

Mark Paul Panning

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Education

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| 2004 | UC Berkeley, Ph.D., Geophysics, Thesis Title: “Deep Earth Seismic Structure and Earthquake Source Processes from Long Period Waveform Modelling” |
| 1999 | Indiana University, B.S., Geological Sciences |

Experience

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| 2017-present | Research Scientist, Geophysics and Planetary Geosciences, Jet Propulsion Lab/California Institute of Technology |
| 2008-2017 | Assistant Professor, Dept. of Geological Sciences, University of Florida |
| 2006-2008 | Postdoctoral Fellow, Department of Geosciences, Princeton University |
| 2004-2006 | Postdoctoral Researcher, Berkeley Seismological Lab/Space Sciences Lab |
| 1999-2004 | Graduate Student Researcher/Instructor, University of California, Berkeley |
| 1999 | Research Assistant, Indiana University |

Honors

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| 2019 | JPL Voyager Award, Outstanding science leadership in planetary seismometry |
| 2018 | JPL Voyager Award, For the selection of Dragonfly |
| 2006 | Princeton University Teaching Postdoctoral Fellowship in Science and Engineering, Council on Science & Technology |
| 1999 | Berkeley Fellowship, University of California, Berkeley |
| 1998 | Faculty Scholarship Award, Dept. of Geological Sciences, Indiana University |
| 1997 | Junior Award, Dept. of Geological Sciences, Indiana University |

Services and Memberships

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| 2017-2019 | Chair, Lehmann Medal selection committee, American Geophysical Union |
| 2015-2016 | Member, Lehmann Medal selection committee, American Geophysical Union |
| 2013-2014 | President, American Geophysical Union SEDI focus group |
| 2012-2014 | Member, IRIS Global Seismic Network Standing Committee |
| 2010-2012 | Vice-Chair, American Geophysical Union SEDI focus group |
| 2010-2014 | Leadership Council, American Geophysical Union |
| 2008-2010 | Program Committee, American Geophysical Union Fall Meeting |
| 2003-2018 | Executive Committee, American Geophysical Union SEDI focus group
(http://www.agu.org/focus_group/SEDI/index.html) |

Peer Reviewed Publications

1. **M. P. Panning**, W. T. Pike, P. Lognonné, W. B. Banerdt, N. Murdoch, D. Banfield, C. Charalambous, S. Kedar, R. D. Lorenz, A. G. Marusiak, J. B. McClean, C. Nunn, S. C. Stähler, A. E. Stott, and T. Warren, “On-deck seismology: Lessons from InSight for future planetary seismology”, *J. Geophys. Res.*, 2020, accepted.
2. T. A. Hurford, W. G. Henning, R. Maguire, V. Lekic, N. Schmerr, **M. P. Panning**, V. J. Bray, M. Manga, S. A. Kattenhorn, L. C. Quick, A. R. Rhoden, “Seismicity on tidally active solid-surface worlds”, *Icarus*, **338**, doi: 10.1038/s41561-020-0544-y, 2020.
3. W. B. Banerdt, S. E. Smrekar, D. Banfield, D. Giardini, M. P. Golombek, C. L. Johnson, P. Lognonné, A. Spiga, T. Spohn, C. Perrin, S. C. Stähler, D. Antonangeli, S. Asmar, C. Beghein, N. Bowles, E. Bozdog, P. T. Chi, U. Christensen, J. F. Clinton, G. S. Collins, I. Daubar, V. Dehant, M. Drilleau, M. Fillingim, W. Folkner, R. F. Garcia, J. Garvin, J. Grant, M. Grott, J. Grygorczuk, T. Hudson, J. C. E. Irving, G. Kargl, T. Kawamura, S. Kedar, S. King, B. Knapmeyer-Endrun, M. Knapmeyer, M. Lemmon, R. D. Lorenz, J. N. Maki, L. Margerin, S. M. McLennan, C. Michaut, D. Mimoun, A. Mittelholz, A. Mocquet, P. Morgan, N. T. Mueller, N. Murdoch, S. Nagihara, C. Newman, F. Nimmo, **M. P. Panning**, W. T. Pike, A.-C. Plesa, S. Rodriguez, J. A. Rodriguez-Manfredi, C. T. Russell, N. Schmerr, M. Siegler, S. Stanley, E. Stutzmann, N. Teanby, J. Tromp, M. van Driel, N. Warner, R. C. Weber, and M. Wiczorek, “Initial results from the InSight mission on Mars”, *Nature Geoscience*, **13**, 183-189, doi: 10.1038/s41561-020-0544-y, 2020.
4. D. Giardini, P. Lognonné, W. B. Banerdt, W. T. Pike, U. Christensen, S. Ceylan, J. F. Clinton, M. van Driel, S. C. Stähler, M. Böse, R. F. Garcia, A. Khan, **M. P. Panning**, C. Perrin, D. Banfield, E. Beucler, C. Charalambous, F. Euchner, A. Horleston, A. Jacob, T. Kawamura, S. Kedar, G. Mainsant, J.-R. Scholz, S. E. Smrekar, A. Spiga, C. Agard, D. Antonangeli, S. Barkaoui, E. Barrett, P. Combes, V. Conejero, I. Daubar, M. Drilleau, C. Ferrier, T. Gabsi, T. Gudkova, K. Hurst, F. Karakostas, S. King, M. Knapmeyer, B. Knapmeyer-Endrun, R. Llorca-Cejudo, A. Lucas, L. Luno, L. Margerin, J. B. McClean, D. Mimoun, N. Murdoch, F. Nimmo, M. Nonon, C. Pardo, A. Rivoldini, J. A. Rodriguez Manfredi, H. Samuel, M. Schimmel, A. E. Stott, E. Stutzmann, N. Teanby, T. Warren, R. C. Weber, M. Wiczorek, and C. Yana, “The seismicity of Mars”, *Nature Geoscience*, **13**, 205-212, doi: 10.1038/s41561-020-0539-8, 2020.
5. P. Lognonné, W. B. Banerdt, W. T. Pike, D. Giardini, U. Christensen, R. F. Garcia, T. Kawamura, S. Kedar, B. Knapmeyer-Endrun, L. Margerin, F. Nimmo, **M. P. Panning**, B. Tauzin, J. R. Scholz, D. Antonangeli, S. Barkaoui, E. Beucler, F. Bissig, N. Brinkman, M. Calvet, S. Ceylan, C. Charalambous, P. Davis, M. van Driel, M. Drilleau, L. Fayon, R. Joshi, B. Kenda, A. Khan, M. Knapmeyer, V. Lekic, J. McClean, D. Mimoun, N. Murdoch, L. Pan, C. Perrin, B. Pinot, L. Pou, S. Menina, S. Rodriguez, C. Schmelzbach, N. Schmerr, D. Sollberger, A. Spiga, S. C. Stähler, A. Stott, E. Stutzmann, S. Tharimena, R. Widmer-Schmidrig, F. Andersson, V. Ansan, C. Beghein, M. Böse, E. Bozdog, J. F. Clinton, I. Daubar, P. Delage, N. Fuji, M. P. Golombek, M. Grott, A. Horleston, K. Hurst, J. Irving, A. Jacob, J. Knollenberg, S. Krasner, C. Krause, R. D. Lorenz, C. Michaut, R. Myhill, T. Nissen-Meyer, J. ten Pierick, A. C. Plesa, C. Quantin-Nataf, J. Robertsson, L. Rochas, M. Schimmel, S. Smrekar, T. Spohn, N. Teanby, J. Tromp, J. Vallade, N. Verdier, C. Vrettos, R. C. Weber, D. Banfield, E. Barrett, M. Bierwirth, S. Calcutt, N. Compaire, C. L. Johnson, D. Mance, F. Euchner, L. Kerjean, G. Mainsant, A. Mocquet, J. A. Rodriguez Manfredi, G. Pont, P. Laudet, T. Nebut, S. de Raucourt, O. Robert, C. T. Russell, A. Sylvestre-Baron, S. Tillier, T. Warren, M. Wiczorek, C. Yana, and P. Zweifel, “Constraints on the shallow elastic and anelastic structure of Mars from InSight seismic data”, *Nature Geoscience*, **13**, 213-220, doi: 10.1038/s41561-020-0536-y, 2020.
6. H. Samuel, P. Lognonné, **M. P. Panning**, and V. Lainey, “The rheology and thermal history of Mars revealed by the orbital evolution of Phobos”, *Nature*, 569, 523-527, doi: 10.1038/s41586-019-1202-7, 2019.

7. M. van Driel, S. Ceylan, J. F. Clinton, D. Giardini, H. Alemany, A. Allam, D. Ambrois, J. Balestra, W. B. Banerdt, D. Becker, M. Böse, M. S. Boxberg, N. Brinkman, T. Casademont, J. Cheze, I. Daubar, A. Deschamps, F. Dethof, M. Ditz, M. Drilleau, D. Essing, F. Euchner, B. Fernando, R. Garcia, T. Garth, H. Godwin, M. P. Golombek, K. Grunert, C. Hadziioannou, C. Haindl, C. Hammer, I. Hochfeld, K. Hosseini, H. Hu, S. Kedar, B. Kenda, A. Khan, T. Kilchling, B. Knapmeyer-Endrun, A. Lamert, J. X. Li, P. Lognonne, S. Mader, L. Marten, F. Mehrkens, D. Mercerat, D. Mimoun, T. Moller, N. Murdoch, P. Neumann, R. Neurath, M. Paffrath, **M. P. Panning**, F. Peix, L. Perrin, L. Rolland, M. Schimmel, C. Schroer, A. Spiga, S. C. Stähler, R. Steinmann, E. Stutzmann, A. Szenicer, N. Trumpik, M. Tsekhmistrenko, C. Twardzik, R. C. Weber, P. Werdenbach-Jarklowski, S. Zhang, and Y. C. Zheng, “Preparing for InSight: Evaluation of the blind test for Martian seismicity”, *Seism. Res. Lett.*, **90**, 1518-1534, doi: 10.1785/0220180379, 2019.
8. S. C. Stähler, **M. P. Panning**, C. Hadziioannou, R. D. Lorenz, S. D. Vance, K. Klingbeil, and S. Kedar, “Seismic signal from waves on Titan's seas”, *Earth Plan. Sci. Lett.*, **520**, 250-259, doi: 10.1016/j.epsl.2019.05.043, 2019.
9. S. R. James, H. A. Knox, R. E. Abbate, **M. P. Panning**, and E. J. Sreaton, “Insights into permafrost and seasonal active-layer dynamics from ambient seismic noise monitoring”, *J. Geophys. Res.*, **124**, 1798-1816, doi: 10.1029/2019JF005051, 2019.
10. Bremner, P. M., **M. P. Panning**, R. M. Russo, V. Mocanu, A. C. Stanciu, M. Torpey, S. Hongsresawat, J. C. VanDecar, T. A. LaMaskin, and D. A. Foster, “Crustal shear wave velocity structure of Central Idaho and Eastern Oregon from ambient seismic noise: Results from the IDOR project”, *J. Geophys. Res.*, **124**, 1601-1625. doi: 10.1029/2018JB016350, 2019.
11. Smrekar, S.E., P. Lognonné, T. Spohn, W. B. Banerdt, D. Breuer, U. Christensen, V. Dehant, M. Drilleau, W. Folkner, N. Fuji, R. F. Garcia, D. Giardini, M. Golombek, M. Grott, T. Gudkova, C. Johnson, A. Khan, B. Langlais, A. Mittelholz, A. Mocquet, R. Myhill, **M. P. Panning**, C. Perrin, W. T. Pike, A.-C. Plesa, A. Rivoldini, H. Samuel, S. C. Stähler, M. van Driel, T. Van Hoolst, O. Verhoeven, R. C. Weber, and M. Wiczeorek, “Pre-mission InSights on the Interior of Mars”, *Space Science Reviews*, **215**, doi: 10.1007/s11214-018-0563-9, 2019.

12. Lognonné, P., W.B. Banerdt, D. Giardini, W.T. Pike, U. Christensen, P. Laudet, S. de Raucourt, P. Zweifel, S. Calcutt, M. Bierwirth, K.J. Hurst, F. Ipelaan, J.W. Umland, R. Llorca-Cejudo, S. Larson, S. Kedar, B. Knapmeyer-Endrun, D. Mimoun, A. Mocquet, **M.P. Panning**, R.C. Weber, A. Sylvestre-Baron, G. Pont, N. Verdier, L. Kerjean, L.J. Facto, V. Gharakanian, J.E. Feldman, T.L. Hoffman, D.B. Klein, K. Klein, N.P. Onufer, J. Paredes-Garcia, M.P. Petkov, J.R. Willis, S.E. Smrekar, M. Drilleau, T. Gabsi, T. Nebut, O. Robert, S. Tillier, C. Moreau, M. Parise, G. Aveni, S. Ben Charef, Y. Bennour, T. Camus, P.A. Dandonneau, C. Desfoux, B. Lecomte, O. Pot, P. Revuz, D. Mance, J. tenPierick, N.E. Bowles, C. Charalambous, A.K. Delahunty, J. Hurley, R. Irshad, H. Liu, A.G. Mukerherjee, I.M. Standley, A. E. Stott, J. Temple, T. Warren, M. Eberhardt, A. Kramer, W. Kühne, E.-P. Miettinen, M. Monecke, C. Aicardi, M. André, J. Baroukh, A. Borrien, A. Bouisset, P. Boutte, K. Brethomé, C. Brysbaert, T. Carlier, M. Deleuze, J.M. Desmarres, D. Dilhan, C. Doucet, D. Faye, N. Faye-Refalo, R. Gonzalez, C. Imbert, C. Larigauderie, E. Locatelli, L. Luno, S. Mehdi, J-R. Meyer, F. Mialhe, J.M. Mouret, M. Nonon, Y. Pahn, A. Paillet, P. Pasquier, G. Perez, R. Perez, L. Perrin, B. Pouilloux, A. Rosak, I. Savin de Larclause, J. Sicre, M.Sodki, N. Toulemont, B. Vella, C. Yana, F. Alibay, O. Avalos, M. Balzer, P. Bhandari, E. Blanco, B.D. Bone, J. Bousman, P. Bruneau, F.Calef, R.J. Calvet, S. D'Agostino, G. de los Santos, R. Deen, B. Denise, J. Ervin, N. Ferraro, H.E Gengl, F. Grinblat, D. Hernandez, M. Hetzel, M. Johnson, L. Khachikyan, J. Lin, S. Madzunkov, S. Marshall, L. Mikellides, E.A.Miller, W. Raff, J. Singer, C. Sunday, J. Villalvazo, M.C. Wallace, D. Banfield, J.A. Rodriguez-Manfredi, C.T. Russell, A. Trebi-Ollennu, J.N. Maki, E. Beucler, M. Böse, C. Bonjour, J.L. Berenguer, S. Ceylan, J. Clinton, V. Conajero, I. Daubar, V. Dehant, P. Delage, F. Euchner, I. Estève, L. Fayon, L. Ferraioli, C. Johnson, J. Gagnepain-Beyneix, M. Golombek, A. Khan, T. Kawamura, B. Kenda, P. Labrot, N. Murdoch, C. Pardo, C. Perrin, L. Pou, A. Sauron, D. Savoie, S. Stähler, E. Stutzman, N.A. Teanby, J. Tromp, M. van Driel, M. Wiczorek, R. Widmer-Schmidrig, and J. Wookey, “SEIS: The Seismic Experiment for Internal Structure of InSight”, *Space Science Reviews*, **215**, doi: 10.1007/s11214-018-0574-6, 2019.
13. **Panning, M.P.** and S. Kedar, “Seismic response of the Mars Curiosity Rover: Implications for future planetary seismology”, *Icarus*, **317**, 373-378, doi: 10.1016/j.icarus.2018.06.017, 2019.
14. Bissig, F., A. Khan, M. van Driel, S. C. Stähler, D. Giardini, **M. P. Panning**, M. Drilleau, P. Lognonné, T. V. Gudkova, V. N. Zharkov, A.-C. Plesa, W. B. Banerdt, “On the detectability and use of normal modes for determining interior structure of Mars”, *Space Science Reviews*, **214**, doi: 10.1007/s11214-018-0547-9, 2018.
15. Clinton, J., D. Giardini, M. Böse, S. Ceylan, M. van Driel, F. Euchner, R. F. Garcia, S. Kedar, A. Khan, S. C. Stähler, W. B. Banerdt, P. Lognonné, E. Beucler, I. Daubar, M. Drilleau, M. Golombek, T. Kawamura, M. Knapmeyer, B. Knapmeyer-Endrun, D. Mimoun, A. Mocquet, **M.P. Panning**, C. Perrin, and N. A. Teanby, “The Marsquake Service: Securing daily analysis of SEIS data and building the Martian seismicity catalogue for InSight”, *Space Science Reviews*, **214**, doi: 10.1007/s11214-018-0567-5, 2018.
16. Daubar, I., P. Lognonné, N. A. Teanby, K. Miljkovic, J. Stevanović, J. Vaubaillon, B. Kenda, T. Kawamura, J. Clinton, A. Lucas, M. Drilleau, C. Yana, G. S. Collins, D. Banfield, M. Golombek, S. Kedar, N. Schmerr, R. Garcia, S. Rodriguez, T. Gudkova, S. May, M. Banks, J. Maki, E. Sansom, F. Karakostas, **M. P. Panning**, N. Fuji, J. Wookey, M. van Driel, M. Lemmon, V. Ansan, M. Böse, S. C. Stähler, H. Kanamori, J. Richardson, S. Smrekar, W. B. Banerdt, “Impact-Seismic investigations of the InSight mission”, *Space Science Reviews*, **214**, doi: 10.1007/s11214-018-0562-x, 2018.

17. Golombek, M., M. Grott, G. Kargl, J. Andrade, J. Marshall, N. Warner, N. A. Teanby, H. E. Abarca, R. G. Deen, V. Ansan, E. Hauber, J. Voigt, R. Lichtenheldt, B. Knapmeyer-Endrun, A. Trebi-Ollennu, J. Singer, J. Maki, C. Schmelzbach, S. Kedar, D. Banfield, I. J. Daubar, D. Kipp, N. Muller, P. Lognonné, W. Folkner, S. Le Maistre, D. Mimoun, N. Murdoch, S. Piqueux, P. Delage, W. T. Pike, C. Charalambous, R. Lorenz, L. Fayon, S. Smrekar, A. Lucas, S. Rodriguez, P. Morgan, A. Spiga, T. Gudkova, O. Karatekin, **M.P. Panning**, R. Garcia, D. Giardini, U. Christensen, T. Nicollier, D. Sollberger, J. Robertsson, K. Ali, W. Kim, O. Khan, C. Sorice, P. Bailey, B. Kenda, M. Siegler, C. Vrettos, and W. B. Banerdt, "Geology and physical properties investigations by the InSight lander", *Space Science Reviews*, **214**, 84, doi: 10.1007/s11214-018-0512-7, 2018.
18. **Panning, M.P.**, S.C. Stähler, H.-H. Huang, S.D. Vance, S. Kedar, V.C. Tsai, W.T. Pike, and R.D. Lorenz, "Expected seismicity and the seismic noise environment of Europa", *J. Geophys. Res.*, **123**(1), 163-179, doi: 10.1002/2017JE005332, 2018.
19. Stähler, S.C., **M.P. Panning**, S.D. Vance, R.D. Lorenz, M. van Driel, T. Nissen-Meyer, and S. Kedar, "Seismic wave propagation in icy ocean worlds", *J. Geophys. Res.*, **123**(1), 206-232, doi: 10.1002/2017JE005338, 2018.
20. Vance, S.D., **M.P. Panning**, S.C. Stähler, F. Cammarano, B.G. Bills, G. Tobie, S. Kamata, S. Kedar, C. Sotin, W.T. Pike, R.D. Lorenz, H.-H. Huang, J.M. Jackson, and W.B. Banerdt, "Geophysical investigations of habitability in ice-covered ocean worlds", *J. Geophys. Res.*, **123**(1), 180-205, doi: 10.1002/2017JE005341, 2018.
21. Lorenz, R.D. and **M.P. Panning**, "Empirical recurrence rates for ground motion signals on planetary surfaces", *Icarus*, **303**, 273-279, doi: 10.1016/j.icarus.2017.10.008, 2018.
22. Vance, S.D., S. Kedar, **M.P. Panning**, S.C. Stähler, B.G. Bills, R.D. Lorenz, H.-H. Huang, W.T. Pike, J.C. Castillo, P. Lognonné, V.C. Tsai, and A.R. Rhoden, "Vital signs: Seismology of icy ocean worlds", *Astrobiology*, **18**, 37-53, 2018.
23. Woo, H.B., **M.P. Panning**, P.N. Adams, and A. Dutton, "Flexural isostasy of the carbonate platform in North-Central Florida", *Geochem. Geophys. Geosys.*, **18**(9), 3327–3339, doi: 10.1002/2017GC006934, 2017.
24. Clinton, J.F., D. Giardini, P. Lognonné, B. Banerdt, M. van Driel, M. Drilleau, N. Murdoch, **M.P. Panning**, R. Garcia, D. Mimoun, M. Golombek, J. Tromp, R. Weber, M. Böse, S. Ceylan, I. Daubar, B. Kenda, A. Khan, L. Perrin, A. Spiga, "Preparing for InSight: an invitation to participate in a blind test for Martian seismicity", *Seism. Res. Lett.*, **88**(5), 1290–1302, doi: 10.1785/0220170094, 2017.
25. James, S.R., E. Sreaton, R.M. Russo, and **M.P. Panning**, "Characterizing hydrostratigraphy of the Floridan aquifer system using ambient seismic noise", *Geophys. J. Int.*, **209**, 876-889, 2017.
26. **Panning, M.P.**, P. Lognonné, W. B. Banerdt, R. Garcia, M. Golombek, S. Kedar, B. Knapmeyer-Endrun, A. Mocquet, N.A. Teanby, J. Tromp, R. Weber, E. Beucler, J.-F. Blanchette-Guertin, M. Drilleau, T. Gudkova, S. Hempel, A. Khan, V. Lekic, A.-C. Plesa, A. Rivoldini, N. Schmerr, Y. Ruan, O. Verhoeven, C. Gao, U. Christensen, J. Clinton, V. Dehant, D. Giardini, D. Mimoun, W. T. Pike, S. Smrekar, M. Wiczorek, M. Knapmeyer, and J. Wookey, "Planned products of the Mars Structure Service for the InSight mission to Mars", *Space Sci. Rev.*, **211**, 611–650, doi: 10.1007/s11214-016-0317-5, 2017.

27. Khan, A., M. van Driel, M. Böse, D. Giardini, S. Ceylan, J. Yan, J. Clinton, F. Euchner, P. Lognonné, **M.P. Panning**, M. Knapmeyer, and W.B. Banerdt, "Single-station and single-event marsquake location and inversion for structure using synthetic Martian waveforms", *Phys. Earth Planet. Int.*, **258**, 28-42, doi: 10.1016/j.pepi.2016.05.017, 2016.
28. Hongsresawat, S., **M.P. Panning**, R.M. Russo, D.A. Foster, V. Monteiller, and S. Chevrot, "USArray Shear Splitting Shows Seismic Anisotropy from Both Lithosphere and Asthenosphere," *Geology*, **43**, 667-670, doi: 10.1130/G36610.1, 2015.
29. **Panning, M.P.**, E. Beucler, M. Drilleau, A. Mocquet, P. Lognonné, W.B. Banerdt, "Verifying single-station seismic approaches using Earth-based data: Preparation for data return from the InSight mission to Mars," *Icarus*, **248**, 230-242, doi: 10.1016/j.icarus.2014.10.035, 2015.
30. Weber, R., **M.P. Panning**, N. Schmerr, and M. Knapmeyer, "Modeling approaches in planetary seismology," chapter in *Extraterrestrial Seismology*, ed. V. Tong and R. Garcia, Cambridge University Press, doi: 2015.
31. **Panning, M.P.**, A. Cao, A. Kim, and B.A. Romanowicz, "Non-linear 3D Born shear waveform tomography in Southeastern Asia," *Geophys. J. Int.*, **190**, 463-475, doi: 10.1111/j.1365-246X.2012.05489.x, 2012.
32. Gallego, A., **M.P. Panning**, R.M. Russo, D. Comte, V.I. Mocanu, R.E. Murdie, J.C. Vandecar, "Azimuthal Anisotropy in the Chile Ridge Subduction Region Retrieved from Ambient Noise," *Lithosphere* **3**, 393-400, doi:10.1130/L139, 2011.
33. **Panning, M.P.**, V. Lekic, and B.A. Romanowicz, "The importance of crustal corrections in the development of a new global model of radial anisotropy," *J. Geophys. Res.*, **115**, B12325, doi:10.1029/2010JB007520, 2010.
34. Lekic, V., **M.P. Panning**, and B.A. Romanowicz, "A simple method for improving crustal corrections in waveform tomography," *Geophys. J. Int.*, **182**, 265-278, 2010.
35. Lekic, V., J. Matas, **M.P. Panning**, and B.A. Romanowicz, "Reply to Comment on 'Measurement and implications of frequency dependence of attenuation,'" *Earth Planet. Sci. Lett.*, **293**, 216-217, 2010.
36. **Panning, M.P.**, Y. Capdeville, and B.A. Romanowicz, "Seismic waveform modelling in a 3-D Earth using the Born approximation: potential shortcomings and a remedy," *Geophys. J. Int.*, **177**, 161-178, 2009.
37. Lekic, V., J. Matas, **M.P. Panning**, and B.A. Romanowicz, "Measurement and implications of frequency dependence of attenuation," *Earth Planet. Sci. Lett.*, **282**, 285-293, 2009.
38. Romanowicz, B.A., **M.P. Panning**, Y. Gung, and Y. Capdeville, "On the computation of long period seismograms in a 3-D earth using normal mode based approximations," *Geophys. J. Int.*, **175**, 520-536, 2008.
39. **Panning, M.P.** and G. Nolet, "Surface Wave Tomography for Azimuthal Anisotropy in a Strongly Reduced Parameter Space," *Geophys. J. Int.*, **174**, 629-648, 2008.

40. **Panning, M.P.**, V. Lekic, M. Manga, F. Cammarano, and B.A. Romanowicz, "Long-period Seismology on Europa: 2. Predicted Seismic Response," *J. Geophys. Res.*, **111**, E12008, 2006.
41. Cammarano, F., V. Lekic, M. Manga, **M.P. Panning**, and B.A. Romanowicz, "Long-period Seismology on Europa: 1. Physically Consistent Interior Models," *J. Geophys. Res.*, **111**, E12009, 2006.
42. **Panning, M.P.**, and B.A. Romanowicz, "A Three Dimensional Radially Anisotropic Model of Shear Velocity in the Whole Mantle," *Geophys. J. Int.*, **167**, 361-379, 2006.
43. **Panning, M.P.**, and B.A. Romanowicz. "Inferences on Flow at the Base of Earth's Mantle Based on Seismic Anisotropy," *Science*, **303**, 351-353, 2004.
44. Gung, Y., **M.P. Panning**, and B.A. Romanowicz. "Global Anisotropy and the Thickness of Continents," *Nature*, **422**, 707-711, 2003.
45. **Panning, M.P.**, D. Dreger, and H. Tkalčić. "Near-Source Velocity Structure and Isotropic Moment Tensors: A Case Study of the Long Valley Caldera," *Geophys. Res. Lett.*, **28**, 1815-1818, 2001.