0.230	1.44	0.002	98.14	2.154	1.816	0.016	0.861	0.016	0.131	0.000	4.995	86.8	49.6
200R-1, 18-24 cm	PH-5	46.12	32.42	0.532	17.07	0.249	1.61	0.000	98.01	2.165	1.794	0.019	0.859	0.017	0.147	0.000	5.001	85.4	48.1
200R-1, 18-24 cm	PH-5	45.91	33.10	0.555	17.37	0.194	1.39	0.007	98.52	2.145	1.823	0.020	0.870	0.014	0.126	0.000	4.997	87.3	40.9
200R-1, 18-24 cm	PH-5	46.69	32.45	0.528	17.43	0.202	1.37	0.013	98.68	2.176	1.783	0.019	0.870	0.014	0.124	0.001	4.986	87.5	43.1
200R-1, 18-24 cm	PH-5	46.36	32																

Table 3. Plagioclase microphenocrysts.

Sample	Grain	Weight percent							Cations per 8 oxygens										
		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O	Total	Si	Al	Fe	Ca	Mg	Na	K	Total	An%	Mg#
Microphenocryst cores																			
137-504B-																			
181M-1, 115-124 cm	MP-1	57.83	26.40	1.21	10.69	0.118	5.35	0.009	101.60	2.563	1.379	0.040	0.508	0.008	0.460	0.001	4.958	52.4	16.2
181M-1, 115-124 cm	MP-1	57.20	26.06	1.41	10.75	0.149	5.21	0.028	100.80	2.558	1.374	0.048	0.515	0.010	0.451	0.002	4.958	53.2	17.3
181M-1, 115-124 cm	MP-2	47.05	32.08	0.66	17.10	0.232	1.28	0.007	98.41	2.195	1.764	0.023	0.855	0.016	0.116	0.000	4.970	88.0	41.2
181M-1, 115-124 cm	MP-2	47.31	31.70	0.53	16.78	0.236	1.41	0.020	97.99	2.213	1.749	0.019	0.841	0.017	0.128	0.001	4.967	86.7	46.7
181M-1, 115-124 cm	MP-2	48.48	31.49	0.47	16.19	0.297	1.68	0.011	98.62	2.247	1.721	0.017	0.804	0.021	0.151	0.001	4.960	84.1	55.4
181M-1, 115-124 cm	MP-2	48.48	31.15	0.61	16.32	0.282	1.74	0.000	98.58	2.251	1.705	0.021	0.812	0.020	0.157	0.000	4.965	83.8	47.8
181M-1, 115-124 cm	MP-2	48.35	31.97	0.55	16.58	0.279	1.63	0.003	99.36	2.228	1.737	0.019	0.819	0.019	0.146	0.000	4.967	84.9	50.3
181M-1, 115-124 cm	MP-3	49.88	29.29	0.58	14.71	0.331	2.71	0.000	97.50	2.332	1.615	0.020	0.737	0.023	0.246	0.000	4.973	75.0	53.2
181M-1, 115-124 cm	MP-3	50.19	29.19	0.56	15.03	0.325	2.62	0.022	97.94	2.338	1.603	0.020	0.750	0.023	0.237	0.001	4.970	75.9	53.6
181M-1, 115-124 cm	MP-4	51.00	30.28	0.95	14.84	0.219	2.83	0.000	100.12	2.324	1.627	0.033	0.724	0.015	0.250	0.000	4.972	74.3	31.3
181M-1, 115-124 cm	MP-4	51.88	29.37	0.94	13.52	0.175	3.61	0.010	99.50	2.372	1.583	0.032	0.662	0.012	0.320	0.001	4.981	67.4	27.0
181M-1, 115-124 cm	MP-4	52.38	29.52	0.93	13.88	0.186	3.48	0.000	100.37	2.374	1.577	0.032	0.674	0.013	0.305	0.000	4.975	68.8	28.4
181M-1, 115-124 cm	MP-5	50.86	30.30	0.90	15.00	0.301	2.65	0.000	100.01	2.320	1.629	0.031	0.733	0.021	0.234	0.000	4.967	75.8	39.8
181M-1, 115-124 cm	MP-5	50.91	30.50	0.75	15.00	0.308	2.68	0.020	100.17	2.317	1.637	0.026	0.732	0.021	0.237	0.001	4.970	75.5	45.0
181M-1, 115-124 cm	MP-5	50.63	30.19	0.71	15.21	0.338	2.73	0.000	99.80	2.316	1.628	0.025	0.745	0.023	0.242	0.000	4.979	75.5	48.4
181M-1, 115-124 cm	MP-5	50.71	30.17	0.72	14.90	0.329	2.64	0.014	99.49	2.323	1.630	0.025	0.731	0.023	0.235	0.001	4.967	75.6	47.4
140-504B-																			
200R-1, 18-24 cm	MP-1	50.49	31.53	0.48	15.70	0.284	2.52	0.012	101.02	2.282	1.680	0.016	0.761	0.019	0.221	0.001	4.980	77.5	53.9
200R-1, 18-24 cm	MP-1	49.97	32.00	0.40	15.95	0.286	2.21	0.000	100.82	2.263	1.708	0.014	0.774	0.019	0.194	0.000	4.973	79.9	58.3
200R-1, 18-24 cm	MP-1	50.43	31.21	0.56	15.67	0.418	2.24	0.000	100.53	2.289	1.669	0.019	0.762	0.028	0.197	0.000	4.965	79.5	59.5
200R-1, 18-24 cm	MP-1	50.16	31.38	0.49	16.08	0.336	2.08	0.000	100.53	2.279	1.680	0.017	0.783	0.023	0.183	0.000	4.964	81.0	57.4
200R-1, 18-24 cm	MP-1	50.08	31.40	0.42	15.67	0.294	2.25	0.000	100.11	2.282	1.680	0.014	0.765	0.020	0.199	0.000	4.967	79.3	58.2
200R-1, 18-24 cm	MP-1	50.31	31.45	0.47	15.68	0.306	2.35	0.000	100.57	2.283	1.682	0.016	0.763	0.021	0.207	0.000	4.971	78.6	56.2
200R-1, 18-24 cm	MP-2	48.75	30.30	0.61	14.70	0.275	2.56	0.000	97.20	2.289	1.677	0.022	0.739	0.019	0.233	0.000	4.979	76.0	47.0
200R-1, 18-24 cm	MP-2	45.83	32.63	0.53	17.18	0.199	1.16	0.007	97.53	2.159	1.812	0.019	0.867	0.014	0.106	0.000	4.978	89.1	42.7
200R-1, 18-24 cm	MP-2	45.29	32.72	0.50	17.44	0.174	1.04	0.000	97.16	2.144	1.826	0.018	0.885	0.012	0.095	0.000	4.981	90.3	40.6
200R-1, 18-24 cm	MP-2	45.44	32.90	0.45	17.61	0.193	1.13	0.000	97.71	2.141	1.827	0.016	0.889	0.014	0.103	0.000	4.989	89.6	46.2
200R-1, 18-24 cm	MP-3	44.81	33.69	0.54	17.61	0.149	1.06	0.000	97.86	2.110	1.870	0.019	0.888	0.010	0.097	0.000	4.994	90.2	35.4
200R-1, 18-24 cm	MP-3	49.21	30.62	0.40	15.20	0.299	2.53	0.000	98.26	2.286	1.677	0.014	0.757	0.021	0.228	0.000	4.982	76.9	59.7
200R-1, 18-24 cm	MP-3	47.08	32.01	0.42	16.91	0.226	1.58	0.000	98.23	2.200	1.763	0.015	0.847	0.016	0.143	0.000	4.983	85.5	51.5
200R-1, 18-24 cm	MP-3	48.54	30.95	0.38	15.65	0.244	2.28	0.018	98.06	2.263	1.701	0.013	0.782	0.021	0.206	0.001	4.983	79.1	56.1
200R-1, 18-24 cm	MP-3	48.30	31.05	0.47	15.60	0.283	2.16	0.000	97.86	2.256	1.710	0.017	0.781	0.020	0.196	0.000	4.979	80.0	54.3
200R-1, 18-24 cm	MP-3	47.00	32.09	0.40	16.73	0.233	1.51	0.021	97.99	2.199	1.770	0.014	0.839	0.016	0.137	0.001	4.977	85.9	53.4
200R-1, 18-24 cm	MP-4	46.90	32.12	0.38	16.73	0.291	1.58	0.000	98.01	2.195	1.772	0.014	0.839	0.020	0.143	0.000	4.984	85.4	60.0
200R-1, 18-24 cm	MP-4	46.81	33.41	0.38	16.69	0.273	1.53	0.004	99.09	2.166	1.822	0.013	0.827	0.019	0.137	0.000	4.985	85.8	59.0
200R-1, 18-24 cm	MP-4	47.34	32.33	0.35	16.92	0.254	1.57	0.000	98.77	2.198	1.770	0.012	0.842	0.018	0.141	0.000	4.981	85.6	58.8
200R-1, 18-24 cm	MP-4	47.32	32.04	0.38	16.50	0.275	1.70	0.009	98.22	2.208	1.762	0.013	0.825	0.019	0.154	0.001	4.982	84.2	59.1
200R-1, 18-24 cm	MP-4	46.81	31.28	0.48	16.64	0.253	1.81	0.000	97.26	2.210	1.741	0.017	0.842	0.018	0.166	0.000	4.994	83.6	51.2
226R-1, 8-12 cm	MP-1	46.32	32.03	0.44	17.06	0.220	1.42	0.000	97.48	2.187	1.782	0.015	0.849	0.016	0.131	0.000	4.980	86.6	52.0
226R-1, 8-12 cm	MP-1	46.28	32.66	0.38	17.07	0.220	1.28	0.010	97.90	2.170	1.805	0.013	0.858	0.015	0.117	0.001	4.979	88.0	53.7
226R-1, 8-12 cm	MP-2	51.81	29.21	0.79	13.34	0.210	3.72	0.000	99.08	2.377	1.580	0.027	0.656	0.014	0.331	0.000	4.985	66.5	34.6
226R-1, 8-12 cm	MP-2	51.50	29.23	0.66	13.66	0.218	3.59	0.000	98.86	2.370	1.585	0.023	0.673	0.015	0.320	0.000	4.986	67.8	39.3
226R-1, 8-12 cm	MP-3	48.81	30.59	0.70	14.44	0.250	2.99	0.000	97.78	2.280	1.685	0.025	0.723	0.017	0.271	0.000	5.001	72.7	41.5
226R-1, 8-12 cm	MP-3	48.57	30.06	0.67	14.64	0.229	2.89	0.005	97.06	2.287	1.669	0.024	0.739	0.016	0.264	0.000	4.999	73.7	40.4
226R-1, 8-12 cm	MP-4	45.60	32.65	0.40	17.19	0.237	1.40	0.000	97.48	2.152	1.817	0.014	0.869	0.017	0.128	0.000	4.997	87.1	53.9
226R-1, 8-12 cm	MP-4	45.38	32.27	0.40	17.40	0.223	1.38	0.012	97.06	2.153	1.805	0.014	0.884	0.016	0.127	0.001	5.001	87.4	52.5
140-504B-																			
200R-1, 18-24 cm	MP-1r	52.60	28.07	0.89	13.60	0.192	3.45	0.007	98.81	2.418	1.521	0.031	0.670	0.013	0.307	0.000	4.960	68.5	29.9
200R-1, 18-24 cm	MP-1r	50.66	30.43	0.49	15.09	0.351	2.66	0.022	99.70	2.317	1.640	0.017	0.739	0.024	0.236	0.001	4.973	75.7	58.4
200R-1, 18-24 cm	MP-1r	52.22	30.75	0.68	14.61	0.328	3.20	0.000	101.62	2.339	1.623	0.023	0.701	0.022	0.264	0.000	4.970	72.7	48.8
200R-1, 18-24 cm	MP-2r	57.80	24.22	1.00	8.46	0.039	6.19	0.009	97.71	2.647	1.308	0.034	0.						

Table 4. Elongate plagioclase.

Sample	Grain	Weight percent									Cations per 8 oxygens										
		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O	Total	Si	Al	Fe	Ca	Mg	Na	K	Total	An%	Mg#		
Elongate plagioclase cores																					
137-504B-																					
181M-1, 115-124 cm	EL-1	51.27	29.52	0.968	14.77	0.292	2.97	0.007	99.80	2.344	1.591	0.033	0.724	0.020	0.263	0.000	4.976	73.3	37.4		
181M-1, 115-124 cm	EL-1	51.00	29.55	0.821	14.62	0.266	2.80	0.011	99.07	2.345	1.602	0.028	0.720	0.018	0.250	0.001	4.965	74.2	39.1		
181M-1, 115-124 cm	EL-2	51.34	28.71	0.915	14.41	0.239	2.95	0.003	98.56	2.372	1.564	0.032	0.713	0.017	0.264	0.000	4.962	73.0	34.1		
181M-1, 115-124 cm	EL-3	50.74	30.73	0.714	15.22	0.359	2.60	0.000	100.36	2.307	1.647	0.024	0.741	0.024	0.229	0.000	4.972	76.4	49.9		
181M-1, 115-124 cm	EL-4	50.96	30.47	0.865	14.84	0.286	2.82	0.013	100.25	2.318	1.634	0.030	0.724	0.019	0.249	0.001	4.974	74.4	39.6		
181M-1, 115-124 cm	EL-4	51.02	30.11	0.918	14.57	0.256	2.97	0.006	99.84	2.330	1.621	0.032	0.713	0.017	0.263	0.000	4.976	73.1	35.6		
181M-1, 115-124 cm	EL-4	50.88	29.98	0.883	14.18	0.282	3.07	0.000	99.27	2.334	1.622	0.031	0.697	0.019	0.273	0.000	4.976	71.9	38.7		
181M-1, 115-124 cm	EL-5	51.20	30.17	1.120	14.46	0.186	3.04	0.005	100.18	2.331	1.619	0.038	0.705	0.013	0.268	0.000	4.975	72.4	24.7		
140-504B-																					
200R-1, 18-24 cm	EL-1	47.36	32.94	0.413	17.16	0.269	1.31	0.013	99.46	2.184	1.790	0.014	0.848	0.018	0.117	0.001	4.973	87.8	56.3		
200R-01, 18-24 cm	EL-1	47.52	33.31	0.321	17.20	0.231	1.38	0.010	99.98	2.180	1.801	0.011	0.845	0.016	0.123	0.001	4.976	87.3	58.8		
200R-1, 18-24 cm	EL-1	45.99	32.75	0.415	17.15	0.215	1.53	0.000	98.05	2.158	1.811	0.015	0.862	0.015	0.139	0.000	4.999	86.1	50.7		
200R-1, 18-24 cm	EL-1	47.05	32.76	0.416	17.13	0.225	1.52	0.001	99.09	2.180	1.789	0.014	0.851	0.016	0.136	0.000	4.986	86.2	51.7		
200R-1, 18-24 cm	EL-1	46.73	33.06	0.468	17.63	0.161	1.10	0.000	99.14	2.165	1.806	0.016	0.876	0.011	0.098	0.000	4.973	89.9	40.5		
200R-1, 18-24 cm	EL-2	49.68	31.06	0.872	14.46	0.255	3.02	0.006	99.36	2.283	1.683	0.030	0.712	0.017	0.269	0.000	4.995	72.5	36.7		
200R-1, 18-24 cm	EL-3	50.65	30.35	0.700	14.42	0.272	3.06	0.015	99.47	2.321	1.639	0.024	0.708	0.019	0.272	0.001	4.984	72.2	43.5		
200R-1, 18-24 cm	EL-3	50.47	31.91	0.804	15.05	0.343	2.83	0.006	101.42	2.273	1.694	0.027	0.726	0.023	0.247	0.000	4.990	74.6	45.8		
200R-1, 18-24 cm	EL-3	50.11	31.02	0.747	14.90	0.310	2.84	0.008	99.93	2.289	1.671	0.026	0.729	0.021	0.252	0.000	4.988	74.3	45.1		
200R-1, 18-24 cm	EL-4	50.56	30.77	0.540	15.14	0.277	2.71	0.000	99.99	2.306	1.654	0.019	0.740	0.019	0.240	0.000	4.977	75.5	50.4		
200R-1, 18-24 cm	EL-4	50.19	30.43	0.589	15.51	0.305	2.38	0.007	99.41	2.304	1.647	0.020	0.763	0.021	0.212	0.000	4.968	78.2	50.6		
200R-1, 18-24 cm	EL-4	49.49	30.04	0.509	15.37	0.320	2.40	0.000	98.13	2.303	1.648	0.018	0.766	0.022	0.217	0.000	4.973	78.0	55.5		
200R-1, 18-24 cm	EL-4	49.53	30.22	0.559	15.29	0.298	2.44	0.021	98.36	2.299	1.654	0.020	0.761	0.021	0.220	0.001	4.975	77.5	51.4		
200R-1, 18-24 cm	EL-4	50.20	30.92	0.602	15.01	0.281	2.57	0.000	99.59	2.298	1.669	0.021	0.736	0.019	0.228	0.000	4.971	76.3	48.0		
200R-1, 18-24 cm	EL-5	50.19	30.59	0.632	15.31	0.241	2.54	0.011	99.51	2.302	1.654	0.022	0.752	0.016	0.226	0.001	4.973	76.9	43.0		
200R-1, 18-24 cm	EL-5	50.18	31.14	0.437	15.21	0.318	2.60	0.017	99.90	2.291	1.676	0.015	0.744	0.022	0.230	0.001	4.979	76.3	59.0		
200R-1, 18-24 cm	EL-5	50.20	29.87	0.500	15.14	0.305	2.60	0.003	98.61	2.322	1.629	0.017	0.750	0.021	0.233	0.000	4.972	76.3	54.7		
200R-1, 18-24 cm	EL-5	50.44	29.09	0.590	14.85	0.302	2.73	0.000	98.00	2.346	1.595	0.021	0.740	0.021	0.246	0.000	4.969	75.0	50.3		
226R-1, 8-12 cm	EL-1	51.28	29.26	0.837	13.18	0.183	3.74	0.006	98.48	2.368	1.593	0.029	0.652	0.013	0.334	0.000	4.989	66.1	30.2		
226R-1, 8-12 cm	EL-1	52.59	28.85	0.961	13.56	0.180	3.81	0.000	99.96	2.393	1.548	0.033	0.661	0.012	0.336	0.000	4.984	66.3	27.1		
226R-1, 8-12 cm	EL-1	51.20	28.26	0.995	13.14	0.170	3.60	0.019	97.39	2.390	1.556	0.035	0.657	0.012	0.326	0.001	4.978	66.8	25.3		
226R-1, 8-12 cm	EL-1	51.10	28.32	1.040	12.80	0.194	3.70	0.009	97.17	2.390	1.561	0.037	0.642	0.014	0.336	0.001	4.979	65.6	27.0		
226R-1, 8-12 cm	EL-2	48.96	30.83	0.619	14.65	0.281	2.74	0.000	98.08	2.278	1.691	0.022	0.731	0.019	0.247	0.000	4.989	74.7	47.3		
226R-1, 8-12 cm	EL-2	49.37	29.74	0.687	14.49	0.235	3.03	0.023	97.57	2.310	1.641	0.024	0.727	0.016	0.275	0.001	4.995	72.5	40.4		
226R-1, 8-12 cm	EL-3	51.30	29.61	0.715	15.17	0.312	2.87	0.005	99.99	2.341	1.593	0.025	0.742	0.021	0.254	0.000	4.977	74.5	46.4		
226R-1, 8-12 cm	EL-3	49.46	29.36	0.884	14.90	0.199	2.89	0.000	97.68	2.315	1.620	0.031	0.747	0.014	0.262	0.000	4.990	74.0	30.8		
226R-1, 8-12 cm	EL-3	50.61	29.22	0.859	13.98	0.176	3.02	0.006	97.87	2.354	1.602	0.030	0.697	0.012	0.272	0.000	4.967	71.9	28.9		
226R-1, 8-12 cm	EL-3	49.99	29.70	0.976	14.35	0.207	2.96	0.023	98.21	2.323	1.627	0.034	0.714	0.014	0.267	0.001	4.981	72.7	29.6		
226R-1, 8-12 cm	EL-3	50.13	29.96	0.752	14.33	0.171	2.96	0.003	98.31	2.324	1.637	0.026	0.712	0.012	0.266	0.000	4.977	72.8	31.1		
226R-1, 8-12 cm	EL-3	50.26	29.73	0.837	14.02	0.237	3.18	0.011	98.28	2.331	1.625	0.029	0.697	0.016	0.286	0.001	4.985	70.8	35.9		
Elongate plagioclase rims																					
137-504B-																					
181M-1, 115-124 cm	EL-1r	51.93	28.91	0.945	14.10	0.277	3.34	0.009	99.51	2.377	1.560	0.033	0.691	0.019	0.296	0.001	4.976	70.0	36.7		
181M-1, 115-124 cm	EL-1r	52.01	28.54	0.971	14.04	0.245	3.31	0.023	99.14	2.388	1.545	0.034	0.691	0.017	0.295	0.001	4.971	70.0	33.3		
181M-1, 115-124 cm	EL-2r	52.94	28.23	0.875	13.37	0.173	3.77	0.000	99.36	2.420	1.521	0.030	0.655	0.012	0.334	0.000	4.972	66.2	28.1		
181M-1, 115-124 cm	EL-2r	53.37	28.31	1.173	13.29	0.189	3.85	0.015	100.20	2.421	1.514	0.040	0.646	0.013	0.339	0.001	4.972	65.6	24.2		
181M-1, 115-124 cm	EL-3r	53.30	29.03	1.081	13.03	0.193	3.92	0.028	100.58	2.406	1.545	0.037	0.630	0.013	0.343	0.002	4.976	64.6	26.1		
181M-1, 115-124 cm	EL-3r	53.12	28.59	1.096	13.21	0.194	3.82	0.000	100.02	2.412	1.531	0.038	0.643	0.013	0.336	0.000	4.972	65.7	26.0		
181M-1, 115-124 cm	EL-4r	51.78	29.45	0.883	13.98	0.233	3.26	0.010	99.59	2.365	1.586	0.030	0.684	0.016	0.289	0.001	4.971	70.3	34.3		
181M-1, 115-124 cm	EL-5r	52.14	29.77	1.180	14.03	0.152	3.36	0.000	100.64	2.360	1.588	0.040	0.681	0.010	0.295	0.000	4.974	69.8	20.3		
140-504B-																					
200R-1, 18-24 cm	EL-1r	50.83	29.58	0.808	14.44	0.264	3.20	0.015	99.13	2.339	1.604	0.028	0.712	0.018	0.285	0.001	4.988	71.3	39.3		
200R-1, 18-24 cm	EL-1r	52.17	28.82	0.763	13.86	0.185	3.32	0.000	99.13	2.392	1.557	0.026	0.681	0.013	0.295	0.000	4.964	69.7	32.4		
200R-1, 18-24 cm	EL-2r	56.29	25.61	0.941	9.13	0.070	5.84	0.016	97.90	2.581	1.384	0.032	0.449	0.005	0.519	0.001	4.971	46.3	12.8		
200R-1, 18-24 cm	EL-2r	54.14	26.59	1.096	10.64	0.114	5.24	0.037	97.86	2.501	1.448	0.038	0.527	0.008	0.469	0.002	4.992	52.8	17.1		
200R-1, 18-24 cm	EL-2r	52.36	28.27	1.016	11.97	0.196	4.57	0.000	98.39	2.416	1.538	0.035	0.592</td								

ophiolitic pyroxenes (Loucks, 1990). On the multivariate plot of Koloskov and Zharinov (1993) most analyses fall within the field for mid-ocean-ridge pyroxenes (Fig. 5). All four pyroxene types follow the same compositional curves in terms of Cr vs. Mg# (Fig. 6), Mn vs. Mg# (Fig. 7), and Ca vs. Mg# (Fig. 8). The highest Cr contents occur in phenocryst cores, but the cores of some microphenocrysts and

poikilitic pyroxenes have significant Cr₂O₃ contents (0.25%–0.50%) indicating that they nucleated and began to grow before the surrounding magma was depleted in Cr₂O₃.

Olivine phenocrysts were analyzed in two samples (Table 11), and are plotted along with the pyroxenes on Figures 6, 7, and 8. Core compositions range from Mg# 84 to Mg# 88. In most grains the outer part

Table 5. Skeletal plagioclase.

Sample	Grain	Weight percent							Cations per 8 oxygens										
		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O	Total	Si	Al	Fe	Ca	Mg	Na	K	Total	An%	Mg#
Skeletal plagioclase cores																			
137-504B-																			
181M-1, 115–124 cm	SK-1	57.27	25.99	1.110	10.06	0.064	5.83	0.026	100.35	2.570	1.375	0.038	0.484	0.004	0.507	0.002	4.979	48.7	10.2
181M-1, 115–124 cm	SK-1	57.39	25.94	1.014	9.75	0.050	5.97	0.005	100.12	2.578	1.374	0.034	0.469	0.003	0.520	0.000	4.978	47.4	8.9
181M-1, 115–124 cm	SK-1	57.06	25.93	1.171	10.13	0.050	5.94	0.034	100.32	2.564	1.374	0.040	0.488	0.003	0.518	0.002	4.989	48.4	7.8
181M-1, 115–124 cm	SK-1	57.45	26.11	0.946	9.77	0.060	6.01	0.031	100.37	2.574	1.379	0.032	0.469	0.004	0.522	0.002	4.982	47.3	11.2
181M-1, 115–124 cm	SK-2	58.70	26.36	1.157	9.48	0.035	5.81	0.020	101.56	2.592	1.372	0.038	0.449	0.002	0.498	0.001	4.952	47.4	5.7
181M-1, 115–124 cm	SK-2	57.34	27.32	1.064	10.41	0.076	5.33	0.017	101.56	2.539	1.426	0.036	0.494	0.005	0.458	0.001	4.959	51.8	12.4
181M-1, 115–124 cm	SK-2	58.76	26.32	1.160	9.38	0.036	5.76	0.026	101.44	2.596	1.371	0.039	0.444	0.002	0.493	0.002	4.947	47.3	5.8
181M-1, 115–124 cm	SK-3	51.21	29.35	0.813	14.31	0.218	3.06	0.004	98.96	2.356	1.592	0.028	0.706	0.015	0.273	0.000	4.970	72.1	34.7
181M-1, 115–124 cm	SK-4	51.71	29.89	1.023	14.21	0.148	3.15	0.014	100.14	2.351	1.602	0.035	0.692	0.010	0.278	0.001	4.969	71.3	22.3
181M-1, 115–124 cm	SK-4	50.53	30.61	0.763	14.90	0.286	2.69	0.006	99.78	2.309	1.649	0.026	0.730	0.020	0.238	0.000	4.972	75.4	42.6
181M-1, 115–124 cm	SK-4	51.09	30.78	0.853	14.73	0.276	2.83	0.009	100.56	2.316	1.645	0.029	0.715	0.019	0.248	0.001	4.972	74.2	39.1
181M-1, 115–124 cm	SK-4	51.03	30.42	1.073	14.42	0.189	2.89	0.000	100.02	2.325	1.634	0.037	0.704	0.013	0.255	0.000	4.967	73.4	25.9
181M-1, 115–124 cm	SK-5	51.67	29.68	0.765	14.62	0.262	2.90	0.004	99.89	2.355	1.595	0.026	0.714	0.018	0.256	0.000	4.963	73.6	40.4
181M-1, 115–124 cm	SK-5	51.20	29.61	0.968	14.38	0.217	3.14	0.000	99.51	2.346	1.599	0.033	0.706	0.015	0.279	0.000	4.977	71.7	30.7
Skeletal plagioclase rims																			
137-504B-																			
226R-1, 8–12 cm	SK-1	49.40	30.96	0.722	15.02	0.240	2.77	0.002	99.10	2.278	1.683	0.025	0.742	0.016	0.247	0.000	4.992	75.0	39.7
226R-1, 8–12 cm	SK-1	49.62	30.07	0.534	14.58	0.313	2.95	0.000	98.07	2.308	1.649	0.019	0.727	0.022	0.266	0.000	4.990	73.2	53.7
226R-1, 8–12 cm	SK-1	49.33	30.62	0.548	14.65	0.274	2.68	0.003	98.10	2.293	1.678	0.019	0.730	0.019	0.241	0.000	4.980	75.1	49.8
226R-1, 8–12 cm	SK-2	48.38	30.77	0.573	14.97	0.309	2.60	0.004	97.61	2.265	1.699	0.020	0.751	0.022	0.236	0.000	4.993	76.1	51.6
226R-1, 8–12 cm	SK-2	49.82	29.61	0.784	13.64	0.187	3.45	0.000	97.50	2.329	1.632	0.028	0.683	0.013	0.313	0.000	4.998	68.6	32.1
226R-1, 8–12 cm	SK-2	50.60	29.45	0.731	13.07	0.216	3.79	0.007	97.85	2.352	1.614	0.026	0.651	0.015	0.341	0.000	4.999	65.6	36.9
226R-1, 8–12 cm	SK-3	49.81	29.16	1.234	12.82	0.183	3.93	0.019	97.15	2.339	1.614	0.044	0.645	0.013	0.357	0.001	5.012	64.3	22.7
226R-1, 8–12 cm	SK-3	50.54	29.05	0.962	12.83	0.160	3.87	0.009	97.42	2.361	1.600	0.034	0.642	0.011	0.350	0.001	4.998	64.7	24.8
140-504B-																			
181M-1, 115–124 cm	SK-1r	58.82	25.81	0.789	9.08	0.008	6.17	0.036	100.71	2.616	1.353	0.026	0.433	0.001	0.532	0.002	4.962	44.8	2.0
181M-1, 115–124 cm	SK-5r	52.42	28.42	1.059	13.41	0.200	3.84	0.000	99.35	2.401	1.535	0.037	0.658	0.014	0.341	0.000	4.984	65.9	27.2
140-504B-																			
226R-1, 8–12 cm	SK-1r	49.74	30.05	0.734	14.68	0.251	3.11	0.000	98.57	2.306	1.642	0.026	0.729	0.017	0.280	0.000	5.000	72.3	40.3
226R-1, 8–12 cm	SK-1r	49.51	29.53	0.670	13.95	0.262	3.23	0.002	97.16	2.323	1.634	0.024	0.702	0.018	0.294	0.000	4.995	70.4	43.6
226R-1, 8–12 cm	SK-2r	58.50	23.92	0.824	6.67	0.005	7.64	0.076	97.62	2.677	1.290	0.028	0.327	0.000	0.678	0.004	5.005	32.4	1.2
226R-1, 8–12 cm	SK-2r	56.38	25.53	0.874	8.43	0.081	6.54	0.015	97.84	2.586	1.381	0.030	0.414	0.006	0.581	0.001	4.999	41.6	15.5
226R-1, 8–12 cm	SK-2r	52.76	27.81	1.198	11.20	0.118	4.78	0.008	97.88	2.442	1.517	0.042	0.555	0.008	0.429	0.000	4.993	56.4	16.3
226R-1, 8–12 cm	SK-3r	56.39	25.59	0.870	8.34	0.052	6.65	0.046	97.93	2.585	1.383	0.030	0.410	0.004	0.591	0.003	5.005	40.8	10.6
226R-1, 8–12 cm	SK-3r	53.11	28.04	1.182	12.23	0.119	4.54	0.019	99.23	2.430	1.513	0.041	0.600	0.008	0.402	0.001	4.995	59.8	16.6

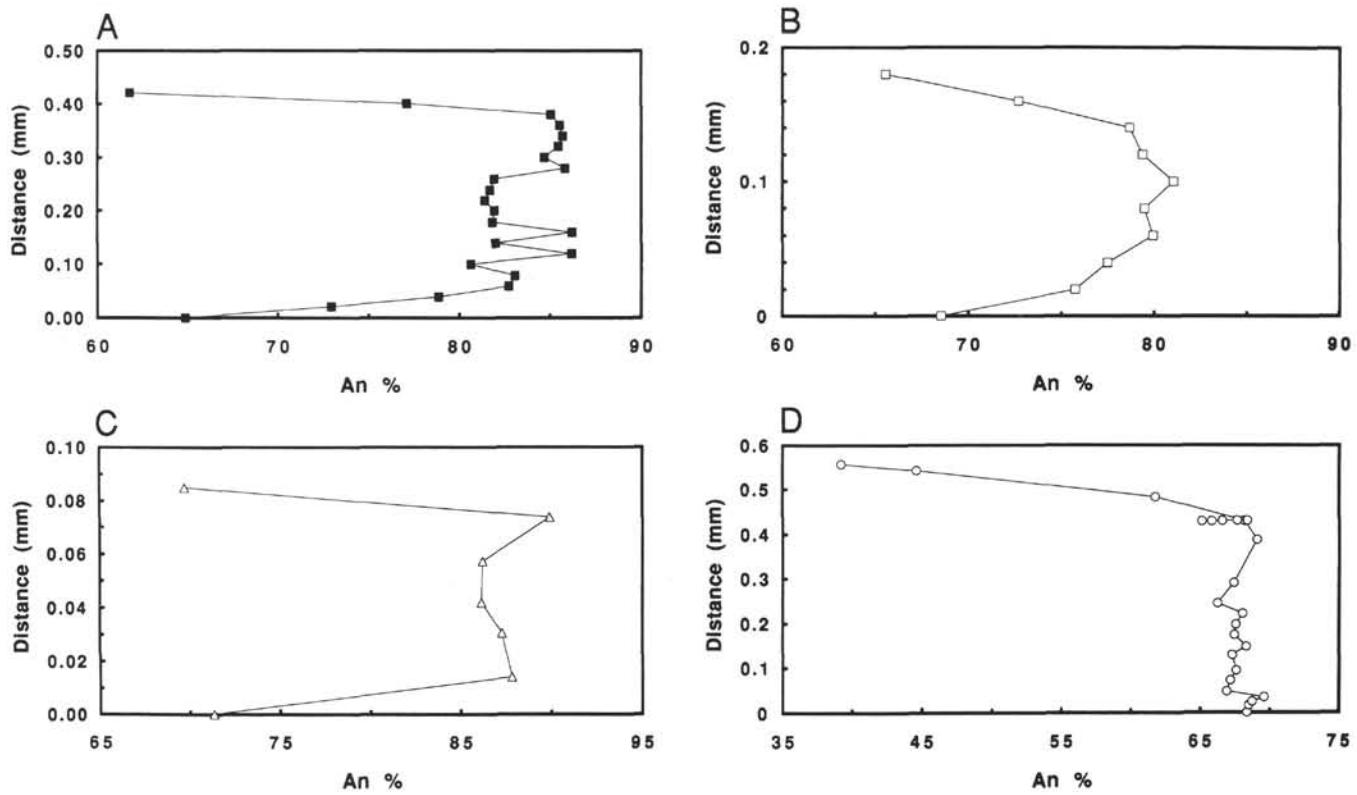


Figure 3. Zoning profiles in plagioclase crystals in Sample 140-504B-200R-1, 18–24 cm. A. Profile across the width of a plagioclase phenocryst. B. Profile across the width of a plagioclase microphenocryst. C. Profile across the width of an elongate plagioclase crystal. D. Profile along the length (and across the width at 0.43 mm) of an individual plagioclase lath in a radial cluster.

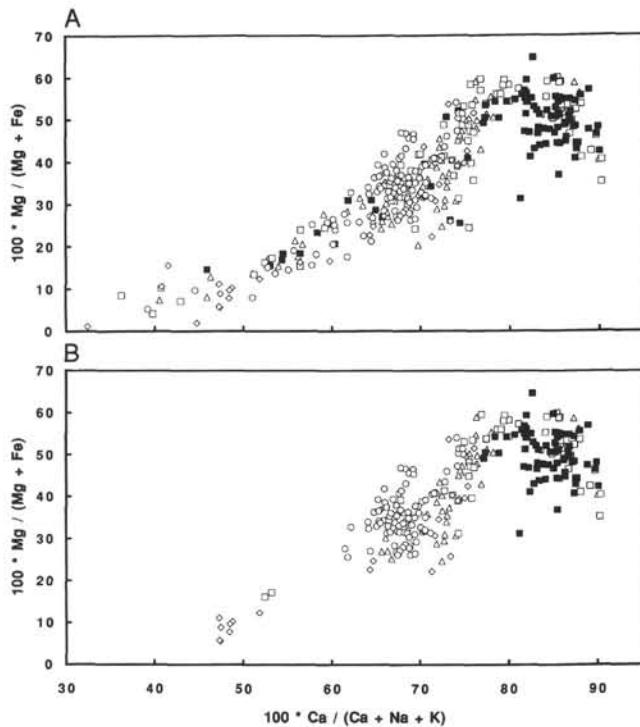


Figure 4. An% vs. Mg# for analyzed plagioclases in medium-grained diabase from Hole 504B. A. Core and rim compositions for plagioclase phenocrysts (filled squares); plagioclase microphenocrysts (open squares); elongate crystals (open triangles); skeletal crystals (open diamonds); and plagioclase radial clusters (open circles). B. Core compositions only, symbols as in (A).

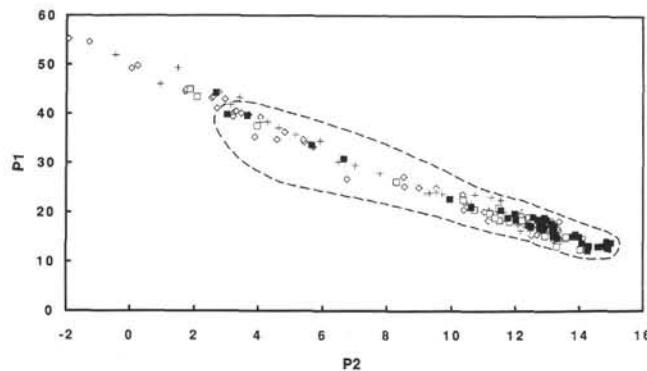


Figure 5. P1 vs. P2 multivariate plot for analyzed pyroxenes in medium-grained diabase from Hole 504B, where $P1 = 8 - 0.02 \text{SiO}_2 + 0.09 \text{TiO}_2 + 0.64 \text{Al}_2\text{O}_3 + 0.59 \text{Cr}_2\text{O}_3 + 1.35 \text{FeO} + 9.65 \text{MnO} - 0.50 \text{MgO} + 0.29 \text{CaO} - 2.26 \text{Na}_2\text{O}$, and $P2 = 8 - 0.93 \text{TiO}_2 + 0.07 \text{Al}_2\text{O}_3 + 1.23 \text{Cr}_2\text{O}_3 - 0.46 \text{FeO} + 1.74 \text{MnO} + 0.36 \text{MgO} + 0.10 \text{CaO} - 1.66 \text{Na}_2\text{O}$ (Koloskov and Zharinov, 1993). Samples fall in the field for mid-ocean-ridge and island-arc pyroxenes (dashed line). Symbols: pyroxene phenocrysts (filled squares); pyroxene microphenocrysts (open squares); ophitic pyroxene (crosses); poikilitic pyroxene (open diamonds).

is altered, so the original rim composition cannot be determined. One unaltered rim had a composition of Mg# 70.

DISCUSSION

The order of crystallization of plagioclase crystal types can be determined from the compositional data. Plagioclase phenocrysts were the initial liquidus phase, followed by plagioclase microphenocrysts, elongate to skeletal crystals, and finally plagioclase radial

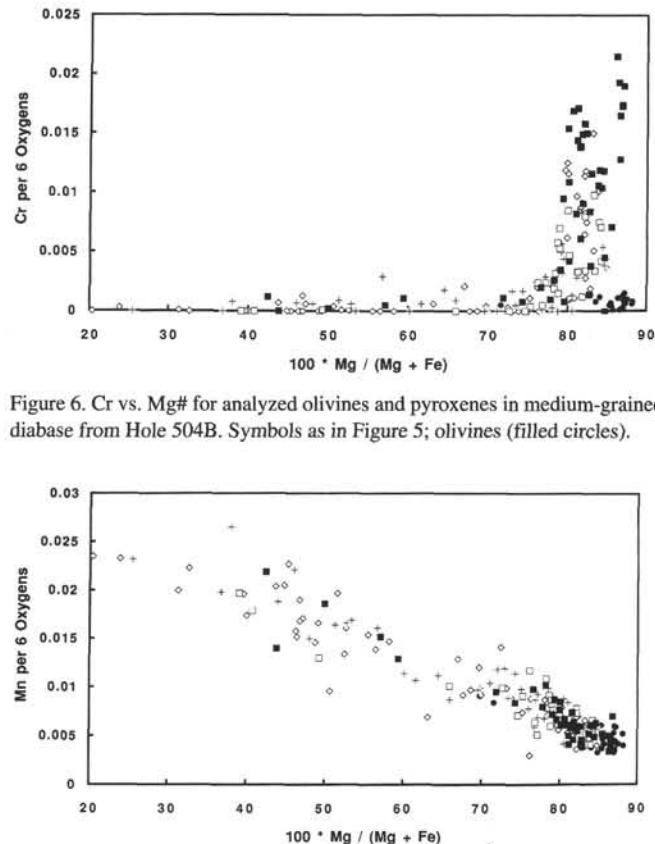


Figure 6. Cr vs. Mg# for analyzed olivines and pyroxenes in medium-grained diabase from Hole 504B. Symbols as in Figure 5; olivines (filled circles).

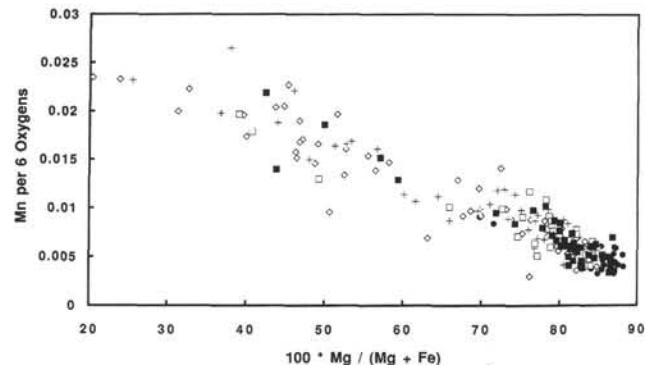


Figure 7. Mn vs. Mg# for analyzed olivines and pyroxenes in medium-grained diabase from Hole 504B. Symbols as in Figure 6.

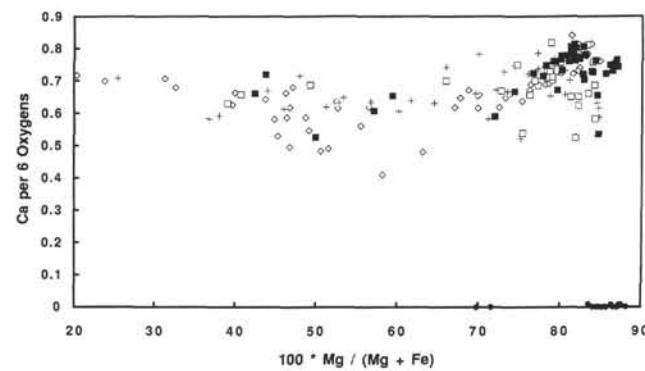


Figure 8. Ca vs. Mg# for analyzed olivines and pyroxenes in medium-grained diabase from Hole 504B. Symbols as in Figure 6.

clusters. The earlier formed crystals continued to grow as each successive stage was nucleated so that the zoning on the outer part of the earlier crystals is compositionally similar to the cores of later crystals. The one exception to this general relationship is the radial clusters, which are unzoned except at their tips. They appear to have grown simultaneously with their enclosing poikilitic pyroxene so that individual radial clusters were armored with pyroxene as they grew. It is likely that plagioclase crystallization depleted the surrounding magma in plagioclase components and enriched it in pyroxene components, so that the rapid growth of the radial plagioclase crystals initiated pyroxene growth in the adjacent melt. Pyroxene growth thus kept pace with plagioclase growth, resulting in a texture in which a single optically continuous pyroxene crystal encloses a cluster or splay of radial plagioclase crystals. The margins of the resulting pyroxene out-

Table 6. Plagioclase radial clusters.

Sample	Grain	Weight percent							Cations per 8 oxygens										
		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O	Total	Si	Al	Fe	Ca	Mg	Na	K	Total	An%	Mg#
Radial plagioclase splays																			
140-504B-																			
200R-1, 18-24 cm	SP-1	52.24	29.25	1.048	13.62	0.465	3.48	0.000	100.11	2.374	1.567	0.036	0.663	0.032	0.307	0.000	4.978	68.4	46.8
200R-1, 18-24 cm	SP-1	52.64	29.35	0.968	13.83	0.250	3.51	0.006	100.55	2.381	1.565	0.033	0.670	0.017	0.308	0.000	4.974	68.5	33.8
200R-1, 18-24 cm	SP-1	52.04	28.03	0.968	13.80	0.411	3.46	0.014	98.72	2.400	1.523	0.034	0.682	0.028	0.309	0.001	4.977	68.7	45.7
200R-1, 18-24 cm	SP-1	52.04	29.50	0.926	13.95	0.194	3.37	0.007	99.99	2.368	1.582	0.032	0.680	0.013	0.297	0.000	4.973	69.6	29.3
200R-1, 18-24 cm	SP-1	52.74	29.18	0.852	13.64	0.209	3.72	0.020	100.36	2.390	1.558	0.029	0.662	0.014	0.327	0.001	4.981	66.9	32.7
200R-1, 18-24 cm	SP-1	53.45	29.84	0.957	13.80	0.248	3.71	0.024	102.03	2.382	1.567	0.032	0.659	0.016	0.321	0.001	4.979	67.2	33.9
200R-1, 18-24 cm	SP-1	52.95	29.82	0.987	13.73	0.345	3.63	0.016	101.47	2.373	1.575	0.033	0.659	0.023	0.315	0.001	4.981	67.6	40.9
200R-1, 18-24 cm	SP-1	53.26	29.73	0.898	13.84	0.278	3.72	0.005	101.72	2.381	1.567	0.030	0.663	0.019	0.322	0.000	4.982	67.3	38.0
200R-1, 18-24 cm	SP-1	52.72	29.02	1.001	13.89	0.203	3.55	0.014	100.40	2.389	1.550	0.034	0.675	0.014	0.312	0.001	4.975	68.3	28.7
200R-1, 18-24 cm	SP-1	52.90	29.31	1.005	13.63	0.285	3.62	0.011	100.76	2.387	1.559	0.034	0.659	0.019	0.317	0.001	4.975	67.5	36.0
200R-1, 18-24 cm	SP-1	52.81	30.26	1.129	13.61	0.206	3.60	0.016	101.63	2.363	1.596	0.038	0.652	0.014	0.312	0.001	4.977	67.6	26.5
200R-1, 18-24 cm	SP-1	52.12	29.71	0.956	13.61	0.188	3.53	0.001	100.10	2.367	1.591	0.033	0.662	0.013	0.311	0.000	4.976	68.1	28.0
200R-1, 18-24 cm	SP-1	53.04	29.15	0.955	13.69	0.221	3.85	0.010	100.91	2.391	1.549	0.032	0.661	0.015	0.337	0.001	4.986	66.2	31.4
200R-1, 18-24 cm	SP-1	52.48	28.89	0.892	13.44	0.211	3.59	0.000	99.50	2.396	1.554	0.031	0.658	0.014	0.318	0.000	4.971	67.4	31.9
200R-1, 18-24 cm	SP-1	51.96	29.64	0.820	13.64	0.207	3.37	0.009	99.65	2.369	1.593	0.028	0.666	0.014	0.298	0.001	4.969	69.1	33.3
200R-1, 18-24 cm	SP-1	52.65	28.73	0.836	13.29	0.240	3.43	0.000	99.18	2.407	1.548	0.029	0.651	0.016	0.304	0.000	4.956	68.2	36.3
200R-1, 18-24 cm	SP-1	53.60	27.51	0.899	12.27	0.157	4.19	0.010	98.63	2.460	1.488	0.031	0.603	0.011	0.373	0.001	4.967	61.8	25.7
200R-1, 18-24 cm	SP-1	52.65	28.77	0.842	13.67	0.371	3.35	0.010	99.66	2.399	1.545	0.029	0.667	0.025	0.296	0.001	4.962	69.2	46.6
200R-1, 18-24 cm	SP-1	52.64	28.46	0.959	13.61	0.252	3.47	0.010	99.41	2.406	1.533	0.033	0.667	0.017	0.308	0.001	4.965	68.4	34.2
200R-1, 18-24 cm	SP-1	53.18	28.75	0.909	13.40	0.228	3.53	0.021	100.01	2.413	1.537	0.031	0.651	0.015	0.310	0.001	4.959	67.6	33.2
200R-1, 18-24 cm	SP-1	53.28	28.75	0.822	13.35	0.227	3.70	0.013	100.13	2.414	1.536	0.028	0.648	0.015	0.325	0.001	4.967	66.6	35.4
200R-1, 18-24 cm	SP-1	53.65	28.87	0.903	13.37	0.239	3.83	0.010	100.88	2.414	1.531	0.031	0.645	0.016	0.334	0.001	4.972	65.8	34.4
200R-1, 18-24 cm	SP-1	53.36	28.61	0.987	12.30	0.191	4.25	0.021	99.71	2.425	1.533	0.034	0.599	0.013	0.374	0.001	4.979	61.5	27.7
200R-1, 18-24 cm	SP-2	53.53	29.08	0.773	12.74	0.191	4.28	0.007	100.61	2.413	1.545	0.026	0.615	0.013	0.374	0.000	4.988	62.1	32.9
200R-1, 18-24 cm	SP-2	53.49	28.95	0.979	12.67	0.184	3.87	0.019	100.16	2.419	1.543	0.033	0.614	0.012	0.339	0.001	4.963	64.3	27.1
200R-1, 18-24 cm	SP-2	53.23	29.36	0.805	13.14	0.232	3.94	0.011	100.72	2.399	1.559	0.027	0.634	0.016	0.344	0.001	4.980	64.8	36.4
200R-1, 18-24 cm	SP-2	52.76	28.98	0.891	13.22	0.232	4.08	0.020	100.19	2.395	1.550	0.030	0.643	0.016	0.359	0.001	4.995	64.1	34.0
200R-1, 18-24 cm	SP-2	52.05	29.15	0.902	13.46	0.211	3.72	0.020	99.51	2.379	1.570	0.031	0.659	0.014	0.330	0.001	4.985	66.6	31.7
200R-1, 18-24 cm	SP-2	52.80	29.59	0.920	13.23	0.215	3.48	0.023	100.26	2.389	1.578	0.031	0.641	0.015	0.305	0.001	4.960	67.7	31.6
200R-1, 18-24 cm	SP-2	52.45	30.23	1.021	13.56	0.238	3.49	0.000	100.99	2.361	1.603	0.035	0.654	0.016	0.304	0.000	4.973	68.2	31.6
200R-1, 18-24 cm	SP-2	52.40	29.59	1.099	13.52	0.221	3.66	0.008	100.50	2.372	1.579	0.037	0.656	0.015	0.321	0.000	4.981	67.1	28.5
200R-1, 18-24 cm	SP-2	52.39	29.35	0.925	13.35	0.243	3.91	0.011	100.17	2.379	1.571	0.032	0.649	0.016	0.344	0.001	4.992	65.3	34.2
200R-1, 18-24 cm	SP-2	52.46	29.17	0.891	13.51	0.319	3.53	0.008	99.89	2.386	1.564	0.031	0.658	0.022	0.311	0.000	4.972	67.9	41.5
200R-1, 18-24 cm	SP-2	52.31	29.88	1.077	13.63	0.300	3.65	0.004	100.84	2.361	1.589	0.037	0.659	0.020	0.319	0.000	4.986	67.4	35.6
200R-1, 18-24 cm	SP-3	50.62	29.38	1.047	13.77	0.300	3.26	0.030	98.41	2.344	1.604	0.036	0.683	0.021	0.293	0.002	4.983	69.9	36.2
200R-1, 18-24 cm	SP-3	50.57	30.84	0.936	13.76	0.183	3.45	0.002	99.75	2.310	1.661	0.032	0.674	0.012	0.306	0.000	4.996	68.8	27.9
200R-1, 18-24 cm	SP-3	50.43	30.26	0.849	13.92	0.209	3.28	0.008	98.96	2.322	1.643	0.029	0.687	0.014	0.293	0.000	4.989	70.1	32.8
200R-1, 18-24 cm	SP-3	50.25	29.21	1.040	13.90	0.187	3.46	0.009	98.05	2.339	1.603	0.036	0.693	0.013	0.312	0.001	4.998	68.9	26.3
200R-1, 18-24 cm	SP-3	50.11	29.19	0.906	13.98	0.210	3.12	0.007	97.52	2.342	1.608	0.032	0.700	0.015	0.283	0.000	4.980	71.2	31.5
200R-1, 18-24 cm	SP-3	50.85	29.75	0.876	13.91	0.205	3.24	0.003	98.83	2.343	1.616	0.030	0.687	0.014	0.289	0.000	4.979	70.3	31.7
200R-1, 18-24 cm	SP-3	50.36	28.72	0.884	13.84	0.209	3.20	0.003	97.22	2.359	1.586	0.031	0.695	0.015	0.291	0.000	4.977	70.5	31.9
200R-1, 18-24 cm	SP-3	49.97	29.13	0.908	13.82	0.248	3.36	0.008	97.44	2.339	1.607	0.032	0.693	0.017	0.305	0.000	4.994	69.4	35.1
200R-1, 18-24 cm	SP-3	50.88	28.93	0.986	13.76	0.234	3.17	0.015	98.88	2.342	1.619	0.034	0.679	0.016	0.283	0.001	4.973	70.5	32.0
200R-1, 18-24 cm	SP-3	51.16	28.85	0.875	13.69	0.282	3.21	0.007	98.07	2.372	1.577	0.031	0.680	0.019	0.289	0.000	4.968	70.2	39.0
200R-1, 18-24 cm	SP-3	51.42	28.76	1.013	13.63	0.231	3.32	0.000	98.38	2.378	1.568	0.035	0.675	0.016	0.298	0.000	4.970	69.4	31.1
200R-1, 18-24 cm	SP-3	50.74	28.74	0.958	13.57	0.274	3.41	0.000	97.69	2.365	1.579	0.034	0.678	0.019	0.308	0.000	4.983	68.7	36.2
200R-1, 18-24 cm	SP-4	51.07	28.70	0.944	13.42	0.422	3.52	0.001	98.08	2.370	1.570	0.033	0.667	0.029	0.317	0.000	4.987	67.8	47.0
200R-1, 18-24 cm	SP-4	50.93	28.58	0.835	13.29	0.193	3.37	0.002	97.20	2.381	1.575	0.029	0.666	0.013	0.305	0.000	4.970	68.5	31.4
200R-1, 18-24 cm	SP-4	51.97	28.51	0.813	13.54	0.235	3.41	0.012	98.49	2.397	1.550	0.028	0.669	0.016	0.305	0.001	4.967	68.6	36.4
200R-1, 18-24 cm	SP-4	53.13	27.77	0.902	12.13	0.219	3.73	0.018	97.89	2.452	1.511	0.031	0.600						

Table 6 (continued).

Sample	Grain	Weight percent							Cations per 8 oxygens										
		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O	Total	Si	Al	Fe	Ca	Mg	Na	K	Total	An%	Mg#
Radial plagioclase splay tips																			
200R-1, 18-24 cm	SP-1t	54.84	27.70	1.315	11.58	0.123	4.67	0.013	100.24	2.475	1.473	0.045	0.560	0.008	0.409	0.001	4.971	57.8	15.6
200R-1, 18-24 cm	SP-1t	54.39	28.39	1.050	12.06	0.137	4.40	0.020	100.45	2.450	1.508	0.036	0.582	0.009	0.385	0.001	4.971	60.1	20.5
200R-1, 18-24 cm	SP-1t	54.23	28.24	0.896	12.18	0.163	4.44	0.025	100.17	2.451	1.504	0.030	0.590	0.011	0.389	0.001	4.977	60.2	26.5
200R-1, 18-24 cm	SP-1t	53.53	27.91	1.055	12.09	0.168	4.38	0.009	99.14	2.446	1.503	0.036	0.592	0.011	0.388	0.001	4.978	60.4	24.0
200R-1, 18-24 cm	SP-1t	53.71	28.33	1.099	12.16	0.186	4.41	0.015	99.91	2.437	1.515	0.038	0.591	0.013	0.388	0.001	4.982	60.3	25.1
200R-1, 18-24 cm	SP-1t	54.61	28.44	1.102	12.02	0.193	4.50	0.023	100.88	2.451	1.504	0.037	0.578	0.013	0.391	0.001	4.975	59.5	25.8
200R-1, 18-24 cm	SP-1t	53.94	27.91	1.056	11.77	0.180	4.73	0.020	99.59	2.453	1.496	0.036	0.573	0.012	0.417	0.001	4.990	57.8	25.2
200R-1, 18-24 cm	SP-1t	54.36	27.45	1.260	11.60	0.141	4.59	0.023	99.40	2.474	1.472	0.043	0.565	0.010	0.405	0.001	4.970	58.3	18.1
200R-1, 18-24 cm	SP-1t	56.14	27.52	1.815	10.67	0.145	5.08	0.035	101.41	2.501	1.445	0.061	0.509	0.010	0.439	0.002	4.966	53.6	13.7
200R-1, 18-24 cm	SP-1t	56.14	27.44	1.412	10.92	0.127	5.38	0.038	101.46	2.502	1.441	0.047	0.521	0.008	0.465	0.002	4.987	52.7	15.1
200R-1, 18-24 cm	SP-1t	56.03	27.40	1.300	11.12	0.155	4.87	0.026	100.91	2.506	1.444	0.044	0.533	0.010	0.422	0.001	4.962	55.7	19.1
200R-1, 18-24 cm	SP-1t	58.43	25.83	1.010	9.02	0.055	6.18	0.016	100.54	2.606	1.357	0.034	0.431	0.004	0.534	0.001	4.966	44.6	9.7
200R-1, 18-24 cm	SP-1t	59.55	25.12	0.892	7.91	0.025	6.74	0.047	100.29	2.653	1.319	0.030	0.378	0.002	0.582	0.003	4.966	39.2	5.3
200R-1, 18-24 cm	SP-2t	54.84	27.70	1.315	11.58	0.123	4.67	0.013	100.24	2.475	1.473	0.045	0.560	0.008	0.409	0.001	4.971	57.8	15.6
200R-1, 18-24 cm	SP-2t	54.39	28.39	1.050	12.06	0.137	4.40	0.020	100.45	2.450	1.508	0.036	0.582	0.009	0.385	0.001	4.971	60.1	20.5
200R-1, 18-24 cm	SP-2t	54.23	28.24	0.896	12.18	0.163	4.44	0.025	100.17	2.451	1.504	0.030	0.590	0.011	0.389	0.001	4.977	60.2	26.5
200R-1, 18-24 cm	SP-2t	53.53	27.91	1.055	12.09	0.168	4.38	0.009	99.14	2.446	1.503	0.036	0.592	0.011	0.388	0.001	4.978	60.4	24.0
200R-1, 18-24 cm	SP-2t	53.71	28.33	1.099	12.16	0.186	4.41	0.015	99.91	2.437	1.515	0.038	0.591	0.013	0.388	0.001	4.982	60.3	25.1
200R-1, 18-24 cm	SP-2t	54.61	28.44	1.102	12.02	0.193	4.50	0.023	100.88	2.451	1.504	0.037	0.578	0.013	0.391	0.001	4.975	59.5	25.8
200R-1, 18-24 cm	SP-2t	53.94	27.91	1.056	11.77	0.180	4.73	0.020	99.59	2.453	1.496	0.036	0.573	0.012	0.417	0.001	4.990	57.8	25.2
200R-1, 18-24 cm	SP-2t	54.36	27.45	1.260	11.60	0.141	4.59	0.000	99.40	2.474	1.472	0.043	0.565	0.010	0.405	0.000	4.970	58.3	18.1
200R-1, 18-24 cm	SP-2t	56.39	27.10	1.658	10.20	0.073	5.40	0.012	100.83	2.522	1.429	0.056	0.489	0.005	0.468	0.001	4.970	51.0	8.0
200R-1, 18-24 cm	SP-2t	56.14	27.52	1.815	10.67	0.145	5.08	0.035	101.41	2.501	1.445	0.061	0.509	0.010	0.439	0.002	4.966	53.6	13.7
200R-1, 18-24 cm	SP-2t	56.14	27.44	1.412	10.92	0.127	5.38	0.038	101.46	2.502	1.441	0.047	0.521	0.008	0.465	0.002	4.987	52.7	15.1
200R-1, 18-24 cm	SP-2t	56.03	27.40	1.300	11.12	0.155	4.87	0.026	100.91	2.506	1.444	0.044	0.533	0.010	0.422	0.001	4.962	55.7	19.1
200R-1, 18-24 cm	SP-2t	58.43	25.83	1.010	9.02	0.055	6.18	0.016	100.54	2.606	1.357	0.034	0.431	0.004	0.534	0.001	4.966	44.6	9.7
200R-1, 18-24 cm	SP-2t	59.55	25.12	0.892	7.91	0.025	6.74	0.047	100.29	2.653	1.319	0.030	0.378	0.002	0.582	0.003	4.966	39.2	5.3
226R-1, 8-12 cm	SP-3t	53.49	28.31	1.169	12.31	0.126	4.20	0.026	99.64	2.434	1.519	0.040	0.600	0.009	0.371	0.002	4.973	61.7	17.6
226R-1, 8-12 cm	SP-3t	52.82	27.49	1.059	12.67	0.156	4.00	0.024	98.22	2.440	1.498	0.037	0.627	0.011	0.358	0.001	4.972	63.6	22.6
226R-1, 8-12 cm	SP-3t	52.25	27.82	1.047	12.98	0.143	3.96	0.009	98.21	2.418	1.518	0.036	0.644	0.010	0.355	0.001	4.982	64.4	21.3
226R-1, 8-12 cm	SP-3t	52.88	28.16	0.960	13.12	0.178	3.96	0.014	99.28	2.420	1.519	0.033	0.644	0.012	0.352	0.001	4.980	64.6	26.9
226R-1, 8-12 cm	SP-3t	54.97	26.47	1.362	11.08	0.117	4.98	0.022	98.99	2.510	1.425	0.047	0.542	0.008	0.441	0.001	4.975	55.1	14.5
226R-1, 8-12 cm	SP-3t	53.55	27.44	0.973	12.79	0.171	4.12	0.016	99.06	2.453	1.481	0.034	0.628	0.012	0.366	0.001	4.973	63.1	25.8
226R-1, 8-12 cm	SP-3t	53.05	28.07	0.999	13.01	0.201	3.72	0.015	99.06	2.429	1.515	0.034	0.638	0.014	0.330	0.001	4.962	65.8	28.5

line the tips of the plagioclase crystals, suggesting that when the crystallization of the individual plagioclase crystals ceased, the driving force for local pyroxene crystallization also ended.

In general, the length of plagioclase grains decreased from the phenocryst stage to the microphenocryst stage, after which it increased and then remained relatively constant from the elongate stage to the skeletal stage, and to the radial growth stage. As crystallization proceeded, the volume of individual grains decreased and the aspect ratio increased. Pyroxene crystal size also initially decreased from the phenocryst stage to the microphenocryst stage and then increased from the microphenocryst stage to the ophitic stage and from the ophitic stage to the poikilitic stage. The volume of individual pyroxene grains, in general, increased as crystallization proceeded, and the aspect ratio remained relatively constant. The plagioclase nucleation rate appears to have increased as crystallization proceeded while the pyroxene nucleation rate decreased. Gray (1970) reports similar changes in the relative nucleation rates of plagioclase and pyroxene from the margins of thick dikes towards their centers (pyroxene nucleation rates decrease more rapidly than plagioclase nucleation rates; plagioclase nucleation/pyroxene nucleation increases), resulting in ophitic and poikilitic textures in the cores of larger dikes. The textures and grain-sizes in the diabase samples recovered on Legs 137 and 140 are compatible with crystallization in the cores of thick dikes or thin sills.

Experimental studies suggest that crystals with acicular, curved, skeletal, or branching morphologies grow under conditions where the growth rate is high relative to the diffusion rate (Kirkpatrick, 1975). These conditions can occur in settings where melt becomes supersaturated as a result of a significant degree of undercooling. The change from equant crystals to elongate, skeletal, curved, and finally branching crystals is indicative of a system with an increasing degree of undercooling as crystallization proceeded (Dowty, 1980; Lofgren, 1980). Experimental studies of plagioclase crystallization from plagioclase-H₂O melts suggest cooling rates on the order of >10°C per hr and undercooling in excess of 100°C to produce the degree of supersaturation necessary to form elongate crystals, and rates >50°C per hr and

undercooling in excess of 200°C to produce the degree of supersaturation necessary to form branching crystals (Lofgren, 1974; Lofgren and Donaldson, 1975). Experimental studies of lunar basalts indicate that cooling rates of 2 to 10°C per hr will produce elongate to skeletal pyroxene crystals, and that cooling rates >10°C per hr will produce dendritic to spherulitic pyroxene crystals (Lofgren, 1980). Movement within a melt increases the nucleation rate so that larger degrees of undercooling are required to produce supersaturation textures in a moving magma than in a stagnant magma (Kouchi et al., 1986). In experimental studies of oceanic tholeiites, subophitic textures similar to those observed in the 504B diabase, but without the splays of radial plagioclase crystals, were produced at cooling rates of 2°C per hr in samples containing preexisting plagioclase nuclei (Lofgren 1980, 1983). In the 504B diabase, the degree of supersaturation in plagioclase appears to have increased with crystallization, suggesting that the melts did not contain preexisting plagioclase nuclei. The 504B diabase textures, therefore, indicate that individual dikes in the Hole 504B sequence at depths up to 1.7 km below seafloor, at time of emplacement, probably cooled at rates in excess of 2° per hr, and may have solidified in a matter of a few hours or days.

Very little correlation is observed between crystal morphology and crystal composition for pyroxene in the medium-grained diabase of Hole 504B. Phenocrysts, microphenocrysts, ophitic pyroxene, and poikilitic pyroxene all follow the same general zoning patterns with core compositions appropriate for crystallization in situ from tholeiitic melt. The fact that the crystals are strongly zoned and preserve fine scale zoning patterns, clearly demonstrates that original compositional differences have not been removed by post-crystallization re-equilibration. There is no evidence that the large Cr-rich phenocrysts were formed elsewhere and subsequently incorporated in the magma that fed these dikes. Pyroxene and olivine crystals in the 504B diabase do not have the elongate, skeletal, or branching textures (cellular morphologies) characteristic of growth under supersaturation conditions. Experimental studies, however, indicate that pyroxene and olivine develop cellular morphologies at similar or lower

degrees of supersaturation than that necessary to produce cellular morphologies in plagioclase. The magmas from which the 504B diabase crystallized must have been emplaced with preexisting olivine and pyroxene nuclei, but with few preexisting plagioclase nuclei. As a result, pyroxene and olivine crystallization and morphology were controlled by their growth rates while plagioclase crystallization and morphology was controlled by its nucleation rate. Variations in nucleation rates between minerals can effect the order in which they appear upon cooling (Gibb, 1974; Tsuchiyama, 1983), and therefore, the order in which they are fractionated and the relative amounts removed by fractional crystallization. The suppression of plagioclase nucleation and crystallization relative to that of pyroxene and olivine could provide a mechanism by which the actual fractionation assemblage is more pyroxene-rich and plagioclase-poor than that predicted from thermodynamic models (see Naslund et al., this volume), or that observed in isothermal crystallization experiments.

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* Abbreviations for names of organizations and publications in ODP reference lists follow the style given in *Chemical Abstracts Service Source Index* (published by American Chemical Society).

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Table 7. Pyroxene phenocrysts.

Sample	Grain	Weight percent										Cations per 6 oxygens										
		SiO ₂	Al ₂ O ₃	FeO	MnO	MgO	CaO	Na ₂ O	TiO ₂	Cr ₂ O ₃	Total	Si	Al	Fe	Mn	Mg	Ca	Na	Ti	Cr	Total	Mg#
137-504B-																						
181M-1, 115–124 cm	PH-1	52.77	3.39	6.21	0.200	18.23	18.73	0.206	0.494	0.416	100.65	1.912	0.145	0.188	0.006	0.985	0.727	0.015	0.014	0.012	4.003	84.0
181M-1, 115–124 cm	PH-1	53.13	3.14	6.36	0.171	18.43	18.89	0.226	0.457	0.373	101.18	1.917	0.134	0.192	0.005	0.991	0.730	0.016	0.012	0.011	4.007	83.8
181M-1, 115–124 cm	PH-1	53.41	2.80	6.51	0.160	19.90	16.98	0.224	0.427	0.413	100.83	1.924	0.119	0.196	0.005	1.068	0.655	0.016	0.012	0.012	4.007	84.5
181M-1, 115–124 cm	PH-1	53.74	1.59	7.17	0.205	22.15	13.73	0.150	0.208	0.158	99.10	1.956	0.068	0.218	0.006	1.202	0.536	0.011	0.006	0.005	4.007	84.6
181M-1, 115–124 cm	PH-1	51.32	3.05	6.15	0.191	18.48	19.31	0.235	0.400	0.357	99.49	1.891	0.132	0.190	0.006	1.015	0.763	0.017	0.011	0.010	4.035	84.3
181M-1, 115–124 cm	PH-1	52.57	2.66	6.99	0.150	18.93	18.01	0.223	0.344	0.131	100.01	1.921	0.115	0.214	0.005	1.031	0.705	0.016	0.010	0.004	4.019	82.8
181M-1, 115–124 cm	PH-1r	52.91	2.58	8.52	0.216	18.68	17.22	0.179	0.430	0.027	100.76	1.926	0.111	0.259	0.007	1.013	0.672	0.013	0.012	0.001	4.013	79.6
181M-1, 115–124 cm	PH-2	53.43	2.69	4.99	0.145	18.47	19.77	0.265	0.221	0.609	100.58	1.932	0.115	0.151	0.004	0.995	0.766	0.019	0.006	0.017	4.005	86.8
181M-1, 115–124 cm	PH-2	53.30	2.80	5.04	0.229	18.55	19.56	0.253	0.261	0.605	100.60	1.927	0.119	0.152	0.007	1.000	0.758	0.018	0.007	0.017	4.006	86.8
181M-1, 115–124 cm	PH-2	53.10	2.91	4.97	0.116	18.69	19.16	0.242	0.285	0.663	100.14	1.926	0.124	0.151	0.004	1.010	0.745	0.017	0.008	0.019	4.003	87.0
181M-1, 115–124 cm	PH-2	52.93	2.66	5.18	0.153	18.69	19.16	0.253	0.270	0.443	99.74	1.930	0.114	0.158	0.005	1.016	0.748	0.018	0.007	0.013	4.009	86.6
181M-1, 115–124 cm	PH-2r	50.03	1.46	20.63	0.424	9.04	17.24	0.271	0.909	0.000	100.01	1.951	0.067	0.673	0.014	0.526	0.721	0.021	0.027	0.000	3.999	43.9
181M-1, 115–124 cm	PH-3r	53.24	2.42	6.87	0.196	18.45	18.50	0.229	0.368	0.047	100.32	1.938	0.104	0.209	0.006	1.001	0.722	0.016	0.010	0.001	4.007	82.7
181M-1, 115–124 cm	PH-3	53.06	3.27	5.29	0.164	18.35	19.36	0.256	0.291	0.752	100.80	1.916	0.139	0.160	0.005	0.988	0.749	0.018	0.008	0.022	4.004	86.1
181M-1, 115–124 cm	PH-3	52.93	2.83	5.07	0.129	18.33	19.23	0.216	0.260	0.573	99.57	1.932	0.122	0.155	0.004	0.997	0.752	0.015	0.007	0.017	4.000	86.6
181M-1, 115–124 cm	PH-3	53.27	2.65	5.32	0.112	18.96	18.85	0.222	0.239	0.675	100.29	1.930	0.113	0.161	0.003	1.024	0.732	0.016	0.007	0.019	4.005	86.4
181M-1, 115–124 cm	PH-3	53.41	2.13	5.79	0.168	19.22	18.54	0.191	0.257	0.247	99.95	1.943	0.091	0.176	0.005	1.042	0.723	0.014	0.007	0.007	4.008	85.5
140-504B-																						
200R-1, 18–24 cm	PH-1	51.14	3.80	6.25	0.130	16.83	20.42	0.241	0.524	0.289	99.64	1.886	0.165	0.193	0.004	0.925	0.807	0.017	0.015	0.008	4.021	82.8
200R-1, 18–24 cm	PH-1	49.91	4.78	6.60	0.183	16.30	19.99	0.294	0.808	0.471	99.33	1.852	0.209	0.205	0.006	0.901	0.795	0.021	0.023	0.014	4.025	81.5
200R-1, 18–24 cm	PH-1	49.71	4.63	6.57	0.157	15.94	20.12	0.250	0.787	0.487	98.66	1.858	0.204	0.205	0.005	0.888	0.806	0.018	0.022	0.014	4.020	81.2
200R-1, 18–24 cm	PH-1	50.89	4.28	6.74	0.148	16.94	19.32	0.230	0.547	0.511	99.60	1.877	0.186	0.208	0.005	0.931	0.764	0.016	0.015	0.015	4.016	81.8
200R-1, 18–24 cm	PH-1	49.90	4.65	6.70	0.130	16.29	19.64	0.183	0.630	0.581	98.71	1.861	0.205	0.209	0.004	0.905	0.785	0.013	0.018	0.017	4.017	81.2
200R-1, 18–24 cm	PH-2	50.12	4.29	6.98	0.213	16.33	19.50	0.238	0.672	0.574	98.92	1.868	0.189	0.218	0.007	0.907	0.779	0.017	0.019	0.017	4.019	80.6
200R-1, 18–24 cm	PH-2	50.62	3.97	7.38	0.244	16.57	19.29	0.215	0.622	0.526	99.43	1.878	0.174	0.229	0.008	0.916	0.767	0.016	0.017	0.015	4.018	80.0
200R-1, 18–24 cm	PH-2	50.25	3.45	7.40	0.267	16.72	19.39	0.270	0.608	0.370	98.72	1.881	0.152	0.232	0.009	0.932	0.778	0.020	0.017	0.011	4.031	80.1
200R-1, 18–24 cm	PH-2	50.50	3.22	7.84	0.274	16.95	18.98	0.211	0.623	0.323	98.93	1.887	0.142	0.245	0.009	0.944	0.760	0.015	0.018	0.010	4.028	79.4
200R-1, 18–24 cm	PH-2	50.78	3.16	7.91	0.228	16.79	19.04	0.257	0.672	0.118	98.96	1.895	0.139	0.247	0.007	0.934	0.761	0.019	0.019	0.004	4.024	79.1
200R-1, 18–24 cm	PH-2	51.09	2.96	8.37	0.324	16.90	18.76	0.259	0.611	0.087	99.36	1.901	0.130	0.260	0.010	0.937	0.748	0.019	0.017	0.003	4.025	78.3
200R-1, 18–24 cm	PH-2	50.70	2.67	8.74	0.250	17.25	17.73	0.224	0.526	0.032	98.12	1.909	0.118	0.275	0.008	0.968	0.715	0.016	0.015	0.001	4.025	77.9
200R-1, 18–24 cm	PH-2	50.62	2.85	9.15	0.307	16.87	18.00	0.224	0.597	0.069	98.69	1.900	0.126	0.287	0.010	0.944	0.724	0.016	0.017	0.002	4.027	76.7
200R-1, 18–24 cm	PH-2	51.36	2.54	10.56	0.266	17.17	16.72	0.283	0.630	0.027	99.56	1.914	0.112	0.329	0.008	0.953	0.668	0.020	0.018	0.001	4.023	74.3
200R-1, 18–24 cm	PH-2	51.24	2.12	12.30	0.300	17.67	14.70	0.254	0.548	0.038	99.16	1.922	0.094	0.386	0.010	0.988	0.591	0.019	0.016	0.001	4.024	71.9
200R-1, 18–24 cm	PH-2r	48.74	1.27	22.74	0.652	9.43	15.59	0.216	0.789	0.037	99.47	1.931	0.059	0.753	0.022	0.557	0.662	0.017	0.024	0.001	4.024	42.5
200R-1, 18–24 cm	PH-2r	51.01	1.82	17.89	0.473	13.38	14.94	0.407	0.773	0.016	100.70	1.936	0.081	0.568	0.015	0.757	0.607	0.030	0.022	0.001	4.016	57.1
226R-1, 8–12 cm	PH-1	51.84	3.18	6.35	0.236	15.81	20.51	0.213	0.585	0.474	99.20	1.920	0.139	0.197	0.007	0.873	0.814	0.015	0.016	0.014	3.995	81.6
226R-1, 8–12 cm	PH-1	52.66	3.24	6.46	0.208	16.32	20.55	0.301	0.574	0.315	100.62	1.921	0.139	0.197	0.006	0.887	0.803	0.021	0.016	0.009	4.000	81.8
226R-1, 8–12 cm	PH-1	53.66	2.92	6.83	0.199	16.41	19.52	0.269	0.453	0.286	100.54	1.951	0.125	0.208	0.006	0.889	0.761	0.019	0.012	0.008	3.979	81.1
226R-1, 8–12 cm	PH-1	52.76	2.89	6.71	0.187	16.66	19.61	0.243	0.426	0.209	99.70	1.938	0.125	0.206	0.006	0.912	0.772	0.017	0.012	0.006	3.994	81.6
226R-1, 8–12 cm	PH-1	52.83	2.76	7.55	0.195	17.14	18.66	0.230	0.438	0.146	99.95	1.937	0.120	0.232	0.006	0.937	0.733	0.016	0.012	0.004	3.997	80.2
226R-1, 8–12 cm	PH-1r	50.89	1.16	21.68	0.570	12.17	12.73	0.242	0.748	0.008	100.21	1.962	0.053	0.699	0.019	0.699	0.526	0.018	0.022	0.000	3.999	50.0
226R-1, 8–12 cm	PH-2	52.27	3.84	6.29	0.178	16.38	19.62	0.320	0.523	0.519	99.93	1.914	0.166	0.193	0.006	0.894	0.770	0.023	0.014	0.015	3.993	82.3
226R-1, 8–12 cm	PH-2	51.87	4.01	6.40	0.191	16.40	19.66	0.260	0.599	0.544	99.92	1.902	0.173	0.196	0.006	0.896	0.772	0.019	0.017	0.016	3.997	82.

Table 8. Pyroxene microphenocrysts.

Sample	Grain	Weight percent										Cations per 6 oxygens										
		SiO ₂	Al ₂ O ₃	FeO	MnO	MgO	CaO	Na ₂ O	TiO ₂	Cr ₂ O ₃	Total	Si	Al	Fe	Mn	Mg	Ca	Na	Ti	Cr	Total	Mg#
137-504B-																						
181M-1, 115–124 cm	MP-1r	50.52	1.69	19.83	0.400	10.83	16.74	0.299	0.856	0.004	101.17	1.935	0.076	0.635	0.013	0.618	0.687	0.022	0.025	0.000	4.013	49.3
181M-1, 115–124 cm	MP-1r	53.25	1.29	11.55	0.293	19.81	13.71	0.182	0.327	0.015	100.43	1.953	0.056	0.354	0.009	1.083	0.539	0.013	0.009	0.000	4.016	75.4
181M-1, 115–124 cm	MP-1	54.46	1.25	8.63	0.242	21.84	13.55	0.144	0.235	0.043	100.39	1.967	0.053	0.261	0.007	1.175	0.524	0.010	0.006	0.001	4.005	81.9
181M-1, 115–124 cm	MP-1	52.55	3.33	6.08	0.132	17.85	19.43	0.253	0.374	0.262	100.26	1.914	0.143	0.185	0.004	0.969	0.758	0.018	0.010	0.008	4.009	84.0
181M-1, 115–124 cm	MP-1	52.92	2.59	6.51	0.215	19.40	17.59	0.165	0.263	0.248	99.90	1.928	0.111	0.198	0.007	1.054	0.687	0.012	0.007	0.007	4.011	84.2
181M-1, 115–124 cm	MP-1	54.07	1.38	7.19	0.171	21.50	15.02	0.154	0.236	0.146	99.87	1.960	0.059	0.218	0.005	1.161	0.583	0.011	0.006	0.004	4.008	84.2
140-504B-																						
200R-1, 18–24 cm	MP-1	51.87	2.82	8.50	0.254	17.31	18.46	0.295	0.556	0.110	100.17	1.911	0.123	0.262	0.008	0.950	0.729	0.021	0.015	0.003	4.021	78.4
200R-1, 18–24 cm	MP-1	51.89	3.05	7.41	0.217	16.84	19.49	0.251	0.437	0.161	99.73	1.915	0.133	0.229	0.007	0.926	0.770	0.018	0.012	0.005	4.014	80.2
200R-1, 18–24 cm	MP-1r	51.91	2.21	11.21	0.316	16.79	16.80	0.195	0.619	0.000	100.04	1.929	0.097	0.348	0.010	0.930	0.669	0.014	0.017	0.000	4.013	72.7
200R-1, 18–24 cm	MP-2	52.02	3.07	8.17	0.295	16.97	18.47	0.283	0.553	0.198	100.02	1.915	0.133	0.252	0.009	0.931	0.728	0.020	0.015	0.006	4.010	78.7
200R-1, 18–24 cm	MP-2	52.35	2.74	8.34	0.267	17.59	17.86	0.294	0.506	0.183	100.13	1.923	0.119	0.256	0.008	0.963	0.703	0.021	0.014	0.005	4.012	79.0
200R-1, 18–24 cm	MP-2	51.12	4.75	5.76	0.133	16.07	20.60	0.299	0.611	0.336	99.68	1.879	0.206	0.177	0.004	0.881	0.811	0.021	0.017	0.010	4.007	83.3
200R-1, 18–24 cm	MP-2	52.51	2.54	9.24	0.163	17.59	17.44	0.215	0.574	0.083	100.36	1.928	0.110	0.284	0.005	0.963	0.686	0.015	0.016	0.002	4.008	77.2
200R-1, 18–24 cm	MP-2	52.46	2.61	9.80	0.375	17.64	16.69	0.241	0.596	0.081	100.51	1.925	0.113	0.301	0.012	0.965	0.657	0.017	0.017	0.002	4.009	76.2
200R-1, 18–24 cm	MP-2	52.26	3.04	8.28	0.280	17.46	18.17	0.214	0.544	0.241	100.48	1.914	0.131	0.254	0.009	0.953	0.713	0.015	0.015	0.007	4.010	79.0
226R-1, 8–12 cm	MP-1	53.60	1.39	7.87	0.215	19.13	16.55	0.223	0.257	0.115	99.35	1.968	0.060	0.242	0.007	1.047	0.651	0.016	0.007	0.003	4.001	81.2
226R-1, 8–12 cm	MP-1	54.40	0.84	6.45	0.166	18.16	16.57	0.161	0.153	0.114	97.00	2.026	0.037	0.201	0.005	1.008	0.661	0.012	0.004	0.003	3.956	83.4
226R-1, 8–12 cm	MP-1	54.04	1.54	7.46	0.252	19.28	16.69	0.231	0.253	0.119	99.86	1.970	0.066	0.227	0.008	1.047	0.652	0.016	0.007	0.003	3.997	82.2
226R-1, 8–12 cm	MP-1	54.11	1.58	7.65	0.235	19.74	16.03	0.158	0.229	0.278	100.01	1.967	0.068	0.233	0.007	1.070	0.625	0.011	0.006	0.008	3.994	82.2
226R-1, 8–12 cm	MP-2	52.85	2.66	8.39	0.352	17.03	18.10	0.286	0.497	0.065	100.24	1.938	0.115	0.257	0.011	0.931	0.711	0.020	0.014	0.002	4.000	78.4
226R-1, 8–12 cm	MP-2	52.42	2.55	9.12	0.206	17.00	17.69	0.263	0.486	0.016	99.75	1.936	0.111	0.282	0.006	0.936	0.700	0.019	0.014	0.001	4.004	76.9
226R-1, 8–12 cm	MP-2r	50.23	0.77	23.90	0.589	8.62	14.90	0.238	0.454	0.000	99.70	1.982	0.036	0.789	0.020	0.507	0.630	0.018	0.014	0.000	3.995	39.1
226R-1, 8–12 cm	MP-3	52.45	3.22	7.31	0.233	16.44	19.25	0.326	0.456	0.291	99.98	1.926	0.139	0.225	0.007	0.900	0.758	0.023	0.013	0.009	3.999	80.0
226R-1, 8–12 cm	MP-3	52.45	2.64	7.42	0.192	15.52	20.67	0.290	0.557	0.050	99.79	1.938	0.115	0.229	0.006	0.855	0.818	0.021	0.016	0.002	3.999	78.9
226R-1, 8–12 cm	MP-3r	52.52	2.73	9.42	0.227	15.61	18.98	0.303	0.590	0.000	100.38	1.937	0.119	0.291	0.007	0.858	0.750	0.022	0.016	0.000	3.999	74.7
226R-1, 8–12 cm	MP-3r	51.82	2.04	13.11	0.317	14.28	17.41	0.322	0.742	0.000	100.04	1.945	0.090	0.412	0.010	0.799	0.700	0.023	0.021	0.000	4.001	66.0
226R-1, 8–12 cm	MP-3r	50.56	1.10	22.91	0.544	8.85	15.76	0.286	0.735	0.000	100.76	1.968	0.051	0.746	0.018	0.514	0.657	0.022	0.022	0.000	3.996	40.8

Table 9. Ophitic pyroxene.

Sample	Grain	Weight percent										Cations per 6 oxygens										
		SiO ₂	Al ₂ O ₃	FeO	MnO	MgO	CaO	Na ₂ O	TiO ₂	Cr ₂ O ₃	Total	Si	Al	Fe	Mn	Mg	Ca	Na	Ti	Cr	Total	Mg#
137-504B-																						
181M-1, 115–124 cm	OP-Ir	52.00	2.39	10.90	0.284	16.94	16.78	0.219	0.498	0.017	100.03	1.928	0.105	0.338	0.009	0.936	0.667	0.016	0.014	0.001	4.013	73.5
181M-1, 115–124 cm	OP-Ir	53.99	1.74	11.66	0.321	19.79	13.44	0.151	0.380	0.000	101.48	1.955	0.075	0.353	0.010	1.068	0.521	0.011	0.010	0.000	4.003	75.2
181M-1, 115–124 cm	OP-I	54.55	1.42	6.77	0.205	20.58	16.33	0.191	0.224	0.191	100.48	1.967	0.061	0.204	0.006	1.106	0.631	0.013	0.006	0.005	4.000	84.4
181M-1, 115–124 cm	OP-I	54.71	1.37	6.92	0.187	21.51	15.24	0.162	0.155	0.154	100.42	1.969	0.058	0.208	0.006	1.154	0.587	0.011	0.004	0.004	4.002	84.7
181M-1, 115–124 cm	OP-I	54.10	1.40	6.77	0.214	20.92	15.80	0.152	0.202	0.134	99.69	1.964	0.060	0.206	0.007	1.132	0.615	0.011	0.006	0.004	4.004	84.6
181M-1, 115–124 cm	OP-I	52.14	2.78	7.47	0.269	17.99	17.75	0.227	0.486	0.095	99.21	1.924	0.121	0.230	0.008	0.990	0.702	0.016	0.014	0.003	4.008	81.1
181M-1, 115–124 cm	OP-Ir	50.07	1.67	19.49	0.458	10.11	17.25	0.278	0.876	0.021	100.22	1.939	0.076	0.631	0.015	0.583	0.716	0.021	0.026	0.001	4.008	48.0
181M-1, 115–124 cm	OP-Ir	48.86	1.14	26.57	0.679	5.10	16.40	0.252	0.580	0.000	99.57	1.970	0.054	0.896	0.023	0.306	0.708	0.020	0.018	0.000	3.995	25.5
140-504B-																						
200R-1, 18–24 cm	OP-Ir	52.12	2.46	9.59	0.251	17.07	18.29	0.229	0.503	0.086	100.59	1.919	0.107	0.295	0.008	0.937	0.722	0.016	0.014	0.003	4.020	76.0
200R-1, 18–24 cm	OP-I	51.54	3.30	7.98	0.290	17.03	18.53	0.289	0.600	0.196	99.76	1.903	0.144	0.247	0.009	0.937	0.733	0.021	0.017	0.006	4.016	79.2
200R-1, 18–24 cm	OP-I	51.90	2.91	7.93	0.265	17.23	18.82	0.245	0.515	0.150	99.96	1.913	0.126	0.244	0.008	0.946	0.743	0.018	0.014	0.004	4.017	79.5
200R-1, 18–24 cm	OP-I	51.99	2.81	7.83	0.268	16.71	19.41	0.222	0.542	0.170	99.95	1.918	0.122	0.242	0.008	0.919	0.767	0.016	0.015	0.005	4.012	79.2
200R-1, 18–24 cm	OP-I	51.82	3.00	8.35	0.318	17.20	18.79	0.233	0.470	0.108	100.28	1.907	0.130	0.257	0.010	0.944	0.741	0.017	0.013	0.003	4.022	78.6
200R-1, 18–24 cm	OP-I	51.88	2.98	7.84	0.237	16.80	18.78	0.298	0.505	0.110	99.42	1.920	0.130	0.243	0.007	0.927	0.745	0.021	0.014	0.003	4.010	79.2
200R-1, 18–24 cm	OP-Ir	51.63	2.86	9.00	0.276	16.82	18.43	0.216	0.505	0.018	99.74	1.914	0.125	0.279	0.009	0.929	0.732	0.016	0.014	0.001	4.017	76.9
200R-1, 18–24 cm	OP-2r	52.09	2.01	10.69	0.377	16.26	18.26	0.154	0.114	0.056	100.00	1.939	0.088	0.333	0.012	0.902	0.728	0.011	0.003	0.002	4.018	73.1
200R-1, 18–24 cm	OP-2r	52.75	2.29	11.48	0.377	16.63	17.03	0.226	0.127	0.000	100.90	1.943	0.099	0.353	0.012	0.913	0.672	0.016	0.004	0.000	4.012	72.1
200R-1, 18–24 cm	OP-2	52.38	2.86	8.77	0.298	16.71	18.66	0.215	0.131	0.093	100.12	1.930	0.124	0.270	0.009	0.918	0.737	0.015	0.004	0.003	4.011	77.2
200R-1, 18–24 cm	OP-2	52.20	2.83	8.65	0.221	16.44	19.92	0.219	0.101	0.099	100.68	1.920	0.123	0.266	0.007	0.901	0.785	0.016	0.003	0.003	4.023	77.2
200R-1, 18–24 cm	OP-2r	51.68	2.65	10.09	0.363	16.43	18.78	0.236	0.106	0.056	100.40	1.916	0.116	0.313	0.011	0.907	0.746	0.017	0.003	0.002	4.031	74.4
200R-1, 18–24 cm	OP-3r	49.64	0.95	25.64	0.793	8.82	14.02	0.147	0.572	0.026	100.61	1.956	0.044	0.845	0.027	0.518	0.592	0.011	0.017	0.001	4.010	38.0
200R-1, 18–24 cm	OP-3r	50.25	1.13	22.50	0.675	10.78	14.79	0.145	0.654	0.022	100.94	1.946	0.052	0.729	0.022	0.622	0.614	0.011	0.019	0.001	4.014	46.1
200R-1, 18–24 cm	OP-3	50.58	1.40	20.52	0.508	12.13	15.12	0.259	0.786	0.031	101.33	1.934	0.063	0.656	0.016	0.691	0.619	0.019	0.023	0.001	4.022	51.3
200R-1, 18–24 cm	OP-3	50.04	1.62	19.59	0.509	12.33	15.38	0.305	0.900	0.020	100.68	1.921	0.074	0.629	0.017	0.705	0.632	0.023	0.026	0.001	4.027	52.9
200R-1, 18–24 cm	OP-3	49.91	1.80	17.79	0.494	13.10	15.39	0.242	0.909	0.096	99.72	1.919	0.082	0.572	0.016	0.751	0.634	0.018	0.026	0.003	4.021	56.7
200R-1, 18–24 cm	OP-3	50.35	1.94	15.71	0.330	14.19	15.56	0.264	0.775	0.021	99.15	1.926	0.088	0.503	0.011	0.809	0.638	0.020	0.022	0.001	4.017	61.7
200R-1, 18–24 cm	OP-3	50.92	2.02	14.74	0.350	15.05	15.57	0.288	0.794	0.059	99.79	1.925	0.090	0.466	0.011	0.848	0.631	0.021	0.023	0.002	4.017	64.5
226R-1, 8–12 cm	OP-1	52.90	2.34	12.46	0.334	17.21	14.79	0.233	0.628	0.000	100.89	1.944	0.101	0.383	0.010	0.943	0.582	0.017	0.017	0.000	3.997	71.1
226R-1, 8–12 cm	OP-1	52.64	2.50	10.89	0.316	14.19	19.82	0.363	0.721	0.002	101.44	1.939	0.109	0.335	0.010	0.779	0.782	0.026	0.020	0.000	4.000	69.9
226R-1, 8–12 cm	OP-1	51.82	2.33	12.72	0.275	13.85	18.54	0.367	0.800	0.029	100.73	1.935	0.103	0.397	0.009	0.770	0.741	0.027	0.022	0.001	4.005	66.0
226R-1, 8–12 cm	OP-1	52.26	1.70	16.25	0.357	13.80	15.03	0.332	0.740	0.000	100.47	1.966	0.075	0.511	0.011	0.774	0.606	0.024	0.021	0.000	3.988	60.2
226R-1, 8–12 cm	OP-1r	51.04	1.00	21.74	0.574	9.61	16.16	0.288	0.553	0.000	100.97	1.972	0.046	0.703	0.019	0.554	0.669	0.022	0.016	0.000	4.000	44.1
226R-1, 8–12 cm	OP-2	53.14	3.11	7.18	0.134	16.70	18.63	0.303	0.446	0.046	99.69	1.947	0.134	0.220	0.004	0.912	0.731	0.022	0.012	0.001	3.984	80.6
226R-1, 8–12 cm	OP-2	54.85	1.61	8.67	0.260	18.03	16.81	0.235	0.295	0.000	100.76	1.988	0.069	0.263	0.008	0.974	0.653	0.017	0.008	0.000	3.978	78.8
226R-1, 8–12 cm	OP-2	53.44	2.36	8.95	0.190	16.62	17.98	0.259	0.502	0.004	100.30	1.958	0.102	0.274	0.006	0.908	0.706	0.018	0.014	0.000	3.986	76.8
226R-1, 8–12 cm	OP-2	53.07	2.09	12.05	0.308	15.45	16.67	0.314	0.552	0.000	100.50	1.963	0.091	0.373	0.010	0.852	0.661	0.023	0.015	0.000	3.987	69.6
226R-1, 8–12 cm	OP-3	51.90	1.49	18.28	0.525	11.77	15.95	0.331	0.788	0.000	101.04	1.967	0.067	0.579	0.017	0.665	0.648	0.024	0.023	0.000	3.989	53.4
226R-1, 8–12 cm	OP-3r	50.87	0.91	24.74	0.594	8.07	13.82	0.322	0.574	0.000	99.90	2.001	0.042	0.814	0.020	0.473	0.583	0.025	0.017	0.000	3.974	36.8
226R-1, 8–12 cm	OP-4	53.97	1.48	7.61	0.280	17.70	16.55	0.219	0.308	0.000	98.12	2.000	0.065	0.236	0.009	0.977	0.657	0.016	0.009	0.000	3.967	80.6
226R-1, 8–12 cm	OP-5	52.98	2.40	8.05	0.218	16.06	18.72	0.280	0.504	0.009	99.22	1.960	0.105	0.249	0.007	0.886	0.742	0.020	0.014	0.000	3.983	78.1

Table 10. Poikilitic pyroxene.

Sample	Grain	Weight percent										Cations per 6 oxygens										
		SiO ₂	Al ₂ O ₃	FeO	MnO	MgO	CaO	Na ₂ O	TiO ₂	Cr ₂ O ₃	Total	Si	Al	Fe	Mn	Mg	Ca	Na	Ti	Cr	Total	Mg#
137-504B-																						
181M-1, 115–124 cm	PO-1r	48.55	1.31	28.44	0.691	4.08	16.66	0.236	0.956	0.000	100.92	1.950	0.062	0.955	0.024	0.244	0.717	0.018	0.029	0.000	3.999	20.4
181M-1, 115–124 cm	PO-1r	49.16	1.59	25.32	0.600	6.48	16.75	0.246	1.	0.004	101.29	1.936	0.074	0.834	0.020	0.380	0.707	0.019	0.034	0.000	4.003	31.3
181M-1, 115–124 cm	PO-1	50.09	1.80	21.57	0.447	11.52	14.23	0.308	0.878	0.000	100.84	1.929	0.082	0.695	0.015	0.661	0.587	0.023	0.025	0.000	4.016	48.8
181M-1, 115–124 cm	PO-1	49.97	1.76	22.48	0.463	10.94	14.16	0.263	0.845	0.000	100.88	1.931	0.080	0.727	0.015	0.630	0.586	0.020	0.025	0.000	4.014	46.4
181M-1, 115–124 cm	PO-1	49.21	1.67	23.46	0.523	8.80	15.79	0.249	0.913	0.000	100.62	1.929	0.077	0.769	0.017	0.514	0.663	0.019	0.027	0.000	4.015	40.1
181M-1, 115–124 cm	PO-1r	49.12	1.40	28.21	0.694	4.96	16.44	0.222	0.730	0.008	101.78	1.949	0.065	0.936	0.023	0.293	0.699	0.017	0.022	0.000	4.005	23.9
181M-1, 115–124 cm	PO-2r	48.91	1.39	25.71	0.665	6.99	16.02	0.231	0.991	0.000	100.91	1.935	0.065	0.851	0.022	0.412	0.679	0.018	0.030	0.000	4.012	32.6
181M-1, 115–124 cm	PO-2	51.04	2.38	12.83	0.305	15.79	16.70	0.319	0.649	0.000	100.01	1.914	0.105	0.402	0.010	0.883	0.671	0.023	0.018	0.000	4.027	68.7
181M-1, 115–124 cm	PO-2r	50.69	1.49	22.04	0.511	11.96	13.28	0.208	0.714	0.000	100.90	1.947	0.068	0.708	0.017	0.685	0.547	0.016	0.021	0.000	4.006	49.2
140-504B-																						
200R-1, 18–24 cm	PO-1	50.71	4.96	6.05	0.194	16.67	19.78	0.287	0.927	0.517	100.10	1.858	0.214	0.185	0.006	0.911	0.777	0.020	0.026	0.015	4.012	83.1
200R-1, 18–24 cm	PO-1	51.98	4.05	6.36	0.115	16.49	20.06	0.218	0.590	0.409	100.28	1.899	0.174	0.194	0.004	0.898	0.786	0.015	0.016	0.012	3.999	82.2
200R-1, 18–24 cm	PO-1	51.21	4.30	5.66	0.150	16.37	20.64	0.227	0.661	0.347	99.57	1.885	0.186	0.174	0.005	0.898	0.814	0.016	0.018	0.010	4.007	83.8
200R-1, 18–24 cm	PO-1	52.25	4.05	6.13	0.215	17.06	20.16	0.244	0.520	0.176	100.80	1.897	0.174	0.186	0.007	0.924	0.784	0.017	0.014	0.005	4.008	83.2
200R-1, 18–24 cm	PO-1	51.23	4.28	6.92	0.170	16.66	19.55	0.276	0.887	0.335	100.31	1.877	0.185	0.212	0.005	0.910	0.768	0.020	0.024	0.010	4.011	81.1
200R-1, 18–24 cm	PO-1	51.26	4.23	6.50	0.172	16.68	19.65	0.209	0.846	0.392	99.94	1.882	0.183	0.200	0.005	0.912	0.773	0.015	0.023	0.011	4.005	82.1
200R-1, 18–24 cm	PO-1r	50.22	2.23	12.47	0.371	16.14	15.99	0.228	0.612	0.013	98.27	1.914	0.100	0.397	0.012	0.917	0.653	0.017	0.018	0.000	4.027	69.8
200R-1, 18–24 cm	PO-1r	52.97	2.41	15.56	0.218	14.98	11.93	0.401	0.599	0.019	99.09	1.989	0.107	0.489	0.007	0.838	0.480	0.029	0.017	0.001	3.956	63.2
200R-1, 18–24 cm	PO-1r	48.37	1.37	21.48	0.470	10.40	15.55	0.237	0.716	0.000	98.60	1.922	0.064	0.714	0.016	0.616	0.662	0.018	0.021	0.000	4.034	46.3
200R-1, 18–24 cm	PO-1r	51.39	2.46	20.13	0.292	11.59	11.62	0.393	0.230	0.012	98.12	1.993	0.112	0.653	0.010	0.670	0.483	0.030	0.007	0.000	3.958	50.6
200R-1, 18–24 cm	PO-2	51.22	4.01	6.52	0.176	16.77	20.10	0.315	0.648	0.225	99.99	1.883	0.174	0.200	0.006	0.919	0.792	0.023	0.018	0.007	4.020	82.1
200R-1, 18–24 cm	PO-2	51.87	3.25	6.71	0.224	17.56	18.80	0.205	0.685	0.257	99.56	1.908	0.141	0.206	0.007	0.963	0.741	0.015	0.019	0.008	4.007	82.3
200R-1, 18–24 cm	PO-2	52.58	3.47	7.43	0.212	18.41	18.68	0.211	0.530	0.305	101.82	1.895	0.147	0.224	0.007	0.989	0.721	0.015	0.014	0.009	4.020	81.5
200R-1, 18–24 cm	PO-2	51.43	3.53	7.61	0.196	16.99	19.11	0.296	0.550	0.213	99.93	1.895	0.154	0.235	0.006	0.933	0.755	0.021	0.015	0.006	4.020	79.9
200R-1, 18–24 cm	PO-2	53.06	2.48	9.82	0.096	17.69	17.19	0.221	0.515	0.069	101.13	1.934	0.106	0.299	0.003	0.961	0.671	0.016	0.014	0.002	4.006	76.2
200R-1, 18–24 cm	PO-2	51.62	2.23	14.10	0.410	16.09	15.50	0.322	0.782	0.073	101.12	1.918	0.098	0.438	0.013	0.891	0.617	0.023	0.022	0.002	4.022	67.0
200R-1, 18–24 cm	PO-2r	49.45	1.30	20.69	0.516	10.38	16.20	0.258	0.759	0.019	99.57	1.937	0.060	0.678	0.017	0.606	0.680	0.020	0.022	0.001	4.020	47.2
200R-1, 18–24 cm	PO-3r	49.57	1.23	22.26	0.613	9.74	15.24	0.193	0.726	0.022	99.59	1.949	0.057	0.732	0.020	0.571	0.642	0.015	0.022	0.001	4.008	43.8
200R-1, 18–24 cm	PO-3r	50.69	1.17	24.12	0.584	11.91	12.01	0.169	0.704	0.000	101.36	1.950	0.053	0.776	0.019	0.683	0.495	0.013	0.020	0.000	4.009	46.8
200R-1, 18–24 cm	PO-3r	50.20	1.09	23.79	0.688	11.07	12.67	0.142	0.636	0.000	100.27	1.956	0.050	0.775	0.023	0.643	0.529	0.011	0.019	0.000	4.006	45.3
200R-1, 18–24 cm	PO-3	52.53	2.35	10.42	0.237	17.81	16.15	0.199	0.531	0.038	100.27	1.934	0.102	0.321	0.007	0.977	0.637	0.014	0.015	0.001	4.007	75.3
200R-1, 18–24 cm	PO-3	52.61	2.53	8.85	0.281	17.77	17.54	0.278	0.512	0.074	100.45	1.928	0.109	0.271	0.009	0.970	0.689	0.020	0.014	0.002	4.012	78.2
200R-1, 18–24 cm	PO-3	52.69	2.95	8.61	0.233	17.72	17.69	0.227	0.502	0.114	100.73	1.922	0.127	0.263	0.007	0.964	0.692	0.016	0.014	0.003	4.007	78.6
200R-1, 18–24 cm	PO-3	52.07	3.41	7.89	0.198	17.34	18.57	0.228	0.567	0.413	100.69	1.902	0.147	0.241	0.006	0.944	0.727	0.016	0.016	0.012	4.011	79.7
200R-1, 18–24 cm	PO-3	51.54	3.94	7.48	0.234	16.84	18.77	0.292	0.724	0.399	100.21	1.891	0.170	0.229	0.007	0.921	0.738	0.021	0.020	0.012	4.009	80.1
200R-1, 18–24 cm	PO-3	52.72	3.80	7.44	0.181	16.61	19.72	0.242	0.107	0.437	101.25	1.913	0.162	0.226	0.006	0.899	0.767	0.017	0.003	0.013	4.005	79.9
200R-1, 18–24 cm	PO-3	51.71	4.13	6.47	0.194	15.83	21.38	0.190	0.158	0.291	100.35	1.897	0.179	0.199	0.006	0.865	0.840	0.014	0.004	0.008	4.012	81.3
226R-1, 8–12 cm	PO-1r	50.38	1.16	23.75	0.593	8.77	14.94	0.301	0.651	0.000	100.54	1.969	0.053	0.776	0.020	0.511	0.626	0.023	0.019	0.000	3.997	39.7
226R-1, 8–12 cm	PO-1r	51.15	1.28	21.65	0.516	10.70	15.04	0.288	0.687	0.042	101.34	1.961	0.058	0.694	0.017	0.611	0.618	0.021	0.020	0.001	4.001	46.8
226R-1, 8–12 cm	PO-1r	51.25	1.40	19.06	0.496	11.93	14.98	0.270	0.771	0.005	100.17	1.964	0.063	0.611	0.016	0.681	0.615	0.020	0.022	0.000	3.993	52.7
226R-1, 8–12 cm	PO-1r	51.29	1.67	17.47	0.431	12.74	15.13	0.266	0.848	0.000	99.84	1.957	0.075	0.557	0.014	0.725	0.619	0.020	0.024	0.000	3.991	56.5
226R-1, 8–12 cm	PO-1	51.88	2.41	13.09	0.292	15.39	16.20	0.345	0.716	0.000	100.33	1.934	0.106	0.408	0.009	0.855	0.647	0.025	0.020	0.000	4.005	67.7
226R-1, 8–12 cm	PO-1	52.98	2.33	10.93	0.317	16.79	16.44	0.258	0.570	0.003	100.62	1.948	0.101	0.336	0.010	0.920	0.647					

Table 11. Olivine phenocrysts.

Sample	Grain	Weight percent										Cations per 4 oxygens										
		SiO ₂	Al ₂ O ₃	FeO	MnO	MgO	CaO	Na ₂ O	TiO ₂	Cr ₂ O ₃	Total	Si	Al	Fe	Mn	Mg	Ca	Na	Ti	Cr	Total	Mg#
140-504B-																						
200R-1, 18-24 cm	OL-1	40.46	0.059	12.49	0.214	47.71	0.039	0.000	0.000	0.038	101.02	0.994	0.0016	0.257	0.0045	1.747	0.0011	0.0000	0.0000	0.0007	3.005	87.2
200R-1, 18-24 cm	OL-1	40.26	0.059	12.51	0.217	47.52	0.039	0.001	0.000	0.074	100.68	0.993	0.0017	0.258	0.0045	1.746	0.0011	0.0000	0.0000	0.0014	3.006	87.1
200R-1, 18-24 cm	OL-1	40.21	0.039	12.47	0.209	47.17	0.059	0.000	0.000	0.048	100.20	0.996	0.0012	0.258	0.0044	1.741	0.0016	0.0000	0.0000	0.0009	3.003	87.1
200R-1, 18-24 cm	OL-2	38.93	0.020	11.31	0.185	47.45	0.029	0.001	0.011	0.041	97.97	0.984	0.0006	0.239	0.0040	1.787	0.0008	0.0000	0.0002	0.0008	3.016	88.2
200R-1, 18-24 cm	OL-2	38.59	0.049	11.46	0.242	47.87	0.049	0.033	0.000	0.030	98.33	0.974	0.0015	0.242	0.0052	1.800	0.0013	0.0016	0.0000	0.0006	3.026	88.2
200R-1, 18-24 cm	OL-2	40.22	0.029	12.45	0.282	47.65	0.039	0.000	0.001	0.076	100.75	0.991	0.0010	0.257	0.0059	1.750	0.0010	0.0000	0.0000	0.0015	3.008	87.2
200R-1, 18-24 cm	OL-2	39.85	0.039	12.56	0.284	47.32	0.039	0.000	0.000	0.066	100.15	0.989	0.0010	0.261	0.0060	1.751	0.0010	0.0000	0.0000	0.0013	3.010	87.0
200R-1, 18-24 cm	OL-3	40.07	0.029	14.15	0.289	46.20	0.039	0.000	0.000	0.028	100.80	0.994	0.0007	0.294	0.0061	1.709	0.0009	0.0000	0.0000	0.0005	3.005	85.3
200R-1, 18-24 cm	OL-3	40.05	0.029	14.04	0.174	46.41	0.049	0.016	0.007	0.034	100.81	0.993	0.0007	0.291	0.0037	1.715	0.0013	0.0008	0.0001	0.0007	3.007	85.5
200R-1, 18-24 cm	OL-3	39.43	0.020	13.80	0.220	45.91	0.059	0.005	0.014	0.019	99.47	0.991	0.0005	0.290	0.0047	1.720	0.0015	0.0002	0.0003	0.0004	3.008	85.6
200R-1, 18-24 cm	OL-4	39.55	0.029	14.59	0.299	44.93	0.049	0.009	0.000	0.000	99.46	0.997	0.0010	0.308	0.0064	1.688	0.0014	0.0004	0.0000	0.0000	3.003	84.6
200R-1, 18-24 cm	OL-4	39.78	0.000	15.18	0.177	45.00	0.059	0.000	0.000	0.061	100.25	0.997	0.0000	0.318	0.0038	1.681	0.0015	0.0000	0.0000	0.0012	3.002	84.1
226R-1, 8-12 cm	OL-1	41.17	0.026	11.93	0.204	47.08	0.309	0.011	0.000	0.053	100.78	1.010	0.0007	0.245	0.0042	1.721	0.0081	0.0005	0.0000	0.0010	2.990	87.6
226R-1, 8-12 cm	OL-1	41.12	0.043	12.11	0.208	46.72	0.299	0.005	0.000	0.029	100.53	1.012	0.0013	0.249	0.0043	1.713	0.0079	0.0002	0.0000	0.0006	2.988	87.3
226R-1, 8-12 cm	OL-1	40.08	0.051	12.80	0.236	45.53	0.315	0.005	0.000	0.056	99.07	1.006	0.0015	0.269	0.0050	1.703	0.0085	0.0002	0.0000	0.0011	2.993	86.4
226R-1, 8-12 cm	OL-1	40.26	0.014	15.45	0.248	44.01	0.354	0.022	0.001	0.042	100.40	1.008	0.0004	0.324	0.0053	1.643	0.0095	0.0011	0.0000	0.0008	2.992	83.5
226R-1, 8-12 cm	OL-2	38.33	0.025	26.80	0.405	34.79	0.030	0.000	0.016	0.003	100.40	1.013	0.0008	0.592	0.0091	1.370	0.0009	0.0000	0.0003	0.0001	2.986	69.8
226R-1, 8-12 cm	OL-2	40.76	0.050	12.67	0.209	45.86	0.050	0.021	0.006	0.007	99.63	1.014	0.0015	0.264	0.0044	1.700	0.0013	0.0010	0.0001	0.0001	2.986	86.6
226R-1, 8-12 cm	OL-2	41.09	0.055	12.32	0.251	46.24	0.038	0.001	0.019	0.015	100.03	1.016	0.0016	0.255	0.0053	1.704	0.0010	0.0000	0.0003	0.0003	2.983	87.0
226R-1, 8-12 cm	OL-2r	38.72	0.012	25.27	0.379	35.75	0.053	0.000	0.000	0.026	100.21	1.017	0.0004	0.555	0.0084	1.399	0.0015	0.0000	0.0000	0.0005	2.983	71.6
226R-1, 8-12 cm	OL-3	40.39	0.020	14.09	0.153	44.50	0.053	0.029	0.008	0.001	99.24	1.015	0.0006	0.296	0.0033	1.667	0.0014	0.0014	0.0001	0.0000	2.985	84.9
226R-1, 8-12 cm	OL-3	40.45	0.001	13.51	0.200	45.48	0.029	0.010	0.012	0.005	99.70	1.010	0.0000	0.282	0.0042	1.692	0.0008	0.0005	0.0002	0.0001	2.990	85.7
226R-1, 8-12 cm	OL-4	41.19	0.045	12.29	0.157	46.33	0.027	0.000	0.000	0.010	100.05	1.017	0.0013	0.254	0.0033	1.705	0.0007	0.0000	0.0000	0.0002	2.982	87.0