LABORATORY TESTS OF FOUNDATION ROCK CORE FOR AUBURN DAM

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Division of General Research
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16. ABSTRACT

Approximately 530 specimens of foundation rock cores selected from 108 drill holes located at the Auburn damsite in California were tested to determine the following physical properties: absorption, porosity, specific gravity, secant modulus of elasticity, Poisson's ratio, compressive and triaxial strengths, and sonic velocity. The cores were classified into 8 rock types; amphibolite, massive amphibolite, foliated amphibolite, dike, biotite porphyry dike, metagabbro, chlorite schist, and talc schist. Conclusions were: (1) the secant moduli of elasticity, by rock type, ranged from an average of 1,470,000 lb/in^2 (103,351.3 kg/cm^2) to 17,310,000 lb/in^2 (1,217,014.2 kg/cm^2); (2) Poisson's ratio ranged from an average of 0.11 to 0.24; (3) compressive strengths ranged from a low of 790 lb/in^2 (55.5 kg/cm^2) to a high of 41,900 lb/in^2 (2,945.9 kg/cm^2); and (4) sonic velocities ranged from 12,950 ft/sec (394,716 cm/sec) to 29,900 ft/sec (911,352 cm/sec).

17. KEY WORDS AND DOCUMENT ANALYSIS

a. *DESCRIPTORS*-- /absorption/ compressive strength/ Poisson's ratio/ specific gravity/ shear strength/ triaxial compression/ elastic deformation/ rock tests/ *rock foundations/ *laboratory tests/ rock mechanics/ rocks/ *dam foundations/ modulus of elasticity/ porosity/ *rock properties/ sonic velocity tests

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Denver, Colorado

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UNITED STATES DEPARTMENT OF THE INTERIOR * BUREAU OF RECLAMATION

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Photography is by W. M. Batts.

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INTRODUCTION

Auburn damsite is located on the west flank of the central Sierra Nevada. The American River has cut an 800-foot-deep (244-meter) canyon through a peneplain capped by tertiary volcanic and fluvial sediments and underlain by metamorphosed Paleozoic and/or Mesozoic volcanic and marine sedimentary formations. The latter are intruded by ultrabasic and granitic bodies. The foundation of the damsite consists mainly of a steeply dipping sequence of amphibolitic schists with minor metagabbroic, metasedimentary, and metaultrabasic bodies. The latter are represented chiefly by talcose and chloritic schists with lesser amounts of serpentine. Fine-grained dioritic dikes are also present and locally prominent.

The classification assigned to each core specimen was determined by visual inspection of the core during logging by field geologists on the staff of L. R. Frei, project geologist. Seventeen subtypes were derived from the major types and the tables are arranged accordingly.

Specimens from each type were tested to determine the following physical properties of the foundation material: absorption, porosity, specific gravity, secant modulus of elasticity, Poisson's ratio, unconfined compressive strength and the sonic velocity of the longitudinal pulse wave through the specimen.

A companion specimen to each test specimen was furnished to the Applied Sciences Branch of the Division of General Research for a petrographic examination. In addition each specimen was examined by petrographers after it was broken to determine the mode of failure. The results of these observations were forwarded by memorandum to the Chief, Hydraulic Structures Branch, Division of Design, and are retained by that office.

Approximately 530 NX[1] rock core specimens from 108 drill holes were selected for testing. Five talcose serpentine specimens, 6 inches (15.2 cm) in diameter were also tested. Figures 1 and 2 show the location of the drill holes, tunnels, and drifts from which these specimens were obtained and where the radial and uniaxial jacking tests were conducted.

DESCRIPTION AND DISCUSSION OF TESTS

Identification of Specimens

All test specimens are designated by a drill hole designation and the depth to the center of the specimen, reported to the nearest one-hundredth of a foot and measured from the drill hole collar.

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[1] NX designates the size of the core sample, nominally 2.125-inch (5.4-cm) diameter.

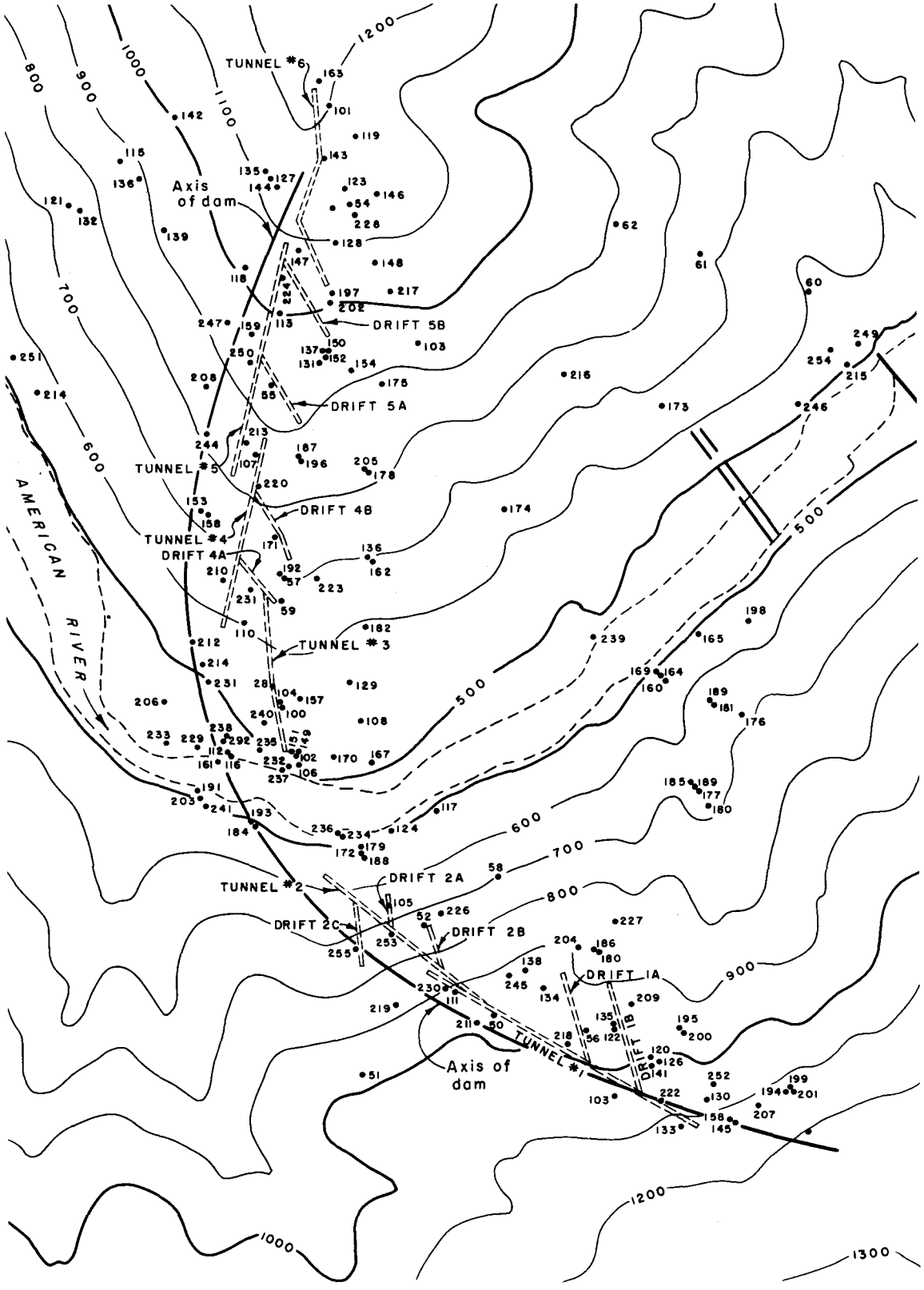


Figure 1. Location map of drill holes and tunnels - Auburn Dam.

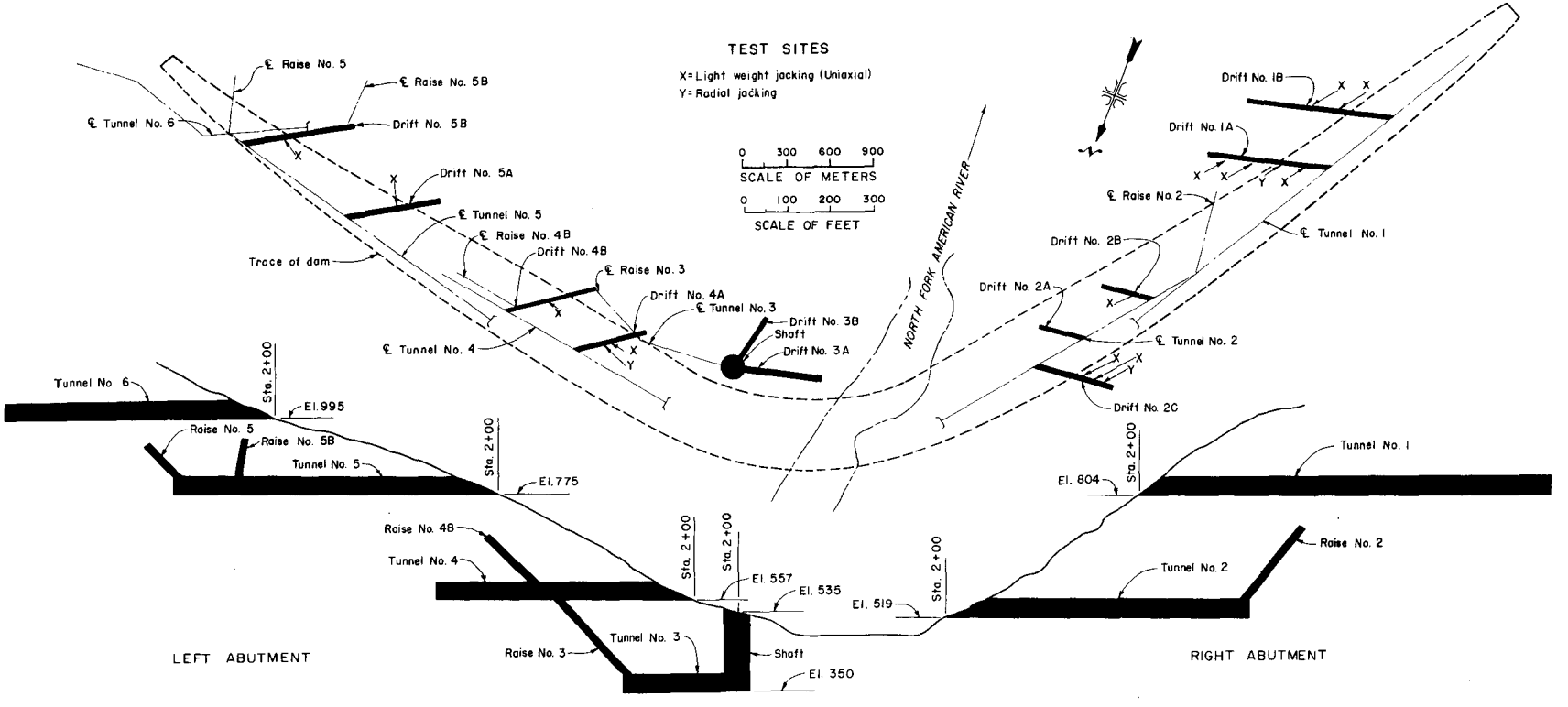


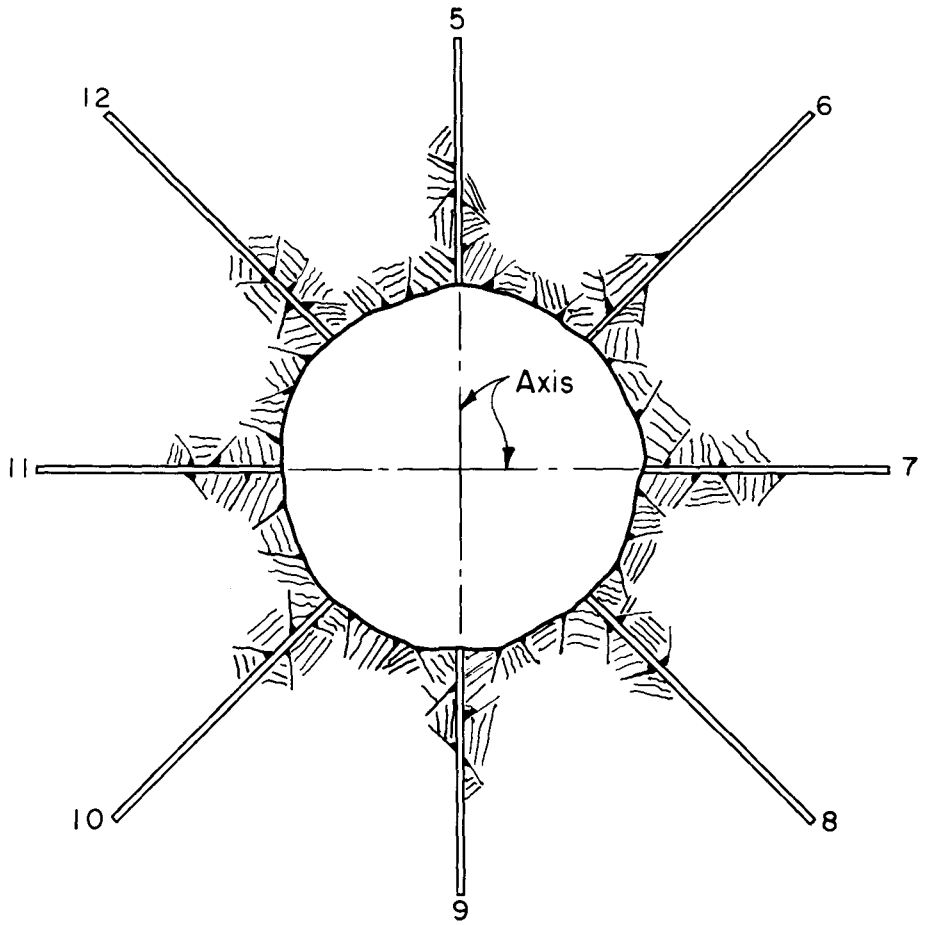
Figure 2. Location map of tunnels, drifts, and raises - Auburn Dam.

The drill hole designation is a number for those holes drilled from the surface and a combination of letters and numbers for holes drilled underground or in conjunction with uniaxial or radial jacking tests.

For example, a specimen from one of the holes drilled from the surface is designated as 105-329.68. The first number (105) is the designation of the particular drill hole, and the second number is the depth in feet from the collar of the hole to the center of the specimen measured along the axis of the drill hole.

Specimens from radial test sites are identified by a combination of letters and numbers, such as R2C1-6-1.30. The R identifies the test (radial), the 2 identifies the tunnel, the C identifies the drift, the 1 indicates that this is the first test site of any type encountered when walking into the drift and the 6 indicates the location of the drill hole in the test site. The depth (in feet) to the center of the specimen (1.30) measured from the drill hole collar is indicated last as is the case with all the specimens discussed in this report. See figure 3 for a graphic illustration of this method of identifying specimens.

Specimens from uniaxial test sites are identified by a number such as U1A4-1-2.38. In this case, the U designates a uniaxial test; while



Example for designating any hole along tunnel:

Hole designated as R2C1-6-1.30 would mean,

R — Radial test site

2 — Tunnel number

C — Drift designation

1 — Site number

6 — Hole number

1.30 — Depth in feet to center of test specimen as measured from drill hole collar

Figure 3. Typical transverse section through tunnel radial test site.

the other letters and numbers in the sequence represent the same things as those designating a specimen from a radial site. The -1- in this case indicates the location of the drill hole in the test site as the 6 did in the example shown for a radial test specimen. However, there are only two drill holes at each uniaxial site. In every case the hole drilled upward from the site was designated number 1 and the hole drilled downward was designated number 2.

Preparation of Specimens

All specimens were cut to a length equal to twice their diameter and the ends were ground flat and perpendicular to the axis of the core. Figure 4 shows the specimens being cut to proper length on a cutting table equipped with a diamond saw blade.

The ends of the specimens are then ground on a special lapping table capable of grinding as many as nine specimens at a time (see fig. 5).

All tests are normally conducted at approximately 75 percent saturation with the exception of sonic velocity tests which are conducted in the air-dry condition[2] before saturation. This procedure

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[2] Samples were allowed to dry under nominal atmospheric conditions.

Figure 4. Cutting test specimens to proper length with diamond saw.

Figure 5. Polishing ends of test specimens on 15-inch-diameter grinder.

provides moisture to simulate conditions that exist in the abutment of a dam; while still providing sufficient void space to prevent the development of pore pressure while loading the test specimen. Although an attempt was made to saturate the test specimens to 75 percent, it is concluded that the only water absorbed was in the joints rather than through the pores of the rock. The low absorption and porosity figures in table 1 support this conclusion.

Specific Gravity, Absorption and Porosity

Specimens were first weighed in the dry condition (as received) and then placed in a vacuum of at least 20 inches (50.8 cm) of mercury for 4 hours.[3] Tap water was then introduced to submerge the specimens and the vacuum was maintained for another 4 hours. The vacuum was then removed and the specimens left submerged under atmospheric pressure for 16 hours. The saturation equipment used is shown in figure 6. Weight of the saturated specimen, and the weight of the saturated specimen suspended in water, were then obtained using the equipment and methods shown in figures 7 and 8. Values for the properties of absorption, specific gravity, and porosity were calculated by means of the formulae:

$$\text{Bulk specific gravity} = \frac{A}{B-H}$$

[3] One atmosphere equals: 29.92 inches (76 cm) of mercury; 14.7 lb/in^2.

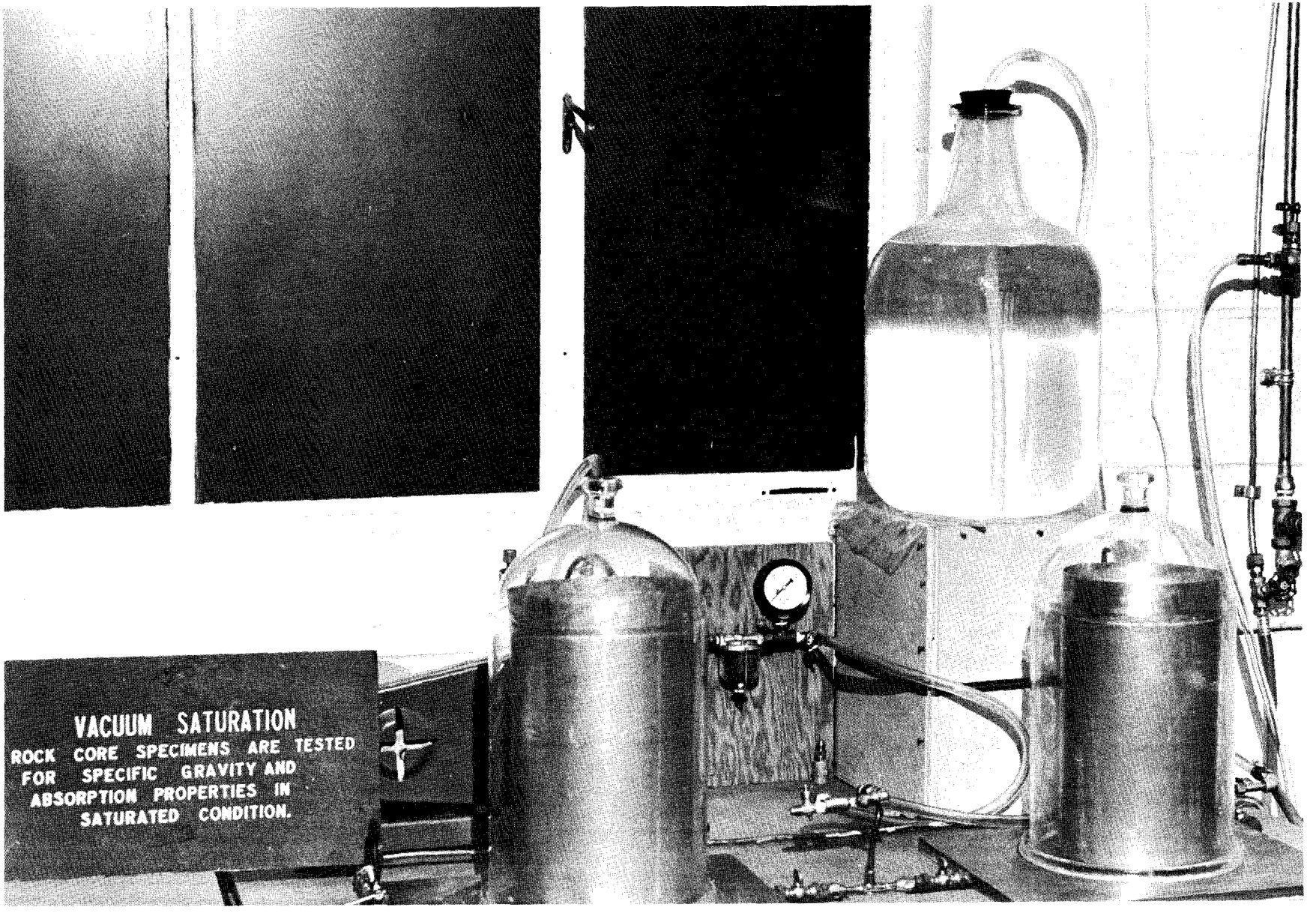

Figure 6. Vacuum saturation equipment used to determine bulk specific gravity, absorption, and porosity.

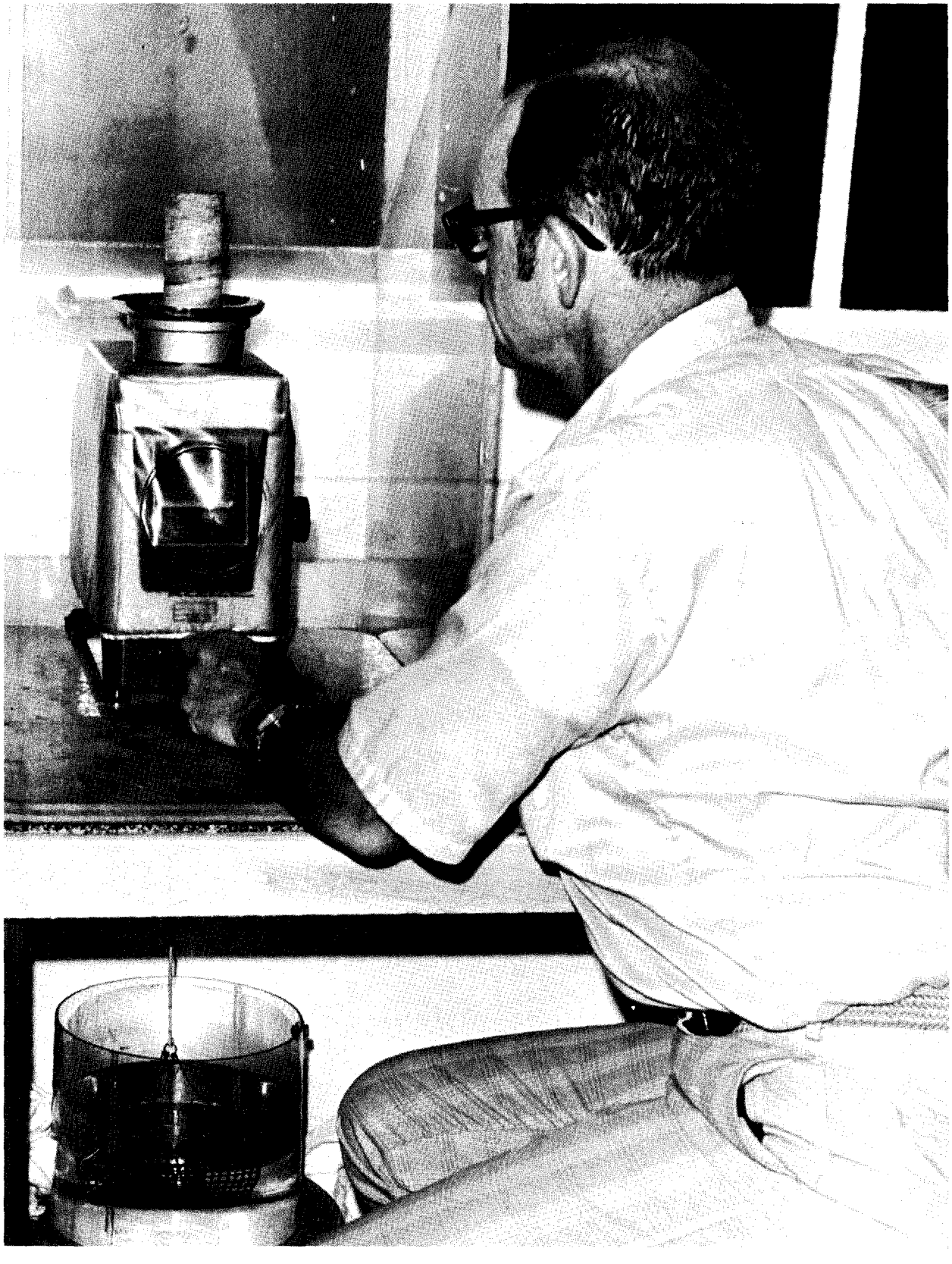

Figure 7. Weighing saturated surface-dried specimen to determine bulk specific gravity, absorption, and porosity.

Figure 8. Weighing saturated specimen suspended in water to determine bulk specific gravity and porosity.

$$\text{Absorption (percent by weight)} = \frac{B-A}{A} \times 100$$

$$\text{Porosity (percent by volume)} = \frac{B-A}{B-H} \times 100$$

where,

A = weight of the dry specimen

B = weight of the saturated specimen, and

H = weight of the saturated specimen suspended in water

The results of these tests are presented in table 1 and summarized in table 2.

Elastic Properties

Elastic properties of the specimens tested are listed in table 3. A summary of averages and ranges of the elastic properties is presented in table 4. The secant modulus of elasticity and Poisson's ratio are given for two successive load cycles applied to each specimen. Between each load cycle, the specimens remained unloaded for an interval of about 2 minutes. Figure 9 shows a test in progress.

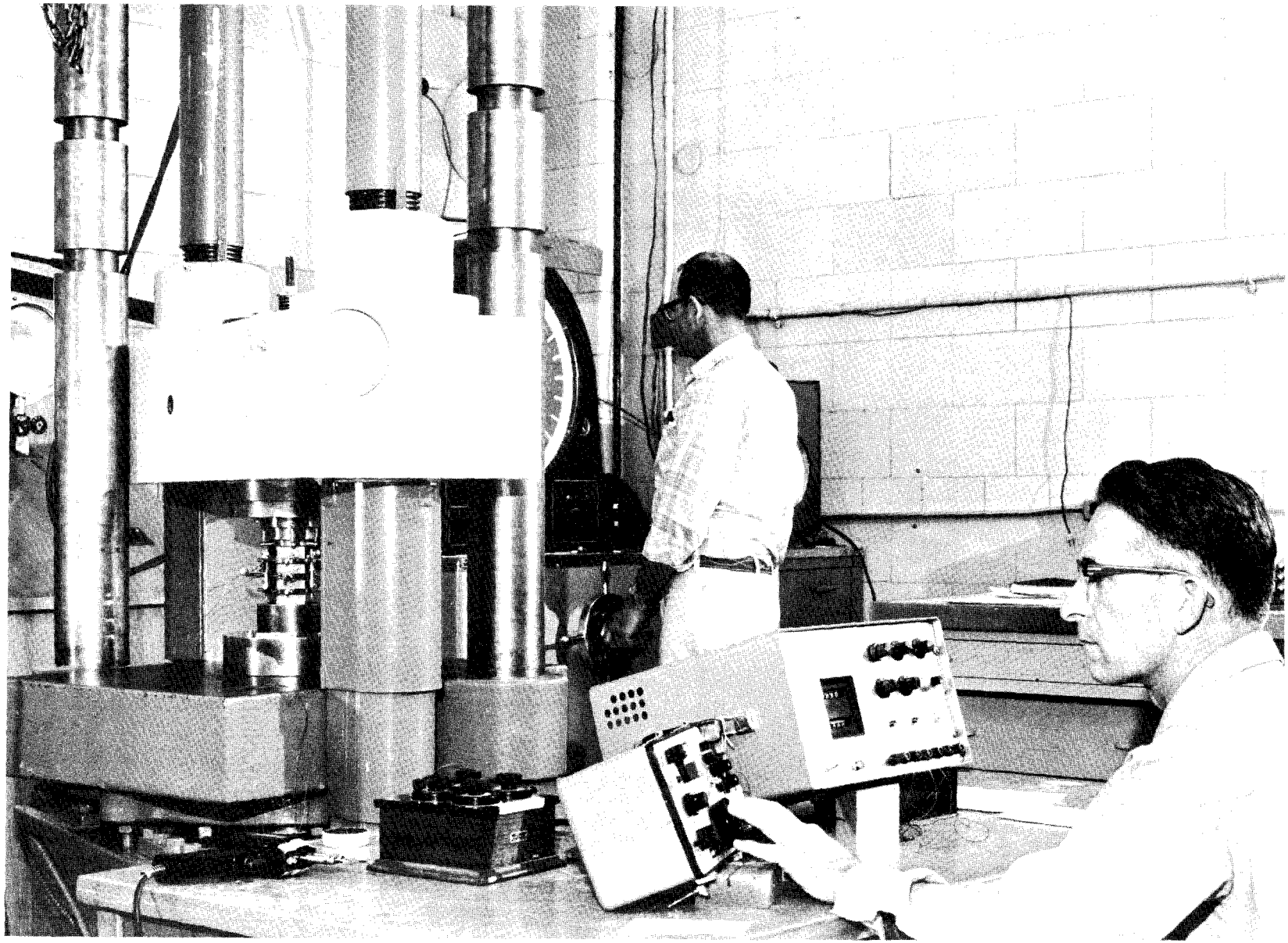

Figure 9. Test to determine secant modulus of elasticity and Poisson's ratio.

Elastic properties are determined by loading the cores axially in compression and measuring axial and lateral strains. Strains are measured using a specially designed frame, which measures strain to a sensitivity of one part in a million. Pretensioned elastic wires, mounted in the vertical and radial tubes, undergo changes in resistance as the specimen is deformed by the applied load. The axial gage measures strain over a 2-inch (5.08-cm) gage length while the lateral gage length is equal to the radius of the specimen. The change in resistance of the three lateral gages is summed electrically in one leg of a wheatstone bridge circuit. Similarly, the axial gages are wired into another circuit.

The values of secant modulus of elasticity and Poisson's ratio in tables 3 and 4 are those obtained at stress levels of 1,000 lb/in^2 (70.3 kg/cm^2) and 5,000 lb/in^2 (351.5 kg/cm^2).

The omission of some values of secant modulus of elasticity or Poisson's ratio in the tables is due to one of two reasons: (1) no reading was obtained at the indicated load; or (2) the reading obtained was so erratic that it was deemed unreliable and therefore was not included.

At the beginning of the testing program the maximum stress applied was 1,000 lb/in^2 (70.3 kg/cm^2). This accounts for the lack of elasticity data at 5,000 lb/in^2 (351.5 kg/cm^2) for many of the specimens.

The determination of Poisson's ratio was unusually difficult for this rock because of the characteristic of expanding laterally due to the orientation of healed joints in the specimen. This factor contributed to the large amount of set in the specimens when they were unloaded. Hence, many of the specimens yielded data which led to values of Poisson's ratio higher than 0.30. Since these data are derived from material with a behavior that is not compatible with the definition of Poisson's ratio, the results are not included. In addition, very low values (less than 0.10) of Poisson's ratio were calculated for some specimens. These values also appear to be related more to jointing and other discontinuities than to elastic behavior and consequently are not included. Because of the wide range of values of Poisson's ratio, the reliability of these data is questionable.

Compressive Strength

The compressive strength of the rock was determined after each core specimen had been tested for elastic properties and the elasticity frame removed. The specimens were loaded until failure occurred. The rate of loading was approximately 2,000 lb/in^2 (140.6 kg/cm^2) per minute. Figure 10 shows typical compressive strength specimens after failure had occurred.

Figure 10. Typical compressive strength specimens after testing.

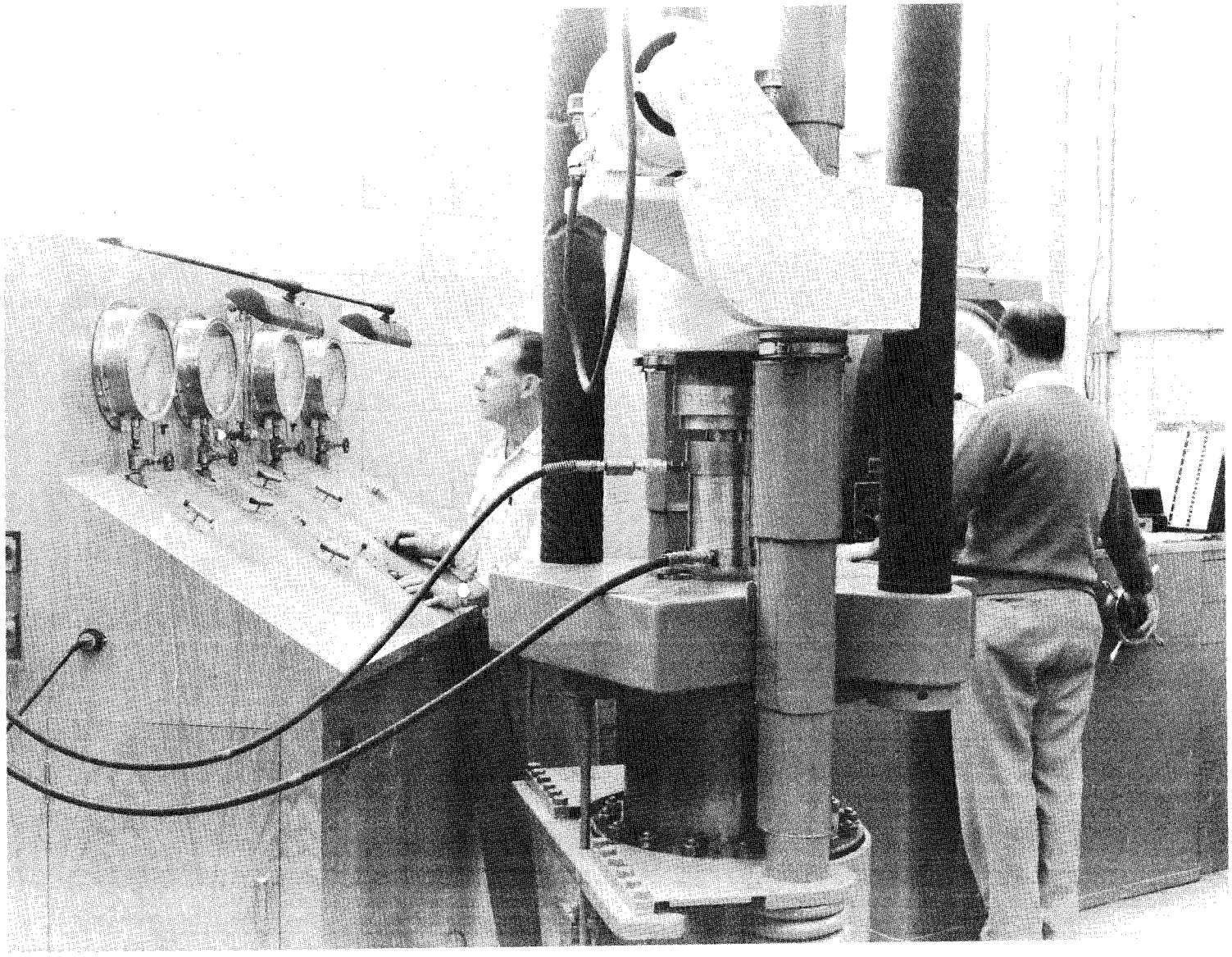

Figure 11. Typical triaxial shear strength specimens after testing. Photo PX-D-46480

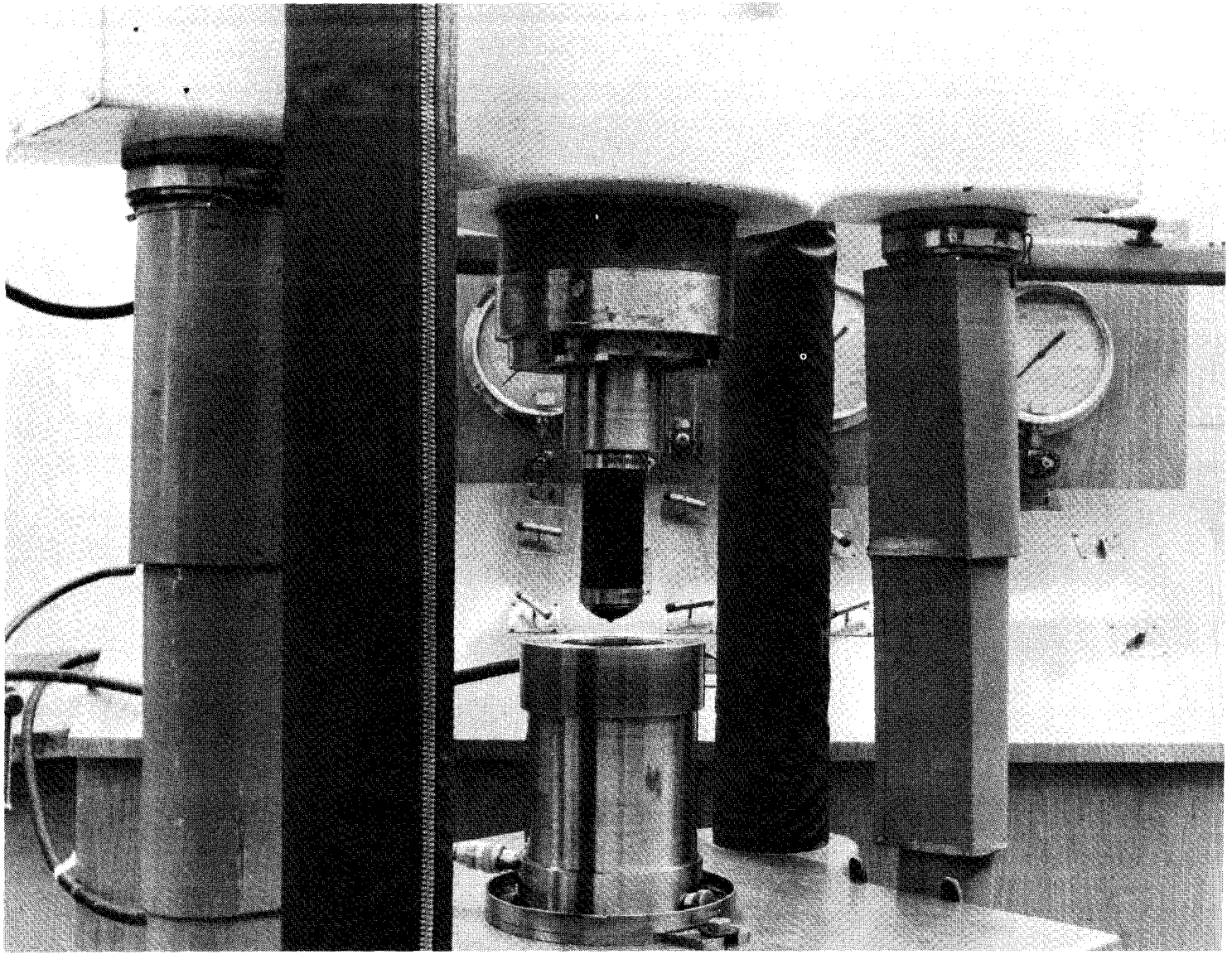

Figure 12. Triaxial compression chamber in open position. Photo PX-D-46727

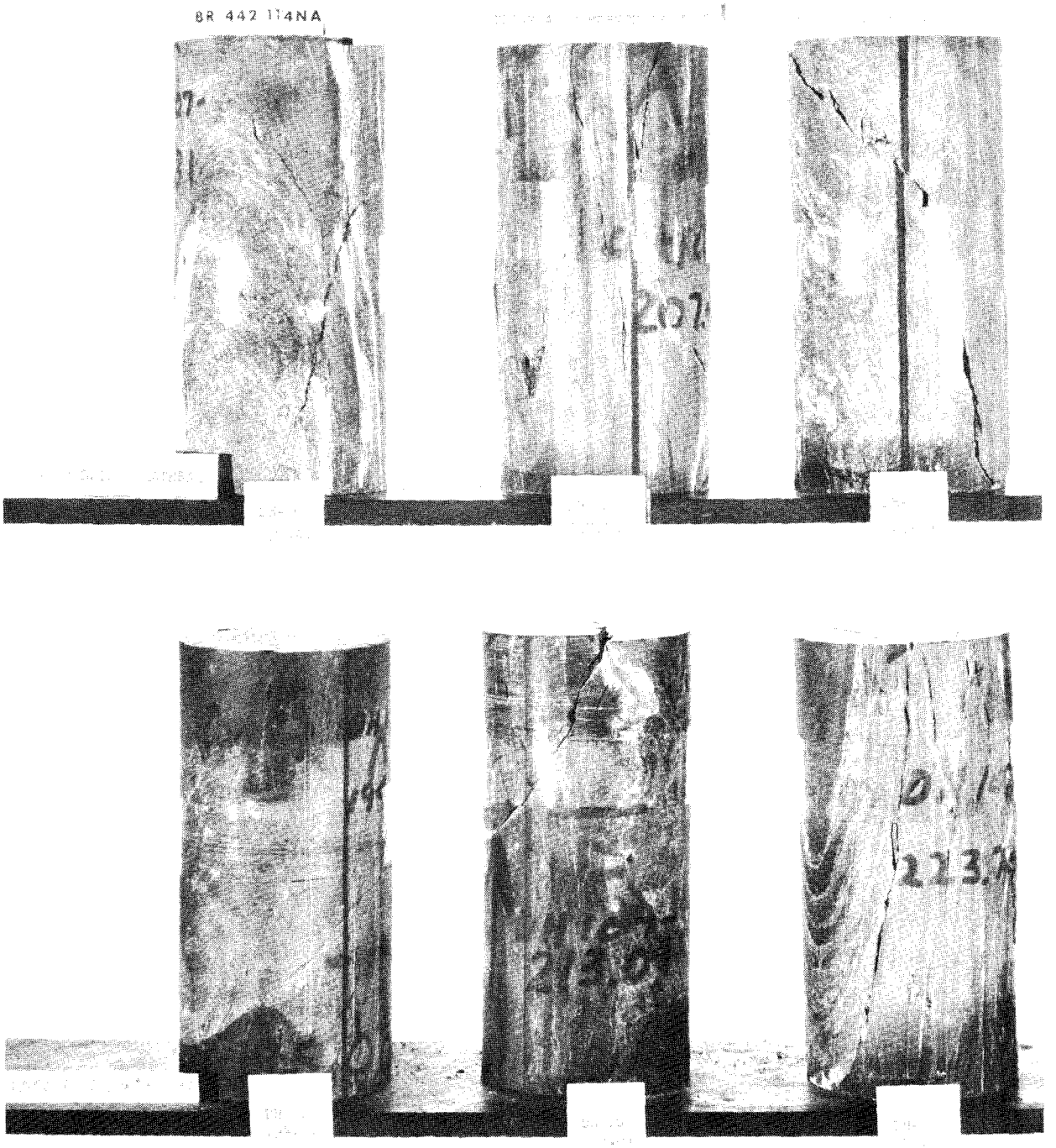

Figure 13. Test in progress in triaxial compression chamber. Photo P849-D-76269

Summary of Results

The averages and ranges of the test results for the elastic properties and compressive strength of the NX core are summarized in table 4. Results are presented by rock type based on the field classification. The letters used as postscripts (B and C) with the amphibolites and chlorite schist refer to the spacing of the joints parallel to the cleavage plane. Since the results reported are from relatively small intact specimens, the results are not considered to be affected by joint spacing and hence were summarized by rock type only, without regard to joint spacing.

Values of modulus of elasticity and Poisson's ratio for the 6-inch (15.2-cm) diameter (talcose serpentine) specimens were determined from measurements made with mechanical extensometers. Much lower stresses were deemed necessary to prevent possible damage to the deformation measuring equipment in the event of a premature failure. Consequently, the results may not be comparable to values obtained from tests of NX specimens of the same rock type. The modulus of elasticity and Poisson's ratio were determined at stresses of 110 lb/in^2 (7.7 kg/cm^2) and 450 lb/in^2 (31.6 kg/cm^2) for three of the five 6-inch (15.2-cm) diameter specimens and 340 lb/in^2 (23.9 kg/cm^2) and 410 lb/in^2 (28.8 kg/cm^2) for the remaining two specimens. The ratio of length to diameter was maintained at two as was the case with the NX specimens.

Measurement of Sonic Velocity

Ultrasonic tests were conducted to determine the velocity of the longitudinal pulse wave in the direction of the core axis. Shear wave velocities were not obtained.

This test was not performed on specimens tested early in the investigations for Auburn Dam. Only 85 specimens were tested for sonic data.

Results are tabulated in table 3 and summarized in table 4. All velocities were determined on air-dry specimens prior to saturation. Figures 14 and 15 show the equipment used to determine sonic velocities.

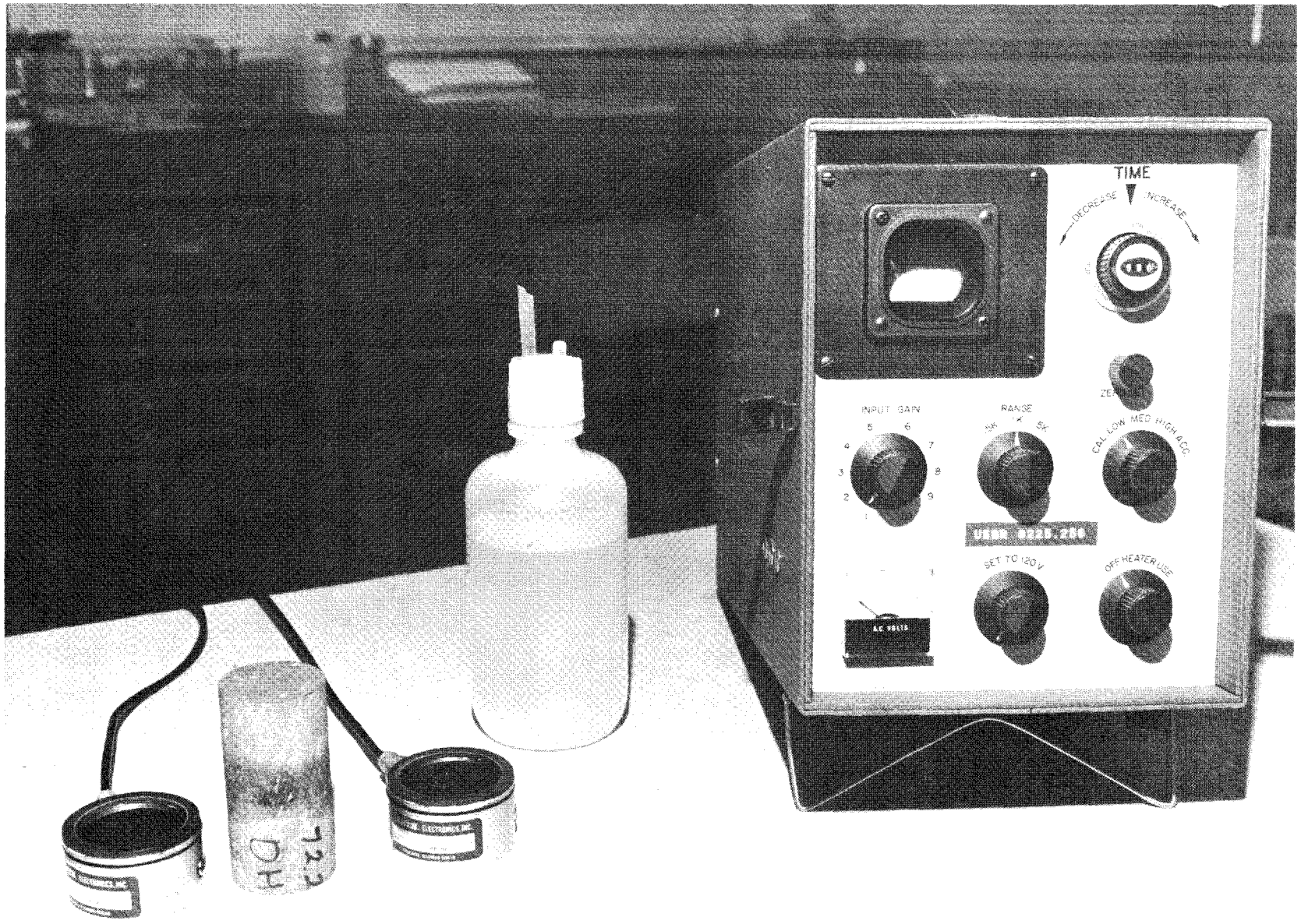

Figure 14. Ultransonic test equipment used to measure sonic velocities.

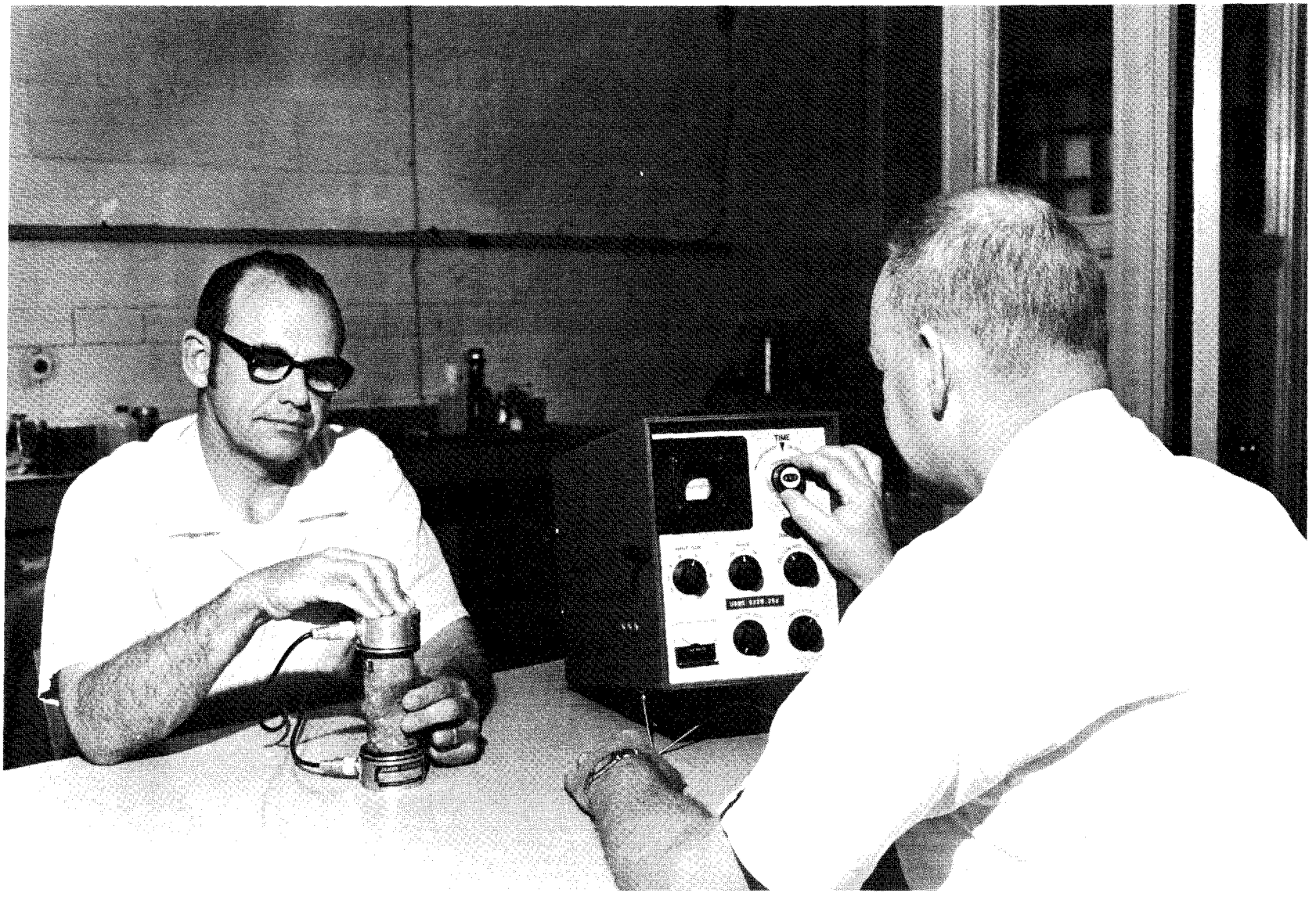

Figure 15. Measuring sonic velocity of test specimen.

GLOSSARY

AMPHIBOLITIC
Relating to metamorphic rock consisting essentially of amphibole (a crystalline structure involving a silicate chain and three groups of metal ions).

CHLORITIC
Any of a group of monoclinic minerals that are essentially hydrous silicates of aluminum, ferrous iron, and magnesium. Resemble the micas and are usually green in color.

DIORITIC
A type of granular crystalline igneous rock commonly of acid plagioclase and hornblende, pyroxene, or biotite.

MESOZOIC
Pertaining to the geological era or rocks intermediate between Paleozoic and Cenozoic; rock comprising the Triassic, Jurassic, and Cretaceous periods or systems.

METAGABBROIC
Being among a family of granular igneous rocks composed essentially of calcic plagioclase.

METASEDIMENTARY
Metamorphic rock of sedimentary origin.

PALEOZOIC
Pertaining to the oldest geological era of rocks having abundant fossils. The era or rocks comprising divisions from Cambrian to Permian.

SCHISTS
Any of a class of crystalline rocks whose constituent minerals have a more or less parallel or folicated arrangement, due mostly to metamorphic action.

SERPENTINE
A common mineral, hydrous magnesium silicate, usually green in color.

SPECIFIC GRAVITY
The ratio of the mass of a given volume of any substance to that same volume of water (solids/liquids) or hydrogen (gas); relative density.

TALCOSE

Containing or composed largely of talc, a soft green-to-gray mineral (hydrous magnesium silicate).

Table 1
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.[1]	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Amphibolite	1B-23	213.93	3.04	0.00	0.00
	2-20	94.08	2.98	.01	.03
	3-12	92.59	2.90	.04	.13
	3-49	68.18	2.95	.01	.02
		265.31	3.03	.00	.00
	3A-61	62.56	3.01	.01	.04
	-65	46.83	2.98	.01	.04
	4-46	213.90	3.05	.01	.03
	105	329.68	2.98	.08	.22
	106	36.60	2.99	.02	.04
		60.49	3.03	.02	.06
		62.75	3.00	.01	.02
		68.31	3.04	.01	.02
		82.79	2.98	.01	.03
		88.75	2.99	.03	.10
	107	313.07	2.98	.03	.08
	109	193.90	2.95	.05	.15
		197.85	2.97	.04	.13
		210.06	2.95	.07	.21
	110	136.89	3.08	.01	.03
		199.60	2.82	.04	.10
	111	114.42	2.80	.02	.06
		262.24	2.94	.02	.05
	113	170.35	2.93	.02	.04
		232.34	3.06	.06	.18
		234.31	3.02	.08	.23
		234.92	2.99	.03	.10
	114	217.08	2.96	.02	.07
		333.57	3.00	.02	.05
	126	121.58	2.90	.02	.04
		210.59	2.90	.02	.05
	145	177.15	2.94	.02	.06
	148	252.93	2.93	.01	.04
	160	99.57	2.98	.07	.21
	179	394.58	2.95	.01	.02
	188	118.26	3.04	.04	.11
		242.35	2.80	.01	.04
	200	280.07	2.96	.01	.03
	203	184.89	2.97	.01	.04
		258.08	2.97	.02	.07

[1] To convert to meters, multiply by 0.3048

Table 1 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Amphibolite	251	120.76	3.00	0.03	0.08
	253	68.35	2.97	.03	.09
	*U1A4-1	2.38	-	-	-
		5.33	-	-	-
		11.00	-	-	-
	*U1A4-2	1.20	-	-	-
		5.45	-	-	-
		11.58	-	-	-
	U2B1-1	1.80	3.00	.05	.14
	U2C1-1	1.21	3.18	.00	.00
		4.75	3.02	.00	.00
		15.22	3.00	.04	.12
	U2C1-2	1.12	3.12	.02	.07
		3.18	3.20	.04	.13
		5.13	3.07	.04	.11
		15.00	2.93	.27	.79
	U4A2-1	3.40	3.03	.05	.15
		5.22	2.92	.14	.39
		15.39	2.97	.01	.02
	U4A2-2	4.07	2.77	.08	.22
		10.30	2.78	.00	.00
		16.82	2.82	.00	.00
	U4B1-1	3.25	3.04	.00	.00
		6.66	3.05	.02	.07
		15.47	3.02	.04	.11
	U4B1-2	1.30	3.04	.00	.00
		4.40	3.02	.00	.00
		14.82	3.07	.00	.00
	R2C1-6	0.31	3.06	.02	.08
		4.73	3.07	.03	.10
		11.41	3.04	.04	.11
	R2C1-7	0.48	3.07	.02	.07
		5.33	3.04	.03	.09
		10.07	3.08	.04	.11
	R2C1-8	2.11	3.04	.02	.08
		5.65	3.01	.06	.17
		12.02	3.04	.02	.08
	R2C1-9	2.36	3.08	.08	.24
		6.60	2.99	.03	.09
		11.00	2.98	.10	.28

* Erroneous test data

Table 1 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Amphibolite	R2C1-10	2.08	3.05	0.13	0.40
		5.67	3.02	.07	.21
		12.30	2.96	.07	.20
	R2C1-11	1.50	3.02	.04	.13
		5.30	3.04	.04	.13
		10.40	2.98	.09	.27
	R2C1-12	1.43	3.18	.05	.15
		5.14	3.12	.03	.09
		10.30	2.95	.07	.22
	R4A1-5	2.46	3.00	.10	.30
		8.67	2.97	.01	.02
		13.70	3.03	.01	.02
	R4A1-6	5.30	3.02	.02	.06
		10.76	2.96	.01	.02
	R4A1-7	0.44	2.99	.01	.04
		4.44	2.96	.00	.01
		10.85	3.05	.03	.09
	R4A1-8	1.94	2.83	.03	.07
		16.14	3.00	.01	.03
	R4A1-9	6.56	2.98	.02	.05
		17.02	2.92	.06	.18
	R4A1-10	1.92	3.03	.03	.09
		9.81	2.83	.05	.14
	R4A1-11	3.19	2.96	.02	.06
		5.34	2.99	.01	.04
		10.90	2.83	.12	.35
	R4A1-12	0.81	2.94	.01	.03
		5.27	3.02	.02	.06
		11.31	2.99	.03	.09
Massive Amphibolite	107	135.06	3.05	.04	.13
		135.22	2.92	.02	.04
		140.46	3.05	.02	.07
		140.97	3.07	.07	.21
		155.40	2.98	.06	.18
Foliated Amphibolite	R2C1-5	0.50	2.93	.02	.06
		4.98	3.02	.03	.09
		10.98	2.96	.06	.19

Table 1 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Amphibolite B	U5A2-1	2.46	3.14	0.07	0.21
		14.94	3.14	.04	.13
		19.22	2.98	.14	.42
	U5A2-2	0.62	3.07	.10	.30
		3.80	3.13	.06	.19
		6.27	3.10	.06	.17
		15.41	3.04	.03	.10
Amphibolite B (with 30% mg)	245	37.09	2.91	.76	2.21
		41.25	2.98	.34	1.01
Amphibolite C	2-52	33.57	3.04	.02	.06
		69.93	3.04	.04	.11
		109.35	2.99	.08	.24
	3-53	16.40	3.01	.01	.02
		78.21	3.00	.02	.07
		104.25	3.10	.01	.03
		159.80	3.03	.01	.03
		193.67	2.96	.04	.13
		252.77	2.98	.02	.04
	3A-54	34.68	3.02	.07	.22
		88.35	2.99	.00	.01
		115.98	2.97	.00	.00
		227.60	2.95	.07	.21
		306.69	2.94	.14	.41
		342.19	2.99	.04	.12
	4-43	22.03	2.99	.02	.07
		46.44	2.79	.03	.10
		111.40	3.03	.02	.05
		150.85	3.01	.04	.12
		182.82	2.99	.05	.15
		208.45	3.02	.04	.13
		302.80	3.05	.03	.10
	4A-68	15.25	2.98	.25	.75
		30.82	3.04	.17	.52
		49.77	3.04	.17	.50
		117.20	2.96	.12	.36
		155.07	2.70	.20	.55
		176.64	2.72	.20	.55
		241.94	2.76	.18	.51
		304.21	2.91	.20	.59
		379.54	2.99	.11	.32

Table 1 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Amphibolite C	105	189.46	2.97	0.04	0.11
		236.97	3.00	.16	.49
		260.17	3.02	.14	.43
	109	271.84	2.79	.12	.32
		273.86	2.99	.02	.07
		315.17	2.90	.07	.21
	110	201.18	2.79	.12	.32
		237.85	2.80	.07	.20
		298.17	2.98	.02	.06
		299.78	3.05	.03	.08
		304.04	3.04	.02	.05
	111	162.72	3.03	.08	.23
		163.97	3.06	.05	.16
		183.70	2.94	.06	.17
	208	56.48	3.01	.34	1.03
		60.35	2.95	.20	.59
		64.12	3.02	.16	.49
		80.81	3.00	.06	.17
		107.63	2.99	.09	.26
		139.29	3.03	.01	.03
		188.62	3.03	.08	.25
		255.01	2.97	.10	.29
		334.91	3.05	.08	.23
	212	10.59	2.98	.08	.23
		14.00	3.00	.29	.87
		17.56	2.99	.03	.10
		30.86	2.94	.03	.09
		32.95	3.01	.04	.11
		37.55	2.94	.12	.35
		76.01	2.97	.03	.08
		204.55	3.01	.03	.10
		394.56	3.01	.03	.10
	219	77.16	3.04	.04	.11
		164.43	3.13	.02	.07
		168.18	3.03	.04	.13
		170.13	3.09	.05	.17
		185.52	2.89	.01	.02
		297.88	2.98	.04	.11

Table 1 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Amphibolite C	220	35.22	2.85	0.81	2.32
		45.56	2.91	.42	1.22
		46.09	2.88	1.16	3.33
		52.83	2.78	3.08	8.56
		79.29	2.98	0.00	.01
		89.94	2.97	.02	.06
		156.67	2.96	.02	.05
		183.63	2.95	.02	.07
		356.74	2.99	.02	.04
		513.40	2.98	.01	.03
		536.00	3.02	.02	.04
	222	7.12	2.99	.49	1.48
		31.63	2.99	.06	.18
		37.24	2.96	.09	.26
		58.92	2.96	.07	.20
		78.50	2.81	.19	.53
		129.31	2.99	.03	.09
		146.80	2.94	.00	.00
		172.62	3.01	-	-
		188.18	3.00	.02	.05
		228.66	2.95	.04	.12
		266.23	2.95	.02	.05
		319.29	2.95	.06	.17
		391.47	2.87	.04	.10
	224	412.14	2.90	.06	.16
		419.78	2.87	.06	.16
		451.82	2.88	.05	.15
	230	102.59	2.95	.11	.33
		109.49	3.05	.12	.38
		132.96	3.02	.22	.66
		219.43	2.94	.05	.14
		241.75	2.98	.08	.22
		467.31	3.00	.00	.00
	241	96.80	3.03	.00	.01
		138.42	2.98	.01	.04
		145.21	3.02	.01	.03
		181.86	3.03	.01	.03
		288.67	2.96	.02	.06
		415.31	2.93	.01	.02
		529.22	2.92	.01	.03

Table 1 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Amphibolite C	245	102.16	3.07	0.02	0.05
		111.36	2.96	.07	.22
		221.40	3.00	.04	.12
		245.59	2.94	.13	.39
		269.69	3.02	.07	.22
		322.59	2.98	.12	.37
	250	36.23	3.05	.05	.16
		37.34	3.02	.32	.96
		44.05	2.90	.27	.79
		65.54	2.96	.12	.34
		67.29	2.97	.04	.11
		74.37	3.02	.02	.07
		82.07	3.00	.04	.11
		205.30	3.00	.08	.26
		350.10	2.98	.05	.16
	253	4.97	2.96	.26	.78
		23.14	3.05	.10	.29
		71.23	2.96	.12	.37
		109.96	3.16	.21	.67
		175.91	2.99	.19	.57
		214.32	3.02	.05	.14
		299.73	3.13	.15	.47
		458.53	3.07	.10	.31
		547.41	2.97	.12	.36
	255	31.14	2.88	.75	2.17
		33.94	2.68	1.96	5.25
		34.14	2.65	2.29	6.06
		63.47	2.99	.03	.09
		92.65	2.98	.09	.26
		129.00	2.95	.10	.29
		147.77	2.97	.06	.16
		265.50	2.95	.04	.11
		369.38	2.97	.16	.49
		391.87	2.97	.18	.52
		404.50	2.97	.08	.23
		441.86	2.96	.17	.51
	256	29.93	2.90	.40	1.16
		36.14	2.99	.10	.30
		37.76	2.95	.14	.41

Table 1 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT
SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Amphibolite C	256 (cont)	120.26	2.99	0.03	0.09
		187.12	3.00	.05	.14
		267.85	3.02	.04	.12
		346.98	3.01	.04	.13
	257	88.53	2.98	.19	.58
		128.66	3.00	.20	.60
		167.37	2.99	.12	.36
		213.16	2.96	.21	.63
		251.94	3.04	.14	.41
		304.95	3.04	.06	.17
	259	59.59	2.77	1.81	5.02
		60.66	2.77	1.84	5.08
		81.17	2.73	2.20	6.01
		90.93	2.87	.83	2.39
		96.18	2.86	1.35	3.86
		105.91	2.90	.34	.98
		116.58	2.97	.14	.40
		195.36	3.00	.14	.42
		265.71	3.02	.14	.43
		294.27	2.99	.09	.26
		298.79	2.95	.13	.37
		303.56	3.03	.13	.38
	U2C3-1	2.50	2.94	.22	.65
		6.30	3.13	.03	.09
		12.50	3.03	.03	.09
	U2C3-2	3.00	2.94	.06	.18
		8.50	3.02	.06	.20
		11.88	2.82	.06	.15
	U5A1-1	0.52	2.98	.00	.00
		7.00	3.00	.18	.54
		12.88	3.00	.20	.60
		15.05	2.97	.02	.06
	U5A1-2	0.97	2.98	.01	.03
		6.06	3.03	.01	.04
		15.00	3.02	.01	.03
		17.82	3.03	.02	.06
	U5B1-1	2.79	3.01	.22	.68
		5.70	2.85	.08	.23
		9.23	2.95	.09	.26

Table 1 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Amphibolite C	U5B1-2	1.79	2.97	0.06	0.16
		4.00	2.93	.06	.18
		7.82	2.90	.13	.38
	U5B2-2	5.38	3.03	.13	.38
		15.45	2.94	.10	.31
		16.80	2.99	.08	.25
	R-5-949	6.70	2.89	.09	.26
		7.00	2.90	.05	.14
		7.25	2.89	.06	.17
		15.00	2.90	.06	.16
		15.50	2.89	.07	.20
		15.52	2.92	.03	.09
		17.00	2.93	.03	.08
		17.50	2.90	.03	.08
		18.00	2.86	.03	.08
		26.70	2.86	.04	.10
Amphibolite C (with 20% mg)	2-52	176.62	2.99	.02	.06
		242.11	3.00	.02	.06
		299.90	2.98	.03	.09
Massive Amphibolite C	U4B2-1	2.26	3.06	.02	.07
		5.82	3.07	.02	.07
		9.12	3.02	.05	.14
	U4B2-2	3.15	3.04	.02	.06
		5.00	3.04	.01	.04
		7.46	3.02	.01	.03
Foliated Amphibolite C	107	165.22	3.02	.10	.29
		173.40	3.04	.05	.14
		180.23	2.96	.05	.15
		183.53	3.02	.05	.16
		193.20	2.99	.11	.32
		205.31	2.96	.10	.30
		224.36	2.99	.03	.09
Chlorite Schist	109	355.90	2.81	.07	.20
		356.37	2.81	.08	.23
		360.61	2.77	.69	1.92
		361.61	2.77	.73	2.03
		383.61	2.93	.14	.40
		386.97	2.79	.65	1.82

Table 1 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Chlorite Schist	111	303.00	2.93	0.06	0.17
		303.93	2.82	.61	1.73
		307.65	2.91	.08	.23
Chlorite Schist B	1A-13	123.46	2.89	.32	.94
		124.00	2.92	.13	.38
	R1A2-8	29.34	2.84	.12	.34
	R1A2-11	13.84	2.95	.50	1.49
	R1A2-12	5.19	2.88	.53	1.53
Chlorite Schist C	107	372.45	2.81	.09	.25
		375.06	2.84	.50	1.41
		378.09	2.79	.94	2.62
	113	135.64	2.85	.42	1.18
		137.36	2.81	.39	1.08
		141.01	2.79	.17	.48
	1A-14	5.30	2.84	.16	.46
		56.87	2.88	.02	.07
		95.58	2.84	.06	.18
	R1A2-5	4.10	2.81	.24	.68
		6.83	2.82	.02	.06
	R1A2-6	9.43	2.83	.04	.12
	R1A2-7	2.25	2.82	.00	.00
		7.56	2.81	.06	.16
	R1A2-8	12.26	2.88	.26	.75
	R1A2-11	6.01	2.85	.04	.12
	U1B2-1	5.66	2.80	.09	.24
	U5B2-1	2.03	2.90	.17	.50
		9.82	2.87	.22	.63
		24.11	2.89	.08	.24
Talc Schist	1A-14	26.78	2.81	.38	1.08
		27.25	2.82	.10	.27
		28.55	2.87	.36	1.04
		58.42	2.76	.00	.00
		75.60	2.87	.08	.21
	U1A1-1	7.72	2.82	.20	.55
		8.08	2.82	.31	.88
		10.83	2.82	.78	2.21
		16.95	2.91	.22	.63
		20.21	2.81	.18	.51

Table 1 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Talc Schist	U1A1-2	4.68	2.90	0.20	0.59
		8.20	2.85	.62	1.77
		10.80	2.87	.31	.90
		12.50	2.92	.35	1.02
		13.03	2.90	.40	1.17
		20.26	2.88	.08	.25
Dike	107	288.79	2.74	.15	.42
		340.53	2.76	.52	1.43
		352.42	2.74	.20	.56
	110	167.68	2.74	.06	.15
	R4A1-6	1.21	2.79	.07	.18
	R4A1-8	5.83	2.87	.06	.19
	R4A1-9	3.30	2.79	.09	.26
	R4A1-10	5.61	2.81	.13	.35
	U2B1-1	6.75	2.90	.08	.23
		14.94	2.83	.04	.11
	U4A2-2	7.30	2.76	.02	.06
Biotite Porphyry Dike	111	331.61	2.70	.04	.10
Metagabbro	3-53	72.58	3.02	.00	.00
		113.28	2.98	.01	.03
		123.02	3.05	.00	.01
	105	113.00	2.96	.13	.40
		134.21	2.96	.47	1.40
		161.65	3.03	.07	.22
		165.20	3.02	.00	.00
		175.17	3.08	.10	.31
		177.68	3.03	.06	.19
		278.00	3.11	.10	.30
	113	197.13	2.95	.03	.09
		198.35	2.98	.01	.03
		200.11	2.96	.01	.02
	224	110.72	2.96	.02	.04
		127.26	2.99	.01	.03
		165.29	2.96	.02	.05
		181.98	2.96	.02	.07
		292.12	2.99	.02	.07
		379.86	2.96	.04	.11

Table 1 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Metagabbro	250	408.74	2.99	0.04	0.13
		483.91	2.99	.03	.10
		551.87	2.99	.02	.06
	253	149.83	3.02	.18	.53
		160.98	3.00	.16	.48
		209.50	3.03	.14	.42
	257	28.18	2.87	.24	.70
		41.97	2.91	.12	.36
		65.02	2.95	.08	.24
		73.73	2.94	.07	.22
	259	214.67	3.02	.13	.39
		227.39	2.95	.15	.44
		280.22	2.90	.14	.40
		285.16	2.90	.14	.40
	R-5-830	3.38	2.97	.00	.00
		4.49	3.01	.00	.00
		8.89	2.95	.00	.00
		11.39	2.96	.00	.00
		13.32	2.96	.00	.01
		17.14	2.97	.00	.00
	U2B1-2	0.53	2.98	.30	.89
		4.81	3.08	.05	.17
		14.77	3.05	.09	.27
Gneissic Metagabbro	2-52	366.12	3.00	.05	.15
		379.05	3.06	.18	.57
		384.30	3.06	.15	.46
	230	87.81	2.79	1.07	2.99
		93.15	2.90	.82	2.38
		94.28	2.95	.40	1.18
		139.61	3.02	.08	.23
		149.17	3.05	.12	.36
		156.60	3.02	.09	.28
	U2C3-1	16.50	2.97	.05	.15
Metasandstone	1A-13	39.32	2.88	.00	.00
		50.71	2.77	.00	.00
		57.24	2.86	.00	.00

Table 1 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Metasediment	R1A2-5	18.20	2.76	0.02	0.06
	R1A2-6	5.82	2.85	.04	.11
		12.04	2.86	.03	.08
	R1A2-7	9.18	2.88	.02	.06
	R1A2-8	7.31	2.87	.04	.12
		8.87	2.80	.07	.20
	R1A2-9	4.50	2.87	.04	.10
		5.95	2.84	.02	.05
	R1A2-11	1.86	2.78	.01	.03
	R1A2-12	1.19	2.81	.12	.32
	U1B1-1	1.32	2.79	.16	.44
		6.15	2.79	.22	.62
		17.68	2.76	.36	1.00
	U1B1-2	4.06	2.77	.05	.14
		8.31	2.76	.07	.19
		11.50	2.76	.09	.26
	U1B2-1	16.30	2.82	.21	.58
	U1B2-2	1.74	2.77	.10	.28
		8.37	2.76	.05	.13
	U3A2-1	0.38	3.00	.02	.06
		10.58	2.99	.03	.09
		11.98	2.96	.06	.16
	U3A2-2	3.34	2.76	.02	.04
		6.50	2.78	.01	.03
		9.58	2.85	.04	.10
Metasediment (Cherty)	R1A2-9	26.78	2.69	.03	.07
	R1A2-10	3.92	2.77	.01	.03
		4.44	2.80	.02	.06
		19.93	2.92	.01	.03
	R1A2-11	20.74	2.74	.01	.03
		24.82	2.91	.01	.03
	R1A2-12	17.67	2.88	.02	.06
Metashale	107	98.85	2.68	1.32	3.53
		107.46	2.82	.06	.16
	109	365.27	2.83	.11	.32
		366.60	2.79	.39	1.09
		396.72	2.87	.10	.29

Table 1 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Metashale	1A-14	117.13	2.74	0.10	0.27
		120.71	2.76	.03	.08
		121.06	2.76	.01	.03
		122.63	2.74	.01	.02
		123.00	2.73	.01	.03
		124.42	2.75	.04	.11
Metasiltstone	111	366.90	2.71	.01	.03
		372.70	2.67	.00	.00
		373.68	2.71	.02	.05
	1A-13	4.17	2.86	.02	.07
		5.80	2.76	.02	.07
		6.94	2.84	.00	.00
Quartzite	1A-13	86.30	2.71	.00	.00
	1A-14	10.73	2.71	.03	.08
		13.82	2.68	.12	.32
	230	338.40	2.80	.02	.06
		345.47	2.75	.06	.15
Serpentine	$U6_1$-1	2.37	2.69	.13	.35
		4.18	2.68	.32	.85
		10.77	2.64	.44	1.18
		17.44	3.13	.18	.55
		18.27	3.23	.27	.86
		19.55	3.29	.30	.98
	$U6_1$-2	2.44	2.71	.24	.64
		5.61	2.68	.26	.69
		8.70	2.67	.31	.84
Talcose Serpentine	111	309.87	2.74	.07	.20
		313.86	2.67	.18	.48
		315.83	2.72	.19	.52
		317.55	2.70	.23	.62
		319.90	2.70	.51	1.37
		320.64	2.59	1.31	3.38
		322.82	2.65	1.13	2.99
	1A-13	101.63	2.78	.00	.00
		109.97	2.61	1.78	4.63

Table 1 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CENTRAL VALLEY PROJECT

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Talcose Serpentine	U3A1-1	1.30			
		5.18	2.86	0.23	0.67
		7.63	2.86	.17	.48
	U3A1-2	2.54	2.81	.15	.41
		4.55	2.88	.15	.44
		13.33	2.84	.16	.47
		6-INCH DIAMETER CORE			
	$R-6_1-506$	1.98	2.85	.69	1.81
	$R-6_2-506$	2.58	2.84	.46	1.30
		6.61	2.83	.64	1.80

Table 2
SUMMARY OF AVERAGES AND RANGES FOR
SPECIFIC GRAVITY, ABSORPTION, POROSITY

AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT - CVP

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Amphibolite and Amphibolite B and C	Avg		2.98	0.12	0.36
	Number		313	312	312
	Range		2.65-3.18	0.00-3.08	0.00-8.56
Amphibolite B (with 30% mg)	Avg		2.94	0.55	1.61
	Number		2	2	2
	Range		2.91-2.98	0.34-0.76	1.01-2.21
Amphibolite C (with 20% mg)	Avg		2.99	0.02	0.07
	Number		3	3	3
	Range		2.98-3.00	0.02-0.03	0.06-0.09
Massive Amphibolite and Mass Amphibolite C	Avg		3.03	0.03	0.09
	Number		11	11	11
	Range		2.92-3.07	0.01-0.07	0.03-0.21
Foliated Amphibolite and Foliated Amphibolite C	Avg		2.99	0.06	0.18
	Number		10	10	10
	Range		2.93-3.04	0.02-0.11	0.06-0.32
Chlorite Schist and Chlorite Schist B and C	Avg		2.85	0.26	0.72
	Number		34	34	34
	Range		2.77-2.95	0.00-0.94	0.00-2.62
Talc Schist	Avg		2.85	0.29	0.82
	Number		16	16	16
	Range		2.76-2.92	0.00-0.78	0.00-2.21
Dike	Avg		2.79	0.13	0.36
	Number		11	11	11
	Range		2.74-2.90	0.02-0.52	0.06-1.43
Biotite Porphyry Dike	Avg		2.70	0.04	0.10
	Number		1	1	1
	Range		n/a	n/a	n/a
Metagabbro	Avg		2.98	0.08	0.23
	Number		42	42	42
	Range		2.90-3.11	0.00-0.47	0.00-1.40

Table 2 (continued)
AUBURN DAMSITE
AUBURN-FOLSOM SOUTH UNIT-CVP

SPECIFIC GRAVITY, ABSORPTION, POROSITY

Rock Type	DH No.	Depth ft.	Bulk Specific Gravity	Absorption % by wt.	Porosity % by vol.
Gneissic Metagabbro	Avg		2.98	0.30	0.88
	Number		10	10	10
	Range		2.97-3.05	0.05-1.07	0.15-2.99
Metasandstone	Avg		2.84	0.00	0.00
	Number		3	3	3
	Range		2.77-2.88	0.00	0.00
Metasediment	Avg		2.83	0.08	0.21
	Number		25	25	25
	Range		2.76-3.00	0.01-0.36	0.03-1.00
Metasediment Cherty	Avg		2.82	0.02	0.04
	Number		7	7	7
	Range		2.69-2.92	0.01-0.03	0.03-0.07
Metashale	Avg		2.77	0.20	0.54
	Number		11	11	11
	Range		2.68-2.87	0.01-1.32	0.02-3.53
Metasiltstone	Avg		2.76	0.01	0.04
	Number		6	6	6
	Range		2.67-2.86	0.00-0.02	0.00-0.07
Quartzite	Avg		2.73	0.05	0.12
	Number		5	5	5
	Range		2.68-2.80	0.00-0.12	0.00-0.32
Serpentine	Avg		2.86	0.27	0.77
	Number		9	9	9
	Range		2.64-3.29	0.13-0.44	0.35-1.18
Talcose Serpentine	Avg		2.76	0.47	1.27
	Number		17	17	17
	Range		2.59-2.88	0.00-1.78	0.00-4.63

Table 3

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY[1]

Auburn Damsite

Auburn-Folsom South Unit - CVP

D H No.	Depth, ft.	E x 10^{-6} [2]				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic[3] Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						AMPHIBOLITE					
1B-23	213.93	13.33	12.66	13.09	13.16	0.20	-	0.21	0.18	47,500	25,000
2-20	94.08	10.64	10.20	10.71	11.14	.20	0.11	.24	.21	22,700	26,080
3-12	92.59	11.49	11.49	11.01	11.29	.16	.10	.23	.20	22,700	24,360
3-49	68.18	12.20	11.49	11.24	11.31	.27	.10	.27	.24	12,200	25,240
	265.31	14.93	13.51	13.93	13.81	.24	.11	.24	.20	40,800	26,820
3A-61	62.56	11.49	14.29	11.39	12.53	.22	.21	.25	.26	26,200	25,740
3A-65	46.83	12.66	11.90	11.88	11.90	.23	.17	.24	.22	29,300	22,510
4-46	213.90	12.82	12.35	12.25	12.41	.19	.14	.21	.20	31,900	26,060
105	329.68	10.10	10.53	8.62	9.17	-	.24	.23	.22	23,530	-
106	36.60	3.89	4.27	6.87	7.43	-	-	.13	.13	27,400	22,060
	60.49	9.52	9.80	10.87	11.04	.11	-	.18	.16	46,000	24,140
	62.75	9.52	9.71	9.42	9.92	.17	.11	.19	.18	31,300	24,260
	68.31	10.99	16.13	12.79	14.71	.15	.24	.23	.26	51,700	24,180
	82.79	9.43	9.90	10.14	10.37	.12	-	.20	.17	17,500	22,910
	88.75	2.39	2.84	-	-	-	-	-	-	18,000	18,890
107	313.07	12.99	9.61	11.44	10.99	.10	.12	.26	.25	11,200	-
109	193.90	7.14	7.30	-	-	.14	.13	-	-	10,330	-
	197.85	11.36	12.50	-	-	.18	.19	-	-	12,910	-
	210.06	8.93	9.80	-	-	.19	.20	-	-	6,480	-
110	136.89	16.13	18.18	17.30	17.92	.19	-	.25	.23	21,420	-
	199.60	10.42	10.31	9.78	10.27	.27	-	.28	.25	10,000	-
111	114.42	8.13	7.87	8.00	8.52	.21	.15	.28	.27	7,800	-
	262.24	11.36	11.36	10.82	11.11	.29	.29	.26	.27	15,730	-

[1] Metric conversions: feet x .3048 equals meters; pounds per square inch x 0.070307 equals kg/cm^2; feet per second x 30.48 equals cm/sec.

[2] "E" represents modulus of elasticity.

[3] Dry condition.

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						AMPHIBOLITE					
113	170.35	14.08	14.93	15.29	15.02	.28	.13	.29	.26	24,960	-
	232.34	10.64	10.99	-	-	.10	-	-	-	20,900	-
	234.31	17.54	17.54	-	-	-	.16	-	-	10,190	-
	234.92	13.89	13.51	-	-	.24	.12	-	-	21,630	-
114	217.08	8.40	8.40	8.38	8.47	0.16	0.10	0.21	0.19	28,700	23,900
	333.57	9.35	9.52	9.52	9.82	.10	-	.18	.17	27,800	23,210
126	121.58	11.90	11.63	10.85	11.26	.25	.17	.24	.22	11,400	27,120
	210.59	10.99	10.53	10.75	10.55	.19	.15	.23	.22	18,200	25,060
145	177.15	13.16	12.99	12.82	13.02	.24	.14	.24	.22	17,400	27,580
148	252.93	11.36	11.11	10.82	10.99	.20	.11	.23	.20	28,600	23,520
160	99.57	6.21	6.94	7.51	7.81	.16	.17	.27	.26	21,600	19,180
179	394.58	10.53	11.36	10.29	10.37	.25	.18	.29	.27	20,500	23,770
188	118.26	9.62	9.71	9.65	10.02	.12	-	.16	.15	30,400	21,960
	242.35	11.49	11.76	11.52	11.01	.20	.13	.24	.20	29,200	24,370
200	280.07	13.33	12.82	13.19	13.02	.20	.10	.24	.21	16,400	24,820
203	184.89	10.87	10.99	10.20	10.35	.20	.12	.21	.19	26,800	24,470
	258.08	7.69	8.47	8.16	8.65	.18	.24	.21	.22	28,500	23,890
251	120.76	3.77	4.41	6.80	7.74	-	-	-	-	22,100	22,750
253	68.35	10.64	10.42	9.51	9.98	.17	.12	.20	.19	25,500	24,810
U1A4-1	2.38	15.87	14.49	13.93	13.93	-	.19	.19	.15	10,660	-
	5.33	13.70	14.29	13.44	13.97	-	.24	.20	.18	10,850	-
	11.00	17.24	17.24	16.72	16.67	-	.21	.28	.25	32,960	-
U1A4-2	1.20	12.99	12.50	13.05	13.62	.17	.10	.23	.22	8,120	-
	5.45	13.33	13.33	12.14	12.89	-	.20	.26	.25	17,510	-
	11.58	15.38	15.15	11.88	12.14	-	.26	-	.29	6,660	-

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						AMPHIBOLITE					
U2B1-1	1.80	5.35	5.52	-	-	0.12	-	-	-	7,200	-
U2C1-1	1.21	19.23	19.23	-	-	-	0.12	-	-	23,150	-
	4.75	14.71	14.49	-	-	.26	.12	-	-	27,600	-
	15.22	14.29	12.99	-	-	-	.10	-	-	15,450	-
U2C1-2	1.12	14.29	14.08	-	-	.16	-	-	-	18,000	-
	3.18	17.54	17.24	-	-	.18	-	-	-	11,330	-
	5.13	13.51	13.16	-	-	.14	-	-	-	16,970	-
	15.00	10.64	10.31	-	-	.15	-	-	-	8,180	-
U4A2-1	3.40	3.36	5.26	-	-	.24	.25	-	-	14,160	-
	5.22	8.77	9.26	-	-	-	-	-	-	6,040	-
	15.39	13.33	13.70	-	-	.25	.11	-	-	23,440	-
U4A2-2	4.07	10.99	10.99	-	-	.18	-	-	-	8,570	-
	10.30	11.24	10.99	-	-	.26	.11	-	-	26,310	-
	16.82	11.76	11.63	-	-	-	.15	-	-	14,750	-
U4B1-1	3.25	13.33	13.33	-	-	.11	-	-	-	19,950	-
	6.66	9.52	10.42	-	-	.17	-	-	-	11,320	-
	15.47	5.52	6.62	-	-	-	.12	-	-	3,550	-
U4B1-2	1.30	15.15	15.15	-	-	.30	.21	-	-	20,250	-
	4.40	15.38	14.93	-	-	.28	-	-	-	15,850	-
	14.82	15.38	15.87	-	-	-	.17	-	-	17,750	-
R2C1-6	0.31	16.95	15.87	16.72	16.84	-	.19	.29	.26	21,510	-
	4.73	16.95	15.63	15.15	15.82	.29	.14	.23	.21	9,270	-
	11.41	13.89	13.51	13.05	13.48	-	.20	-	.29	9,820	-
R2C1-7	0.48	16.39	15.87	15.72	15.87	-	.18	.26	.23	29,150	-
	5.33	13.89	12.99	13.55	13.85	-	.21	.24	.23	17,420	-
	10.07	15.87	14.93	15.02	14.79	-	.16	.27	.23	24,480	-

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

D H No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						AMPHIBOLITE					
R2C1-8	2.11	16.13	14.71	16.89	17.01	-	0.18	0.28	0.25	24,780	-
	5.65	18.18	16.67	17.30	17.06	-	.20	.28	.25	29,270	-
	12.02	17.86	17.86	17.36	18.18	-	.23	.29	.26	28,000	-
R2C1-9	2.36	10.99	11.90	12.47	13.85	-	.11	-	-	6,120	-
	6.60	17.54	17.54	17.42	17.86	-	.19	.27	.24	20,000	-
	11.00	17.54	15.15	14.93	15.29	0.19	-	.20	.18	8,820	-
R2C1-10	2.08	8.70	8.40	9.38	9.51	.16	.15	.29	.27	8,570	-
	5.67	11.11	10.87	11.16	11.82	-	-	.24	.23	6,610	-
	12.30	11.76	12.35	11.63	12.25	-	-	.25	.26	30,720	-
R2C1-11	1.50	14.08	13.89	13.62	13.62	-	.28	.26	.26	37,140	-
	5.30	16.67	14.49	15.72	15.87	-	.17	.30	.27	28,570	-
	10.40	11.63	11.76	11.39	11.68	.21	.15	.21	.21	17,420	-
R2C1-12	1.43	18.87	17.54	17.48	17.61	-	.23	.28	.25	14,300	-
	5.14	20.83	20.83	20.66	21.37	.23	-	.25	.23	24,030	-
	10.30	16.67	16.67	13.89	13.93	-	.20	.27	.23	22,780	-
R4A1-5	2.46	16.67	16.67	16.23	16.95	-	.15	.29	.26	21,180	-
	8.67	15.63	15.63	15.29	15.63	-	.20	.30	.27	20,180	-
	13.70	16.13	16.39	17.79	17.24	-	.21	.30	.27	36,110	-
R4A1-6	5.30	16.39	16.95	16.78	17.48	.30	.15	.27	.26	23,960	-
	10.76	17.24	16.67	16.50	16.39	.26	.25	.28	.27	18,750	-
R4A1-7	0.44	15.63	15.38	14.79	15.43	.28	.12	.25	.23	18,330	-
	4.44	13.89	14.93	14.84	15.63	.28	.27	.25	.24	20,000	-
	10.85	14.29	15.38	19.76	20.58	-	-	-	-	15,300	-
R4A1-8	1.94	11.49	10.87	10.04	10.55	-	-	.30	.30	10,480	-
	16.14	14.49	14.71	14.33	14.66	-	.29	.27	.26	14,850	-

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						AMPHIBOLITE					
R4A1-9	6.56	16.13	14.93	14.45	14.88	-	0.13	0.28	0.25	15,880	-
	17.02	7.58	4.63	-	-	0.20	.28	-	-	3,880	-
R4A1-10	1.92	14.49	13.89	15.34	15.77	-	-	-	.30	9,420	-
	9.81	10.00	10.10	8.80	9.34	.27	.24	.28	.27	8,090	-
R4A1-11	3.19	5.02	6.21	9.88	11.14	-	-	.17	.17	12,720	-
	5.34	13.16	13.16	13.19	13.85	-	.21	.25	.24	18,000	-
	10.90	7.41	7.41	9.75	8.48	.12	.15	-	-	6,700	-
R4A1-12	0.81	14.71	14.71	14.41	14.62	-	.28	.28	.26	24,000	-
	5.27	16.39	16.13	16.29	16.39	.28	-	.24	.22	20,210	-
	11.31	15.38	15.15	14.33	14.62	-	.26	.28	.24	20,300	-
						MASSIVE AMPHIBOLITE					
107	135.06	17.86	17.86	-	-	.18	.16	-	-	21,330	-
	135.22	12.99	14.29	-	-	.21	.19	-	-	-	-
	140.46	17.24	17.24	-	-	.21	.17	-	-	-	-
	140.97	17.86	18.18	-	-	.16	-	-	-	12,840	-
	155.40	20.00	19.61	-	-	.24	.20	-	-	21,970	-
						FOLIATED AMPHIBOLITE					
R2C1-5	0.50	17.86	16.95	17.30	17.24	.21	-	.24	.21	29,450	-
	4.98	17.54	17.24	15.38	16.95	-	.28	.26	.26	23,330	-
	10.98	14.93	14.93	14.53	15.15	.16	.18	.22	.22	11,700	-
						AMPHIBOLITE B					
U5A2-1	2.46	11.36	10.87	11.74	12.22	.11	-	.22	.19	16,510	-
	14.94	14.49	13.51	13.30	13.62	.20	.12	.24	.21	23,470	
	19.22	6.71	6.45	9.40	9.56	.12	-	.22	.23	22,290	-

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
					AMPHIBOLITE B						
U5A2-2	0.62	3.97	4.88	6.44	7.23	-	-	0.16	0.16	10,000	-
	3.80	16.39	15.38	15.77	15.29	0.26	-	.29	.24	21,630	-
	6.27	10.64	10.20	11.31	11.68	.20	0.14	.26	.24	12,640	-
	15.41	17.86	18.52	16.67	14.84	-	.13	.30	.23	29,610	-
				AMPHIBOLITE B (with 30 percent metagabbro)							
245	37.09	2.56	2.92	-	-	-	-	-	-	3,070	20,490
	41.25	-	-	-	-	-	-	-	-	3,060	-
					AMPHIBOLITE C						
2-52	33.57	15.15	14.29	14.93	14.88	.18	.11	.21	.19	15,800	25,300
	69.93	14.08	13.51	13.51	13.85	.23	.23	.24	.23	17,500	24,650
	109.35	12.20	11.90	12.08	12.11	.23	.14	.21	.18	17,000	25,360
3-53	16.40	16.95	21.28	16.03	16.45	.22	.21	-	.25	26,400	28,230
	78.21	14.08	13.89	13.51	13.89	.20	-	.21	.19	30,000	28,590
	104.25	16.13	15.38	15.43	15.58	.24	.11	.24	.22	30,600	29,190
	159.80	16.39	15.38	15.63	16.03	.25	.12	.24	.21	32,500	27,260
	193.67	12.66	14.29	-	-	-	.24	-	-	5,530	26,790
	252.77	12.05	11.76	11.66	11.82	.18	.14	.24	.22	13,100	26,190
3A-54	34.68	12.66	12.20	12.76	12.89	.24	.11	.25	.24	14,600	26,790
	88.35	14.71	15.15	14.97	14.93	-	.14	-	.23	21,700	28,320
	115.98	14.93	13.33	14.66	14.45	.22	.12	-	.23	29,500	26,720
	227.60	3.46	4.08	-	-	.16	.17	-	-	3,100	22,240
	306.69	-	-	-	-	-	-	-	-	27,050	20,640
	342.19	12.05	11.24	12.92	12.95	.18	-	.27	.21	17,300	26,920

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						AMPHIBOLITE C					
4-43	22.03	17.54	16.67	16.39	16.08	0.25	0.15	0.26	0.23	33,300	26,670
	46.44	11.24	10.20	8.76	9.24	.29	.15	.30	.27	5,810	20,300
	111.40	13.89	13.33	14.49	14.12	.22	.12	.25	.21	34,700	25,300
	150.85	13.89	14.08	14.20	14.16	.18	.06	.17	.10	15,700	24,250
	182.82	13.39	13.70	13.26	13.33	.22	-	.23	.20	6,940	27,150
	208.45	14.49	14.71	13.55	13.89	.23	.12	.24	.22	26,100	26,650
	302.80	17.54	16.67	17.18	16.18	.25	.13	.26	.23	21,100	27,710
4A-68	15.25	14.93	14.93	14.66	14.66	.25	.27	.22	.22	15,900	25,590
	30.82	9.80	12.05	-	-	.22	.17	-	-	11,200	25,740
	49.77	18.87	20.41	-	-	-	-	-	-	7,900	24,650
	117.20	9.80	10.20	-	-	.19	.18	-	-	10,400	25,000
	155.07	9.17	8.93	-	-	.10	-	-	-	6,320	23,670
	176.64	12.99	13.33	13.12	13.30	.16	.13	.15	.15	12,300	23,970
	241,94	12.66	12.66	12.25	12.53	.16	.10	.20	.19	17,400	23,730
	304.21	11.49	10.99	10.82	10.99	.25	.19	.29	.26	13,200	23,390
	379.54	13.16	12.66	13.66	13.51	.29	.19	.26	.25	29,200	24,420
105	189.46	15.38	13.89	-	-	.22	.11	-	-	22,060	-
	236.97	14.71	14.49	-	-	-	-	-	-	14,960	-
	260.17	2.94	3.42	-	-	.11	-	-	-	8,540	-
109	271.84	17.86	15.15	-	-	.25	.18	-	-	14,060	-
	273.86	15.15	14.71	-	-	.15	.15	-	-	16,340	-
	315.17	9.52	10.10	-	-	.23	.20	-	-	8,900	-
110	201.18	6.10	6.10	-	-	-	-	-	-	4,280	-
	237.85	12.20	12.50	-	-	.16	.12	-	-	10,040	-
	298.17	15.63	16.13	-	-	.22	.13	-	-	23,740	-
	299.78	16.67	17.54	-	-	.12	-	-	-	21,200	-
	304.04	18.18	17.54	-	-	.20	.14	-	-	31,600	-

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						AMPHIBOLITE C					
111	162.72	12.82	12.99	-	-	0.19	-	-	-	9,420	-
	163.97	7.14	7.63	-	-	-	-	-	-	12,330	-
	183.70	12.82	14.08	-	-	.12	0.16	-	-	27,810	-
208	56.48	14.71	14.29	13.48	13.70	.25	.21	0.24	0.24	13,800	25,000
	60.35	10.64	-	-	-	-	-	-	-	7,910	24,940
	64.12	14.71	11.90	-	-	-	.12	-	-	10,800	26,440
	80.81	16.13	17.54	16.61	17.42	.29	.23	.26	.25	31,700	27,280
	107.63	16.39	17.24	16.45	17.06	.23	-	-	.24	26,900	27,390
	139.29	16.13	16.67	16.89	17.61	.21	.15	.26	.25	36,400	27,620
	188.62	17.24	17.86	15.67	16.95	-	.29	-	.30	15,600	27,190
	255.01	15.15	15.38	13.81	14.84	.27	.12	.25	.23	13,300	24,390
	334.91	16.67	15.15	15.29	15.24	-	.20	-	-	23,100	24,530
212	10.59	9.09	8.70	8.73	9.01	-	-	-	-	14,000	26,410
	14.00	-	-	-	-	-	-	-	-	13,900	24,260
	17.56	18.18	16.67	16.39	16.03	-	.15	.26	.21	31,600	28,460
	30.86	10.00	9.52	11.76	11.96	.22	.14	.23	.20	15,800	25,490
	32.95	12.05	12.50	13.09	13.26	.19	.12	.21	.19	14,100	24,330
	37.55	8.47	7.04	-	-	.06	.07	-	-	4,210	21,650
	76.01	16.95	14.71	15.63	14.84	-	.13	.29	.23	23,200	27,280
	204.55	13.89	12.99	13.40	13.40	.22	.16	.22	.20	33,700	28,460
	394.56	16.67	15.38	15.92	15.43	.30	.14	.27	.22	23,000	27,730
219	77.16	16.67	16.67	15.92	16.08	.18	-	.20	.17	28,100	29,900
	164.43	18.87	16.63	17.30	16.67	.23	-	.22	.17	21,100	25,180
	168.18	19.23	16.95	17.73	17.12	.19	-	.21	.16	31,700	25,670
	170.13	16.39	15.87	18.25	18.32	.21	-	.20	.16	20,200	29,100
	185.52	12.20	12.05	10.80	11.79	.20	.13	.21	.20	18,500	22,060

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
					AMPHIBOLITE C						
220	35.22	5.56	6.02	-	-	-	-	-	-	4,560	21,340
	45.56	-	-	-	-	-	-	-	-	8,820	23,210
	46.09	11.36	10.75	-	-	-	-	-	-	9,550	23,650
	52.83	4.03	4.03	-	-	-	-	-	-	5,750	21,820
	79.29	19.23	14.08	16.84	14.12	0.35	0.11	0.30	0.22	28,400	24,420
	89.94	13.33	13.33	13.74	13.59	.19	.13	.24	.21	29,200	24,140
	156.67	14.49	14.71	13.93	14.41	.20	-	.23	.20	25,600	25,180
	183.63	15.63	15.38	16.39	15.92	-	.15	.29	.23	19,900	26,530
	356.74	13.33	13.16	13.77	14.04	.21	.14	.24	.22	22,800	26,410
	513.40	16.13	16.13	16.78	16.56	-	.13	.27	.23	27,100	27,980
	536.00	14.71	14.29	14.25	14.62	.22	.13	.23	.22	20,400	27,580
222	7.12	10.00	8.62	11.09	11.11	.16	-	.21	.19	21,700	23,730
	31.63	12.82	12.66	13.12	13.37	.23	.13	.21	.19	26,800	25,530
	37.24	13.51	13.33	13.09	13.16	.22	.15	.24	.22	28,200	25,420
	58.92	14.71	14.29	15.06	14.66	.19	.11	.23	.21	24,200	24,390
	78.50	3.34	2.91	-	-	.10	.12	-	-	12,600	21,040
	129.31	16.95	17.86	17.61	17.54	.22	.12	.24	.21	19,500	28,620
	146.80	16.95	15.15	15.72	15.24	.17	-	.23	.20	24,200	24,250
	172.62	17.54	16.13	15.97	16.84	.25	.11	.24	.21	39,600	26,920
	188.18	15.38	15.15	16.18	15.58	.22	.14	.24	.21	22,400	25,550
	228.66	13.33	13.16	13.16	13.30	.24	.13	.24	.22	18,100	26,660
	266.23	15.87	15.63	16.39	15.87	.25	-	.26	.21	21,600	27,130
	319.29	12.99	10.42	-	-	.16	.12	-	-	9,480	26,580
	391.47	12.66	12.50	13.02	12.89	.23	.15	.26	.23	6,920	26,090

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6} 0-1000 lb/in² 1st cycle	E x 10^{-6} 0-1000 lb/in² 2nd cycle	E x 10^{-6} 0-5000 lb/in² 1st cycle	E x 10^{-6} 0-5000 lb/in² 2nd cycle	Poisson's Ratio 0-1000 lb/in² 1st cycle	Poisson's Ratio 0-1000 lb/in² 2nd cycle	Poisson's Ratio 0-5000 lb/in² 1st cycle	Poisson's Ratio 0-5000 lb/in² 2nd cycle	Compressive Strength, lb/in²	Sonic Velocity, ft./sec.
					AMPHIBOLITE C						
224	412.14	8.46	-	-	-	0.14	-	-	-	4,010	25,000
	419.78	12.66	12.66	11.04	11.74	.28	0.16	0.24	0.23	9,630	24,650
	451.82	12.66	12.66	11.90	11.96	.27	.15	.27	.24	7,220	23,490
230	102.59	11.36	10.75	11.49	11.74	.19	.12	.23	.20	10,100	22,180
	109.49	11.90	12.20	12.22	12.11	.17	.13	.21	.18	14,100	23,680
	132.96	7.69	6.67	8.62	8.82	.19	-	.23	.19	12,000	22,380
	219.43	9.80	9.52	10.12	10.29	-	-	.12	.10	22,000	23,450
	241.75	8.55	8.85	9.01	9.24	-	-	.10	.10	29,700	21,370
	467.31	14.29	13.51	12.76	13.19	.17	-	.21	.18	30,000	26,330
241	96.80	16.39	18.18	17.36	17.24	.28	.16	.29	.24	22,300	24,770
	138.42	14.08	14.08	13.85	-	.20	.10	.24	-	19,500	25,060
	145.21	11.24	10.64	11.42	11.55	.22	.11	.26	.23	17,300	23,820
245	102.16	19.23	16.67	17.86	17.54	.23	.12	.28	.20	13,900	25,670
	111.36	6.58	6.10	7.36	7.53	.11	.12	.24	.24	10,600	22,990
	221.40	12.66	12.20	11.90	12.17	.23	-	.23	.20	17,800	24,770
	245.59	11.36	12.66	10.99	11.85	.19	.18	.22	.22	15,900	23,760
	269.69	10.00	8.33	10.35	10.42	-	-	-	-	14,400	25,420
	322.59	8.85	8.70	-	-	.13	.14	-	-	12,900	23,910
250	36.23	10.53	8.00	10.80	11.26	.23	-	.29	.22	7,990	25,800
	37.34	16.95	16.67	16.39	16.67	-	.25	.25	.24	16,000	26,450
	44.05	3.13	3.56	-	-	-	-	-	-	3,460	20,930
	65.54	11.24	-	-	-	.19	-	-	-	9,490	25,330
	67.29	14.49	14.93	15.63	15.38	.26	.19	.24	.22	11,900	24,590
	74.37	13.33	17.54	16.56	17.73	.23	.12	.25	.22	27,100	25,300
	82.07	9.90	15.63	14.01	15.67	-	-	-	-	12,700	26,780
	205.30	14.08	13.89	13.93	14.20	.20	.17	.27	.26	13,000	23,030
	350.10	8.00	8.13	8.99	10.64	-	-	.18	.19	5,220	22,370

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						AMPHIBOLITE C					
253	4.97	8.93	9.35	-	-	-	-	-	-	11,500	24,400
	23.14	13.89	13.51	14.04	13.81	-	0.19	0.26	0.23	27,000	25,420
	71.23	10.64	9.26	10.53	10.89	0.21	.15	.20	.19	35,200	23,030
	109.96	9.17	8.62	8.82	9.38	.11	-	.18	.17	12,900	22,660
	175.91	9.35	8.26	-	-	.23	.17	-	-	7,310	21,600
	214.32	12.82	12.35	12.35	12.47	.18	-	.24	.22	20,300	24,260
	299.73	8.55	5.35	7.55	7.35	.12	-	-	-	7,610	23,860
	458.53	14.29	-	-	-	.17	-	-	-	8,630	25,330
	547.41	9.35	9.35	-	-	.20	.12	-	-	8,510	22,970
255	31.14	6.13	6.49	-	-	.21	.23	-	-	5,040	19,780
	33.94	-	-	-	-	-	-	-	-	620	13,520
	34.14	-	-	-	-	-	-	-	-	740	12,950
	63.47	15.38	14.71	15.20	15.43	-	.10	-	.23	41,000	25,670
	92.65	14.29	13.70	14.37	14.62	.20	.10	.22	.19	9,830	24,310
	129.00	13.70	12.50	13.05	12.79	-	.16	.22	.19	9,240	25,060
	147.77	15.63	15.15	15.11	15.34	.28	.21	.22	.27	37,500	25,420
	265.50	14.71	14.29	15.53	15.24	.25	.17	.27	.24	20,700	24,650
	369.38	16.95	14.71	15.53	15.02	.24	.18	.21	.19	26,100	22,670
	391.87	15.15	14.29	14.71	14.29	.27	.19	-	.27	17,600	24,940
	404.50	14.93	14.08	14.20	14.37	.21	.14	.25	.23	20,200	24,530
	441.86	11.36	9.43	-	-	.23	-	-	-	10,600	22,690
256	29.93	4.48	5.08	-	-	-	.17	-	-	8,410	22,710
	36.14	9.17	7.75	7.51	8.10	.13	.10	.14	.14	18,600	25,120
	37.76	12.05	11.76	12.11	12.32	-	-	-	-	15,300	24,030
	120.26	7.52	7.58	12.41	12.82	.11	-	.20	.19	18,700	25,830
	187.12	16.95	14.93	15.92	15.20	.27	.15	.27	.24	14,400	26,850
	267.85	16.13	16.39	16.39	16.34	-	.11	-	.26	29,800	26,120
	346.98	17.24	16.67	16.84	16.95	.21	.10	.26	.22	18,000	26,850

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						AMPHIBOLITE C					
257	88.53	5.32	4.81	-	-	0.14	0.12	-	-	9,670	22,490
	128.66	14.71	14.08	-	-	.25	.13	-	-	5,900	23,280
	167.37	10.20	10.42	-	-	-	-	-	-	6,850	24,220
	213.16	10.42	9.62	-	-	.27	-	-	-	7,870	25,360
	251.94	20.41	17.86	20.00	18.66	-	.14	0.29	0.22	15,400	27,980
	304.95	17.24	17.54	17.99	17.92	-	.21	.28	.25	16,500	26,480
259	59.59	-	-	-	-	-	-	-	-	2,090	16,850
	60.66	-	-	-	-	-	-	-	-	2,610	17,270
	81.17	-	-	-	-	-	-	-	-	2,300	15,510
	90.93	3.88	4.03	-	-	-	-	-	-	4,190	21,040
	96.18	2.62	2.79	-	-	-	-	-	-	3,190	18,570
	105.91	15.38	13.70	14.29	13.74	-	.21	.28	.24	10,500	22,330
	116.58	15.87	15.38	15.11	15.38	-	.20	.28	.25	19,100	24,590
	195.36	15.87	15.15	15.29	15.48	.30	.23	.28	.26	32,400	25,330
	265.71	14.29	14.49	14.37	14.71	.30	.25	.26	.24	25,800	25,090
	294.27	15.38	15.15	15.67	15.67	.26	.21	-	.30	26,800	25,300
	298.79	14.29	13.51	14.79	13.97	-	.20	.29	.25	16,100	24,030
	303.56	16.95	15.87	16.56	17.06	.29	.13	-	.27	34,500	25,150
U2C3-1	2.50	8.93	9.17	-	-	.19	.12	-	-	11,690	20,070
	6.30	15.63	14.42	14.97	15.92	.23	-	.19	.17	19,860	21,360
	12.50	13.89	13.89	13.44	13.70	.17	-	.18	.14	27,000	20,760
U2C3-2	3.00	12.35	12.50	12.11	12.14	.10	.10	.18	.17	12,660	21,540
	8.50	11.76	10.87	10.80	11.26	.13	-	.23	.19	10,000	20,450
	11.88	11.63	11.76	11.68	11.88	.19	.12	.28	.25	23,420	20,330

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						AMPHIBOLITE C					
U5A1-1	0.52	22.22	18.87	16.67	16.95	-	0.13	0.29	0.25	37,870	24,640
	7.00	5.88	3.76	-	-	-	-	-	-	6,970	21,520
	12.88	3.52	1.97	5.00	4.63	-	.10	.16	.16	11,360	19,390
	15.05	16.13	15.38	1.506	15.29	-	-	.28	.22	21,430	24,260
U5A1-2	0.97	16.95	16.67	16.23	16.34	-	.12	.29	.25	35,830	24,360
	6.06	15.63	14.93	14.84	15.29	-	.12	.26	.23	28,180	24,810
	15.00	15.63	15.15	13.89	14.58	-	-	.24	.20	27,900	25,000
	17.82	14.49	13.33	14.45	14.75	-	-	.26	.21	17,700	25,390
U5B1-1	2.79	13.89	12.66	12.66	12.44	0.29	.18	.24	.22	23,260	-
	5.70	10.42	10.75	10.10	10.31	.19	.16	.23	.22	19,810	-
	9.23	13.33	13.51	12.89	13.26	.25	.16	.24	.22	23,680	-
U5B1-2	1.79	13.70	10.00	12.41	12.47	.19	-	.21	.21	15,370	-
	4.00	13.16	13.70	13.40	13.77	.20	.12	.23	.22	32,770	-
	7.82	10.10	9.52	9.40	9.75	-	-	.16	.17	10,550	-
U5B2-2	5.38	8.93	8.20	9.16	9.24	-	.12	.22	.23	7,550	-
	15.45	7.81	8.33	8.82	9.38	.17	.12	.21	.21	9,120	-
	16.80	13.33	13.33	12.95	13.16	.19	.15	.24	.22	11,030	-
R-5-949	6.70	8.93	8.00	9.26	-	-	.14	-	-	6,230	-
	7.00	9.01	6.08	6.62	7.44	.11	-	-	-	10,790	-
	7.25	7.69	6.94	-	-	-	-	-	-	9,760	-
	15.00	4.00	6.90	7.11	8.58	-	-	.19	.19	8,420	-
	15.50	11.63	10.64	12.08	12.25	-	-	.20	.21	7,280	-
	15.52	15.87	16.39	15.67	16.13	-	.13	.26	.23	17,200	-
	17.00	13.51	12.66	12.44	12.66	-	.23	.30	.27	10,010	-
	17.50	12.82	12.82	12.56	13.37	.23	.21	.27	.28	11,560	-
	18.00	12.20	12.35	12.20	12.66	-	.30	-	-	11,320	-
	26.70	10.87	10.87	9.92	10.37	.27	.13	-	.30	15,800	-

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6} 0-1000 lb/in^2 1st cycle	E x 10^{-6} 0-1000 lb/in^2 2nd cycle	E x 10^{-6} 0-5000 lb/in^2 1st cycle	E x 10^{-6} 0-5000 lb/in^2 2nd cycle	Poisson's Ratio 0-1000 lb/in^2 1st cycle	Poisson's Ratio 0-1000 lb/in^2 2nd cycle	Poisson's Ratio 0-5000 lb/in^2 1st cycle	Poisson's Ratio 0-5000 lb/in^2 2nd cycle	Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
					MASSIVE AMPHIBOLITE C						
U4B2-1	2.26	15.87	16.13	15.48	15.77	0.25	0.21	0.26	0.24	27,380	26,230
	5.82	14.92	14.08	14.79	14.49	.24	.10	.24	.19	22,250	27,180
	9.12	11.11	10.20	12.35	12.69	.17	-	.19	.16	21,360	25,520
U4B2-2	3.15	13.89	13.33	13.19	13.81	.17	-	.14	.12	8,550	26,120
	5.00	16.95	16.13	16.50	16.61	.25	-	.27	.27	28,660	25,090
	7.46	16.39	17.24	15.72	15.72	.23	.12	.25	.22	22,740	26,070
					FOLIATED AMPHIBOLITE C						
107	165.22	11.76	12.05	-	-	-	-	-	-	11,060	-
	173.40	19.23	19.23	-	-	.17	.12	-	-	31,240	-
	180.23	15.87	16.39	-	-	-	-	-	-	-	-
	183.53	18.87	18.87	-	-	.13	-	-	-	29,030	-
	193.20	18.18	17.24	-	-	.24	.14	-	-	16,150	-
	205.31	16.67	16.13	-	-	.27	.14	-	-	12,360	-
	224.36	22.22	21.74	-	-	.27	-	-	-	23,710	-
					AMPHIBOLITE C (with 20 percent metagabbro)						
2-52	176.62	15.38	15.38	15.20	15.43	.23	.17	.23	.22	19,700	27,140
	242.11	17.24	17.24	15.38	15.24	.26	.16	.25	.21	17,400	28,390
	299.90	12.05	11.49	11.52	11.47	.27	.17	.25	.22	33,800	25,970
					CHLORITE SCHIST						
109	355.90	6.56	6.62	6.01	-	.13	.11	.25	-	4,490	20,040
	356.37	8.13	8.40	7.44	7.70	.18	.23	.26	.26	5,440	22,720
	360.61	1.48	1.63	-	-	.14	.12	-	-	5,170	13,560
	361.61	1.68	1.75	-	-	.15	.13	-	-	4,200	13,890
	383.61	5.40	-	-	-	.10	-	-	-	1,440	13,830
	386.97	1.88	2.02	-	-	.27	.22	-	-	3,470	14,300
111	303.00	10.99	8.77	-	-	-	-	-	-	3,490	26,290
	303.93	-	-	-	-	-	-	-	-	1,920	13,730
	307.65	7.19	-	-	-	-	-	-	-	3,640	23,090

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit — CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
					CHLORITE SCHIST B						
1A-13	123.46	0.60	0.94	-	-	0.13	0.18	-	-	6,790	-
	124.00	1.83	2.72	-	-	.13	.15	-	-	7,570	-
R1A2-8	29.34	5.00	-	-	-	.25	-	-	-	3,680	21,490
R1A2-11	13.84	1.61	1.96	-	-	.21	.19	-	-	2,250	21,240
R1A2-12	5.19	3.33	3.44	-	-	-	-	-	-	4,550	22,930
					CHLORITE SCHIST C						
107	372.45	4.67	5.99	-	-	.19	.24	-	-	-	-
	375.06	14.93	13.16	-	-	.22	.20	-	-	6,490	-
	378.09	7.14	7.25	-	-	.16	.13	-	-	-	-
113	135.64	6.58	8.33	-	-	-	-	-	-	4,790	-
	137.36	2.81	3.01	-	-	-	-	-	-	4,450	-
	141.01	4.29	5.13	-	-	.16	.20	-	-	3,120	-
1A-14	5.30	3.20	3.66	-	-	.21	.22	-	-	8,600	-
	56.87	8.06	8.85	-	-	.26	.20	-	-	16,200	-
	95.58	3.23	6.85	-	-	-	.17	-	-	8,580	-
R1A2-5	4.10	9.01	7.52	-	-	-	-	-	-	3,880	23,880
	6.83	14.08	13.89	15.43	16.34	.21	.11	0.26	0.24	16,370	26,140
R1A2-6	9.43	5.65	-	-	-	.12	-	-	-	2,740	21,260
R1A2-7	2.25	10.10	9.80	9.75	9.78	.16	.13	.20	.19	12,180	22,570
	7.56	5.24	-	-	-	.22	-	-	-	3,650	20,200
R1A2-8	12.26	2.39	2.21	-	-	-	-	-	-	1,430	20,110
R1A2-11	6.01	7.69	-	-	-	.17	-	-	-	1,830	21,850
U1B2-1	5.66	11.76	11.63	10.68	11.06	.27	.22	.27	.26	5,000	-
U5B2-1	2.03	13.70	12.99	13.48	12.95	.23	.13	.26	.23	15,780	-
	9.82	9.43	9.01	8.05	8.46	.21	.15	.25	.24	8,260	-
	24.11	5.52	6.67	7.44	8.38	.18	.19	.26	.27	9,940	-

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						TALC SCHIST					
1A-14	26.78	1.14	1.46	-	-	0.17	0.17	-	-	3,510	-
	27.25	2.34	2.74	-	-	.24	.23	-	-	-	-
	28.55	0.92	1.16	-	-	-	-	-	-	-	-
	58.42	2.08	3.16	-	-	-	.12	-	-	3,880	-
	75.60	1.20	1.52	-	-	.28	.25	-	-	-	-
U1A1-1	7.72	4.46	-	-	-	.17	-	-	-	2,150	19,740
	8.08	3.73	-	-	-	-	-	-	-	1,000	18,690
	*10.83	0.94	1.13	-	-	-	-	-	-	820	18,720
	16.95	2.81	3.33	-	-	.22	.20	-	-	2,330	18,790
	*20.21	1.37	-	-	-	-	-	-	-	790	18,370
U1A1-2	4.68	4.76	4.85	-	-	-	-	-	-	4,300	21,460
	8.20	2.78	3.58	-	-	-	-	-	-	2,000	20,100
	10.80	1.41	1.81	-	-	-	-	-	-	2,420	20,310
	12.50	3.34	4.52	-	-	-	-	-	-	3,970	22,080
	13.03	4.72	6.10	-	-	-	-	-	-	4,510	22,830
	20.26	4.70	6.49	-	-	-	-	-	-	2,480	19,360
						DIKE					
107	288.79	12.05	11.36	-	-	.17	.14	-	-	14,580	-
	340.53	8.70	8.55	-	-	.24	.14	-	-	21,200	-
	352.42	7.52	8.00	-	-	.13	.12	-	-	12,180	-
110	167.68	8.40	8.48	8.17	8.50	-	-	0.27	0.26	18,480	-
R4A1-6	1.21	8.48	8.26	8.00	8.33	-	.22	.23	.21	22,000	-
R4A1-8	5.83	11.11	10.99	10.46	10.57	.26	.14	.23	.21	17,820	-
R4A1-9	3.30	6.99	5.13	-	-	.24	-	-	-	3,600	-
R4A1-10	5.61	8.93	9.09	6.30	7.23	.24	-	-	-	4,850	-

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit — CVP

D H No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						DIKE					
U2B1-1	6.75	8.85	8.85	-	-	0.23	0.23	-	-	30,840	-
	14.94	10.10	10.00	-	-	.21	-	-	-	29,820	-
U4A2-2	7.30	10.75	10.53	-	-	.24	-	-	-	19,800	-
						BIOTITE PORPHYRY DIKE					
111	331.61	10.31	10.75	-	-	.14	.12	-	-	21,720	-
						METAGABBRO					
3-53	72.58	16.95	16.13	16.23	16.13	.24	.15	0.24	0.22	25,200	28,330
	113.28	14.71	15.15	14.58	15.02	.21	.12	.22	.21	24,800	28,000
	123.02	16.39	15.38	14.45	15.34	.18	-	.22	.20	34,000	27,710
105	113.00	12.99	12.66	-	-	.16	-	-	-	19,600	-
	134.21	6.29	6.37	-	-	-	-	-	-	7,180	-
	161.65	14.49	14.49	-	-	.17	.13	-	-	17,240	-
	165.20	16.13	15.63	-	-	-	-	-	-	-	-
	175.17	13.70	14.49	-	-	.18	.16	-	-	17,370	-
	177.68	13.51	16.13	-	-	-	-	-	-	15,930	-
	278.00	3.73	3.64	6.08	6.35	-	-	-	-	24,780	-
113	197.13	14.71	15.38	-	-	-	.22	-	-	27,050	-
	198.35	16.67	15.87	-	-	.23	-	-	-	28,420	-
	200.11	17.86	16.67	-	-	-	.25	-	-	21,810	-
224	110.72	14.71	14.71	14.97	14.97	.21	.12	.24	.21	34,600	22,630
	127.26	14.71	14.08	13.89	14.16	.25	.13	.24	.22	35,100	24,770
	165.29	16.39	15.87	16.29	16.03	.28	.14	.29	.24	22,400	24,700
	181.98	14.08	13.33	13.70	13.66	-	.15	.26	.22	39,700	25,510
	292.12	16.67	15.87	15.97	15.67	.25	.11	.25	.22	31,600	25,610
	379.86	12.82	12.35	12.17	12.25	.27	.16	.24	.21	25,500	25,420

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit — CVP

D H No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						METAGABBRO					
250	408.74	15.15	14.49	15.29	14.93	0.24	-	0.22	0.19	15,400	25,360
	483.91	16.39	15.63	15.58	15.48	.30	0.12	-	.25	21,200	24,590
	551.87	15.15	14.49	14.53	14.75	.24	.13	.27	.24	33,100	25,180
253	149.83	11.90	11.90	12.05	12.38	.17	.11	.19	.18	18,700	24,480
	160.98	10.31	10.31	11.44	12.14	.19	.13	.20	.19	11,900	23,950
	209.50	14.71	14.08	14.16	14.45	.22	.13	.25	.21	19,400	25,420
257	28.18	2.84	3.18	-	-	.25	.26	-	-	3,520	21,270
	41.97	13.89	13.33	13.85	13.81	.25	.11	.24	.21	18,300	25,930
	65.02	16.13	15.15	15.77	15.48	.27	.14	-	.27	26,800	26,280
	73.73	15.38	15.63	15.53	15.53	.25	.16	.28	.26	41,900	27,820
259	214.67	14.93	14.49	15.82	16.03	.22	-	-	.29	10,700	26,080
	227.39	14.49	14.49	14.33	14.62	.23	.20	.27	.25	33,400	25,090
	280.22	13.51	14.29	13.44	13.81	.24	.19	.25	.23	32,700	24,770
	285.16	14.49	14.49	14.71	14.49	.28	.19	-	.30	25,100	24,140
R5-830	3.38	14.29	14.93	14.04	14.93	-	.30	.28	.28	39,040	-
	4.49	16.67	16.13	15.38	16.23	-	.14	.28	.26	29,450	-
	8.89	14.29	15.15	14.16	14.79	-	.29	-	.29	39,220	-
	11.39	10.31	12.20	11.11	13.19	.19	.13	.20	.21	27,540	-
	13.32	14.29	14.29	13.81	14.25	-	-	-	-	17,220	-
	17.14	15.38	16.95	15.38	15.87	-	.20	.27	.26	34,500	-
U2B1-2	0.53	7.41	7.75	-	-	.14	-	-	-	15,210	-
	4.81	9.80	10.31	-	-	.17	-	-	-	21,000	-
	14.77	12.66	12.99	-	-	.17	-	-	-	9,090	-

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0-5000 lb/in^2		0-1000 lb/in^2		0-5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
					GNEISSIC METAGABBRO						
2-52	366.12	13.89	14.08	14.20	14.25	0.22	0.13	0.22	0.19	16,000	26,190
	379.05	12.82	11.63	11.76	11.71	.15	.07	.18	.15	9,060	26,580
	384.30	12.20	12.05	12.17	12.44	.18	.12	.21	.19	16,000	26,760
230	87.81	1.10	1.21	-	-	-	-	-	-	5,290	17,330
	93.15	4.81	4.44	-	-	-	-	-	-	6,120	19,730
	94.28	6.41	6.33	-	-	-	-	-	-	6,850	21,320
	139.61	13.51	13.33	12.59	12.82	.19	-	.20	.18	21,500	24,730
	149.17	6.62	6.37	-	-	-	-	-	-	2,710	20,070
	156.60	14.29	13.33	13.33	13.66	.20	.12	.21	.20	19,800	24,590
U2C3-1	16.50	11.90	12.05	-	-	.22	.16	-	-	18,180	21,060
					METASANDSTONE						
1A-13	39.32	13.51	13.51	-	-	.26	.14	-	-	22,900	-
	50.71	13.33	13.16	-	-	.27	.17	-	-	24,100	-
	57.24	16.67	15.38	-	-	.18	.11	-	-	27,020	-
					METASEDIMENT						
109	387.84	1.71	1.87	-	-	.11	.10	-	-	3,120	-
	391.79	1.49	1.50	-	-	-	-	-	-	3,060	-
	398.40	3.70	3.94	-	-	.17	.16	-	-	5,660	-
R1A2-5	18.20	11.24	10.31	10.92	10.75	.26	.14	.25	.22	17,220	22,510
R1A2-6	5.82	10.31	-	-	-	.22	-	-	-	3,410	22,310
	12.04	9.62	-	-	-	.24	-	-	-	3,800	21,260
R1A2-7	9.18	8.93	9.01	8.99	9.07	.23	.19	.29	.26	7,430	20,470
R1A2-8	7.31	7.52	6.90	-	-	-	-	-	-	5,290	22,490
	8.87	7.81	6.10	6.42	6.88	-	-	-	.30	6,400	22,770
R1A2-9	4.50	12.20	11.49	11.96	11.71	.28	.17	.27	.24	15,390	26,920
	5.95	15.38	13.89	13.93	13.30	-	.17	.28	.23	12,480	25,290

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit — CVP

D H No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0-5000 lb/in^2		0-1000 lb/in^2		0-5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						METASEDIMENT					
R1A2-11	1.86	11.36	10.20	9.86	9.77	0.27	0.17	0.28	0.25	14,620	24,470
R1A2-12	1.19	7.87	-	-	-	.18	-	-	-	6,110	25,130
U1B1-1	1.32	10.20	11.11	8.59	9.71	-	.30	.21	.22	9,090	-
	6.15	9.26	4.70	-	-	-	-	-	-	5,880	-
	17.68	-	-	-	-	-	-	-	-	5,880	-
U1B1-2	4.06	15.38	20.41	16.67	16.23	.25	.10	-	.30	19,570	-
	8.31	2.32	1.89	-	-	-	-	-	-	2,300	-
	11.50	7.41	6.02	7.24	7.69	-	.20	-	-	6,180	-
U1B2-1	16.30	2.51	1.61	-	-	.19	.14	-	-	2,670	-
U1B2-2	1.74	12.82	11.90	12.02	11.96	.24	.10	.26	.23	10,180	-
	8.37	11.63	-	-	-	-	-	-	-	12,060	-
U3A2-1	0.38	17.24	16.95	15.67	15.62	.28	.20	.28	.25	25,910	-
	10.58	12.82	13.16	12.79	13.02	.20	.16	.24	.22	18,770	-
	11.98	4.81	-	-	-	-	-	-	-	3,900	-
U3A2-2	3.34	12.99	12.05	11.79	12.02	.18	.11	.16	.14	28,010	-
	6.50	12.99	14.08	13.70	13.97	.17	.16	.17	.16	20,370	-
	9.58	11.63	11.90	11.63	11.79	.14	-	.19	.18	14,270	-
						METASEDIMENT (cherty)					
R1A2-9	26.78	12.05	10.87	12.02	11.60	.17	-	.16	.13	17,180	24,420
R1A2-10	3.92	10.00	10.31	10.80	11.06	.19	.13	.23	.22	17,200	24,540
	4.44	10.10	9.62	9.62	9.54	.24	.18	.26	.24	15,350	23,720
	19.93	14.49	14.08	14.58	14.33	.16	.10	.11	.12	11,880	27,410
R1A2-11	20.74	12.20	11.63	10.99	11.11	.24	.16	.26	.23	7,220	25,480
	24.82	12.20	11.36	12.26	12.16	.20	.14	.22	.21	27,150	26,740
R1A2-12	17.67	12.82	11.36	12.05	11.39	.30	.17	.28	.24	23,630	25,090
						METASHALE					
107	98.85	5.95	5.65	5.44	5.90	.14	-	-	.10	11,690	22,100
	107.46	14.08	14.71	13.51	13.89	.14	.10	.18	.16	31,300	23,220

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6} 0-1000 lb/in² 1st cycle	E x 10^{-6} 0-1000 lb/in² 2nd cycle	E x 10^{-6} 0-5000 lb/in² 1st cycle	E x 10^{-6} 0-5000 lb/in² 2nd cycle	Poisson's Ratio 0-1000 lb/in² 1st cycle	Poisson's Ratio 0-1000 lb/in² 2nd cycle	Poisson's Ratio 0-5000 lb/in² 1st cycle	Poisson's Ratio 0-5000 lb/in² 2nd cycle	Compressive Strength, lb/in²	Sonic Velocity, ft./sec.
						METASHALE					
109	365.27	4.35	3.91	-	-	-	-	-	-	5,680	21,960
	366.60	1.54	1.64	-	-	0.12	0.12	-	-	2,160	14,270
	396.72	7.75	7.58	7.22	7.63	.19	.16	0.22	0.22	5,910	13,980
1A-14	117.13	5.29	5.68	-	-	-	-	-	-	16,460	-
	120.71	5.32	5.95	-	-	.12	-	-	-	-	-
	121.06	10.42	10.64	-	-	.23	.14	-	-	-	-
	122.63	7.30	7.81	-	-	.16	.10	-	-	18,000	-
	123.00	9.35	10.00	-	-	.14	.16	-	-	-	-
	124.42	7.35	7.52	-	-	.11	-	-	-	-	-
						METASILTSTONE					
111	366.90	11.36	11.63	-	-	-	-	-	-	8,840	-
	372.70	9.01	9.52	-	-	-	-	-	-	-	-
	373.68	12.35	12.20	-	-	-	-	-	-	6,760	-
1A-13	4.17	4.24	5.10	-	-	-	-	-	-	13,150	-
	5.80	2.26	3.46	-	-	-	-	-	-	5,880	-
	6.94	8.13	8.33	-	-	.24	.20	-	-	20,120	-
						QUARTZITE					
**1A-13	86.30	17.86	-	-	-	.14	-	-	-	16,240	-
1A-14	10.73	5.08	5.68	-	-	.27	.20	-	-	21,510	-
	13.82	11.76	12.20	-	-	-	-	-	-	25,090	-
230	338.40	12.20	11.36	12.02	11.57	.22	.11	-	.22	7,480	25,930
	345.47	4.08	4.24	-	-	-	.15	-	-	3,400	20,370
						SERPENTINE					
$U6_1$-1	2.37	10.00	10.00	10.14	10.18	.22	-	.22	.20	28,310	-
	4.18	5.88	6.41	6.67	7.00	-	-	.20	.22	10,710	-
	10.77	8.33	8.40	8.50	8.53	.18	.12	.21	.19	10,520	-
	17.44	11.76	10.99	10.55	11.16	.21	.15	.22	.21	13,250	-

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
						SERPENTINE					
$U6_1$-1	18.27	6.71	4.61	-	-	-	0.14	-	-	3,080	-
	19.55	8.48	-	-	-	-	-	-	-	2,400	-
$U6_1$-2	2.44	9.43	9.71	8.90	9.40	0.26	.16	0.23	0.21	17,810	-
	5.41	10.99	10.64	10.29	10.50	.24	.16	.24	.23	18,500	-
	8.70	8.62	9.01	8.52	8.80	.21	.15	.24	.23	21,680	-
						TALCOSE SERPENTINE					
111	309.87	8.13	8.06	8.16	-	.24	-	-	-	8,080	23,480
	313.86	4.65	4.03	6.36	6.55	-	-	.19	.17	9,850	20,270
	315.83	4.83	3.42	5.87	5.99	.10	-	.22	.18	11,220	21,960
	317.55	6.25	6.41	-	-	.10	-	-	-	15,590	23,920
	319.90	3.47	3.76	-	-	-	-	-	-	6,750	21,110
	320.64	5.59	6.33	-	-	.13	.13	-	-	4,720	17,500
	322.82	3.73	3.41	-	-	-	.11	-	-	3,740	18,430
1A-13	101.63	6.76	6.94	-	-	.24	.17	-	-	8,630	-
	109.97	0.96	1.06	-	-	.26	.12	-	-	2,630	-
U3A1-1	5.18	2.57	2.60	-	-	.15	.17	-	-	4,170	13,920
	7.63	1.91	2.05	-	-	.17	.17	-	-	3,870	14,330
U3A1-2	2.54	6.29	5.99	5.82	5.71	.20	.21	.30	.28	7,720	17,320
	4.55	8.20	-	7.79	8.06	.21	-	.23	.21	11,830	20,410
	13.33	1.29	1.52	-	-	-	-	-	-	2,900	14,800

Table 3 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
					TALCOSE SERPENTINE						
R-6_1-506	2.57	1.51	1.76	1.52	1.50	0.12	0.15	0.12	0.11	3,480	-
	3.54	1.47	2.26	***1.28	1.51	.11	-	***.14	.14	3,610	-
R-6_2-506	3.17	1.59	2.04	1.41	1.48	.10	.16	.17	.17	1,440	-
	4.19	1.64	1.92	1.37	1.58	-	-	-	-	4,140	-
	6.00	1.16	1.34	****1.00	1.14	-	.10	****.10	.10	2,950	-

*** Elasticity and Poisson's ratio at 410 lb/in^2

**** Elasticity and Poisson's ratio at 340 lb/in^2

Table 4

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY[1]

(Averages and Ranges)

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6} [2]				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic[3] Velocity, ft./sec.
		0 - 1000 lb/in^2		0 - 5000 lb/in^2		0 - 1000 lb/in^2		0 - 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
					AMPHIBOLITE AMPHIBOLITE B AMPHIBOLITE C						
Avg		12.68	12.44	13.24	13.45	0.20	0.16	0.24	0.22	18,820	23,580
Number		306	302	230	228	203	210	203	216	314	194
Range		2.39- 22.22	1.97- 21.28	5.00- 20.66	4.63- 21.37	0.10- 0.30	0.10- 0.30	0.10- 0.30	0.10- 0.30	620- 51,700	12,950- 29,900
				AMPHIBOLITE B (with 30 percent metagabbro)							
Avg		2.56	2.92	-	-	-	-	-	-	3,065	20,490
Number		1	1	-	-	-	-	-	-	2	1
Range		-	-	-	-	-	-	-	-	3,060- 3,070	-
				AMPHIBOLITE C (with 20 percent metagabbro)							
Avg		14.89	14.70	14.03	14.05	0.25	0.17	0.24	0.22	23,630	27,170
Number		3	3	3	3	3	3	3	3	3	3
Range		12.05- 17.24	11.49- 17.24	11.52- 15.38	11.47- 15.43	0.23- 0.27	0.16- 0.17	0.23- 0.25	0.21- 0.22	17,400- 33,800	25,970- 28,390
				FOLIATED AMPHIBOLITE AND FOLIATED AMPHIBOLITE C							
Avg		17.31	17.08	15.74	16.45	0.21	0.17	0.24	0.23	20,890	-
Number		10	10	3	3	7	5	3	3	9	-
Range		11.76- 22.22	12.05- 21.74	14.53- 17.30	15.15- 17.24	0.13- 0.27	0.12- 0.28	0.22- 0.26	0.21- 0.26	11,060- 31,240	- -
				MASSIVE AMPHIBOLITE and MASSIVE AMPHIBOLITE C							
Avg		15.92	15.84	14.67	14.85	0.21	0.16	0.22	0.20	20,790	26,040
Number		11	11	6	6	11	7	6	6	9	6
Range		11.11- 20.00	10.20- 19.61	12.35- 16.50	12.69- 16.61	0.16- 0.25	0.10- 0.21	0.14- 0.27	0.12- 0.27	8,550- 28,660	25,090- 27,180

[1] Metric conversions: pounds per square inch x 0.070307 equals kg/cm^2; ft/sec x 30.48 equals cm/sec
[2] "E" represents modulus of elasticity
[3] Dry condition

Table 4 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

(Averages and Ranges)

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6} 0-1000 lb/in² 1st cycle	E x 10^{-6} 0-1000 lb/in² 2nd cycle	E x 10^{-6} 0-5000 lb/in² 1st cycle	E x 10^{-6} 0-5000 lb/in² 2nd cycle	Poisson's Ratio 0-1000 lb/in² 1st cycle	Poisson's Ratio 0-1000 lb/in² 2nd cycle	Poisson's Ratio 0-5000 lb/in² 1st cycle	Poisson's Ratio 0-5000 lb/in² 2nd cycle	Compressive Strength, lb/in²	Sonic Velocity, ft./sec.
				CHLORITE SCHIST and CHLORITE SCHIST B and C							
Avg		6.22	6.45	9.79	10.67	0.19	0.17	0.25	0.24	5,980	20,160
Number		33	27	8	7	25	21	8	7	32	19
Range		0.60-14.93	0.94-13.89	6.01-15.43	7.70-16.34	0.10-0.27	0.11-0.24	0.20-0.27	0.19-0.27	1,430-16,370	13,560-26,290
						TALC SCHIST					
Avg		2.67	3.22	-	-	0.22	0.19	-	-	2,630	20,040
Number		16	13	-	-	5	5	-	-	13	11
Range		0.92-4.76	1.13-6.49	-	-	0.17-0.28	0.12-0.25	-	-	790-4,510	18,370-22,830
						DIKE					
Avg		9.26	9.02	8.23	8.66	0.22	0.16	0.24	0.23	17,740	-
Number		11	11	4	4	9	6	3	3	11	-
Range		6.99-12.05	5.13-11.36	6.30-10.46	7.28-10.57	0.13-0.26	0.12-0.23	0.23-0.27	0.21-0.26	3,600-30,840	-
					BIOTITE PORPHYRY DIKE						
Avg		10.31	10.75	-	-	0.14	0.12	-	-	21,720	-
Number		1	1	-	-	1	1	-	-	1	-
Range		-	-	-	-	-	-	-	-	-	-
						METAGABBRO					
Avg		13.62	13.59	14.09	14.37	0.22	0.16	0.25	0.23	24,310	25,350
Number		42	42	29	29	30	29	22	27	41	23
Range		2.84-17.86	3.18-16.95	6.08-16.29	6.35-16.23	0.14-0.30	0.11-0.30	0.19-0.29	0.18-0.30	3,520-41,900	21,270-28,330

Table 4 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

(Averages and Ranges)

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0 – 1000 lb/in^2		0 – 5000 lb/in^2		0 – 1000 lb/in^2		0 – 5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
					GNEISSIC METAGABBRO						
Avg		9.75	9.48	12.81	12.98	0.19	0.12	0.20	0.18	12,150	22,840
Number		10	10	5	5	6	5	5	5	10	10
Range		1.10-14.29	1.21-14.08	11.76-14.20	11.71-14.25	0.15-0.22	0.07-0.16	0.18-0.22	0.15-0.20	2,710-18,180	17,330-26,580
					METASANDSTONE						
Avg		14.50	14.02	-	-	0.24	0.14	-	-	24,670	-
Number		3	3	-	-	3	3	-	-	3	-
Range		13.33-16.67	13.16-15.38	-	-	0.18-0.27	0.11-0.17	-	-	22,900-27,020	-
					METASEDIMENT						
Avg		9.38	9.14	11.48	11.57	0.21	0.16	0.24	0.23	10,320	23,360
Number		27	22	15	15	17	16	12	14	28	10
Range		1.49-17.24	1.50-20.41	6.42-16.67	6.88-16.23	0.11-0.28	0.10-0.30	0.16-0.29	0.14-0.30	2,300-28,010	21,260-26,920
					METASEDIMENT (cherty)						
Avg		11.98	11.32	11.76	11.60	0.21	0.15	0.22	0.20	17,090	25,340
Number		7	7	7	7	7	6	7	7	7	7
Range		10.00-14.49	9.62-14.08	9.62-14.58	9.54-14.33	0.16-0.30	0.10-0.18	0.11-0.28	0.12-0.24	7,220-27,150	23,720-27,410
					METASHALE						
Avg		7.15	7.37	8.72	9.14	0.15	0.13	0.20	0.16	13,030	19,110
Number		11	11	3	3	9	6	2	3	7	5
Range		1.54-14.08	1.64-14.71	5.44-13.51	5.90-13.89	0.11-0.23	0.10-0.16	0.18-0.22	0.10-0.22	2,160-31,300	13,980-23,220

Table 4 (continued)

SUMMARY OF ELASTIC PROPERTIES AND ULTRASONIC VELOCITY

(Averages and Ranges)

Auburn Damsite

Auburn-Folsom South Unit – CVP

DH No.	Depth, ft.	E x 10^{-6}				Poisson's Ratio				Compressive Strength, lb/in^2	Sonic Velocity, ft./sec.
		0-1000 lb/in^2		0-5000 lb/in^2		0-1000 lb/in^2		0-5000 lb/in^2			
		1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle	1st cycle	2nd cycle		
					METASILTSTONE						
Avg		7.89	8.37	-	-	0.24	0.20	-	-	10,950	-
Number		6	6	-	-	1	1	-	-	5	-
Range		2.26-12.35	3.46-12.20	-	-	-	-	-	-	5,880-20,120	-
					QUARTZITE						
Avg		10.20	8.37	12.02	11.57	0.21	0.15	-	0.22	14,740	-
Number		5	4	1	1	3	3	-	1	5	-
Range		4.08-17.86	4.24-12.20	-	-	0.14-0.27	0.11-0.20	-	-	3,400-25,090	-
					SERPENTINE						
Avg		8.91	8.72	9.08	9.37	0.22	0.15	0.22	0.21	14,030	-
Number		9	8	7	7	6	6	7	7	9	-
Range		5.88-11.76	4.61-10.99	6.67-10.55	7.00-11.16	0.18-0.26	0.12-0.16	0.20-0.24	0.19-0.23	2,400-28,310	-
					TALCOSE SERPENTINE						
Avg		4.62	4.28	6.80	6.58	0.18	0.15	0.24	0.21	7,260	18,950
Number		14	13	5	4	10	7	4	4	14	12
Range		0.96-8.20	1.06-8.06	5.82-8.16	5.71-8.06	0.10-0.26	0.11-0.21	0.19-0.30	0.17-0.28	2,630-15,590	13,920-23,920
					6-INCH DIAMETER CORE						
		0-110	lb/in^2	0-450	lb/in^2	0-110	lb/in^2	0-450	lb/in^2		
Avg		1.47	1.86	1.43	1.44	0.11	0.14	0.15	0.14	3,120	-
Number		5	5	3	5	3	3	2	2	5	-
Range		1.16-1.64	1.34-2.26	1.37-1.52	1.14-1.58	0.10-0.12	0.10-0.16	0.12-0.17	0.11-0.17	1,440-4,140	-

7-1750 (12-74)
Bureau of Reclamation

CONVERSION FACTORS—BRITISH TO METRIC UNITS OF MEASUREMENT

The following conversion factors adopted by the Bureau of Reclamation are those published by the American Society for Testing and Materials (ASTM Metric Practice Guide, E 380-72) except that additional factors (*) commonly used in the Bureau have been added. Further discussion of definitions of quantities and units is given in the ASTM Metric Practice Guide.

The metric units and conversion factors adopted by the ASTM are based on the "International System of Units" (designated SI for Systeme International d'Unites), fixed by the International Committee for Weights and Measures; this system is also known as the Giorgi or MKSA (meter-kilogram (mass)-second-ampere) system. This system has been adopted by the International Organization for Standardization in ISO Recommendation R-31.

The metric technical unit of force is the kilogram-force; this is the force which, when applied to a body having a mass of 1 kg, gives it an acceleration of 9.80665 m/sec/sec, the standard acceleration of free fall toward the earth's center for sea level at 45 deg latitude. The metric unit of force in SI units is the newton (N), which is defined as that force which, when applied to a body having a mass of 1 kg, it gives it an acceleration of 1 m/sec/sec. These units must be distinguished from the (inconstant) local weight of a body having a mass of 1 kg, that is, the weight of a body is that force with which a body is attracted to the earth and is equal to the mass of a body multiplied by the acceleration due to gravity. However, because it is general practice to use "pound" rather than the technically correct term "pound-force," the term "kilogram" (or derived mass unit) has been used in this guide instead of "kilogram-force" in expressing the conversion factors for forces. The newton unit of force will find increasing use, and is essential in SI units.

Where approximate or nominal English units are used to express a value or range of values, the converted metric units in parentheses are also approximate or nominal. Where precise English units are used, the converted metric units are expressed as equally significant values.

Table 1

QUANTITIES AND UNITS OF SPACE

Multiply	By	To obtain
	LENGTH	
Mil	25.4 (exactly)	Micron (μ)
Inches (in)	25.4 (exactly)	Millimeters (mm)
Inches	2.54 (exactly)*	Centimeters (cm)
Feet (ft)	30.48 (exactly)	Centimeters
Feet	0.3048 (exactly)*	Meters (m)
Feet	0.0003048 (exactly)*	Kilometers (km)
Yards (yd)	0.9144 (exactly)	Meters (m)
Miles (statute) (mi)	1,609.344 (exactly)*	Meters
Miles	1.609344 (exactly)	Kilometers (km)
	AREA	
Square inches (in^2)	6.4516 (exactly)	Square centimeters (cm^2)
Square feet (ft^2)	*929.03	Square centimeters
Square feet	0.092903	Square meters (m^2)
Square yards (yd^2)	0.836127	Square meters
Acres	*0.40469	Hectares (ha)
Acres	*4,046.9	Square meters (m^2)
Acres	*0.0040469	Square kilometers (km^2)
Square miles (mi^2)	2.58999	Square kilometers
	VOLUME	
Cubic inches (in^3)	16.3871	Cubic centimeters (cm^3)
Cubic feet (ft^3)	0.0283168	Cubic meters (m^3)
Cubic yards (yd^3)	0.764555	Cubic meters (m^3)
	CAPACITY	
Fluid ounces (U.S.) (oz)	29.5737	Cubic centimeters (cm^3)
Fluid ounces (U.S.)	29.5729	Milliliters (ml)
Liquid pints (U.S.) (pt)	0.473179	Cubic decimeters (dm^3)
Liquid pints (U.S.)	0.473166	Liters (l)
Quarts (U.S.) (qt)	*946.358	Cubic centimeters (cm^3)
Quarts (U.S.)	*0.946331	Liters (l)
Gallons (U.S.) (gal)	*3,785.43	Cubic centimeters (cm^3)
Gallons (U.S.)	3.78543	Cubic decimeters (dm^3)
Gallons (U.S.)	3.78533	Liters (l)
Gallons (U.S.)	*0.00378543	Cubic meters (m^3)
Gallons (U.K.)	4.54609	Cubic decimeters (dm^3)
Gallons (U.K.)	4.54596	Liters (l)
Cubic feet (ft^3)	28.3160	Liters
Cubic yards (yd^3)	*764.55	Liters
Acre-feet	*1,233.5	Cubic meters (m^3)
Acre-feet	*1,233,500	Liters

Table II

QUANTITIES AND UNITS OF MECHANICS

Multiply	By	To obtain
MASS		
Grains (1/7,000 lb) (gr)	64.79891 (exactly)	Milligrams (mg)
Troy ounces (480 grains)	31.1035	Grams (g)
Ounces (avdp) (oz)	28.3495	Grams
Pounds (avdp) (lb)	0.45359237 (exactly)	Kilograms (kg)
Short tons (2,000 lb)	907.185	Kilograms
Short tons (2,000 lb)	0.907185	Metric tons
Long tons (2,240 lb)	1,016.05	Kilograms (kg)
FORCE/AREA		
Pounds per square inch (lb/in^2)	0.070307	Kilograms per square centimeter (kg/cm^2)
Pounds per square inch	6894.76	Pascals (Pa), or Newtons per square meter (N/m^2)
Pounds per square foot (lb/ft^2)	4.88243	Kilograms per square meter (kg/m^2)
Pounds per square foot	47.8803	Pascals (Pa), or Newtons per square meter (N/m^2)
MASS/VOLUME (DENSITY)		
Ounces per cubic inch (oz/in^3)	1.72999	Grams per cubic centimeter (g/cm^3)
Pounds per cubic foot (lb/ft^3)	16.0185	Kilograms per cubic meter (kg/m^3)
Pounds per cubic foot	0.0160185	Grams per cubic centimeter (g/cm^3)
Tons (long) per cubic yard	1.32894	Grams per cubic centimeter
MASS/CAPACITY		
Ounces per gallon (U.S.) (oz/gal)	7.4893	Grams per liter (g/l)
Ounces per gallon (U.K.)	6.2362	Grams per liter
Pounds per gallon (U.S.) (lb/gal)	119.829	Grams per liter
Pounds per gallon (U.K.)	99.779	Grams per liter
BENDING MOMENT OR TORQUE		
Inch-pounds (in-lb)	0.011521	Meter-kilograms (m-kg)
Inch-pounds	1.12985×10^6	Centimeter-dynes (cm-dyn)
Foot-pounds (ft-lb)	0.138255	Meter-kilograms (m-kg)
Foot-pounds	1.35582×10^7	Centimeter-dynes
Foot-pounds per inch (ft-lb/in)	5.4431	Centimeter-kilograms per centimeter (cm-kg/cm)
Ounce-inches (oz-in)	72.008	Gram-centimeters (g-cm)
VELOCITY		
Feet per second (ft/s)	30.48 (exactly)	Centimeters per second (cm/s)
Feet per second	0.3048 (exactly)*	Meters per second (m/s)
Feet per year (ft/yr)	*0.965873×10^{-6}	Centimeters per second
Miles per hour (mi/h)	1.609344 (exactly)	Kilometers per hour (km/hr)
Miles per hour	0.44704 (exactly)	Meters per second
ACCELERATION*		
Feet per second^2 (ft/s^2)	*0.3048	Meters per second^2 (m/s^2)
FLOW		
Cubic feet per second (second-feet) (ft^3/s)	*0.028317	Cubic meters per second (m^3/s)
Cubic feet per minute (ft^3/m)	0.4719	Liters per second (l/s)
Gallons (U.S.) per minute (gal/min)	0.06309	Liters per second
FORCE*		
Pounds (lb)	*0.453592	Kilograms (kg)
Pounds	*4.4482	Newtons (N)
Pounds	*4.4482×10^5	Dynes (dyn)

Table II—Continued

Multiply	By	To obtain
WORK AND ENERGY*		
British thermal units (Btu)	*0.252	Kilogram calories (kg-cal)
British thermal units (Btu)	1,055.06	Joules (J)
Btu per pound	2.326 (exactly)	Joules per gram (J/g)
Foot-pounds (ft-lb)	*1.35582	Joules (J)
POWER		
Horsepower (hp)	745.700	Watts (w)
Btu per hour (Btu/hr)	0.293071	Watts
Foot-pounds per second (ft-lb/sec)	1.35582	Watts
HEAT TRANSFER		
Btu in./hr ft^2 degree F (k, thermal conductivity)	1.442	Milliwatts/cm degree C
Btu in./hr ft^2 degree F (k, thermal conductivity)	0.1240	Kg cal/hr m degree C
Btu ft/hr ft^2 degree F	*1.4880	Kg cal m/hr m^2 degree C
Btu/hr ft^2 degree F (C, thermal conductance)	0.568	Milliwatts/cm^2 degree C
Btu/hr ft^2 degree F (C, thermal conductance)	4.882	Kg cal/hr m^2 degree C
Degree F hr ft^2/Btu (R, thermal resistance)	1.761	Degree C cm^2/milliwatt
Btu/lb degree F (c, heat capacity)	4.1868	J/g degree C
Btu/lb degree F	*1.000	Cal/gram degree C
Ft^2/hr (thermal diffusivity)	0.2581	Cm^2/sec
Ft^2/hr (thermal diffusivity)	*0.09290	M^2/hr
WATER VAPOR TRANSMISSION		
Grains/hr ft^2 (water vapor) transmission)	16.7	Grams/24 hr m^2
Perms (permeance)	0.659	Metric perms
Perm-inches (permeability)	1.67	Metric perm-centimeters

Table III

OTHER QUANTITIES AND UNITS

Multiply	By	To obtain
Cubic feet per square foot per day (seepage)	*304.8	Liters per square meter per day
Pound-seconds per square foot (viscosity)	*4.8824	Kilogram second per square meter
Square feet per second (viscosity)	*0.092903	Square meters per second
Fahrenheit degrees (change)*	5/9, then subtract 17.78	Celsius or Kelvin degrees
Volts per mil	0.03937	Kilovolts per millimeter
Lumens per square foot (foot-candles)	10.764	Lumens per square meter
Ohm-circular mils per foot	0.001662	Ohm-square millimeters per meter
Millicuries per cubic foot	*35.3147	Millicuries per cubic meter
Milliamps per square foot	*10.7639	Milliamps per square meter
Gallons per square yard	*4.527219	Liters per square meter
Pounds per inch	*0.17858	Kilograms per centimeter

ABSTRACT

Approximately 530 specimens of foundation rock cores selected from 108 drill holes located at the Auburn damsite in California were tested to determine the following physical properties: absorption, porosity, specific gravity, secant modulus of elasticity, Poisson's ratio, compressive and triaxial strengths, and sonic velocity. The cores were classified into 8 rock types; amphibolite, massive amphibolite, foliated amphibolite, dike, biotite porphyry dike, metagabbro, chlorite schist, and talc schist. Conclusions were: (1) the secant moduli of elasticity, by rock type, ranged from an average of 1,470,000 lb/in^2 (103,351.3 kg/cm^2) to 17,310,000 lb/in^2 (1,217,014.2 kg/cm^2); (2) Poisson's ratio ranged from an average of 0.11 to 0.24; (3) compressive strengths ranged from a low of 790 lb/in^2 (55.5 kg/cm^2) to a high of 41,900 lb/in^2 (2,945.9 kg/cm^2); and (4) sonic velocities ranged from 12,950 ft/sec (394,716 cm/sec) to 29,000 ft/sec (911,352 cm/sec).

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GR-12-75
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DESCRIPTORS--/ absorption/ compressive strength/ Poisson's ratio/ specific gravity/ shear strength/ triaxial compression/ elastic deformation/ rock tests/ *rock foundations/ *laboratory tests/ rock mechanics/ rocks/ *dam foundations/ modulus of elasticity/ porosity/ *rock properties/ sonic velocity tests
IDENTIFIERS--/ Auburn Dam, Calif/ Central Valley Project

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