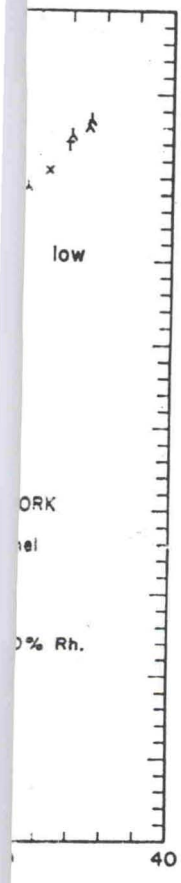
th chromel-alumel thermo-
ompression and decompres-
ade (in an almost ideal run),
was clearly demonstrated
thermocouples were briefly
C. Friction corrections were
ed and varied up to ~1.5
the highest pressures. The
e believed precise to ±6°C
0.5 kb. Because of mechani-
mpression, it was difficult to
~5 kb.
ere made with Platinel II
sk, 1963] (Figure 1), but
es invariably failed on de-

runs with Pt versus Pt +



Interpolation equations
ts. For the present work,

10% Rh thermocouples are also shown in Figure 1. Accurate data on decompression were obtained in several of the runs and the double-value of friction was ~1.5 kb. The greatest problem in these experiments at the highest pressures and temperatures was the disappearance of the thermal arrests, a phenomenon not encountered at the lower pressures and temperatures and not yet understood. In the vicinity of the sample, one may expect contaminants such as water from the decomposition of talc and carbon from the graphite heating sleeve. The quartz-water phase relations at elevated pressures [*Kennedy et al.*, 1962; *Ostrovsky*, 1966] do not suggest any mechanism for the inconsistent vanishing of the arrests. The data of *Keith and Tuttle* [1952] indicate that solid solution of small amounts of impurities may cause a large change in temperature of the inversion, but no such change in inversion temperature was detected within the precision of the present measurements. Evidence of 'stuffed' high quartz was sought in X-ray patterns [*Schreyer and Schairer*, 1961], but none was detected. Examination of the samples after the runs often indicated carbon around the thermocouples; attempts to 'getter' this carbon were made by placing an 0.05-mm-thick molybdenum sheet between sample and graphite sleeve, but there was no clear success here either.

The data (Figure 1) obtained in the runs using Pt versus Pt + 10% Rh thermocouples may be assigned a precision of better than ±10° and an accuracy of ±1 kb.

Since the temperature-measuring thermocouple was placed in a groove between two thin disks of quartz crystal, there may be some question as to whether pressure on the sample near the thermocouple was the same as the applied pressure elsewhere in the furnace. The thin disks readily crushed around the thermocouple. All experiments were in a hydrous environment, since the heating element in the furnace was placed next to talc which dehydrates below ~830°C [*Kitahara et al.*, 1966] for the pressures involved here. *Griggs and Blacic* [1965] and *Griggs* [1966] have demonstrated that the strength of quartz is markedly reduced at elevated temperatures in the presence of water. The ~20-kb compressive strength of anhydrous quartz at 5-kb confining pressure and 800°C [*Griggs et al.*, 1960] is reduced by more than an order of magnitude under similar conditions, as determined in shearing experiments, if the quartz is originally hydrous or is hydrated during the experiment. Apparently, therefore, no salient problems connected with the strength of quartz were involved in the present experiments, since the results from separate runs were in consonance and in general agreement with other high-pressure investigations under dissimilar conditions (see below).

In addition to absence of detectable variation in transition temperature with heating/cooling rate and the absence of any systematic difference between temperatures of heating and cooling signals ('hysteresis'), the following observations can be recorded: cycling in temperature across the transition as many as 10–20 times at a given pressure did not change the transition temperature, within experimental error; deterioration of the signals in many of the runs appeared to proceed gradually with time, as well as with increasing temperature (and pressure); annealing, for as long as 10–20 min as much as 200° above and below the transition, had little effect on the nature and temperature of the arrest; the over-all durations of the runs were less than 2–3 hr.

Intercomparison of the data (Figure 1) obtained with the several thermocouples suggests consistency and concordance, within the experimental error, although no attempts were made to correct for the effects of pressure on thermocouple emf. The most recent and extensive investigations of these effects [*Hanneman and Strong*, 1965, 1966] have been seriously questioned [*Cohen et al.*, 1966*b*], and the problem remains unresolved; qualitatively and tentatively it has been suggested [e.g., *Hanneman and Strong*, 1965] that pressure only slightly alters the emf for chromel-alumel (compared with the zero pressure calibration), whereas a somewhat larger subtractive correction may be involved for Pt versus Pt + 10% Rh thermocouples. There do not seem to have been any investigations for the Platinel series thermocouples, but the present results suggest behavior similar to chromel-alumel.

The zero pressure transition temperature is taken as ~573–574°C for the present samples and hysteresis, effect of rate of temperature change is ignored as being beyond the pre-