true rock resistivity for resistive rocks (> 100 ohm-m) in any well, especially where a conductive (1.0 to 3.1 ohm-m) drilling mud was used, as in this case. Simmons and Nur apparently used the log of the "short normal" tool, which is known to give a poor estimate of rock resistivity under these conditions (*3*). In the complete log, both the long normal and lateral tools gave resistivities approximately an order of magnitude greater than for the short normal, resistivities which are probably closer to the actual value for the rock.

3) Resistivity of saturated rocks is determined, as the authors evidently realize, by rock porosity and pore fluid salinity, not by mineralogy. Yet they compare the resistivity of laboratory samples of three granites with the resistivity measured in the wells (*1*, Fig. 4). The comparison may as well have been with three gabbros or three shales. Such a comparison is meaningless without a knowledge of how porosity and salinity vary with depth in the wells.

4) In the upper 5 to 10 km of the crust, the principal contribution to porosity will probably be faults, joints, and other natural planes of separation rather than the intergranular cracks evident in laboratory samples. Fracture porosity under pressure does not behave like typical crack porosity in the laboratory with respect to resistivity (*4*). Geologic evidence indicates that there must be appreciable fracture porosity in the areas of the two wells, areas of major faulting and overthrusting. In fact, the presence of many faults is suggested by the wide variation with depth in the electric logs of the Matoy well.

5) Finally, a small point is that the conversion from pressure to depth may be incorrect. Effective pressure (rock weight minus pore pressure) rather than lithostatic pressure must be computed. At the bottom of the Matoy well, for example, effective pressure is about 600 bars, not 1000 bars as given in the paper. This reduces the slopes of the laboratory curves presented by about a factor of 2.

In general, studies of crustal materials in the laboratory cannot easily be extended to measurements *in situ*. That extension requires not only a basic understanding of the laboratory measurements but also an awareness of the difficulties of obtaining data *in situ* and then interpreting them.

ARNOLD S. ORANGE
Geoscience Incorporated,
Cambridge, Massachusetts 02141

References

1. G. Simmons and A. Nur, *Science* **162**, 789 (1968).
2. W. E. Ham, R. E. Denison, C. A. Merritt, *Okla. Geol. Surv. Bull. No. 95* (1964).
3. *Introduction to Schlumberger Well Logging* (Schlumberger Well Surveying Corp., Houston, 1958), document No. 8, p. 53.
4. W. F. Brace and A. S. Orange, *J. Geophys. Res.* **73**, 1433 (1968).

2 January 1969

We believe that Orange missed the significant points of our paper (*1*). The properties of the granites *in situ* do not change as much with depth (in the two wells that we examined) as one would have expected on the basis of previous laboratory data. Two explanations were offered: (i) complete saturation with water has an effect on the elastic properties of granite [demonstrated in the laboratory measurements on Troy granite (*1*)], and (ii) the microcracks that exist in the small laboratory specimens of granite either do not exist in the rocks *in situ* or do not behave as a function of depth in the way that one would predict from the laboratory observations. At present, we are unable to decide between these alternatives. Thill and Bur (*2*) recently reported the effects of saturation on the St. Cloud grey granodiorite; their results are similar to our observations on the Troy granite and show the dramatic effect of saturation on the elastic properties of another very low-porosity rock.

Our conclusions were based, in part, on data for the Phillips Petroleum Company No. 1 Matoy well, taken over several granite sections in the well. The velocity data for two such sections were shown in our original paper. The lithologic log (*3*) based on the well cuttings and a few cores indicates that rock in the interval from 387 to 523 m is granite, except for two dikes at 472 to 485 and 504 to 518 m. The other interval from 2954 to 3086 m is shown as all granite. Because we restricted our observations to granite sections, Orange's remarks that other rocks were penetrated by the drill seem irrelevant.

Because of the difficulty of obtaining the true resistivity of highly resistive rock from electrical logs, we emphasized the change of electrical properties with depth, rather than their absolute values. The presence of faults, joints, and related openings in the rocks of the Matoy well, although not numerous, has no bearing on the evidence presented since they have very little effect on the interval velocity log and can be readily recognized on the electrical logs (and therefore were omitted from consideration).

In his last point Orange suggests that the effective pressure at the bottom of the Matoy well is about 600 bars rather than 1000 bars. His suggestion contains the implicit assumption that the pore pressure is equal to the hydrostatic head, and hence that the pores, completely filled with water, are connected to the surface. Stress concentration around the borehole further complicates any analysis. Fortunately, precise knowledge of the effective pressure is not critical to our observations that the properties change much less with depth than the previous laboratory data would have led us to expect.

GENE SIMMONS
AMOS NUR
Department of Earth and Planetary Sciences, Massachusetts Institute of Technology, Cambridge 02139

References

1. G. Simmons and A. Nur, *Science* **162**, 789 (1968).
2. R. E. Thill and T. R. Bur, *Geophysics* **34**, 101 (1969).
3. W. E. Ham, R. E. Denison, C. A. Merritt, *Okla. Geol. Surv. Bull. No. 95* (1964), plate 3.

22 April 1969

Carbon-14 Labeled Vasoactive Peptides Available

The following peptides are available in limited amounts (up to 20 μc of the labeled and 10 mg of the nonlabeled peptides) to qualified applicants. *Labeled peptides:* Asp^1-Ileu^5-angiotensin II (200 μc/μmole) containing uniformly labeled C^{14}-isoleucine; Lysylbradykinin (200 μc/μmole) in which the 3 and 4 positions contain uniformly labeled C^{14}-proline. *Nonlabeled peptides:* Asp^1-Ileu^5-angiotensin II, Lysylbradykinin, and Methionyllysylbradykinin.

Requests should be submitted in duplicate and contain a brief nonconfidential description of the intended research. Reprints or other documentation of the applicant's proficiency in the projected research will also aid the selection committee in its recommendation for distribution.

Reply to: Administrative Officer, Intramural Research, National Heart Institute, Bethesda, Maryland 20014.

JOHN J. PISANO
Section of Peptide Biochemistry, Experimental Therapeutics Branch, National Heart Institute, Bethesda, Maryland 20014

15 May 1969