von Seggern, David, The effects of radiation patterns of magnitude estimates, *Bull. Seismol. Soc. Amer., 60*, 503–516, 1970.
Wyss, Max, Stress estimates for South American shallow and deep earthquakes, *J. Geophys. Res., 75*, 1529–1544, 1970.
Wyss, M., and J. N. Brune, Seismic moment, stress, and source dimensions for earthquakes in the California–Nevada region, *J. Geophys. Res., 73*, 4681–4694, 1968.

Instrumentation and Data Processing

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Instrumentation

Two recent developments in seismometry allow the study of seismic phenomena over a broad period range. *Block and Moore* [1970] developed a quartz accelerometer with the required stability and sensitivity to record seismic waves as well as earth tides. The instrument, especially useful at periods greater than 80 sec, recorded free oscillations of the earth associated with an earthquake of magnitude 6.5 [*Block et al.*, 1970]. *Pomeroy et al.* [1969] described three-component wide-band long-period seismographs that operate at maximum magnifications up to 500,000 in the period range of 30 to 60 sec. Relatively noise-free output at these magnifications was achieved by using rigid environmental control (i.e., an air-tight chamber in a deep mine). A displacement transducer output on the same instrumentation permits concurrent recording of the solid-earth tides.

A symmetrical triaxial seismometer, in which the orthogonal directions of response form equal angles (approximately 55°) with the vertical, minimizes some problems of natural period variation and allows matched response characteristics [*Melton and Kirkpatrick*, 1970]. *Farrell* [1969] described a gyroscopic seismometer consisting of two counter-rotating pendulous gyroscopes that permits the separation of tilts from horizontal displacements. The Ocean Bottom Seismometer (OBS) off the coast of northern California produced a variety of geophysical data [*Latham et al.*, 1967; *Latham and Nowroozi*, 1968; *Nowroozi et al.*, 1968; *Anderson and Latham*, 1969]. *Bradner* [1970] described measurements with a free-floating midwater seismometer. A system for counting seismic events was designed by *Decker* [1968]. *Mereu and Kovach* [1970] described a portable seismic system for crustal studies. Response characteristics and seismograph design criteria were discussed by *Rodgers* [1968], *Russell et al.* [1968], *Bollinger* [1969], *Mitchell and Landisman* [1969], *Reasenberg* [1969], and *Rodgers* [1969]. *Rihn* [1969] presented data on the design of electromagnetic damping circuits.

Research in instrumentation for the measurement of earth strains produced several new instruments. A laser interferometer 1000 meters long was described by *Vali et al.* [1966, 1968], *Bostrom and Vali* [1968*a*, *b*], and *Vali and Bostrom* [1968*a*, *b*]. A laser strain meter with an 800 meter baseline was described by *Berger and Lovberg* [1969]. A general review of laser developments for measurement of long distances was presented by *Bender* [1967]. Errors in electronic distance measurements were discussed by *Thompson and Janes* [1967]. A diamagnetic suspension tiltmeter [*Simon et al.*, 1968; *McConnell and Simon*, 1969; *Simon and Strong*, 1968] is now being adapted for borehole use. The use of confined fluids in the earth as strain measuring devices was discussed by *Bodvarsson* [1970] and *Bredehoeft* [1967]. *Shopland and Kirklin* [1969, 1970] discussed the discrimination of seismic waves through the use of surface extensometers. *Hade et al.* [1968] presented a strain calibration system that utilizes a laser interferometer.

A history of the development of seismometry up to 1900 was published by *Dewey and Byerly* [1969].

Data Processing

Significant progress was made in improving existing techniques or in introducing new ones for processing of seismological data to elucidate evidence for tectonic processes of the earth, to infer earth structure, to explain features of the seismograms, and to determine hypocentral data for earthquakes more precisely.

Ben-Menahem et al. [1968] described a computer program for fast reduction of multistation surface-wave and body-wave data to determine focal mechanisms of earthquakes. *Ben-Menahem et al.* [1970] published universal tables for fast determination of focal mechanisms from isolated surface-wave signals. *Kanamori* [1970] used syntheses of long-period surface waves to infer focal mechanisms. *Tsai and Aki* [1970] analyzed surface waves at a small number of stations to determine seismic moment and dislocation at the focus, provided the focal mechanism of the earthquake was known independently. *Bollinger* [1968] used amplitude spectra of *P* waves to infer time duration of the earthquake.

Comprehensive seismicity maps based on U.S. Coast and Geodetic Survey epicenter data were constructed by *Barazangi and Dorman* [1969, 1970] and by *Tarr* [1970]. *Levy et al.* [1970] described a technique for displaying earthquake occurrence in space and time in a motion-picture format.

Landisman et al. [1969], *Dziewonski et al.* [1969], *Bloch and Hales* [1968], and *Savage* [1969] discussed new techniques for obtaining surface-wave dispersion curves from seismograms. Universal dispersion tables were computed by *Anderson and Harkrider* [1968] for

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Love waves and by *Anderson and Kovach* [1969] for free oscillations of the earth. *Randall* [1967], *Watson* [1970], and *Schwab and Knopoff* [1970] proposed schemes for rapid and precise computation of theoretical dispersion curves. *Backus and Gilbert* [1967] and *Dziewonski* [1970] investigated the uniqueness of models obtained from inversion of seismological data. *Chander et al.* [1968] determined leaking-mode dispersion curves from synthesis of the dispersed waves associated with *S*, *SS*, and *SSS* phases, on the basis of the shear-coupled *PL*-wave hypothesis.

Tsai and Aki [1970] proposed a scheme for determining focal depths of seismic events from analyses of surface waves at a small number of stations, provided that the focal mechanism of the event was known independently. *Freedman* [1967] presented a modified scheme for computing mean body-wave magnitude for an earthquake from the magnitudes reported by individual stations.

Arrays

Numerous geophysical studies were based on the seismological data obtained from the Large Aperture Seismic Array (Lasa) in eastern Montana. By using various data-processing techniques [e.g., techniques of *Capon et al.*, 1967], signal-to-noise ratio was improved by $N^{1/2}$ (where N is the number of sensors used) for short-period seismic signals [*Capon et al.*, 1968] and by 12–20 db for long-period body and surface waves [*Capon et al.*, 1969]. *Capon et al.* [1969] showed that surface waves from earthquakes with body-wave magnitude (m_b) greater than 4.9 at epicentral distances between 50–60° were detected at Lasa. *Capon* [1970] argued that, in some cases, the surface waves recorded at Lasa had followed paths other than the great-circles to the epicenters.

The structure of the seismic background noise at Lasa was investigated by several authors. *Lacoss et al.* [1969] and *Toksöz and Lacoss* [1968] showed that, at periods smaller than 5 sec, the microseisms consisted of body waves and higher-mode surface waves. *Haubrich and McCamy* [1969] showed that the peaks centered at 7 and 14 sec in the energy spectra of microseisms consisted predominantly of fundamental-mode Rayleigh waves, with contributions in some cases from Love waves, higher-mode Rayleigh waves, and long-period body waves. In both studies the body waves were associated with distant storms over open oceans. *Capon* [1969] demonstrated that noise in the 20–40 sec period range consisted of Rayleigh waves and nonpropagating noise generated by local atmospheric conditions.

Mack [1969] showed that crustal variations within Lasa were responsible for variations in the *P*-wave signals at different sensors and that delayed summation of individual sensor outputs could yield a better estimate of the *P*-wave pulse at the base of the crust. *Glover and Alexander* [1969] presented further evidence of lateral variations in the crust under Lasa. Amplitude corrections were computed by *Syed* [1969], and dipping interface corrections for $dT/d\Delta$ were computed by *Zengeni* [1970]. Applications of arrays were discussed by *Evernden* [1969] and *Baker* [1970]. Array design was discussed by *Haubrich* [1968]. *Johnson* [1968] outlined one problem in array utilization. *Niazi* [1968] suggested the use of source arrays to study regional crustal structure.

Johnson [1967], using inversion of $dT/d\Delta$ measurements [discussed by *Husebye*, 1969] on array data, presented a *P*-wave velocity structure for the upper 750 kilometers of the mantle, with a low-velocity zone between 70 and 150 kilometers and a high-velocity gradient near the lower boundary of the zone. *Johnson* [1969] presented data that indicated the presence of several other regions in the mantle with high-velocity gradients.

Strain Measurements

In earlier seismological studies of underground explosions, the tacit assumption was made that any release of pre-existing tectonic strain occurred in a small region (a few square kilometers) surrounding a nuclear explosion. Recently, the possibility was investigated that large explosions can affect tectonic strain and trigger earthquakes at distances up to a few hundred kilometers. *Smith et al.* [1969*b*] estimated from extensometer records that at Isabella, 260 km from the site of the Boxcar explosion (m_b = 6.3), the static strain was less than 2×10^{-10} and concluded that significant strain changes associated with large explosions are confined to distances less than 100 km. *Smith et al.* [1969*a*] reported a strain step of 1.2×10^{-7} at a distance of 29 km from Benham (m_b = 6.3) and concluded that permanent and quasi-static strains could affect occurrence of local earthquakes to a distance of 15 km from the explosion. From a series of strain measurements in conjunction with Benham, *Romig et al.* [1969] reported step-like residual strains of 1.8×10^{-7} and 0.35×10^{-7} at distances of 28 and 71 km, respectively, from the explosion; the strains decayed to about zero within half an hour. The strains measured by Romig et al. are comparable to the strains observed from earthquakes of similar body-wave magnitude at comparable distances, but the earthquake strains decay over several days, if at all. *Dickey* [1969] reported on strain measurements from geodetic observations. *McKeown and Dickey* [1969] and *Houser* [1969] discussed explosion-triggered motions on faults adjacent to the explosions.

Wideman and Major [1967] concluded from extensive measurements of residual strain steps associated with earthquakes in the 3–8.5 magnitude range, that strain steps of about 10^{-9} may be expected at distances of 20 times the fault length. The strain steps propagate at 3.3 ± 0.3 km/sec under continents and at 3.6 km/sec under oceans; the amplitude decreases with distance according to the $R^{-3/2}$ law.

Based on repeated precision leveling, *Tryggvason* [1968, 1970] presented evidence of vertical crustal movements in Iceland, whereas *Decker* [1968] initiated a study of horizontal movements in Iceland. *Whitten* [1969] reported vertical and horizontal movements of up to 15 meters south of Montague Island during the great Alaskan earthquake of 1964. *Meister et al.* [1968] reduced USCGS triangulation data for the Dixie Valley–Fairview Peak earthquakes of 1954 and inferred that the epicentral area suffered NW–SE extension, with parallel contraction in the surrounding region. *Scholz and Fitch* [1969, 1970] concluded, from analysis of geodimeter data for long lines across faults on which creep is observed in California, that the observed creep accounts for a quarter of the total strain measured and that slippage or creep on secondary faults is required if there is no net accumulation of strain in the fault zones. *Rayleigh and Burford* [1969] reported that areal dilation is the predominant form of strain at San Andreas Lake, California. *Hoffmann* [1968] reported on geodimeter measurements in California. *Hoffmann* [1969] prescribed criteria for adequate geodimeter measurements and attempted earthquake prediction on the basis of observations of anomalous movements on faults. *Major and Romig* [1969] reported a cumulative shear in the Denver area of 2.5×10^{-5} in a 9-month period, and *Marshall and Stephens* [1968] reported tilts prior to some of the Denver events. *Smith and Van de Lindt* [1969] presented a new model for calculating strain energy release and suggested net increase of stored strain in parts of California.

BIBLIOGRAPHY

Instrumentation

Anderson, R. S., and G. V. Latham, Determination of sediment properties from first shear-mode Rayleigh waves recorded on the ocean bottom, *J. Geophys. Res., 74*, 2747–2757, 1969.

Bender, P. L., Laser measurements of long distances, *Proc. IEEE, 55*, 1039–1045, 1967.

Berger, J., and R. H. Lovberg, A laser earth strain meter, *Rev. Sci. Instrum. 40*, 1569–1575, 1969.

Block, B., and R. D. Moore, Tidal to seismic frequency investigations with a quartz accelerometer of new geometry, *J. Geophys. Res., 75*, 1493–1506, 1970.

Block, B., J. Dratler, Jr., and R. D. Moore, Earth normal modes from a 6.5 magnitude earthquake, *Nature, 226*, 343–344, 1970.

Bodvarsson, G., Confined fluids as strain meters, *J. Geophys. Res., 75*, 2711–2718, 1970.

Bollinger, G. A., Benndorf's formula for the dynamic magnification of an electromagnetic seismograph, *Bull. Seismol. Soc. Amer., 59*, 1713–1718, 1969.

Bostrom, R. C., and V. Vali, A seismograph to measure deviatoric strains, *Trend Eng., 20*, 7–12, 1968*a*.

Bostrom, R. C., and V. Vali, Strains recorded on a high magnification interferometric seismograph, *Nature, 220*, 1018–1020, 1968*b*.

Bradner, H., L. G. deJerphanion, and R. Langlois, Ocean microseism measurements with a neutral buoyancy free-floating midwater seismometer, *Bull. Seismol. Soc. Amer., 60*, 1139–1150, 1970.

Bredehoeft, J. D., Response of well-aquifer systems to earth tides, *J. Geophys. Res., 72*, 3075–3087, 1967.

Decker, R. W., A seismic event counter for active volcanoes, *Bull. Seismol. Soc. Amer., 58*, 1353–1358, 1968.

Dewey, J., and P. Byerly, The early history of seismometry (to 1900), *Bull. Seismol. Soc. Amer., 59*, 183–228, 1969.

Farrell, W. E., A gyroscopic seismometer: Measurements during the Borrego earthquake, *Bull. Seismol. Soc. Amer., 59*, 1239–1246, 1969.

Hade, G., M. Conner, and J. T. Kuo, Laser interferometer calibration system for extensometers, *Bull. Seismol. Soc. Amer., 58*, 1379–1384, 1968.

Latham, G. V., and A. A. Nowroozi, Waves, weather, and ocean bottom microseisms, *J. Geophys. Res., 73*, 3945–3956, 1968.

Latham, G. V., R. S. Anderson, and M. Ewing, Pressure variations produced at the ocean bottom by hurricanes, *J. Geophys. Res., 72*, 5693–5704, 1967.

McConnell, R. K., Jr., and I. Simon, In situ stress measurements from tilts induced by mining operations, *Trans. Soc. Mining Eng. AIME, 241*, 311–313, 1968.

Melton, B. S., and B. M. Kirkpatrick, The symmetrical triaxial seismometer–its design for application to long-period seismometry, *Bull. Seismol. Soc. Amer., 60*, 717–740, 1970.

Mereu, R. F., and R. J. Kovach, A portable inexpensive seismic system for crustal studies, *Bull. Seismol. Soc. Amer., 60*, 1607–1614, 1970.

Mitchell, B., and M. Landisman, Electromagnetic seismograph constants by least squares inversion, *Bull. Seismol. Soc. Amer., 59*, 1335–1348, 1969.

Nowroozi, A. A., M. Ewing, J. E. Nafe, and M. Fliegel, Deep ocean current and its correlation with the ocean tide off the coast of northern California, *J. Geophys. Res., 73*, 1921–1932, 1968.

Pomeroy, P. W., G. Hade, J. Savino, and R. Chander, Preliminary results from high-gain, wide-band long-period electromagnetic seismograph systems, *J. Geophys. Res., 74*, 3295–3298, 1969.

Reasenberg, P., Nonlinearity test of an accelerometer system designed for the seismic near-field measurements, *Bull. Seismol. Soc. Amer., 59*, 1213–1226, 1969.

Rihn, W. J., The design of electromagnetic damping circuits, *Bull. Seismol. Soc. Amer., 59*, 967–972, 1969.

Rodgers, P. W., The response of the horizontal pendulum seismometer to Rayleigh and Love waves, tilt and free oscillations of the earth, *Bull. Seismol. Soc. Amer., 58*, 1385–1406, 1968.

Rodgers, P. W., A note on the response of the pendulum seismometer to plane wave rotation, *Bull. Seismol. Soc. Amer., 59*, 2101–2102, 1969.

Russell, R. D., R. D. Meldrum, and O. G. Jensen, The Maxwell bridge as a circuit element in electromagnetic feedback seismographs, *Bull. Seismol. Soc. Amer., 58*, 1621–1630, 1968.

Shopland, R. C., and R. H. Kirklin, Applications of strain seismographs to the discrimination of seismic waves, *Bull. Seismol. Soc. Amer., 59*, 673–690, 1969.

Shopland, R. C., and R. H. Kirklin, Application of a vertical strain seismograph to the enhancement of *P* waves, *Bull. Seismol. Soc. Amer., 60*, 105–124, 1970.

Simon, I., and P. F. Strong, Measurement of static and dynamic response of the Green building at the MIT campus to insolation and wind, *Bull. Seismol. Soc. Amer., 58*, 1631–1638, 1968.

Simon, I., A. G. Emslio, P. F. Strong, and R. K. McConnell, Jr., Sensitive tiltmeter utilizing a diamagnetic suspension, *Rev. Sci. Instrum., 39*, 1666–1671, 1968.

Thompson, M. C., and H. B. Janes, Correction of atmospheric errors in electronic measurements of earth crust movements, *Bull. Seismol. Soc. Amer., 57*, 641–656, 1967.

Vali, V., and R. C. Bostrom, Some earth strain observations with a thousand meter laser interferometer, *Earth Planet. Sci. Lett., 4*, 436, 1968*a*.

Vali, V., and R. C. Bostrom, One thousand meter laser interferometer, *Rev. Sci. Instrum., 39*, 1304–1306, 1968*b*.

Vali, V., R. S. Krogstad, and R. W. Moss, Observation of earth tides using a laser interferometer, *J. Appl. Phys., 37*, 580–582, 1966.

Vali, V., R. S. Krogstad, R. W. Moss, and R. Engel, Some observations of strains across the Kern River fault using laser interferometer, *J. Geophys. Res., 73*, 6143–6147, 1968.

Data Processing

Anderson, D. L., and D. G. Harkrider, Universal dispersion tables, 2, Variational parameters for amplitudes, phase velocity, and group velocity for first four Love modes for an oceanic and a continental earth model, *Bull. Seismol. Soc. Amer., 58*, 1407–1500, 1968.

Anderson, D. L., and R. L. Kovach, Universal dispersion tables, 3, Free oscillation variational parameters, *Bull. Seismol. Soc. Amer., 59*, 1677–1694, 1969.

Backus, G. E., and J. F. Gilbert, Numerical applications of a formalism for a geophysical inversion problem, *Geophys. J. Roy. Astron. Soc., 13*, 247–276, 1967.

Barazangi, M., and J. Dorman, World seismicity maps compiled from ESSA, Coast and Geodetic Survey, epicenter data, 1961–1967, *Bull. Seismol. Soc. Amer., 59*, 369–380, 1969.

Barazangi, M., and J. Dorman, Seismicity map of the Arctic compiled from ESSA, Coast and Geodetic Survey, epicenter data, January 1961 through September 1969, *Bull. Seismol. Soc. Amer., 60*, 1741–1744, 1970.

Ben-Menahem, A., H. Jarosch, and M. Rosenman, Large scale processing of seismic data in search of regional and global stress patterns, *Bull. Seismol. Soc. Amer., 58*, 1899–1932, 1968.

Ben-Menahem, A., M. Rosenman, and D. G. Harkrider, Fast evaluation of source parameters from isolated surface-wave signals, 1, *Bull. Seismol. Soc. Amer., 60*, 1337–1387, 1970.

Bloch, S., and A. L. Hales, New techniques for the determination of surface wave phase velocities, *Bull. Seismol. Soc. Amer., 58*, 1021–1034, 1968.

Bollinger, G. A., Determination of earthquake fault parameters from long-period *P* waves, *J. Geophys. Res., 73*, 785–807, 1968.

Chander, R., L. E. Alsop, and J. Oliver, On the synthesis of shear-coupled *PL*-waves, *Bull. Seismol. Soc. Amer., 58*, 1849–1878, 1968.

Dziewonski, A. M., Correlation properties of free period partial derivatives and their relation to the resolution of gross earth data, *Bull. Seismol. Soc. Amer., 60*, 741–768, 1970.

Dziewonski, A. M., S. Bloch, and M. Landisman, A technique for the analysis of transient seismic signals, *Bull. Seismol. Soc. Amer., 59*, 427–444, 1969.

Freedman, H. W., Estimating earthquake magnitude, *Bull. Seismol. Soc. Amer., 57*, 747–760, 1967.

Kanamori, H., Synthesis of long-period surface waves and its application to earthquake source studies–Kurile Islands earthquake of October 13, 1963, *J. Geophys. Res., 75*, 5011–5028, 1970.

Landisman, M., A. Dziewonski, and Y. Sato, Recent improvements in the analysis of surface wave observations, *Geophys. J. Roy. Astron. Soc., 17*, 369–403, 1969.

Levy, M. A., H. N. Pollack, and P. W. Pomeroy, Motion picture of the seismicity of the Earth, 1961–1967, *Bull. Seismol. Soc. Amer., 60*, 1015, 1970.

Randall, M. J., Fast programs for layered half-space problems, *Bull. Seismol. Soc. Amer., 57*, 1299–1312, 1967.

Savage, J. C., A new method of analyzing the dispersion of oceanic Rayleigh waves, *J. Geophys. Res., 74*, 2608–2617, 1969.

Schwab, F., and L. Knopoff, Surface-wave dispersion computations, *Bull. Seismol. Soc. Amer., 60*, 321–344, 1970.

Tarr, A. C., New maps of polar seismicity, *Bull. Seismol. Soc. Amer., 60*, 1745–1748, 1970.

Tsai, Y., and K. Aki, Source mechanism of the Truckee, California, earthquake of September 12, 1966, *Bull. Seismol. Soc. Amer., 60*, 1199–1208, 1970.

Watson, T. H., A note on fast computation of Rayleigh wave dispersion in the multilayered elastic half-space, *Bull. Seismol. Soc. Amer., 60*, 161–166, 1970.

Arrays

Baker, R. G., Suggested use of a medium-period seismograph array, *Bull. Seismol. Soc. Amer., 60*, 1735–1738, 1970.

Capon, J., Investigation of long-period noise at the large aperture seismic array, *J. Geophys. Res., 74*, 3182–3194, 1969.

Capon, J., Analysis of Rayleigh-wave multipath propagation at Lasa, *Bull. Seismol. Soc. Amer., 60*, 1701–1732, 1970.

Capon, J., R. J. Greenfield, and R. J. Kolker, Multidimensional maximum likelihood processing of a large aperture seismic array, *Proc. IEEE, 55*, 192–211, 1967.

Capon, J., R. J. Greenfield, R. J. Kolker, and R. T. Lacoss, Short-period signal processing results for the large aperture seismic array, *Geophysics, 33*, 452–472, 1968.

Capon, J., R. J. Greenfield, and R. T. Lacoss, Long-period signal processing results for the large aperture seismic array, *Geophysics, 34*, 305–329, 1969.

Evernden, J. F., Beam-steering of large randomly-spaced long period arrays, *Bull. Seismol. Soc. Amer., 59*, 1559–1568, 1969.

Glover, P., and S. S. Alexander, Lateral variations in crustal structure beneath the Montana Lasa, *J. Geophys. Res., 74*, 505–531, 1969.

Haubrich, R. A., Array design, *Bull. Seismol. Soc. Amer., 58*, 977–992, 1968.

Haubrich, R. A., and K. McCamy, Microseisms: Coastal and pelagic sources, *Rev. Geophys., 7*, 539–572, 1969.

Husebye, E. S., Direct measurement of $dT/d\Delta$, *Bull. Seismol. Soc. Amer., 59*, 717–728, 1969.

Johnson, K. R., Correlation function of teleseismic noise, *Bull. Seismol. Soc. Amer., 58*, 521–538, 1968.

Johnson, L. R., Array measurements of *P* velocities in the upper mantle, *J. Geophys. Res., 72*, 6309–6325, 1967.

Johnson, L. R., Array measurements of *P* velocities in the lower mantle, *Bull. Seismol. Soc. Amer., 59*, 973–1008, 1969.

Lacoss, R. T., E. J. Kelly, and M. N. Toksöz, Estimation of seismic noise structure using arrays, *Geophysics, 34*, 21–38, 1969.

Mack, H., Nature of short-period *P* wave signal variations at Lasa, *J. Geophys. Res., 74*, 3161–3170, 1969.

Niazi, M., Use of source arrays in studies of regional structure, *Bull. Seismol. Soc. Amer., 59*, 1631–1644, 1969.

Syed, A. A., Station corrections for vertical component *P* wave amplitude at Lasa, *Earthquake Notes, 40*, 51–53, 1969.

Toksöz, M. N., and R. T. Lacoss, Microseisms: Mode structure and sources, *Science, 159*, 872–873, 1968.

Zengeni, T. G., A note on an azimuthal correction for $dT/d\Delta$ for a single dipping plane interface, *Bull. Seismol. Soc. Amer., 60*, 299–306, 1970.

Strain Measurements

Decker, R. L., Measurement of horizontal ground surface deformation in Iceland (abstract), *Trans. AGU, 49*, 114, 1968.

Derr, J. S., Free oscillation observations through 1968, *Bull. Seismol. Soc. Amer., 59*, 2079–2099, 1969.

Dickey, D. D., Strain associated with the Benham underground nuclear explosion, *Bull. Seismol. Soc. Amer., 59*, 2221–2230, 1969.

Hoffmann, R. B., Geodimeter fault movement investigations in California, *Calif. Dep. Water Res. Bull. 116-6*, 1968.

Hoffmann, R. B., Earthquake prediction from fault movement monitoring in California, *EOS, Trans. AGU, 50*, 381, 1969.

Houser, F. N., Subsidence related to underground nuclear explosions, Nevada Test Site, *Bull. Seismol. Soc. Amer., 59*, 2231–2252, 1969.

Kuo, J. T., Areal strain of solid earth tides observed in Ogdensburg, New Jersey, *J. Geophys. Res., 74*, 1635–1644, 1969.

Major, M. W., and P. R. Romig, Secular strain and earthquakes near Denver, *EOS, Trans. AGU, 50*, 385–387, 1969.

Marshall, G. E., and J. R. Stephens, Observations of earth tilt and earthquake correlation, *Earthquake Notes, 39*, 23–36, 1968.

McKeown, F. A., and D. D. Dickey, Fault displacements and motions related to nuclear explosions, *Bull. Seismol. Soc. Amer., 59*, 2253–2270, 1969.

Meister, L., R. O. Burford, G. A. Thompson, and R. L. Kovach, Surface strain changes and strain energy release in the Dixie Valley–Fairview Peak area, Nevada, *J. Geophys. Res., 73*, 5981–5994, 1968.

Nowroozi, A. A., J. Kuo, and M. Ewing, Solid earth and oceanic tides recorded on the ocean floor off the coast of northern

California, *J. Geophys. Res.*, *74*, 605–614, 1969.
Press, F., Zero frequency seismology, in *The Earth's Crust and Upper Mantle, Geophys. Monogr. 13*, edited by P. J. Hart, pp. 171–173, AGU, Washington, D. C., 1969.
Rayleigh, C. B., and R. O. Burford, Tectonics of the San Andreas fault system–strain studies, *EOS, Trans. AGU*, *50*, 380, 1969.
Romig, R. R., M. W. Major, C. J. Wideman, and D. Tocher, Residual strains associated with a nuclear explosion, *Bull. Seismol. Soc. Amer.*, *59*, 2167–2176, 1969.
Scholz, C. H., and T. J. Fitch, Strain accumulation along the San Andreas fault, *J. Geophys. Res.*, *74*, 6649–6666, 1969.
Scholz, C. H., and T. J. Fitch, Strain and creep in central California, *J. Geophys. Res.*, *75*, 4447–4454, 1970.
Smith, S. W., and W. Van de Lindt, Strain adjustments associated with earthquakes in southern California, *Bull. Seismol. Soc. Amer.*, *59*, 1569–1590, 1969.
Smith, S. W., C. B. Archambeau, and W. Gile, Transient and residual strains from large underground explosions, *Bull. Seismol. Soc. Amer.*, *59*, 2185–2196, 1969*a*.
Smith, S. W., J. McGinley, Jr., C. Scholz, and L. Johnson, Effects of large explosions on tectonic strain, *J. Geophys. Res.*, *74*, 3308–3309, 1969*b*.
Tryggvason, E., Measurement of surface deformation in Iceland by precision leveling, *J. Geophys. Res.*, *73*, 7039–7050, 1968.
Tryggvason, E., Surface deformation and fault displacement associated with an earthquake swarm in Iceland, *J. Geophys. Res.*, *75*, 4407–4423, 1970.
Whitten, C. A., An evaluation of the geodetic and photogrammetric surveys in the Prince William Sound, Alaska, earthquake of 1964 and aftershocks, vol. 3, *U.S. Coast Geodet. Surv. Publ. 10-3*, 1–4, 1969.
Wideman, W. J., and M. W. Major, Strain steps associated with earthquakes, *Bull. Seismol. Soc. Amer.*, *57*, 1429–1444, 1967.