TABLE 1. Derivation of the Hypothetical Mantle Composition

	Average Basalt			Pyrolite		
	(1) Average Anhydrous Dunite* %	(2a) Normal Tholeiite [*Nockolds*, 1954] %	(2b) Normal Alkali Basalt [*Nockolds*, 1954] %	(3) 1 : 4 ratio of Basalt to Dunite %	(4) 1 : 3 ratio of Basalt to Dunite %	(5) Mantle Composition from Chondritic Model [*Ringwood*, 1959] %
SiO_2	41.32	50.83	45.78	42.71	43.06	44.69
MgO	49.81	6.34	9.39	41.41	39.32	39.08
FeO	5.91	9.06	8.73	6.51	6.66	7.81
Fe_2O_3	1.21	2.88	3.16	1.57	1.66	
Al_2O_3	0.54	14.07	14.64	3.30	3.99	4.09
CaO	Trace	10.42	10.74	2.11	2.65	3.19
Na_2O	Trace	2.23	2.63	0.49	0.61	1.14
K_2O	Trace	0.82	0.95	0.18	0.22	
Cr_2O_3	0.56	Not given	Not given	0.45	0.42	
NiO	0.52	Not given	Not given	0.42	0.39	
CoO	0.02	Not given	Not given	0.02	0.02	
MnO	0.11	0.18	0.20	0.13	0.13	
P_2O_5	Trace	0.23	0.39	0.06	0.08	
H_2O^+	Nil	0.91	0.76	0.17	0.21	
TiO_2	Trace	2.03	2.63	0.47	0.58	
	100.00	100.00	100.00	100.00	100.00	100.00

* Normative composition: 91.6% olivine; 5.3% enstatite; 3.1% spinel.

discussion we shall adopt the 3:1 mixture in column 4 as the composition of pyrolite.

In the model previously referred to, it was pointed out that material of pyrolite composition could occur in a number of distinct mineral assemblages under the *P-T* conditions existing in the upper mantle. The intersection of geotherms with the stability fields for these mineral assemblages would have an important effect upon the seismic velocity distributions and particularly upon the formation of a low-velocity zone.

In the previous paper the different mineral assemblages were inferred from rather limited experimental and petrographic data. In the present paper we draw attention to naturally occurring peridotitic rocks which possess chemical compositions very similar to the postulated pyrolite composition. These rocks exhibit several distinct mineral assemblages, despite their similarity in chemical composition, and these assemblages correspond closely to those suggested in the previous model. A consideration of the geologic occurrence of these assemblages, combined with experimental data, permits their relative stability to be established as a function of temperature and pressure, thereby leading toward a concept of mineral zoning in the upper mantle.

2. *Natural mineral assemblages in rocks of pyrolitic composition.* We have assembled in Table 2 a series of analyses taken from the literature. These analyses are extremely similar to one another and compare closely with the postulated pyrolite composition. Their main divergences lie in having lower Na_2O, K_2O, and TiO_2 than the pyrolite. These analyses have been grouped according to the mineralogy displayed by the rock, available mineralogical information also being summarized in Table 2.

Table 2 demonstrates that from essentially the same bulk composition, four distinct mineral assemblages may form as follows:

1. Olivine + amphibole (edenite, pargasite) + accessory chromian spinel.
2. Olivine + plagioclase + enstatite + clinopyroxene + accessory chromite.
3. Olivine + aluminous enstatite + aluminous diopside + spinel.
4. Olivine + pyrope garnet + pyroxene(s).

These different assemblages, which give every indication of representing equilibrium, must be