

Supplementary Material

Anton Linder Hales 1911–2006

Kurt Lambeck

Emeritus Professor of Geophysics, Research School of Earth Sciences, The Australian National University, ACT 2601, Australia. Email: kurt.lambeck@anu.edu.au

Publications of A. L. Hales 1935–1997

Hales, A. L. (1935) The thermal stability of the lower atmosphere, *Proceedings of the Royal Society of London A*, 151, 624-640.

Hales, A. L. (1936) Convection currents in the Earth, *Geophysical Supplements to the Monthly Notices of Royal Astronomical Society*, 3, 372-379.

Hales, A. L. (1937) Convection currents in geysers, *Geophysical Supplements to the Monthly Notices of the Royal Astronomical Society*, 4, 122-131.

Gane, P. G., Hales, A. L. and Oliver, H. O. (1946), A seismic investigation of the Witwatersrand earth tremors, *Bulletin of the Seismological Society of America*, 36, 49-80.

Hales A. L. and Gough, D. I. (1947) Blackett's fundamental theory of the earth's magnetic field, *Nature*, 160, 746.

Hales, A. L. (1948) A possible mode of propagation of the 'slow' or tail component in atmospheric, *Proceedings of the Royal Society of London A*, 193, 60-71.

Hales, A. L. and Gough, D. I. (1950), *Measurements of Gravity in Southern Africa*, Government Printers, Pretoria.

Hales, A. L. (1951). Crustal layers of the Earth, *Nature*, 168, 163-164.

Willmore, P. L., Hales, A. L. and Gane, P. G. (1952) A seismic investigation of crustal structure in the western Transvaal, *Bulletin of the Seismological Society of America*, 42, 53-80.

Hales, A. L. (1953) The thermal contraction theory of mountain building (second paper), *Geophysical Supplement to the Monthly Notices to the Royal Astronomical Society*, 6, 458-466.

Hales, A. L. (1953) The thermal contraction theory of mountain building (second paper), *Geophysical Supplement to the Monthly Notices to the Royal Astronomical Society*, 6, 486-493.

Hales, A. L. (1956) The interior of the Earth, *Transactions of the South African Institute for Electrical Engineers*, 47, 248-257.

Graham, K. W. T. and Hales, A. L. (1957), Palaeomagnetic measurements on Karoo dolerites, *Advances in Physics*, 6, 149-161.

Hales, A. L. (1958) Geophysics in South Africa, *Geophysical Journal of the Royal Astronomical Society*, 1, 249-256.

Hales, A. L. and Sacks, S. I. (1959) Evidence for an intermediate layer from crustal structure studies in the eastern Transvaal, *Geophysical Journal of the Royal Astronomical Society*, 2, 15-33.

Hales, A. L. and D. I. Gough (1959) Gravity anomalies and crustal structure in South Africa, *Geophysical Journal of the Royal Astronomical Society*, 2, 324-336.

Hales, A. L. (1960) Research at the Bernard Price Institute of Geophysical Research, University of the Witwatersrand, Johannesburg, *Proceedings of the Royal Society of London A*, 258, 1-26.

Hales, A. L. and Gough, D. I. (1960) Isostatic anomalies and crustal structure in the southern Cape, *Geophysical Journal of the Royal Astronomical Society*, 3, 225-236.

Hales, A. L. (1960) Seismic and gravity research on crustal structure in South Africa, *Journal of Geophysical Research*, 65, 2155-2168.

Graham, K. W. T. and Hales, A. L. (1961) Preliminary palaeomagnetic measurements on Silurian sediments from South Africa, *Geophysical Journal of the Royal Astronomical Society*, 5, 318-325.

Hales, A. L. (1961) A weak layer in the mantle, *Geophysical Journal of the Royal Astronomical Society*, 4, 312-319.

Hales, A. L. (1961) An upper limit to the age of the Witwatersrand system, *Annals of the New York Academy of Sciences*, 91, 524-528.

Van Zijl, J. S. V., Graham, K. W. T. and Hales A. L. (1962) The paleomagnetism of the Stormberg lavas

of South Africa. I. Evidence for a genuine reversal of the earth's field in Triassic-Jurassic times, *Geophysical Journal of the Royal Astronomical Society*, 7, 23-39.

Van Zijl, J. S. V., Graham, K. W. T. and Hales A. L. (1962) The paleomagnetism of the Stormberg lavas of South Africa. II. The behaviour of the Earth's field during a reversal, *Geophysical Journal of the Royal Astronomical Society*, 7, 169-182.

Van Zijl, J. S. V., Graham, K. W. T. and Hales A. L. (1962) Palaeomagnetic evidence regarding the relative ages of the Stormberg lavas and the Karroo dolerites, *Transactions of the Geological Society of South Africa*, 65, 47-55.

Gough, D. I. and Hales, A. L. (1962) The gravity survey of the Republic of South Africa, Handbook 3, Part II, isostatic anomalies and crustal structure, Government Printers, Pretoria, 477 pp.

Harkrider, D. G., Press, F. and Hales, A. L. (1963) On detecting soft layers in the mantle with Raleigh waves, *Bulletin of the Seismological Society of America*, 53, 539-548.

Graham, K. W. T., Helsley, C. E. and Hales A. L. (1964) Determination of the relative continents from palaeomagnetic data, *Journal of Geophysical Research*, 69, 3859-3900.

Graham, K. W. T. and Hales A. L. (1965) Surface-ship gravity measurements in the Agulhas Bank area, south of South Africa, *Journal of Geophysical Research*, 70, 4005-4011.

Taylor, J. H., Rutten, M. G., Hales, A. L. Shackleton, R. M., Nairn, A. E., Harland, W. B., Blackett, P. M. S., Bullard, E., and Runcorn, S. K. (1965) Discussion of continental reconstructions, *Philosophical Transactions of the Royal Society of London*, A258, 52-75.

Green, R. W. E. and Hales A. L. (1966) Seismic refraction measurements in the southwestern Indian Ocean, *Journal of Geophysical Research*, 71, 1637-1647.

Cleary, J. R. and Hales, A. L. (1966) An analysis of the travel times of P waves to North American stations in the distance range 32° to 100°, *Bulletin of the Seismological Society of America*, 56, 467-489.

Cleary, J. R. and Hales, A. L. (1966) Azimuthal variation of U.S station residuals, *Nature*, 210, 619-620.

Asada, T. and Hales, A. L. (1966) Crustal structure in coastal Alaska, in *The Earth Beneath the Continents* (J. S. Steinhardt and T. J. Smith, editors). *Geophysical Monograph*, 10, American Geophysical Union, Washington, 420-432.

Nation, J. B. and Hales, A. L. (1966) Reflections at the Mohorovicic discontinuity and the origin of microseisms, in *The Earth Beneath the Continents* (J. S. Steinhardt and T. J. Smith, editors). Geophysical Monograph, 10, American Geophysical Union, Washington, 529-537.

Hales, A. L. (1967) Crustal structure of the Earth as revealed by earthquakes, in *The International Dictionary of Geophysics* (S. K. Runcorn, editor) 1, 308-311, Pergamon Press, Oxford.

Hales, A. L. (1967) Seismology and finite strain theory, in *The International Dictionary of Geophysics* (S. K. Runcorn, editor) 2, 1388-1389, Pergamon Press, Oxford.

Hales, A. L. (1967) The core and mantle, in *The Earth in Space* (H. Odishaw, editor) Basic Books, New York, 59-67.

Helsley, C. E., Nation, J. B. and Hales, A. L. (1967) The Gulf Coast on-shore off-shore experiment: some preliminary results, *Transactions of the American Geophysical Union*, 48, 753-756.

Doyle, H. A. and Hales, A. L. (1967) An analysis of the travel times of S waves to North American stations in the distance range 28° to 82°, *Bulletin of the Seismological Society of America*, 57(4), 761-771.

Hales, A. L. and Doyle H. A. (1967) P and S travel times and their interpretation, *Geophysical Journal of the Royal Astronomical Society*, 13, 403-415.

Green, R. W. E. and Hales, A. L. (1968) The travel times of P waves to 30° in the central United States and upper mantle structure, *Bulletin of the Seismological Society of America*, 58, 267-289.

Hales, A. L., Helsley, C. E., Dowling, J. J. and Nation, J. B. (1968) The east coast onshore-offshore experiment. I. The first arrival phases, *Bulletin of the Seismological Society of America*, 58, 757-819.

Bloch, S. and Hales, A. L. (1968) New techniques for determination of surface wave phase velocities, *Bulletin of the Seismological Society of America*, 58, 1021-1034.

Hales, A. L., Cleary, J. R., Doyle, H. A., Green, R. and Roberts, J. (1968) P-wave station anomalies and structure of upper mantle, *Journal of Geophysical Research*, 73, 3885-3896.

Hales, A. L., Cleary, J. R. and Roberts, J. L. (1968) Velocity distribution in lower mantle, *Bulletin of the Seismological Society of America*, 58, 1975-1989.

Cleary, J. and Hales, A. L. (1968), P times from nuclear explosion 'Greeley', *Earth and Planetary Science*

Letters, 4, 305-309.

Hales, A. L. and Bloch, S. (1969) Upper mantle structure - are low velocity layers thin, *Nature*, 221, 930-933.

Hales, A. L. (1969) Gravitational sliding and continental drift, *Earth and Planetary Science Letters*, 6, 31-34.

Hales, A. L. (1969) A seismic discontinuity in the lithosphere, *Earth and Planetary Science Letters*, 7, 44-46.

Bloch, S., Hales, A. L. and Landisman, M. (1969) velocities in crust and upper mantle of southern Africa from multi-mode surface wave dispersion, *Bulletin of the Seismological Society of America*, 59, 1599-1629.

Hales, A. L. (1969) Crustal and upper mantle structure in the region of the Gulf of Mexico, *Bulletin of the Mexican Geological Society*, 32, 63-70.

Hales, A. L., Helsley, C. E. and Nation, J. B. (1970) P-travel times for an oceanic path, *Journal of Geophysical Research*, 75, 7362-7381.

Hales, A. L., Eastern continental margin of the U.S.: a review, in *The Sea 4, Part II* (A.E. Maxwell, editor), Wiley Interscience, 311-320.

Hales, A. L., Helsley, C. E. and Nation, J. B. (1970) Crustal structure study on the Gulf Coast of Texas, *American Association of Petroleum Geologists Bulletin*, 54, 2040-2057.

Hales, A. L. and Roberts, J. (1970) The travel times of S and SKS, *Bulletin of the Seismological Society of America*, 60, 461-489.

Hales, A. L. and Roberts, J. (1970) Shear velocities in the lower mantle and the radius of the core, *Bulletin of the Seismological Society of America*, 60, 1427-1436.

Clearly, J. and Hales, A. L. (1970) PKIKP residuals at stations in North-America and Europe, *Earth and Planetary Science Letters*, 8, 279-282.

Hales, A. L. and Roberts, J. (1971) The velocities in the outer core, *Bulletin of the Seismological Society of America*, 61, 1051-1059.

Cleary, J. and Hales, A. L. (1971) PKIKP times and station anomalies, *Journal of Geophysical Research*,

76, 7249-7259.

Hales, A. L. (1971) The travel times of P seismic waves and their relevance to the upper mantle velocity distribution, *Tectonophysics*, 13, 447-482.

Hales, A. L. and Nation, J. B. (1972) A crustal structure profile on the Agulhas Bank, *Bulletin of the Seismological Society of America*, 62, 1029-1051.

Hales, A. L. and Herrin, E. (1972) Travel times of seismic waves, in *The Nature of the Solid Earth* (E. C. Robertson, J. F. Hays and L. Knopoff, editors) McGraw Hill, New York, 172-215.

Dziewonski, A. M. and Hales, A. L. (1972) Numerical analysis of dispersed seismic waves, *Methods in Computational Physics*, 11, 13-85.

Hales, A. L. (1972) Travel times of P seismic waves and their relevance to upper mantle velocity distribution, *Tectonophysics*, 13, 447-482.

Hales, A. L. (1973) The crust of the Gulf of Mexico: a discussion. *Tectonophysics*, 20, 217-235.

Hales, A. L. and Nation, J. B. (1973) A seismic refraction study in the northern Rocky Mountains: more evidence for an intermediate crustal layer, *Geophysical Journal of the Royal Astronomical Society*, 35, 381-399.

Hales, A. L. and Nation, J. B. (1973) A seismic refraction study in the southern Indian Ocean, *Bulletin of the Seismological Society of America*, 63, 1951-1966.

Hales, A. L. and Roberts, J. (1974) The Zoeppritz amplitude equations: more errors, *Bulletin of the Seismological Society of America*, 64, 285.

Hales, A. L. (1974) Crustal structure modelling in a spherically symmetrical earth, *Physics of the Earth and Planetary Interiors*, 9, 7-8.

Hales, A. L. (1974) Eigenperiods of earth models and the determination of travel time baselines, *Journal of Geophysical Research*, 79, 422-423.

Dziewonski, A. M., Hales, A. L. and Lapwood, E. R. (1974) Parametrization of a spherically symmetrical Earth model with special references to the upper mantle, *Physics of the Earth and Planetary Interiors*, 9, 9-12.

Hales, A. L., Muirhead, K. J., Rynn, J. M. and Gettrust, J. F. (1975) Upper mantle travel times in

Australia – a preliminary report, *Physics of the Earth and Planetary Interiors*, 11, 109-118.

Dziewonski, A. M., Hales, A. L. and Lapwood, E. R. (1975) Parametrically simple earth models consistent with geophysical data, *Physics of the Earth and Planetary Interiors*, 10, 12-48.

Goncz, J. H., Hales, A. L. and Muirhead, K. J. (1975) Analysis to extended period of Rayleigh and Love dispersion across Australia, *Geophysical Journal of the Royal Astronomical Society*, 41, 81-105.

Meyer, R. P., Mooney, W. D., Hales, A. L., Helsley, C. E., Woollard, G. P., Hussong, D. M. and Ramirez, J. E. (1975) Refraction observations across a leading edge, Malepo Island to the Columbian Cordillera occidental, In *Geophysics of the Pacific Ocean Basin and its Margin*, *Geophysical Monograph*, 19, American Geophysical Union, Washington, 105-132.

Hales, A. L. (1977) ScS travel time residuals and the difference between continents and oceans, *Earth and Planetary Science Letters*, 33, 249-254.

Mills, J. M. and Hales, A. L. (1977) Great-circle Rayleigh wave attenuation and group velocity: I. Observations for periods between 150 and 600 seconds for seven great circle paths, *Physics of the Earth and Planetary Interiors*, 14, 109-119.

Mills, J. M. and Hales, A. L. (1978) Great-circle Rayleigh attenuation and group velocity: II. Observations for periods between 50 and 200 seconds for non-great circle paths and global averages for periods of 50 to 600 seconds, *Physics of the Earth and Planetary Interiors*, 17, 209-231.

Hales A. L. and Rynn, J. M. W. (1978) A long-range controlled source seismic profile in northern Australia, *Geophysical Journal of the Royal Astronomical Society*, 55, 633-644.

Christie, D. R., Muirhead, K. J. and Hales, A. L. (1978) On solitary waves in the atmosphere, *Journal of Atmospheric Sciences*, 35, 805-825.

Christie, D. R., Muirhead, K. J. and Hales, A. L. (1979) Intrusive density flows in the lower troposphere: a source of atmospheric solitons, *Journal of Geophysical Research*, 84, 4959-4970.

Hales, A. L. (1979) Keith Edward Bullen 1906-1976, *Historical Records of Australian Science*, 4, 42-64.

Hales, A. L., Muirhead, K. J. and Rynn, J. M. W. (1980). A compressional velocity distribution for the upper mantle, *Tectonophysics*, 63, 309-348.

Muirhead, K. J. and Hales, A. L. (1980) Evidence for P-wave velocity discontinuities at depths greater

than 650 km in the mantle, *Physics of the Earth and Planetary Interiors*, 23, 304-313.

Hales, A. L. and Muirhead, K. J. (1980) The ratio of the travel times for S and P at distances less than 10°. *Bulletin of the Seismological Society of America*, 70, 823-829.

Hales, A. L., Maki-Lopez, L. and Muirhead, K. J. (1981) The times of origin and depths of focus of intermediate and deep focus earthquakes: model calculations, *Bulletin of the Seismological Society of America*, 71, 1539-1552.

Hales, A. L. (1981) The upper mantle velocity distribution, *Physics of the Earth and Planetary Interiors*, 25, 1-11.

Hales, A. L. (1981) Geodynamics: the unanswered questions, in *Evolution of the Earth*, Geodynamic Series, 5, (R.J. O'Connell and W.S. Fyfe. editors), American Geophysical Union, 4-5.

Hales, A. L. and Maki-Lopez, L. (1982) Hypocentral parameters, *Physics of the Earth and Planetary Interiors*, 30, 131-134.

Drummond, B. J., Muirhead, K. J. and Hales, A. L. (1982) Evidence for a seismic discontinuity near 200 km depth under a continental margin, *Geophysical Journal International*, 70, 67-77.

Hales, A. L. (1986) Geophysics on three continents, *Annual Review of Earth and Planetary Sciences*, 14, 1-20.

Hales, A. L. (1988) Geophysical research in South Africa, 1937-1962, *South African Geophysical Association Yearbook 1988*, 17-21.

Hales, A. L. (1991) Upper mantle models and the thickness of the continental lithosphere, *Geophysical Journal International*, 105, 355-363.

Hales, A. L. (1992) Speculations about crustal evolution, *Journal of Geodynamics*, 16, 55-64.

Hales, A. L. (1995) Amplitudes of core waves near the PKP caustic, from nuclear-explosions in the south-pacific recorded at the laboratoire de detection et geophysique network in France – comment, *Bulletin of the Seismological Society of America*, 85, 957-958.

Hales, A. L. (1997) The Anelasticity of the Earth; how much do we know about Q? *In Upper Mantle Heterogeneities from Active and Passive Seismology* (K. Fuchs, editor), 173-186, Kluwer Academic Publishers.