This quartz crystal was placed between the punch and the sample as shown in Figure 18. Only one crystal was used in our preliminary investigation. The first experiment conducted using one crystal was quite successful. Very little cracking occurred in the quartz crystal. The cracks that formed were due to the collapse of the pyrophyllite disc which was located at the other end of the sample as shown in Figure 18. When the pyrophyllite collapsed, a shock wave traveled through the sample and cracked the crystal.

The sample mounting was modified, as shown in Figure 24, so that the load was on the crystal and the sample and not in the pyrophyllite. The punches were broken and the quartz transducer was crushed. It is believed that this failure was initiated by undetected cracks in the punches and/or in the sample. Additional punches used for these measurements were plated with nickel to decrease the contact resistance between the transducer and the punches.

The assembly of the sample was modified and the transducers were modified as shown in Figure 25. The transducers were placed between the punch and a piece of aluminum foil. Silicone grease or Vaseline was rubbed on both sides of the aluminum disc. This was done to assure coupling of the transducer with the sample. The sample used in this experiment was Stupalox; doped alumina.

In the first attempt, at atmospheric pressure, quartz crystals, vapor plated with gold, were used as the transducers. Using a 3-MHz pulse generator, no signal was detected in the sample. Another attempt was made with X-cut 3-MHz quartz crystals, and again, no signal was detected. Therefore, a dummy assembly was made using the same sample material and quartz crystals. It was found that with the 3-MHz pulse generator, the quartz crystals could not be activated, and lead zirconate crystals (silver plated on each side) were substituted for quartz. Electrical contact was made at one side directly to the tungsten carbide punch and at the other side to the aluminum foil which was brought out through the pyrophyllite insulation. Mica rings surrounded the transducer crystal provided lateral support as shown in Figure 25.

The instrumentation used for this assembly is illustrated in Figure 26. A piece of copper 0.750 inch x 0.750 inch x 0.500 inch was used as a velocity standard. The velocity of sound through this reference standard was determined to be 0.128 inch per μ sec, while the sound velocity for the Stupalox specimen was 0.401 inch per μ sec, at 1 atmosphere pressure. As the pressure was increased very slowly on the specimen, the signal through the crystals was lost. The signal could neither be received nor transmitted into the Stupalox. The reference standard was operating properly, but a resistance check of the sample indicated a short between punch face and the aluminum disk. Therefore, the press was opened and transducer examined in place. The mica insulation rings had compressed so badly that the full load was on the crystal. This shattered the crystals and shorted the aluminum leads to the punch assembly.

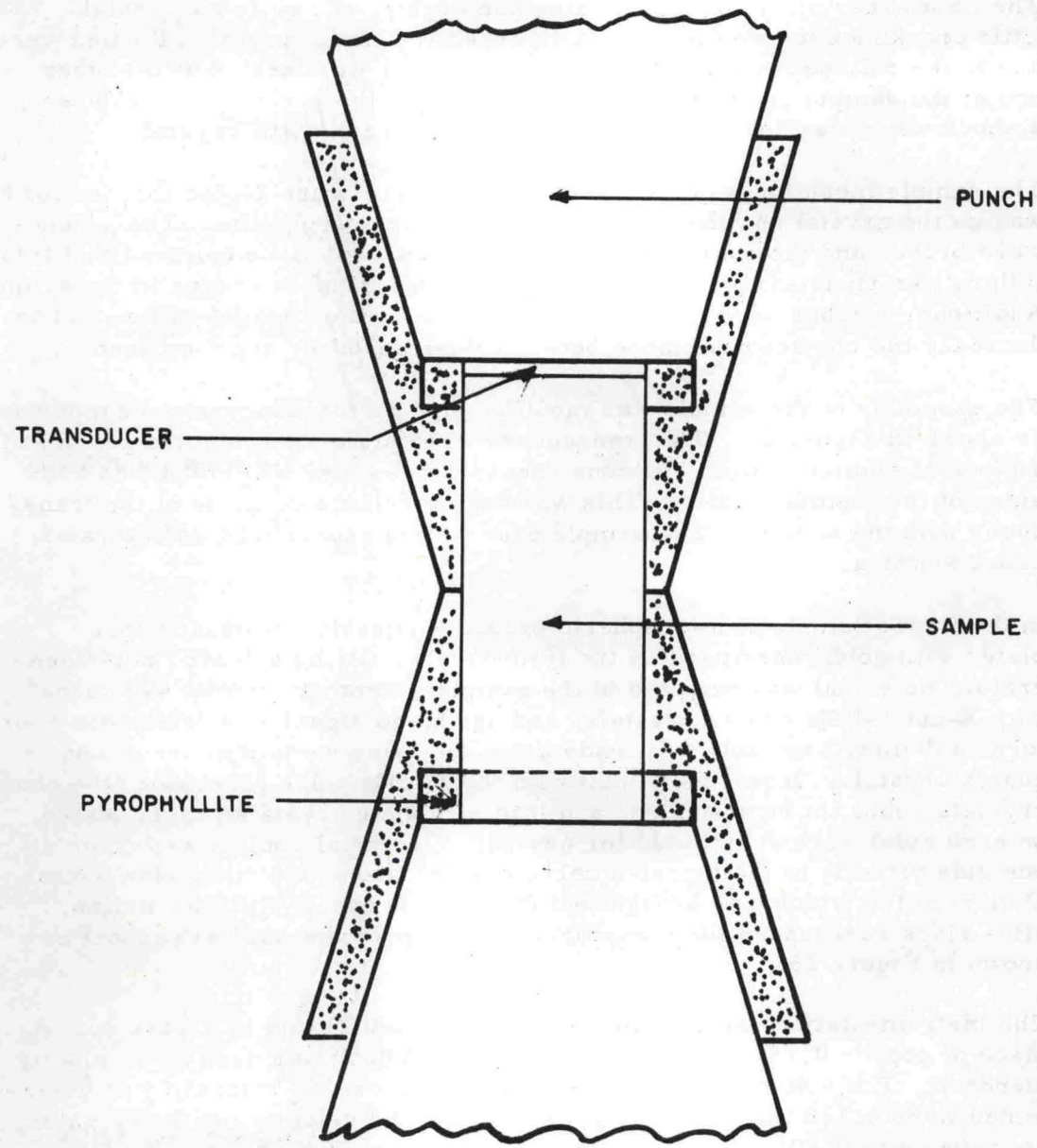

Figure 24 SAMPLE DETAIL PRELIMINARY TESTS