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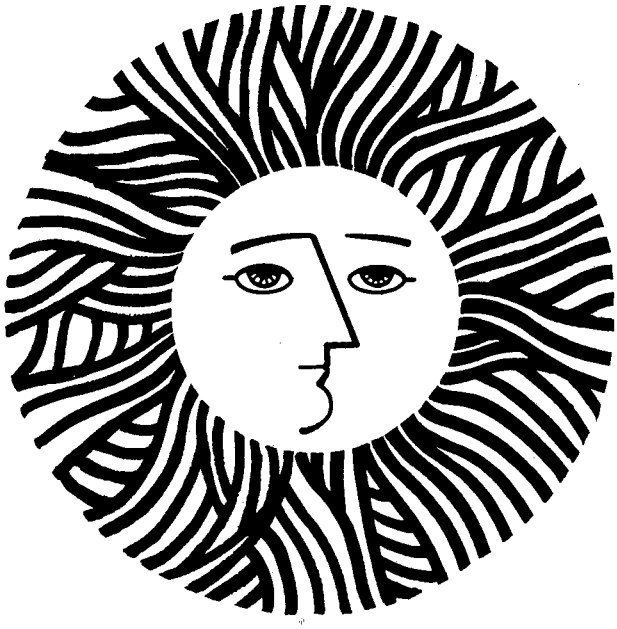

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LAWRENCE BERKELEY LABORATORY
Bldg.: 70 Room: 128 Ext.: 5931

July 20, 1981

TO: Charles Grua, Brian Harney, and Art Hartstein

FROM: Peter Persoff, Bill Hall, and Mohsen Mehran

RE: Monthly Progress Report for June
Control Technology for In-Situ Oil Shale Retorts
LBID-423

TASK 3. BARRIER OPTIONS

Evaluation of Surface Retorted Spent Shale for Cementing and Pozzolanicity

An attractive option for disposal of surface related spent shales is using them as construction materials or as ingredients in blended cements. To explore this possibility, we are testing two samples of spent shale for pozzolanicity (ASTM C 311) and cementing (ASTM C 109). In the test for pozzolanicity, the strength of a mortar cube made with portland cement is compared to one made with 35% of the cement replaced with spent shale. The ratio of strengths of the two cubes is termed "pozzolanic activity index". To meet current standards for pozzolans, this index must be $\geqslant$ 0.75 (cement + spent shale strength : cement only strength) and the spent shale must also meet certain requirements of chemical analysis and fineness. The pozzolanic activity indices of the two spent shales tested were 0.65 and 0.73, failing this test. Other spent shales will be evaluated when they are received.

Surface Disposal of Spent Shale

Literature review on air and water quality impacts of spent shale disposal is continuing. In the laboratory, particle size distributions of spent shale samples are being determined by sedimentation velocity, using the method described by Galehouse (1971), while equipment for permeability measurement on compacted spent shale has been ordered.

Permeability Measurements on Spent Shale Grouts

Permeability measurements have been completed on one specimen each of grouts R-2, R-3, and R-4. Formulae of these grouts are shown in Table 1. These grouts contain only spent shale and 1/4 of 1% lignosulfonate

fluidizer; R-4 also contains 9 ½% Wyodak fly ash (Class C) and ½% reagent gypsum. The results of these measurements are shown in Figure 1. Tests of duplicate specimens are planned.

Penetration of Grout Through Rubble

Experimental work on this phase of the project is completed and a final report is in preparation.

TASK 5. LEACHING OPTIONS

Leaching of Organics from Spent Shale

Experimental leaching work is now complete. Samples of leachate from the large column runs have been submitted for analysis for major ions and for organic characterization.

Work continues on fitting the experimental total organic carbon and electrical conductivity data to the leaching and transport model. We have modeled the particles as cylinders with solute transport occuring only in the radial direction, which corresponds to bedding planes. This conforms to the observed anisotropy of permeability of raw and spent shale. With this modification, one column run has given a good fit of TOC data to the model; work is continuing on the fitting of data from other runs.

Chapter drafts of the final report are now being prepared.

TASK 6. GEOHYDROLOGIC MODIFICATION

Solute Transport Model Development

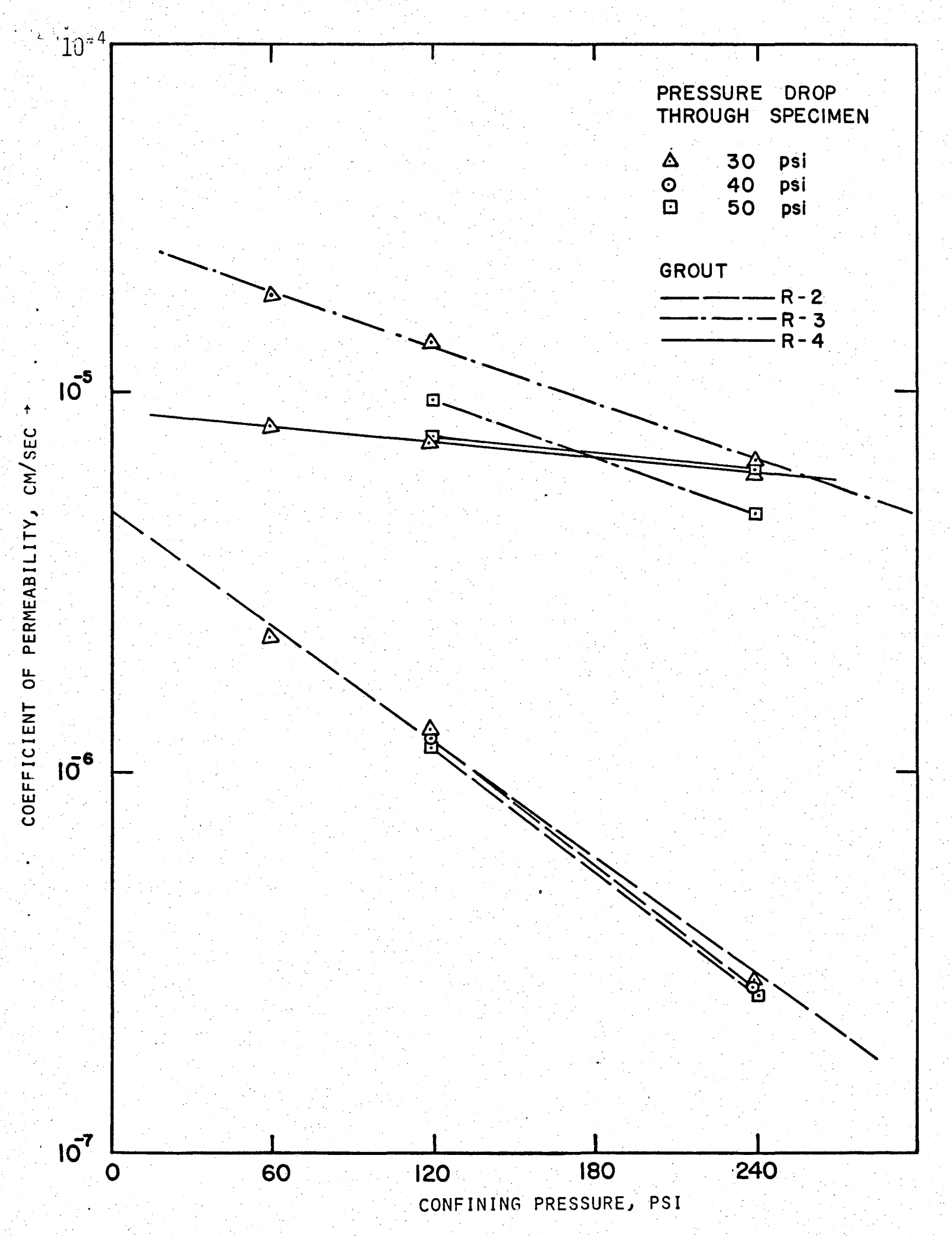
Work continued on the development of a model for simultaneous fluid and mass transport with unsaturated flow. The model, as modified for this work by the exclusion of stress calculations, was verified this month for heat or solute transport. Attention was next directed to the problem of a sharp concentration front moving through the flow medium. Large concentration gradients can cause instability in the calculations; one method for overcoming this problem is to apply weighting functions to the upstream concentrations. This is now being implemented in the program.

Table 1. Formulae of Experimental Grouts.

	R-2	R-3	R-4	R-5
Lurgi Spent Shale, g	100	100	90	90
Craig Fly Ash (Class F), g	0	0	0	10
Wyodak Fly Ash (Class C), g	0	0	9.5	0
Gypsum, g	0	0	0.5	0
Lignosulfonate Fluidizer, C2-503	0.25	0	0	0
Lignosulfonate Fluidizer, C2-512	0	0.25	0.25	0.25
Water	74.8	71.8	69.1	63.5

REFERENCE

Galehouse, Jon S. Sedimentation Analysis. Chapter 4 in Carver, R.E. ed. Procedures in Sedimentary Petrology, Wiley Interscience, New York, 1971.


PRESSURE DROP THROUGH SPECIMEN
30 psi
40 psi
50 psi
GROUT
R-2
R-3
R-4
10^{-4}
10^{-5}
10^{-6}
10^{-7}
COEFFICIENT OF PERMEABILITY, CM/SEC →
0
60
120
180
240
CONFINING PRESSURE, PSI

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