curve for the liquidus in figure 2 (table 3) is drawn on this basis. A complication might arise because hematite is known to dissociate to magnetite plus oxygen at 1457°C at 1 atm (Darken and Gurry, 1946) so that an additional reaction could be involved. However, it is likely that the effect of pressure on this transition is to increase the temperature stability of hematite even though the P-T slope is unknown.

An attempt to check the position of the suggested liquidus boundary was made by the following method: By reference to the 1-atm relations depicted in figure 1, it may be seen that with increasing temperature, and for the bulk composition of acmite, the composition of the liquid changes in a regular manner from the onset of incongruent melting to point Y. The refractive index of the quenched glasses representing these liquids should change with composition also. The total iron content of the liquid will remain constant (for acmite composition) after the temperature is raised beyond point Y, and the refractive index of the glass should no longer change appreciably (or, at least, in the same way as before). Thus a series of isobaric runs (15 kb) at increasing temperature above the incongruent melting curve was made to follow the change in index of the quench glasses (table 4). Unfortunately, at 1400°C the glass exhibited a variable index of refraction, and at 1450°C the values spread over more than 0.01. The index was lower in glass fragments that contained abundant oxides, supporting a possible quench origin for some of the oxides. These data would nevertheless indicate that the position of the liquidus is probably approximately as shown in figure 2.

In order to investigate the effect of oxygen fugacity on acmite stability, some runs were made in graphite and in iron crucibles. If the gas phase inside the graphite capsule contains only the species CO_2, CO, and O_2, then f_{O_2} is defined (French and Eugster, 1965). In the iron capsules, the equilibrium $Fe + 1/2\ O_2 = FeO$ should prevail and fix f_{O_2}. Experiments in these capsules gave erratic and nonreproducible results regarding temperature of melting. Variations in the drying procedure did not lead to consistency in the results. Nevertheless, some interesting observa-

TABLE 4

Refractive index measurements of glasses at 15 kb

Run no.*	T, °C	Duration, minutes	Starting material	Index, ±0.002
A105	1300	5	Hm + gl	1.646
A106	1350	5	Hm + gl	1.654
A107	1400	5	Hm + gl	1.666, ranges above and below
A108	1450	5	Hm + gl	<1.670 to 1.682

*Isobarically quenched.

Yagi (1966, table 1) gives 1.643 as the index of a glass of acmite composition at 1 atmosphere.

TABLE 5

Summary of results with graphite and iron capsules, showing highest temperature (°C) at which pyroxene was obtained as a run product

	10 Kb		20 Kb		30 Kb		40 Kb
	C	Fe	C	Fe	C	Fe	Fe
Pyroxene	900	800	1025	1050	1100	1100	1200

tions were obtained (table 5). Melting temperatures seem to be lowered by 200° to 300°C or more compared to that found when oxygen fugacity is defined by hematite + magnetite. An amphibole, presumably arfvedsonitic because of the low relative oxygen fugacity and high temperature (see Ernst, 1962), appeared in a number of the runs. The amphibole may have been a quench product in some runs, although no "quench texture" was observed. Only rarely was it present in sufficient amounts to be detected by means of powder X-ray diffraction. Evidently, water either found its way into the charge from the dehydrating talc sleeve or was not eliminated during drying.

An acmitic pyroxene does appear to be stable at low oxygen fugacity (that is, in equilibrium with iron) in an anhydrous environment. This clearly points up the importance of H_2O because Bailey (1969) showed that acmite in the presence of water had no stability field at fluid pressures of 1 kb or more at oxygen fugacities defined by the wustite-magnetite and iron-wustite buffers. Instead, an arfvedsonitic amphibole was the stable solid phase. These results appear to be confirmed in this study, where amphibole crystallized readily when the environment became hydrous.

Cell parameters for acmites held in graphite or iron capsules are listed in table 1 and seem to indicate little solid solution toward ferrosilite. However, almost all runs at low relative f_{O_2} contained small amounts of phases of low refractive index, presumably Na silicate and quartz (especially if opaques, glass, or amphibole were present), possibly indicating some deviation away from ferric acmite. Ernst (1962, p. 715), on the basis of refractive index, noted that the acmitic pyroxene formed at oxygen fugacities defined by the iron-wustite buffer (and $\leq$1000 bars fluid pressure) showed possible solid solution toward ferrosilite (11 ± 9 mole percent).

Incongruent melting behavior is retained up to 40 kb in iron capsules where acmite melts to fayalite + liquid. This is consistent with the 1-atm relations in the system Na_2O-FeO-SiO_2, where a field of fayalite exists on the liquidus over reduced "acmite" composition (Schairer, Yoder, and Keene, 1954).