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**Coalbed Methane Bibliography
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- Abraham, K.S., 2006, Coalbed methane activity expands further in North America: *World Oil*, v. 226, no. 8, p. 61-62.
- Adams, M.A., G.E. Eddy, J.L. Hewitt, J.N. Kirr, and C.T. Rightmire, 1984, Geologic overview, coal resources, and potential methane recovery from coalbeds of the northern Appalachian coal basin—Pennsylvania, Ohio, Maryland, West Virginia, and Kentucky, *in* C.T. Rightmire, G.E. Eddy, and J.N. Kirr, eds., *Coalbed methane resources of the United States: AAPG Studies in Geology 17*, p. 15-43.
- Adams, M.A., 1984, Geologic overview, coal resources, and potential methane recovery from coalbeds of the central Appalachian basin—Maryland, West Virginia, Virginia, Kentucky, and Tennessee, *in* C.T. Rightmire, G.E. Eddy, and J.N. Kirr, eds., *Coalbed methane resources of the United States: AAPG Studies in Geology 17*, p. 45-71.
- Adams, M.A., and J.N. Kirr, 1984, Geologic overview, coal deposits, and potential for methane recovery from coalbeds of the Uinta Basin—Utah and Colorado, *in* C.T. Rightmire, G.E. Eddy, and J.N. Kirr, eds., *Coalbed methane resources of the United States: AAPG Studies in Geology 17*, p. 253-269.
- Adeboye, O.O., and R.M. Bustin, 2013, Variation of gas flow properties in coal with probe gas, composition and fabric: Examples from western Canadian sedimentary basin: *International Journal of Coal Geology*, v. 108, p. 47-52.
- Adkins-Heljeson, D., L.L. Brady, T.A. Carr, and J.P. Penka, 2004, Summary of Kansas coalbed methane wells and production history: Kansas Geological Survey Open-file Report 2004-37.
(http://www.kgs.ku.edu/PRS/publication/2004/OFR04_37/index.html).
- Advanced Resources International, 2003, Directional drilling technology: U.S. Environmental Agency, Surface Drilling Series, 11 p.
<http://www.epa.gov/coalbed/pdf/dir-drilling.pdf>
- Aguilera, R.F., R.D. Ripple, and R. Aguilera, 2014, Link between endowments, economics and environment in conventional and unconventional gas reservoirs: *Fuel*, v. 126, p. 224-238.
- Ahmed, M., and J.W. Smith, 2001, Biogenic methane generation in the degradation of eastern Australian Permian coals: *Organic Geochemistry*, v. 32, p. 809-816.
- Alain, A.K., and G.M. Denes, 1992, Cavity stress relief method to stimulate demethanation boreholes, *in* *Coalbed methane: Society of Petroleum Engineers, Reprint Series 35*, p. 131-138.
- Alexeev, A.D., E.V. Ulyanova, G.P. Starikov, and N.N. Kovriga, 2004, Latent methane in fossil coals: *Fuel*, v. 83, p. 1407-1411.
- Alexeev, A.D., E.P. Feldman, and T.A. Vasilenko, 2007, Methane desorption from a coal-bed: *Fuel*, v. 86, p. 2574-2580.
- Alexis, D.A., Z.T. Karpyn, T. Ertekin, and D. Crandall, 2015, Fracture permeability and relative permeability of coal and their dependence on stress conditions: *Journal of Unconventional Oil and Gas Resources*, v. 10, p. 1-10.
- Al-Mahmoud, M.J., S. Inan, and A.A. Al-Duaiji, 2014, Coal occurrence in the Jurassic Dhurma Formation in Saudi Arabia: Inferences on its gas and surface mining potential: *International Journal of Coal Geology*, v. 124, p. 5-10.
- Alsaab, D., M. Elie, A. Izart, R.F. Sachsenhofer, V.A. Privalov, I. Suarez-Ruiz, and L. Martinez, 2008, Comparison of hydrocarbon gases (C1-C5) production from

- Carboniferous Donets (Ukraine) and Cretaceous Sabinas (Mexico) coals: *International Journal of Coal Geology*, v. 74, p. 154-162.
- Alsaab, D., M. Elie, A. Izart, R.F. Sachsenhofer, and V.A. Privalov, 2008, Predicting methane accumulations generated from humic Carboniferous coals in the Donbas fold belt (Ukraine): *AAPG Bulletin*, v. 92, p. 1029-1053.
- Alsaab, D., M. Elie, A. Izart, R.F. Sachsenhofer, V.A. Privalov, I. Suarez-Ruiz, L. Martinez, and E.A. Panova, 2009, Distribution of thermogenic methane in Carboniferous coal seams of the Donets Basin (Ukraine): "Applications to exploitation of methane and forecast of mining hazards": *International Journal of Coal Geology*, v. 78, p. 27-37.
- Alsaab, D., M. Elie, A. Izart, R.F. Sachsenhofer, V.A. Privalov, I. Suarez-Ruiz, and A. Martinez, 2011, Erratum to "Comparison of hydrocarbon gases (C1-C5) production from Carboniferous Donets (Ukraine) and Cretaceous Sabinas (Mexico) coals": *International Journal of Coal Geology*, v. 86, p. 295.
- Ambrose, W.A., and W.B. Ayers, Jr., 1991, Geologic controls on coalbed methane occurrence and producibility in the Fruitland Formation, Cedar Hill field and COAL site, San Juan Basin, Colorado and New Mexico, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., *Coalbed methane of western North America: Denver, CO, Rocky Mountain Association of Geologists Guidebook*, p. 227-240.
- Ambrose, W.A., and W.B. Ayers, Jr., 2007, Geologic controls on transgressive-regressive cycles in the upper Pictured Cliffs Sandstone and coal geometry in the lower Fruitland Formation, northern San Juan Basin, New Mexico and Colorado: *AAPG Bulletin*, v. 91, p. 1099-1122.
- Ambrose, W.A., E.C. Potter, and R. Briceno, 2008, An "unconventional" future for natural gas in the United States: *Geotimes*, v. 53, no. 2, p. 37-41.
- American Society for Testing and Materials, 2010, Standard practice for determination of gas content of coal—Direct desorption method: American Society for Testing and Materials, Standard D7569-10, 12 p.
- Aminian, K., and G. Rodvelt, 2014, Evaluation of coalbed methane reservoirs, *in* P. Thakur, K. Aminian, and S. Schatzel, eds., *Coal bed methane: from prospect to pipeline: New York, Elsevier*, p. 63-91.
- Ammosov, I.I., and I.V. Eremin, 1963, *Fracturing in coal* (translated from Russian): IZDAT Publishers, Office of Technical Services, Washington, D.C., 112 p. (cleat vs. rank)
- An, H., X.R. Wei, G.X. Wang, P. Massarotto, F.Y. Wang, V. Rudolph, and S.D. Golding, 2015, Modeling anisotropic permeability of coal and its effects on CO₂ sequestration and enhanced coalbed methane recovery: *International Journal of Coal Geology*, v. 152, Part B, p. 15-24.
- Anderson, J., and 15 others, 2003, Producing natural gas from coal: *Schlumberger, Oilfield Review*, v. 15, no. 3, p. 8-31.
- Andrews, R.D., B.J. Cardott, and T. Storm, 1998, The Hartshorne play in southeastern Oklahoma: regional and detailed sandstone reservoir analysis and coalbed-methane resources: Oklahoma Geological Survey Special Publication 98-7, 90 p.
- Anna, L.O., 2003, Groundwater flow associated with coalbed gas production, Ferron Sandstone, east-central Utah: *International Journal of Coal Geology*, v. 56, p. 69-95.
- Anonymous, 2006, Canadian CBM: hitting the target: An investor's guide to coalbed methane, A supplement to *Oil and Gas Investor*, v. 26, no. 12, p. 26-27.
- Anonymous, 2006, Geo-modeling of thin-bed coal reservoirs: An investor's guide to coalbed methane, A supplement to *Oil and Gas Investor*, v. 26, no. 12, p. 28.
- Anonymous, 2010, China wants to hasten coalbed methane development: *Oil & Gas Journal*, v. 108.33, p. 84-87.
- Archer, P.L., and J. N. Kirr, 1984, Pennsylvanian geology, coal, and coalbed methane resources of the Illinois Basin—Illinois, Indiana, and Kentucky, *in* C.T. Rightmire,

- G.E. Eddy, and J.N. Kirr, eds., Coalbed methane resources of the United States: AAPG Studies in Geology 17, p. 105-134.
- Arif, M., F. Jones, A. Barifcani, and S. Iglauer, 2017, Influence of surface chemistry on interfacial properties of low to high rank coal seams: *Fuel*, v. 194, p. 211-221.
- Arri, L.E., D. Yee, W.D. Morgan, and M.W. Jeansonne, 1992, Modeling coalbed methane production with binary gas sorption: Society of Petroleum Engineers, Rocky Mountain Regional Meeting, SPE Paper 24363, p. 459-472. (use of Nitrogen or CO₂ injection to desorb methane)
- Arthur, D., B. Langhus, and V. Rawn-Schatzinger, 2003, Coalbed natural gas resources and produced water management: *GasTIPS*, v. 9, no. 3, p. 20-24.
- Ashley, M., 2005, Wyodak coal, Tongue River member of the Fort Union Formation, Powder River Basin, Wyoming: "no coal zones" and their effect on coalbed methane production, *in* P. Lufholm and D. Cox, eds., 2005 WTGS Fall Symposium: West Texas Geological Society, Publication No. 05-115, p. 67-82.
- Attanasi, E.D., 1998, Relative importance of physical and economic factors in Appalachian coalbed gas assessment, *in* P.C. Lyons, ed., Special issue: Appalachian coalbed methane: *International Journal of Coal Geology*, v. 38, p. 47-59.
- Ayers, W.B., Jr., and B.S. Kelso, 1989, Knowledge of methane potential for coalbed resources grows, but needs more study: *Oil & Gas Journal*, v. 87, no. 43, p. 64-67.
- Ayers, W.B., Jr., and S.D. Zellers, 1989, Geologic controls on occurrence and producibility of coalbed methane, Fruitland Formation, north-central San Juan basin, New Mexico: Proceedings of the 1989 Coalbed Methane Symposium, paper 8925, p. 75-86.
- Ayers, W.B., Jr., 1991, Geologic evaluation of critical production parameters for coalbed methane resources: *Quarterly Review of Methane from Coal Seams Technology*, v. 8, no. 2, p. 27-33.
- Ayers, W.B., Jr., W.R. Kaiser, and J.R. Levine, 1993, Coal as source rock and gas reservoir: Birmingham, Alabama, 1993 Coalbed Methane Symposium, Short Course 1, 257 p.
- Ayers, W.B., Jr., 1993, Geologic characterization of coalbed methane occurrence and producibility, *in* W.B. Ayers, Jr., W.R. Kaiser, and J.R. Levine, Coal as source rock and gas reservoir: Birmingham, Alabama, 1993 Coalbed Methane Symposium, Short Course 1, p. 121-187.
- Ayers, W.B., Jr., and W.R. Kaiser, eds., 1994, Coalbed methane in the Upper Cretaceous Fruitland Formation, San Juan basin, New Mexico and Colorado: New Mexico Bureau of Mines and Mineral Resources Bulletin 146, 216 p. (Colorado Geological Survey Resource Series 31)
- Ayers, W.B., Jr., W.A. Ambrose, and J. Yeh, 1994, Coalbed methane in the Fruitland Formation, San Juan Basin: depositional and structural controls on occurrence and resources, *in* W.B. Ayers, Jr., and others, eds., Geological and hydrologic controls on the occurrence and producibility of coalbed methane, Fruitland Formation, San Juan Basin: Gas Research Institute Topical Report GRI-91/0072, p. 9-46.
- Ayers, W.B., Jr., 2002, Coalbed gas systems, resources, and production and a review of contrasting cases from the San Juan and Powder River Basins: *AAPG Bulletin*, v. 86, p. 1853-1890.
- Ayers, W.B., Jr., 2003, Coalbed methane in the Fruitland Formation, San Juan Basin, western United States: a giant unconventional gas play, *in* M.T. Halbouty, ed., Giant oil and gas fields of the decade 1990-1999: *AAPG Memoir* 78, p. 159-188.
- Ayers, W.B., Jr., S.K. Ruhl, M. Hoffman, J.A. Rushing, D.A. McVay, and R.I. Ramazanov, 2005, Low-rank coals of the Wilcox Group, east-central Texas: coalbed methane resources, potential for CO₂ sequestration, and enhanced

- methane production, in P. Lufholm and D. Cox, eds., 2005 WTGS Fall Symposium: West Texas Geological Society, Publication No. 05-115, p. 43-65.
- Ayoub, J., L. Colson, J. Hinkel, D. Johnston, and J. Levine, 1991, Learning to produce coalbed methane: *Oilfield Review*, v. 3, p. 27-40.
- Bachu, S., and K. Michael, 2003, Possible controls of hydrogeological and stress regimes on the producibility of coalbed methane in Upper Cretaceous—Tertiary strata of the Alberta basin, Canada: *AAPG Bulletin*, v. 87, p. 1729-1754.
- Bailey, H.E., B.W. Glover, S. Holloway, and S.R. Young, 1995, Controls of coalbed methane prospectivity in Great Britain, in M.K.G. Whateley and D.A. Spears, eds., *European coal geology*: London, Geological Society Special Publication 82, p. 251-265.
- Baker, E.C., D.C. Oyler, J.H. Perry, and G.L. Finfinger, 1984, Economic evaluation of directional drilling for methane drainage from coalbeds: U.S. Bureau of Mines Report of Investigations 8842, 11 p.
- Baker, H.A., and S.J. Zarrouk, 2016, Geochemical multiaquifer assessment of the Huntly coalfield, New Zealand, using a novel chloride-bicarbonate-boron ternary diagram: *International Journal of Coal Geology*, v. 167, p. 136-147.
- Banerjee, B.D., 1987, A new approach to the determination of methane content in coal seams: *International Journal of Mining and Geological Engineering*, v. 5, p. 369-376.
- Banerjee, B.D., 1988, Spacing of fissuring network and rate of desorption of methane from coals: *Fuel*, v. 67, p. 1584-1586. (cleat)
- Bao, Y., C. Wei, and B Neupane, 2016, Generation and accumulation characteristics of mixed coalbed methane controlled by tectonic evolution in Liulin CBM field, eastern Ordos Basin, China: *Journal of Natural Gas Science and Engineering*, v. 28, p. 262-270.
- Bao, Y., Y. Ju, H. Huang, J. Yun, and C. Guo, 2019, Potential and constraints of biogenic methane generation from coals and mudstones from Huaibei coalfield, eastern China: *Energy & Fuels*, v. 33, p. 287-295.
- Barker, C.E., R.C. Johnson, B.L. Crysdale, and A.C. Clark, 1991, A field and laboratory procedure for desorbing coal gases: USGS Open-File Report OF 91-0563, 16 p.
- Barker, C.E., T.C. Bartke, P.G. Hatcher, and T.A. Daws, 1993, An empirical correlation between coal bed gas with Rock-Eval pyrolysis and ^{13}C NMR results, Cretaceous Mesaverde and Meeteetse formations, Wind River basin, Wyoming, in W.R. Keefer and others, eds., *Wyoming Geological Association special symposium on oil and gas and other resources of the Wind River basin*, Wyoming: Casper, Wyoming Geological Association, p. 243-256.
- Barker, C.E., 1996, A field and laboratory procedure to desorb coal bed gases from drill core and cuttings: U.S. Geological Survey, Open-File Report 96-658.
- Barker, C.E., L.R. Biewick, P.D. Warwick, and J.R. SanFilipo, 2000, Preliminary Gulf Coast coalbed methane exploration maps; depth to Wilcox, apparent Wilcox thickness, and vitrinite reflectance: U.S. Geological Survey, Open-File Report 00-0113. (see <http://greenwood.cr.usgs.gov/pub/open-file-reports/ofr-00-0113/wlcxmaps.htm>)
- Barker, C.E., J.G. Clough, S.B. Roberts, and R. Fisk, 2002, Coalbed methane in northern Alaska: potential resources for rural use and added supply for the proposed Trans-Alaska gas pipeline (abstract): *AAPG Bulletin*, v. 86, p. 1135.
- Barker, C.E., J.G. Clough, S.B. Roberts, and B. Fisk, 2002, Coalbed methane in northern Alaska: potential resources for rural use and added supply for the proposed trans-Alaska gas pipeline (abstract): *AAPG Annual Convention Official Program*, v. 11, p. A13.
- Barker, C.E., M. Gose, R.J. Scott, P.D. Warwick, J.R. SanFilipo, J.M. Klein, and R.W. Hook, 2002, The Sacatosa coalbed methane field: a first for Texas (abstract): *AAPG Annual Convention Official Program*, v. 11, p. A13.

- Barker, C.E., T.A. Dallegge, and A.C. Clark, 2002, USGS coal desorption equipment and a spreadsheet for analysis of lost and total gas from canister desorption measurements: U.S. Geological Survey Open File Report 02-496, 13 p.
- Barker, C.E., P.D. Warwick, M. Gose, and R.J. Scott, 2003, Olmos coal, Maverick Basin, south Texas: from prospect to production, *in* M.R. Silverman, ed., Emerging coalbed methane plays of North America (part 2): Denver, CO, Petroleum Frontiers, v. 18, no. 4, p.1-10.
- Barker, C.E., 2003, Coalbed methane prospects of the Tyonek Formation, onshore northern Cook Inlet Basin, south-central Alaska, *in* M.R. Silverman, ed., Emerging coalbed methane plays of North America (part 3): Petroleum Frontiers, v. 19, no. 2, p. 9-19.
- Barker, C.E., 2003, A first report of significant coalbed methane production from a Paleozoic coal, Kerr Basin, west-central Texas, *in* M.R. Silverman, ed., Emerging coalbed methane plays of North America (part 3): Petroleum Frontiers, v. 19, no. 2, p. 31-36.
- Barker, C.E., W. Heck, and C. Eble, 2003, Coalbed methane in Late Pennsylvanian to Early Permian coal, Kerr Basin, Edwards County, Texas: Gulf Coast Association of Geological Societies Transactions, v. 53, p. 38-50.
- Barker, C.E., and T. Dallegge, 2006, Secondary gas emissions during coal desorption, Marathon Grassim Oskolkoff-1 well, Cook Inlet Basin, Alaska: implications for resource assessment: Bulletin of Canadian Petroleum Geology, v. 54, p. 273-291.
- Barker, C.E., 2006, Visual detection of gas shows from coal core and cuttings using liquid leak detector: Bulletin of Canadian Petroleum Geology, v. 54, p. 292-297.
- Barnhart, E.P., K.B. De León, B.D. Ramsay, A.B. Cunningham, and M.W. Fields, 2013, Investigation of coal-associated bacterial and archaeal populations from a diffusive microbial sampler (DMS): International Journal of Coal Geology, v. 115, p. 64-70.
- Barnhart, E.P., E.P. Weeks, E.J.P. Jones, D.J. Ritter, J.C. McIntosh, A.C. Clark, L.F. Ruppert, A.B. Cunningham, D.S. Vinson, W. Orem, and M.W. Fields, 2016, Hydrogeochemistry and coal-associated bacterial populations from a methanogenic coal bed: International Journal of Coal Geology, v. 162, p. 14-26. (biogenic methane)
- Barnhart, E.P., K.J. Davis, M. Varonka, W. Orem, A.B. Cunningham, B.D. Ramsay, and M.W. Fields, 2017, Enhanced coal-dependent methanogenesis coupled with algal biofuels: Potential water recycle and carbon capture: International Journal of Coal Geology, v. 171, p. 69-75. (biogenic methane)
- Bartholomew, C.H., S.J. Butala, J.C. Medina, M.L. Lee, T.Q. Taylor, and D.B. Andrus, 1999, Mineral-catalyzed formation of natural gas during coal maturation, *in* M. Mastalerz, M. Glikson, and S.D. Golding, eds., Coalbed methane: scientific, environmental and economic evaluation: Boston, Kluwer Academic Publishers, p. 279-296.
- Bastian, P.A., O.F.R. Wirth, L. Wang, and G.W. Voneiff, 2005, New techniques key in 'dry' CBM play: American Oil & Gas Reporter, v. 48, no. 12, p. 65-75.
- Battistutta, E., M. Lutynski, H. Bruining, K.-H. Wolf, and S. Rudolph, 2012, Adequacy of equation of state models for determination of adsorption of gas mixtures in a nanometric set up: International Journal of Coal Geology, v. 89, p. 114-122.
- Baublys, K.A., S.K. Hamilton, S.D. Golding, S. Vink, and J. Esterle, 2015, Microbial controls on the origin and evolution of coal seam gases and production waters of the Walloon Subgroup; Surat Basin, Australia: International Journal of Coal Geology, v. 147-148, p. 85-104.
- Baumgardner, R.W., Jr., 1991, Lineament analysis of northern San Juan Basin, New Mexico and Colorado—Applications to coalbed methane exploration, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., Coalbed methane of western

- North America: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 21-34.
- BCMCM, 2004, Coalbed gas potential in British Columbia: Victoria, British Columbia Ministry of Energy and Mines, Petroleum Geology Paper 2004-1, 76 p.
www.empr.gov.bc.ca/mining/geoscience/coal/documents/coalbedgas/cbgsopotential_2004-1.pdf
- Beamish, B.B., and P.J. Crosdale, 1998, Instantaneous outbursts in underground coal mines: an overview and association with coal type: *International Journal of Coal Geology*, v. 35, p. 27-55.
- Bearce, D. N., J. C. Pashin, and W. E. Osborne, eds., 1997, *Geology of the Coosa coalfield: Alabama Geological Society 34th Annual Field Trip Guidebook*, 79 p.
- Beaton, A., D. Chen, C. Pana, and R.J.H. Richardson, 2002, Coal and coalbed methane potential of Upper Cretaceous-Tertiary strata in the plains region, Alberta, Canada (abstract): AAPG Annual Convention Official Program, v. 11, p. A15.
- Beaton, A.P., C. Pana, D. Chen, D.A. Wynne, and C.W. Langenberg, 2004, Coalbed methane potential of Upper Cretaceous-Tertiary strata, Alberta Plains: Alberta Energy and Utilities Board, Alberta Geological Survey, EUB/AGS Earth Sciences Report 2002-06 (revised 2004), 76 p.
http://ags.aer.ca/publications/ESR_2002_06.html
- Beaton, A., W. Langenberg, and C. Pană, 2006, Coalbed methane resources and reservoir characteristics from the Alberta Plains, Canada: *International Journal of Coal Geology*, v. 65, p. 93-113.
- Bell, J.S., and S. Bachu, 2003, *In situ* stress magnitude and orientation estimates for Cretaceous coal-bearing strata beneath the plains area of central and southern Alberta: *Bulletin of Canadian Petroleum Geology*, v. 51, p. 1-28.
- Bell, J.S., 2006, In-situ stress and coal bed methane potential in western Canada: *Bulletin of Canadian Petroleum Geology*, v. 54, p. 197-220.
- Berbesi, L.A., G. Márquez, M. Martínez, and A. Requena, 2009, Evaluating the gas content of coals and isolated maceral concentrates from the Paleocene Guasare coalfield, Venezuela: *Applied Geochemistry*, v. 24, p. 1817-1824.
- Berggren, L.W., and G.A. Sanderson, 2001, Recent developments in the application of the §29 tax credit to coal seam gas: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 104, p. 257-269.
- Bertard, C., B. Bruyet, and J. Gunther, 1970, Determination of desorbable gas concentration of coal (Direct Method): *International Journal of Rock Mechanics and Mining Science*, v. 7, p. 43-65.
- Bertrand, G., 1984, Geochemical and petrographic characterization of humic coals considered as possible petroleum source rocks: *Organic Geochemistry*, v. 6, p. 481-488.
- Bhaskaran, R., and U.P. Singh, 2000, Indian coalbed methane: *Mintech*, v. 21, no. 2, p. 13-20.
- Bhattacharya, G., 2016, Natural gas, unconventional resources can assist India in meeting future energy demand: *Oil & Gas Journal*, v. 114.11, p. 46-51.
- Bhowmik, S., and P. Dutta, 2013, Adsorption rate characteristics of methane and CO₂ in coal samples from Raniganj and Jharia coalfields of India: *International Journal of Coal Geology*, v. 113, p. 50-59.
- Bibler, C.J., J.S. Marshall, and R.C. Pilcher, 1998, Status of worldwide coal mine methane emissions and use: *International Journal of Coal Geology*, v. 35, p. 283-310.
- Bibler, C., and P. Carothers, 2000, Overview of coal mine gas use technologies: Second International Methane Mitigation Conference, Novosibirsk, Russia, June 2000, 8 p. (available at Raven Ridge web site: www.ravenridge.com)

- Bleizeffer, D., 2015, Coal-bed methane: Boom, bust and hard lessons: Wyofile.
<https://www.wyofile.com/coal-bed-methane-boom-bust-and-hard-lesson/>;
<https://www.wyohistory.org/encyclopedia/coalbed-methane-boom-bust-and-hard-lessons>
- Boardman, E.L., and J.H. Rippon, 1997, Coalbed methane migration in and around fault zones, *in* R. Gayer and J. Pesek, eds., *European coal geology and technology*: London, Geological Society Special Publication 125, p. 391-408.
- Bodden, W.R., III, and R. Ehrlich, 1998, Permeability of coals and characteristics of desorption tests: implications for coalbed methane production, *in* R.M. Flores, ed., *Coalbed methane: from coal-mine outbursts to a gas resource*: International Journal of Coal Geology, v. 35, p. 333-347.
- Boger, C., J.S. Marshall, and R.C. Pilcher, 2014, Worldwide coal mine methane and coalbed methane activities, *in* P. Thakur, K. Aminian, and S. Schatzel, eds., *Coal bed methane: from prospect to pipeline*: New York, Elsevier, p. 351-407.
- Bordelon, N.J., 2006, Coalbed methane production potential in the Hartshorne Formation (Oklahoma)(abstract): Gulf Coast Association of Geological Societies, Annual Meeting, Lafayette, LA, September 25-27, 2006, abstracts.
<http://www.qcags2006.com/ABSTRACTS/shale.html>
- Boreham, C.J., S.G. Golding, and M. Glikson, 1998, Factors controlling the origin of gas in Australian Bowen basin coals: *Organic Geochemistry*, v. 29, p. 347-362.
- Boreham, C.J., S.D. Golding, and M. Glikson, 2001, Reply to Comment of Smith and Pallasser on "Factors controlling the origin of gas in Australian Bowen basin coals": *Organic Geochemistry*, v. 32, p. 207-210.
- Bostic, J., L. Brady, M. Howes, R.R. Burchett, and B.S. Pierce, 1993, Investigation of the coal properties and the potential for coal-bed methane in the Forest City basin: USGS Open-File Report OF 93-0576, 44 p.
- Bowe, M., and T.A. Moore, 2015, Coalbed methane potential and current realization in Indonesia: AAPG Search and Discovery Article No. 90234, 5 p.
http://www.searchanddiscovery.com/pdfz/abstracts/pdf/2015/90234qtw/abstracts/ndx_bowe.pdf.html
- Boyer, C.M., II, 1989, The coalbed methane resource and the mechanisms of gas production: GRI Topical Report GRI 89/0266, 115 p.
- Boyer, C.M., II, and S.R. Reeves, 1989, A strategy for coalbed methane production development part III: production operations: *Proceedings of the 1989 Coalbed Methane Symposium*, paper 8913, p. 19-27.
- Boyer, C.M., II, and B. Quingzhao, 1998, Methodology of coalbed methane resource assessment, *in* R.M. Flores, ed., *Coalbed methane: from coal-mine outbursts to a gas resource*: International Journal of Coal Geology, v. 35, p. 349-368.
- Brady, L.L., 1997, Kansas coal resources and their potential for coalbed methane, *in* G. McMahan, ed., *Transactions of the 1997 AAPG Mid-Continent Section Meeting*: Oklahoma City Geological Society, p. 150-163.
- Brady, L.L., 2000, Kansas coal distribution, resources, and potential for coalbed methane: *The Compass of Sigma Gamma Epsilon*, v. 75, nos. 2 & 3, p. 122-133.
- Brady, L.L., 2002, Eastern Kansas—some considerations for coalbed methane *in* *Proceedings of 2002 Coalbed Methane Symposium*: Rocky Mountain Association of Geologists, Denver, Colorado, June 19, 2002, 5p.
- Brady, L. L., and K.D. Newell, 2004, Kansas coal and coalbed methane—an overview, *in* *Overview of coal and coalbed methane in the Cherokee basin, northeast Oklahoma: Fieldtrip guidebook for the First Coalbed Methane Symposium*, Tulsa, Oklahoma, November, 9, 2004, Oklahoma Geological Survey and Kansas Geological Survey, p. 97-116. (Available as Kansas Geological Survey Open-file report 2004-49).

- Brake, D.E., 2009, Airborne technology identifies, maps CBM seeps: *Hart's E&P*, v. 62, no. 12, p. 63.
- Breland, F.C., Jr. and C.J. John, 2002, Regional trends and exploration potential for coal bed methane in Louisiana (abstract): *AAPG Annual Convention Official Program*, v. 11, p. A22-23.
- Breland, F.C., Jr., 2004, Coalbed methane potential in Louisiana, in P.D. Warwick, ed., *Selected presentations on coal-bed gas in the eastern United States*: U.S. Geological Survey Open File Report 2004-1273, p. 27-35.
(<http://pubs.usgs.gov/of/2004/1273/>)
- Breland, F.C., Jr., and P.D. Warwick, 2004, Coalbed methane (CBM) activity in Louisiana, in *Coalbed methane in the Gulf Coast: Gulf Coast Association of Geological Societies/Gulf Coast Section SEPM, 54th Annual Convention*, San Antonio, TX, Short Course No. 3.
- Breland, F.C., Jr., 2005, A brief discussion of coalbed methane (CBM) in Louisiana: *Society of Independent Professional Earth Scientists, SIPES Quarterly*, v. 42, no. 1, p. 1, 8-9.
- Brook, M.S., B.W. Hebblewhite, and R. Mitra, 2016, Cleat aperture-size distributions: A case study from the Late Permian Rangal coal measures, Bowen Basin, Australia: *International Journal of Coal Geology*, v. 168, p. 186-192.
- Brown, A., 2011, Identification of source carbon for microbial methane in unconventional gas reservoirs: *AAPG Bulletin*, v. 95, p. 1321-1338.
- Brown, K., D.A. Casey, J.R. Enever, R.A. Facer, and K. Wright, 1996, New South Wales coal seam methane potential: *Geological Survey of New South Wales, Petroleum Bulletin* 2, 96 p.
- Brown, P.J., W.J. Haskett, and P. Leach, 2006, Risk analysis approach helping operators see the light in unconventional plays: *The American Oil & Gas Reporter*, v. 49, no. 3, p. 84-93.
- Brown, W.T., 2001, Natural gas potential of the Almond Formation coals, Greater Green River Basin, southwestern Wyoming, in M.R. Silverman, ed., *Emerging coalbed methane plays of North America*: Denver, CO, *Petroleum Frontiers*, v. 18, no. 3, p. 29-39.
- Brown, W.T., Jr., 2003, Natural gas potential of the Almond Formation coals, Greater Green River Basin, southwestern Wyoming, in *Emerging coalbed methane plays of North America*, part 1: *Petroleum Frontiers*, v. 18, no. 3, p. 29-39.
- Brownfield, M.E., C.J. Schenk, T.R. Klett, M.E. Tennyson, T.J. Mercier, S.B. Gaswirth, K.R. Marra, S.J. Hawkins, T.M. Finn, P.A. Le, and H.M. Leathers-Miller, 2017, Assessment of coalbed gas resources of the Kalahari Basin Province of Botswana, Zimbabwe, and Zambia, Africa, 2016: U.S. Geological Survey, *Fact Sheet* 2017-3003, 2 p. <https://pubs.er.usgs.gov/publication/fs20173003>
- Bruner, K.R., A.V. Oldham, T.E. Repine, Jr., A.K. Markowski, and J.A. Harper, 1995, Geological aspects of coalbed methane in the northern Appalachian coal basin, southwestern Pennsylvania and north-central West Virginia: *Pennsylvanian Geological Survey*, 4th ser., *Open-File Report* 98-13, 72 p.
- Brunner, D., 2000, Enhanced gob gas recovery: U.S. Environmental Protection Agency, 18 p. (www.epa.gov/coalbed, see CMOP Library, CMOP Reports)
- Bucha, M., M.-O. Jędrysek, D. Kufka, Ł. Pleśniak, L. Marynowski, K. Kubiak, and M. Błaszczak, 2018, Methanogenic fermentation of lignite with carbon-bearing additives, inferred from stable carbon and hydrogen isotopes: *International Journal of Coal Geology*, v. 186, p. 65-79. (biogenic methane)
- Burra, A., J.S. Esterle, and S.D. Golding, 2014, Horizontal stress anisotropy and effective stress as regulator of coal seam gas zonation in the Sydney Basin, Australia: *International Journal of Coal Geology*, v. 132, p. 103-116.

- Burra, A., J.S. Esterle, and S.D. Golding, 2015, Use of temperature logs in coal seam gas reservoirs: Application to the Sydney Basin, Australia: *International Journal of Coal Geology*, v. 143, p. 68-77.
- Busch, A., B.M. Krooss, Y. Gensterblum, F. van Bergen, and H.J.M. Pagnier, 2003, High-pressure adsorption of methane, carbon dioxide and their mixtures on coals with a special focus on the preferential sorption behaviour: *Journal of Geochemical Exploration*, v. 78-79, p. 671-674.
- Busch, A., Y. Gensterblum, and B.M. Krooss, 2003, Methane and CO₂ sorption and desorption measurements on dry Argonne premium coals: pure components and mixtures: *International Journal of Coal Geology*, v. 55, p. 205-224.
- Busch, A., Y. Gensterblum, N. Siemons, B. M. Kroos, F. van Bergen, H. J. M. Pagnier, and P. David, 2003, Investigation of preferential sorption behaviour of CO₂ and CH₄ on coals by high pressure adsorption/desorption experiments with gas mixtures: Tuscaloosa, Alabama, University of Alabama, College of Continuing Studies, 2003 International Coalbed Methane Symposium Proceedings, paper 0350, 14 p.
- Busch, A., Y. Gensterblum, B.M. Krooss, and R. Littke, 2004, Methane and carbon dioxide adsorption—diffusion experiments on coal: upscaling and modeling: *International Journal of Coal Geology*, v. 60, p. 151-168.
- Busch, A., Y. Gensterblum, B.M. Krooss, and N. Siemons, 2006, Investigation of high-pressure selective adsorption/desorption behaviour of CO₂ and CH₄ on coals: an experimental study: *International Journal of Coal Geology*, v. 66, p. 53-68.
- Busch, A., and Y. Gensterblum, 2011, CBM and CO₂-ECBM related sorption processes in coal: a review: *International Journal of Coal Geology*, v. 87, p. 49-71.
- Bustin, A.M.M., and R.M. Bustin, 2008, Coal reservoir saturation: Impact of temperature and pressure: *AAPG Bulletin*, v. 92, p. 77-86.
- Bustin, A.M.M., and R.M. Bustin, 2012, Horseshoe Canyon and Belly River coal measures, south central Alberta: Part 2—Modeling reservoir properties and producible gas: *Bulletin of Canadian Petroleum Geology*, v. 59, p. 235-260.
- Bustin, A.M.M., and R.M. Bustin, 2016, Total gas-in-place, gas composition and reservoir properties of coal of the Mannville coal measures, central Alberta: *International Journal of Coal Geology*, v. 153, p. 127-143.
- Bustin, A.M.M., and R.M. Bustin, 2016, Contribution of non-coal facies to the total gas-in-place in Mannville coal measures, central Alberta: *International Journal of Coal Geology*, v. 154-155, p. 69-81.
- Bustin, A.M.M., R.M. Bustin, L. Chikatamarla, R. Downey, and J. Mansoori, 2016, Learnings from a failed nitrogen enhanced coalbed methane pilot: Piceance Basin, Colorado: *International Journal of Coal Geology*, v. 165, p. 64-75. (ECBM)
- Bustin, R.M., 1997, Importance of fabric and composition on the stress sensitivity of permeability in some coals, northern Sydney basin, Australia: relevance to coalbed methane exploitation: *AAPG Bulletin*, v. 81, p. 1894-1908.
- Bustin, R.M., and C.R. Clarkson, 1998, Geological controls on coalbed methane reservoir capacity and gas content, in P.C. Lyons, ed., Special issue: Appalachian coalbed methane: *International Journal of Coal Geology*, v. 38, p. 3-26.
- Bustin, R.M., and C.R. Clarkson, 1999, Free gas storage in matrix porosity: a potentially significant coalbed resource in low rank coals: Tuscaloosa, Alabama, *International Coalbed Methane Symposium*, p. 197-214.
- Bustin, R.M., 2000, Hydrogen sulphide sorption on coal with comparisons to methane, carbon dioxide, nitrogen and hydrogen sorption: implications for acid gas sequestering and co-production of methane (abstract): *TSOP Abstracts and Program*, v. 17, p. 15.

- Bustin, R.M., 2001, Hydrogen sulphide sorption on coal with comparisons to methane, carbon dioxide, nitrogen and hydrogen: implications for acid gas sequestration and co-production of methane: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 112, p. 343-350.
- Bustin, R.M., X. Cui, and L. Chikatamarla, 2008, Impacts of volumetric strain on CO₂ sequestration in coals and enhanced CH₄ recovery: AAPG Bulletin, v. 92, p. 15-29.
- Bustin, R.M., and A.M.M. Bustin, 2012, Horseshoe Canyon and Belly River coal measures, south central Alberta: Part 1—Total original gas-in-place: Bulletin of Canadian Petroleum Geology, v. 59, p. 207-234.
- Butala, S.J.M., J.C. Medina, T.Q. Taylor, C.H. Bartholomew, and M.L. Lee, 2000, Mechanisms and kinetics of reactions leading to natural gas formation during coal maturation: Energy Fuels, v. 14, p. 235-259.
- Butland, C.I., and T.A. Moore, 2008, Secondary biogenic coal seam gas reservoirs in New Zealand: A preliminary assessment of gas contents: International Journal of Coal Geology, v. 76, p. 151-165.
- Bybee, K., 2002, Multiseam coal stimulation by coiled-tubing fracturing: Journal of Petroleum Technology, v. 54, p. 47.
- Bybee, K., 2006, A parametric study of horizontal and multilateral wells in coalbed-methane reservoirs: Journal of Petroleum Technology, v. 58, no. 5, p. 71-72.
- Bybee, K., 2009, Maximizing energy at coalface for coalbed-methane fracturing: Journal of Petroleum Technology, v. 61, no. 6, p. 59-60.
- Byrer, C.W., T.H. Mroz, and G.L. Covatch, 1987, Coalbed methane production potential in U.S. basins: Journal of Petroleum Technology, v. 39, no. 7, p. 821-834.
- Cai, Y., D. Liu, Y. Yao, J. Li, and Y. Qiu, 2011, Geological controls on prediction of coalbed methane of No. 3 coal seam in southern Qinshui Basin, north China: International Journal of Coal Geology, v. 88, p. 101-112.
- Cai, Y., D. Liu, J.P. Mathews, Z. Pan, D. Elsworth, Y. Yao, J. Li, and X. Guo, 2014, Permeability evolution in fractured coal — Combining triaxial confinement with X-ray computed tomography, acoustic emission and ultrasonic techniques: International Journal of Coal Geology, v. 122, p. 91-104.
- Cai, Y., D. Liu, Y. Yao, Z. Li, and Z. Pan, 2014, Partial coal pyrolysis and its implication to enhance coalbed methane recovery, part I: An experimental investigation: Fuel, v. 132, p. 12-19.
- Cai, Y., D. Liu, Z. Pan, Y. Yao, and C. Li, 2015, Mineral occurrences and its impact on fracture generation in selected Qinshui Basin coals: An experimental perspective: International Journal of Coal Geology, v. 150-151, p. 35-50. (cleat)
- Cai, Y., Q. Li, D. Liu, Y. Zhou, and D. Lv, 2018, Insights into matrix compressibility of coals by mercury intrusion porosimetry and N₂ adsorption: International Journal of Coal Geology, v. 200, p. 199-212.
- Cameron, J.R., I.D. Palmer, and Z.A. Moschovidis, 2007, Effectiveness of horizontal wells in CBM: 2007 International Coalbed Methane Symposium, Tuscaloosa, AL, Paper 0716, 18 p.
- Campbell, B., 2002, Courts wrestle with CBM ownership: American Oil & Gas Reporter, v. 45, no. 9, p. 34-36.
- Campbell, B., 2003, Coalbed methane potential excites Illinois Basin: American Oil & Gas Reporter, v. 46, no. 6, p. 119-120.
- Campen, E.B., and J.R. Gruber, Jr., 1991, Coal and coalbed methane resources of Montana, in S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., Coalbed methane of western North America: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 265-272.

- Campen, E.B., and E.B. Campen, 2002, Basic log analysis in coalbed methane exploration, *in* S.D. Schwochow and V.F. Nuccio, eds., Coalbed methane of North America, II: Rocky Mountain Association of Geologists, p. 17-23.
- Cao, Y., D. He, and D.C. Glick, 2001, Coal and gas outbursts in footwalls of reverse faults: *International Journal of Coal Geology*, v. 48, p. 47-63.
- Cardott, B.J., 1999, Coalbed methane activity in Oklahoma, *in* B.J. Cardott, compiler, Oklahoma coalbed-methane workshop: OGS Open-File Report OF 6-99, p. 47-66.
- Cardott, B.J., 2000, Coalbed methane activity in Oklahoma, *in* B.J. Cardott, compiler, Oklahoma coalbed-methane workshop: OGS Open-File Report OF 2-2000, p. 13-35.
- Cardott, B.J., 2001, Oklahoma coalbed-methane completions, 1988 to 1996, *in* K.S. Johnson, ed., Pennsylvanian and Permian geology and petroleum in the southern Midcontinent, 1998 symposium: OGS Circular 104, p. 81-85.
- Cardott, B.J., 2001, Introduction to coal as gas source rock and reservoir, *in* B.J. Cardott, compiler, Oklahoma coalbed-methane workshop 2001: OGS Open-File Report 2-2001, p. 1-27.
- Cardott, B.J., 2001, Coalbed-methane activity in Oklahoma, 2001, *in* B.J. Cardott, compiler, Oklahoma coalbed-methane workshop 2001: OGS Open-File Report 2-2001, p. 93-118.
- Cardott, B.J., 2002, Coalbed methane development in Oklahoma, *in* S.D. Schwochow and V.F. Nuccio, eds., Coalbed methane of North America, II: Rocky Mountain Association of Geologists, p. 83-98.
- Cardott, B.J., 2002, Lessons learned from coalbed-methane exploration (abstract): *TSOP Abstracts and Program*, v. 18, p. 21-22.
- Cardott, B.J., 2002, Coalbed-methane activity in Oklahoma, 2002 update, *in* B.J. Cardott, compiler, Fourth annual Oklahoma coalbed-methane workshop: OGS Open-File Report 9-2002, p. 56-82.
- Cardott, B.J., and M.A. Biddick, 2003, Coalbed methane: economic success in the Arkoma Basin, Oklahoma (abstract): *AAPG Mid-Continent Section Meeting, Official Program Book*, p. 26.
- Cardott, B.J., 2005, Coalbed-methane activity in Oklahoma, 2004 update, *in* B.J. Cardott, ed., Unconventional energy resources in the southern Midcontinent, 2004 symposium: Oklahoma Geological Survey Circular 110, p. 69-81.
- Cardott, B.J., 2013, Hartshorne coal rank applied to Arkoma Basin coalbed methane activity, Oklahoma, USA: *International Journal of Coal Geology*, v. 108, p. 35-46.
- Carlton, D.R., 2006, Discovery and development of a giant coalbed methane resource, Raton Basin, Las Animas County, southeast Colorado: *The Mountain Geologist*, v. 43, no. 3, p. 231-236.
- Carr, T.R., K.D. Newell, T.A. Johnson, W.M. Brown, and J.P. Lange, 2005, Coalbed-methane development in Kansas, *in* B.J. Cardott, ed., Unconventional energy resources in the southern Midcontinent, 2004 symposium: Oklahoma Geological Survey Circular 110, p. 63-65.
- Carroll, R.E., and J.C. Pashin, 2002, Carbon sequestration potential of coalbed methane reservoirs in the Black Warrior basin: relationship of sorption capacity to coal quality (abstract): *TSOP Abstracts and Program*, v. 18, p. 23-24.
- Carroll, R. E., and J. C. Pashin, 2003, Relationship of sorption capacity to coal quality: CO₂ sequestration potential of coalbed methane reservoirs in the Black Warrior basin: Tuscaloosa, Alabama, University of Alabama College of Continuing Studies, 2003 International Coalbed Methane Symposium Proceedings, Paper 0317, 11 p.

- Carter, R.H., S.A. Holditch, J. Hinkel, and R. Jeffrey, 1989, Enhanced gas production through hydraulic fracturing of coal seams: Gas Research Institute, Final Report, GRI-90/0061, 71 p.
- Cates, L. M., M. R. McIntyre, W. B. Hawkins, and R. H. Groshong, Jr., 2004, Structure and oil and gas production in the Black Warrior basin: Tuscaloosa, Alabama, University of Alabama College of Continuing Studies, 2004 International Coalbed Methane Symposium Proceedings, Paper 0440, 34 p.
- Cathyl-Bickford, C.G., 1991, Coal geology and coalbed methane potential of Comox and Nanaimo coal fields, Vancouver Island, British Columbia, in S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., Coalbed methane of western North America: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 155-162.
- Ceglarska-Stefańska, G., and K. Zarębska, 2002, The competitive sorption of CO₂ and CH₄ with regard to the release of methane from coal: Fuel Processing Technology, v. 77-78, p. 423-429.
- Ceglarska-Stefańska, G., and K. Zarebska, 2005, Sorption of carbon dioxide–methane mixtures: International Journal of Coal Geology, v. 62, p. 211-222.
- Cervik, J., 1969, Behaviour of coal-gas reservoirs: U.S. Bureau of Mines, Technical Progress Report 10, 10 p.
- Chaffee, A.L., G. Lay, M. Marshall, W.R. Jackson, Y. Fei, T.V. Verheyen, P.J. Cassidy, and S.G. Scott, 2010, Structural characterization of Middle Jurassic, high-volatile bituminous Walloon Subgroup coals and correlation with the coal seam gas content: Fuel, v. 89, p. 3241-3249.
- Chalmers, G.R.L., and R.M. Bustin, 2007, On the effects of petrographic composition on coalbed methane sorption: International Journal of Coal Geology, v. 69, p. 288-304.
- Chalmers, G.R.L., and R.M. Bustin, 2007, The organic matter distribution and methane capacity of the Lower Cretaceous strata of northeastern British Columbia, Canada: International Journal of Coal Geology, v. 70, p. 223-239.
- Chance, D.L., 2008, Louisiana CBM on the cusp?: An Investor's Guide to Unconventional Gas: Shales and Coalbed Methane, Supplement to Oil & Gas Investor, January 2008, p. 30-31.
- Chang, E., 2008, CNX: a CBM and shale gas play: An Investor's Guide to Unconventional Gas: Shales and Coalbed Methane, Supplement to Oil & Gas Investor, January 2008, p. 20-22.
- Charoensuppanimit, P., S.A. Mohammad, R.L. Robinson, Jr., and K.A.M. Gasem, 2015, Modeling the temperature dependence of supercritical gas adsorption on activated carbons, coals and shales: International Journal of Coal Geology, v. 138, p. 113-126.
- Charrière, D., Z. Pokryszka, and P. Behra, 2010, Effect of pressure and temperature on diffusion of CO₂ and CH₄ into coal from the Lorraine Basin (France): International Journal of Coal Geology, v. 81, p. 373-380.
- Chattaraj, S., D. Mohanty, T. Kumar, and G. Halder, 2016, Thermodynamics, kinetics and modeling of sorption behavior of coalbed methane — A review: Journal of Unconventional Oil and Gas Resources, v. 16, p. 14-33.
- Chatterjee, R., and S. Paul, 2013, Classification of coal seams for coal bed methane exploitation in central part of Jharia coalfield, India—A statistical approach: Fuel, v. 111, p. 20-29.
- Chen, D., Z. Pan, J. Liu, and L.D. Connell, 2013, An improved relative permeability model for coal reservoirs: International Journal of Coal Geology, v. 109-110, p. 45-57.

- Chen, D., J.-Q. Shi, S. Durucan, and A. Korre, 2014, Gas and water relative permeability in different coals: Model match and new insights: *International Journal of Coal Geology*, v. 122, p. 37-49.
- Chen, D., Z. Pan, J.-Q. Shi, G. Si, Z. Ye, and J. Zhang, 2016, A novel approach for modelling coal permeability during transition from elastic to post-failure state using a modified logistic growth function: *International Journal of Coal Geology*, v. 163, p. 132-139.
- Chen, D., Z. Ye, Z. Pan, Y. Tan, and H. Li, 2019, Theoretical models to predict gas adsorption capacity on moist coal: *Energy & Fuels*, v. 33, p. 2908-2914.
- Chen, S., D. Tang, S. Tao, H. Xu, S. Li, J. Zhao, P. Ren, and H. Fu, 2017, In-situ stress measurements and stress distribution characteristics of coal reservoirs in major coalfields in China: Implication for coalbed methane (CBM) development: *International Journal of Coal Geology*, v. 182, p. 66-84.
- Chen, S., D. Tang, S. Tao, Z. Chen, H. Xu, and S. Li, 2018, Coal reservoir heterogeneity in multicoal seams of the Panguan Syncline, western Guizhou, China: Implication for the development of superposed CBM-bearing systems: *Energy & Fuels*, v. 32, p. 8241-8253.
- Chen, T., H. Zheng, S. Hamilton, S. Rodrigues, S.D. Golding, and V. Rudolph, 2017, Characterisation of bioavailability of Surat Basin Walloon coals for biogenic methane production using environmental microbial consortia: *International Journal of Coal Geology*, v. 179, p. 92-112.
- Chen, T., S. Rodrigues, S.D. Golding, and V. Rudolph, 2018, Improving coal bioavailability for biogenic methane production via hydrogen peroxide oxidation: *International Journal of Coal Geology*, v. 195, p. 402-414.
- Chen, Y., Y. Qin, C. Wei, L. Huang, Q. Shi, C. Wu, and X. Zhang, 2018, Porosity changes in progressively pulverized anthracite subsamples: Implications for the study of closed pore distribution in coals: *Fuel*, v. 225, p. 612-622.
- Chen, Y., Y. Qin, Z. Li, Q. Shi, C. Wei, C. Wu, C. Cao, and Z. Qu, 2019, Differences in desorption rate and composition of desorbed gases between undeformed and mylonitic coals in the Zhina coalfield, southwest China: *Fuel*, v. 239, p. 905-916.
- Chen, Z., J. Liu, D. Elsworth, L.D. Connell, and Z. Pan, 2010, Impact of CO₂ injection and differential deformation on CO₂ injectivity under in-situ stress conditions: *International Journal of Coal Geology*, v. 81, p. 97-108.
- Cheng, A.-L., and W.-L. Huang, 2004, Selective adsorption of hydrocarbon gases on clays and organic matter: *Organic Geochemistry*, v. 35, p. 413-423.
- Cheung, K., H. Sanei, P. Klassen, B. Mayer, and F. Goodarzi, 2009, Produced fluids and shallow groundwater in coalbed methane (CBM) producing regions of Alberta, Canada: Trace element and rare earth element geochemistry: *International Journal of Coal Geology*, v. 77, p. 338-349.
- Cheung, K., P. Klassen, B. Mayer, F. Goodarzi, and R. Aravena, 2010, Major ion and isotope geochemistry of fluids and gases from coalbed methane and shallow groundwater wells in Alberta, Canada: *Applied Geochemistry*, v. 25, p. 1307-1329.
- Chi, W., and L. Yang, 2001, Feasibility of coalbed methane exploitation in China: *Journal of Petroleum Technology*, v. 53, no. 9, p. 74.
- Choate, R., J. Lent, and C.T. Rightmire, 1984, Upper Cretaceous geology, coal, and the potential for methane recovery from coalbeds in San Juan Basin—Colorado and New Mexico, in C.T. Rightmire, G.E. Eddy, and J.N. Kirr, eds., *Coalbed methane resources of the United States: AAPG Studies in Geology* 17, p. 185-222.
- Choate, R., D. Jurich, and G.J. Saulnier, Jr., 1984, Geologic overview, coal deposits, and potential for methane recovery from coalbeds, Piceance Basin—Colorado, in C.T. Rightmire, G.E. Eddy, and J.N. Kirr, eds., *Coalbed methane resources of the United States: AAPG Studies in Geology* 17, p. 223-251.

- Choate, R., C.A. Johnson, and J.P. McCord, 1984, Geologic overview, coal deposits, and potential for methane recovery from coalbeds—Powder River Basin, *in* C.T. Rightmire, G.E. Eddy, and J.N. Kirr, eds., Coalbed methane resources of the United States: AAPG Studies in Geology 17, p. 335-351.
- Choate, R., C.A. Johnson, and J.P. McCord, 1984, Geologic overview, coal, and coalbed methane resources of the western Washington coal region, *in* C.T. Rightmire, G.E. Eddy, and J.N. Kirr, eds., Coalbed methane resources of the United States: AAPG Studies in Geology 17, p. 353-372.
- Choate, R., J.P. McCord, and C.T. Rightmire, 1986, Assessment of natural gas from coalbeds by geologic characterization and production evaluation, *in* D.D. Rice, ed., Oil and gas assessment; methods and applications: AAPG Studies in Geology 21, p. 223-245.
- Choi, S.K., and M.B. Wold, 2001, Advances in simulation of gas outburst conditions in underground coal mines: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 126, p. 283-294.
- Christie, R., and S. Campbell, 2007, Micro imaging key in CBM development: American Oil & Gas Reporter, v. 50, no. 11, p. 60-65.
- Cienfuegos, P., and J. Loredó, 2010, Coalbed methane resources assessment in Asturias (Spain): International Journal of Coal Geology, v. 83, p. 366-376.
- Ciu, X., R.M. Bustin, and G. Dipple, 2004, Selective transport of CO₂, CH₄ and N₂ in coals: insight from modeling of experimental gas adsorption data: Fuel, v. 83, p. 293-303.
- Clark, A.C., 2014, Coalbed natural gas exploration, drilling activities, and geologic test results, 2007–2010, Wainwright, Alaska: U.S. Geological Survey Open-File Report 2014-1004, 65 p.
- Clark, J., 2004, Far East Energy pressing big CBM schemes in China: Oil & Gas Journal, v. 102.33, p. 24-26.
- Clark, W.F., and T. Hemler, 1988, Completing, equipping, and operating Fruitland Formation coal-bed methane wells in the San Juan basin, New Mexico and Colorado, *in* J.E. Fassett, ed., Geology and coal-bed methane resources of the northern San Juan basin, Colorado and New Mexico: Denver, Rocky Mountain Association of Geologists Guidebook, p. 125-132.
- Clarkson, C.R., M.N. Lamberson, and R.M. Bustin, 1993, Variation in surface area and micropore size distribution with composition of medium volatile bituminous coal of the Gates Formation, northeastern British Columbia: implications for coalbed methane potential: Current Research, Part E, Geological Survey of Canada Paper 93-1, p. 97-104.
- Clarkson, C.R., and R.M. Bustin, 1996, Variation in micropore capacity and size distribution with composition in bituminous coal of the western Canadian sedimentary basin: Fuel, v. 75, p. 1483-1498.
- Clarkson, C.R., and R.M. Bustin, 1997, Variation in permeability with lithotype and maceral composition of Cretaceous coals of the Canadian Cordillera: International Journal of Coal Geology, v. 33, p. 135-151.
- Clarkson, C.R., R.M. Bustin, and J.H. Levy, 1997, Application of the mono/multilayer and adsorption potential theories to coal methane adsorption isotherms at elevated temperature and pressure: Carbon, v. 35, p. 1689-1705.

- Clarkson, C.R., and R.M. Bustin, 1999, The effect of pore structure and gas pressure upon the transport properties of coal: a laboratory and modelling study: 1. Isotherms and pore volume distributions: *Fuel*, v. 78, p. 1333-1344.
- Clarkson, C.R., and R.M. Bustin, 2000, Binary gas adsorption/desorption isotherms: effect of moisture and coal composition upon carbon dioxide selectivity over methane: *International Journal of Coal Geology*, v. 42, p. 241-271.
- Clarkson, C.R., M. Rahmanian, A. Kantzas, and K. Morad, 2011, Relative permeability of CBM reservoirs: Controls on curve shape: *International Journal of Coal Geology*, v. 88, p. 204-217.
- Clarkson, C.R., 2013, Production data analysis of unconventional gas wells: Review of theory and best practices: *International Journal of Coal Geology*, v. 109-110, p. 101-146.
- Clarkson, C.R., 2013, Production data analysis of unconventional gas wells: Workflow: *International Journal of Coal Geology*, v. 109-110, p. 147-157.
- Clarkson, C.R., and F. Qanbari, 2015, Transient flow analysis and partial water relative permeability curve derivation for low permeability undersaturated coalbed methane wells: *International Journal of Coal Geology*, v. 152, Part B, p. 110-124.
- Clarkson, C.R., and F. Qanbari, 2016, A semi-analytical method for forecasting wells completed in low permeability, undersaturated CBM reservoirs: *Journal of Natural Gas Science and Engineering*, v. 30, p. 19-27.
- Clarkson, C.R., 2018, Coalbed methane, *in* R. Aguilera, ed., *Unconventional gas and tight oil exploitation: Society of Petroleum Engineers, Monograph Series*, p. 175-266.
- Clayton, J. L., J. S. Leventhal, D. D. Rice, J. C. Pashin, B. Mosher, and P. Czepiel, 1994, Atmospheric methane flux from coals—preliminary investigation of coal mines and geologic structures in the Black Warrior basin, Alabama, *in* D.G. Howell, ed., *The future of energy gases: U.S. Geological Survey Professional Paper 1570*, p. 471-492.
- Clayton, J.L., 1998, Geochemistry of coalbed gas — a review, *in* R.M. Flores, ed., *Coalbed methane: from coal-mine outbursts to a gas resource: International Journal of Coal Geology*, v. 35, p. 159-173.
- Close, J.C., and T.M. Erwin, 1989, Significance and determination of gas content data as related to coalbed methane reservoir evaluation and production implications: *Proceedings of the 1989 Coalbed Methane Symposium*, paper 8922, p. 37-55.
- Close, J.C., and M.J. Mavor, 1991, Influence of coal composition and rank on fracture development in Fruitland coal gas reservoirs of San Juan basin, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., *Coalbed methane of western North America: Denver, Rocky Mountain Association of Geologists*, p. 109-121.
- Close, J.C., 1992, Western Cretaceous coal seam project: *Quarterly Review of Methane from Coal Seams Technology*, v. 10, no. 1, p. 11-15.
- Close, J.C., 1993, Natural fractures in coal, *in* B.E. Law and D.D. Rice, eds., *Hydrocarbons from coal: AAPG Studies in Geology 38*, p. 119-132.
- Close, J.C., and R.R. Dutcher, 2002, Geomorphology of drainage patterns: clues to coal gas natural fracture timing, orientation and location, Raton basin, Colorado–New Mexico, *in* S.D. Schwochow and V.F. Nuccio, eds., *Coalbed methane of North America, II: Rocky Mountain Association of Geologists*, p. 25-48.

- Clough, J.G., 2001, Coalbed methane—potential energy source for rural Alaska: State of Alaska Division of Geological and Geophysical Surveys, Alaska GeoSurvey News, v. 5, no. 2, p. 1-4.
- Clouser, G., 2006, Powder River Basin CBM production still growing: An investor's guide to coalbed methane, A supplement to Oil and Gas Investor, v. 26, no. 12, p. 8-12.
- Clouser, G., 2006, Water management a key concern: An investor's guide to coalbed methane, A supplement to Oil and Gas Investor, v. 26, no. 12, p. 13-18.
- Clouser, G., 2008, Green light at Atlantic Rim: An Investor's Guide to Unconventional Gas: Shales and Coalbed Methane, Supplement to Oil & Gas Investor, January 2008, p. 38-40.
- Coates, J., 2003, A review of coalbed methane operational issues in the Cherokee Basin, Kansas and Oklahoma: a case study (abstract): AAPG Mid-Continent Section Meeting, Official Program Book, p. 28.
- Cohen, D.M., 2007, Coalbed methane activity cools off: World Oil, v. 228, no. 8, p. 91-94.
- Cohen, D.M., 2008, Coalbed methane expansion stalls: World Oil, v. 229, no. 8.
- Cohen, D.M., 2009, US coalbed methane takes a dive: World Oil, v. 230, no. 8, p. 71-72.
- Collett, T.S., and C.E. Barker, eds., 2003, Coalbed methane in the Ferron coals, Utah: a multidisciplinary study: International Journal of Coal Geology, v. 56, p. 1-201.
- Colmenares, L.B., and M.D. Zoback, 2007, Hydraulic fracturing and wellbore completion of coalbed methane wells in the Powder River Basin, Wyoming: Implications for water and gas production: AAPG Bulletin, v. 91, p. 51-67.
- Colosimo, F., R. Thomas, J.R. Lloyd, K.G. Taylor, C. Boothman, A.D. Smith, R. Lord, and R.M. Kalin, 2016, Biogenic methane in shale gas and coal bed methane: A review of current knowledge and gaps: International Journal of Coal Geology, v. 165, p. 106-120.
- Condon, S.M., 2003, Fracture network of the Ferron Sandstone member of the Mancos Shale, east-central Utah, USA: International Journal of Coal Geology, v. 56, p. 111-139.
- Connell, L.D., and R.G. Jeffery, 2005, History matching for optimization of gas drainage from horizontal wells containing sand propped hydraulic fractures: 2005 International Coalbed Methane Symposium, Tuscaloosa, AL, Paper 0508, 13 p.
- Connell, L.D., 2009, Coupled flow and geomechanical processes during gas production from coal seams: International Journal of Coal Geology, v. 79, p. 18-28.
- Connell, L.D., M. Lu, and Z. Pan, 2010, An analytical coal permeability model for tri-axial strain and stress conditions: International Journal of Coal Geology, v. 84, p. 103-114.
- Connell, L.D., R. Sander, Z. Pan, M. Camilleri, and D. Heryanto, 2011, History matching of enhanced coal bed methane laboratory core flood tests: International Journal of Coal Geology, v. 87, p. 128-138.
- Connell, L.D., S. Mazumder, R. Sander, M. Camilleri, Z. Pan, and D. Heryanto, 2015, Laboratory characterisation of coal matrix shrinkage, cleat compressibility and the geomechanical properties determining reservoir permeability: Fuel, v. 165, p. 499-512.
- Connell, L.D., 2016, A new interpretation of the response of coal permeability to changes in pore pressure, stress and matrix shrinkage: International Journal of Coal Geology, v. 162, p. 169-182.
- Connell, L.D., Z. Pan, and M. Camilleri, 2019, The variation in produced gas composition from mixed gas coal seam reservoirs: International Journal of Coal Geology, v. 201, p. 62-75.

- Conner, C., 2009, Technology optimizes CBM production: American Oil & Gas Reporter, v. 52, no. 8, p. 90-95.
- Cook, T., 2003, Calculation of estimated ultimate recovery for wells in continuous-type oil and gas accumulations of the Uinta-Piceance Province: International Journal of Coal Geology, v. 56, p. 39-44.
- Cooper, J.R., J.C. Crelling, S.M. Rimmer, and A.G. Whittington, 2007, Coal metamorphism by igneous intrusion in the Raton Basin, CO and NM: Implications for generation of volatiles: International Journal of Coal Geology, v. 71, p. 15-27.
- Counts, R.A., 1990, Ownership questions can stymie development of coalbed methane: Oil & Gas Journal, v. 88, no. 1, p. 66-70.
- Cramer, B., 2004, Methane generation from coal during open system pyrolysis investigated by isotope specific, Gaussian distributed reaction kinetics: Organic Geochemistry, v. 35, p. 379-392.
- Cramer, D., 2008, Stimulation key in unconventional plays: American Oil & Gas Reporter, v. 51, no. 7, p. 101-107.
- Creedy, D.P., 1988, Geological controls on the formation and distribution of gas in British coal measure strata: International Journal of Coal Geology, v. 10, p. 1-31.
- Creedy, D.P., 2002, CBM business in China: World Coal, v. 11, no. 6, p. 65-68.
- Crosdale, P.J., B.B. Beamish, and M. Valix, 1998, Coalbed methane sorption related to coal composition, *in* R.M. Flores, ed., Coalbed methane: from coal-mine outbursts to a gas resource: International Journal of Coal Geology, v. 35, p. 147-158.
- Crosdale, P.J., T.A. Moore, and T.E. Mares, 2008, Influence of moisture content and temperature on methane adsorption isotherm analysis for coals from a low-rank, biogenically-sourced gas reservoir: International Journal of Coal Geology, v. 76, p. 166-174.
- Crosdale, P.J., 2017, Coal bed methane, *in* I. Suárez-Ruiz, and J.G. Mendonça Filho, eds., The role of organic petrology in the exploration of conventional and unconventional hydrocarbon systems: Sharjah, U.A.E., Bentham Science Publishers, p. 258-286.
- Crovelli, R.A., 2003, Probabilistic assessment methodology for continuous-type petroleum accumulations: International Journal of Coal Geology, v. 56, p. 45-48.
- Cui, X., R.M. Bustin, and G. Dipple, 2004, Selective transport of CO₂, CH₄, and N₂ in coals: insights from modeling of experimental gas adsorption data: Fuel, v. 83, p. 293-303.
- Cui, X., R.M. Bustin, and G. Dipple, 2004, Differential transport of CO₂ and CH₄ in coalbed aquifers: implications for coalbed gas distribution and composition: AAPG Bulletin, v. 88, p. 1149-1161.
- Cui, X., and R.M. Bustin, 2005, Volumetric strain associated with methane desorption and its impact on coalbed gas production from deep coal seams: AAPG Bulletin, v. 89, p. 1181-1202.
- Curl, S.J., 1978, Methane prediction in coal mines: IEA Coal Research, Report no. ICTIS/TR 4, 79 p.
- Czerw, K., 2011, Methane and carbon dioxide sorption/desorption on bituminous coal—Experiments on cuboidal samples cut from the primal coal lump: International Journal of Coal Geology, v. 85, p. 72-77.
- Czerw, K., P. Baran, and K. Zarębska, 2017, Application of the stretched exponential equation to sorption of mine gases and sorption induced swelling of bituminous coal: International Journal of Coal Geology, v. 173, p. 76-83. (ECBM)
- Dabbous, M.K., A.A. Reznik, J.J. Taber, and P.F. Fulton, 1992, The permeability of coal to gas and water, *in* Coalbed methane: Society of Petroleum Engineers, Reprint Series 35, p. 46-55.

- Dai, J., C. Zou, J. Li, Y. Ni, G. Hu, X. Zhang, Q. Liu, C. Yang, and A. Hu, 2009, Carbon isotopes of Middle-Lower Jurassic coal-derived alkane gases from the major basins of northwestern China: *International Journal of Coal Geology*, v. 80, p. 124-134.
- Dai, J., D. Gong, Y. Ni, S. Huang, and W. Wu, 2014, Stable carbon isotopes of coal-derived gases sourced from the Mesozoic coal measures in China: *Organic Geochemistry*, v. 74, p. 123-142.
- Dallegge, T.A., and C.E. Barker, 2002, Implications to conventional gas reserve growth of coalbed methane desorption analyses from the Beaver Creek and Kenai gas fields, Kenai Peninsula, Alaska (abstract): *AAPG Bulletin*, v. 86, p. 1140-1141.
- Daly, D.J., and G. Mesing, 1993, Gas industry-related produced-water demographics: *Quarterly Review of Methane from Coal Seams Technology*, v. 11, no. 2, p. 3-5.
- D'Amico, J.S., 2000, Processing key to CBM economics: *American Oil & Gas Reporter*, v. 43, no. 8, p. 118-124.
- Danell, R.E., Å. Källstrand, J. Nunn, and B. Heed, 2001, Reduction of methane emissions from underground coal mining: demonstration of abatement and utilisation in mine ventilation exhaust air: Tuscaloosa, Alabama, *Proceedings, International Coalbed Methane Symposium*, Paper 152, p. 87-99.
- Danesh, N.N., Z. Chen, L.D. Connell, M.S. Kizil, Z. Pan, and S.M. Aminossadati, 2017, Characterisation of creep in coal and its impact on permeability: An experimental study: *International Journal of Coal Geology*, v. 173, p. 200-211.
- Darbonne, N., 2006, Domestic gas supply: CBM review: *Oil and Gas Investor*, v. 26, no. 6, p. 65-68.
- Darton, N.H., 1915, Occurrence of explosive gases in coal mines: *U.S. Bureau of Mines Bulletin* 72, 248 p.
- Das, B.M., D.J. Nikols, Z.U. Das, and V.J. Hucka, 1991, Factors affecting rate and total volume of methane desorption from coalbeds, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., *Coalbed methane of western North America*: Denver, Rocky Mountain Association of Geologists, p. 69-76.
- Datta, R.K., K.K. Sen, R.N. Das, K. Mondal, and G. Mukherjee, 2001, Coalbed methane prospect in Raniganj coalfield — a prognosis, *in* *Proceedings of national seminar on recent advances in geology of coal and lignite basins of India*: Geological Survey of India, Special Publication 54, p. 287-294.
- Davidson, R.M., L.L. Sloss, and L.B. Clarke, 1995, *Coalbed methane extraction*: London, IEA Coal Research, IEACR/76, 67 p.
- Davis, K.J., and R. Gerlach, 2018, Transition of biogenic coal-to-methane conversion from the laboratory to the field: A review of important parameters and studies: *International Journal of Coal Geology*, v. 185, p. 33-43.
- Davis, T.L., R.D. Benson, C. Ansorger, and S.L. Roche, 2007, 4-D, 9-C delineates key CBM variables: *American Oil & Gas Reporter*, v. 50, no. 12, p. 97-101.
- Dawson, F.M., 1995, *Coalbed methane: a comparison between Canada and the United States*: Geological Survey of Canada, Bulletin 489, 60 p.
- Dawson, F.M., 1999, Coalbed methane exploration in structurally complex terrain, *in* M. Mastalerz, M. Glikson, and S.D. Golding, eds., *Coalbed methane: scientific, environmental and economic evaluation*: Boston, Kluwer Academic Publishers, p. 111-121.
- Dawson, F.M., D.L. Marchioni, T.C. Anderson, and W.J. McDougall, 2000, An assessment of coalbed methane exploration projects in Canada: *Geological Survey of Canada, Bulletin* 549, 218 p.
- Dawson, F.M., D.L. Marchioni, T.C. Anderson, and W.J. McDougall, 2004, An assessment of coalbed methane exploration projects in Canada: *Geological Survey of Canada, Bulletin* 549, CD-ROM.
- Dawson, G.K.W., and J.S. Esterle, 2010, Controls on coal cleat spacing: *International Journal of Coal Geology*, v. 82, p. 213-218.

- Dawson, M., and W. Kalkreuth, 1994, Coal rank and coalbed methane potential of Cretaceous/Tertiary coals in the Canadian Rocky Mountain foothills and adjacent foreland: 1. Hinton and Grande Cache areas, Alberta: *Bulletin of Canadian Petroleum Geology*, v. 42, p. 544-561.
- Day, S., R. Sakurovs, and S. Weir, 2008, Supercritical gas sorption on moist coals: *International Journal of Coal Geology*, v. 74, p. 203-214.
- Day, S., R. Fry, and R. Sakurovs, 2011, Swelling of moist coal in carbon dioxide and methane: *International Journal of Coal Geology*, v. 86, p. 197-203.
- Day, S., R. Fry, and R. Sakurovs, 2012, Swelling of coal in carbon dioxide, methane and their mixtures: *International Journal of Coal Geology*, v. 93, p. 40-48.
- De Bruin, R.H., R.M. Lyman, R.W. Jones, and L.W. Cook, 2001, Coalbed methane in Wyoming: Wyoming State Geological Survey, Information Pamphlet 7 (revised).
- De Bruin, R.H., R.M. Lyman, and N.R. Jones, 2003, Coalbed methane update: Wyoming Geo-notes, no. 78, p. 23-24.
- De Bruin, R.H., R.M. Lyman, and N.R. Jones, 2004, Coalbed methane update: Wyoming Geo-notes, no. 80, p. 21-22.
- De Bruin, R.H., R.M. Lyman, L.L. Hallberg, and N.R. Jones, 2004, Coalbed methane activity in the eastern Powder River Basin, Campbell and Converse Counties, Wyoming: Wyoming Geological Survey, Map Series 56.
- De Bruin, R.H., R.M. Lyman, L.L. Hallberg, M.M. Harrison, and N.R. Jones, 2004, Coalbed methane activity in the western Powder River Basin, Campbell, Converse, Johnson, Natrona, and Sheridan Counties, Wyoming: Wyoming Geological Survey, Map Series 57.
- De Bruin, R.H., R.M. Lyman, L.L. Hallberg, M.M. Harrison, and N.R. Jones, 2004, Coalbed methane activity in the Powder River Basin, Campbell, Converse, Johnson, Natrona, and Sheridan Counties, Wyoming: Wyoming Geological Survey, Map Series 58.
- Decker, A.D., and D.M. Horner, 1987, Origin and production implications of abnormal coal reservoir pressure: Tuscaloosa, Alabama, Proceedings of the 1987 Coalbed Methane Symposium, paper 8714, p. 51-62.
- Decker, D., S.J. Jeu, J.D. Cooper, and D.E. Wicks, 1988, Geology, geochemistry, reservoir engineering, and completion methods at the Cedar Hill field, San Juan County, New Mexico: a field study of classic coal degasification behavior, in J.E. Fassett, ed., *Geology and coal-bed methane resources of the northern San Juan basin, Colorado and New Mexico*: Denver, Rocky Mountain Association of Geologists Guidebook, p. 221-235.
- Deisman, N., T. Gentzis, and R.J. Chalaturnyk, 2008, Unconventional geomechanical testing on coal for coalbed reservoir well design: The Alberta Foothills and Plains: *International Journal of Coal Geology*, v. 51, p. 15-26.
- Deisman, N., D.M. Ivars, C. Darcel, and R.J. Chalaturnyk, 2010, Empirical and numerical approaches for geomechanical characterization of coal seam reservoirs: *International Journal of Coal Geology*, v. 82, p. 204-212.
- Deisman, N., M. Khajeh, and R.J. Chalaturnyk, 2013, Using geological strength index (GSI) to model uncertainty in rock mass properties of coal for CBM/ECBM reservoir geomechanics: *International Journal of Coal Geology*, v. 112, p. 76-86.
- Demir, I., D.G. Morse, S.D. Elrick, and C.A. Chenoweth, 2004, Delineation of the coalbed methane resources of Illinois: Illinois State Geological Survey Circular 564, CD-ROM.
- Denney, D., 2008, Modeling hydraulic-fracture treatments in San Juan Basin coals: Fully functional 3D fracture model: *Journal of Petroleum Technology*, v. 60, no. 3, p. 62-66.
- Denney, D., 2008, Coalbed-methane pilots: timing, design, and analysis: *Journal of Petroleum Technology*, v. 60, no. 7, p. 75-78.

- Deul, M., and A.G. Kim, 1975, Degasification of coalbeds - a commercial source of pipeline gas: Presented at Symposium on Clean Fuels from Coal II, Institute of Gas Technology, 14 p.
- Deul, M., 1976, Natural gas from coalbeds, *in* Natural gas from unconventional geologic sources: Washington, D.C., National Academy of Sciences, p. 193-205.
- Deul, M., and A.G. Kim, 1988, Methane control research: summary of results, 1964-1980: U.S. Bureau of Mines Bulletin 687, 174 p.
- Deul, M., and A.G. Kim, 2002, Coal beds: a source of natural gas: *Oil & Gas Journal*, v. 100, no. 35, p. 68, 70. (reprint of 1975 article)
- Deul, M., 2005, Methane from coalbeds: a reminiscence, *in* C.A. Sternbach, M.W. Downey, and G.M. Friedman, eds., *Discoverers of the 20th century: Perfecting the search*: AAPG, p. 134-141.
- Dhir, R., M.J. Mavor, and J.C. Close, 1991, Evaluation of Fruitland coal properties and development economics, San Juan Basin, Colorado and New Mexico, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., *Coalbed methane of western North America*: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 287-295.
- Diamond, W.P., G.W. Murrie, and C.M. McCulloch, 1976, Methane gas content of the Mary Lee Group of coalbeds, Jefferson, Tuscaloosa, and Walker Counties, Alabama: U.S. Bureau of Mines Report of Investigations 8117, 9 p.
- Diamond, W.P., C.M. McCulloch, and B.M. Bench, 1976, Use of surface joint and photolinear data for predicting subsurface coal cleat orientation: U.S. Bureau of Mines Report of Investigations 8120, 13 p.
- Diamond, W.P., 1979, Evaluation of the methane gas content of coalbeds: part of a complete coal exploration program for health and safety and resource evaluation, *in* G.O. Argall, Jr., ed., *Coal exploration*, v. 2: Denver, Proceedings of the second International Coal Exploration Symposium, p. 211-227.
- Diamond, W.P., and J.R. Levine, 1981, Direct method determination of the gas content of coal: procedures and results: U.S. Bureau of Mines Report of Investigations 8515, 36 p.
- Diamond, W.P., 1982, Site-specific and regional geologic considerations for coalbed gas drainage: U.S. Bureau of Mines Information Circular 8898, 24 p.
- Diamond, W.P., J.C. LaScola, and D.M. Hyman, 1986, Results of direct-method determination of the gas content of U.S. coalbeds: U.S. Bureau of Mines Information Circular 9067, 95 p.
- Diamond, W.P., 1987, Underground observations of mined-through stimulation treatments of coalbeds: *Quarterly Review of Methane from Coal Seams Technology*, v. 4, no. 4, p. 19-29.
- Diamond, W.P., and D.C. Oyler, 1987, Effects of stimulation treatments on coalbeds and surrounding strata: U.S. Bureau of Mines, Report of Investigations 9083, 48 p. (induced fractures intercepted by mining)
- Diamond, W.P., C.H. Elder, and P.W. Jeran, 1988, Influence of geology on methane emission from coal, *in* M. Deul and A.G. Kim, *Methane control research: summary of results, 1964-80*: U.S. Bureau of Mines Bulletin 687, p. 26-40.
- Diamond, W.P., A.T. Iannacchione, D.G. Puglio, and P.F. Steidl, 1988, Geologic studies of gassy coalbeds, *in* M. Deul and A.G. Kim, *Methane control research: summary of results, 1964-80*: U.S. Bureau of Mines Bulletin 687, p. 41-78.
- Diamond, W.P., 1993, Methane control for underground coal mines, *in* B.E. Law and D.D. Rice, eds., *Hydrocarbons from coal*: AAPG Studies in Geology 38, p. 237-267.
- Diamond, W.P., 1994, Methane control for underground coal mines: U.S. Bureau of Mines Information Circular 9395, 44 p. (induced fractures intercepted by mining)

- Diamond, W.P., and S.J. Schatzel, 1998, Measuring the gas content of coal: a review, *in* R.M. Flores, ed., *Coalbed methane: from coal-mine outbursts to a gas resource: International Journal of Coal Geology*, v. 35, p. 311-331.
- Diamond, W.P., S.J. Schatzel, F. Garcia, and J.P. Ulery, 2001, The modified direct method: a solution for obtaining accurate coal desorption measurements: Tuscaloosa, Alabama, *Proceedings, International Coalbed Methane Symposium*, Paper 128, p. 331-342.
- Dias, R.F., M.D. Lewan, J.E. Birdwell, and M.J. Kotarba, 2014, Differentiation of pre-existing trapped methane from thermogenic methane in an igneous-intruded coal by hydrous pyrolysis: *Organic Geochemistry*, v. 67, p. 1-7.
- Dixit, N.C., M. Ahmadi, C.L. Hanks, and O. Awoleke, 2017, Preliminary study of the carbon sequestration and enhanced coal bed methane production potential of subbituminous to high-volatile bituminous coals of the Healy Creek Formation, Nenana Basin, interior Alaska: *Natural Resources Research*, v. 26, p. 339-363. (ECBM)
- Doelling, H.H., A.D. Smith, and F.D. Davis, 1979, Methane content of Utah coals: *Utah Geological and Mineralogical Survey Special Studies* 49, 102 p.
- Dong, J., Y. Cheng, K. Jin, H. Zhang, Q. Liu, J. Jiang, and B. Hu, 2017, Effects of diffusion and suction negative pressure on coalbed methane extraction and a new measure to increase the methane utilization rate: *Fuel*, v. 197, p. 70-81.
- Dongkun, L., C. Wangtao, W. Xiaodong, and L. Weichao, 2009, Analysis on economic benefits of coalbed methane drilling technologies: *Petroleum Exploration and Development*, v. 36, p. 403-407.
- Donovan, W.S., 2000, Mudlogging method calculates coalbed gas content: *Oil & Gas Journal*, v. 98, no. 7, p. 64-67.
- Doscher, T.M., V.A. Kuusdraa, and E. Hammerschaib, 1981, The controlling production mechanism of methane gas from coalbeds: *Enegy Sources*, v. 5, p. 71-84.
- Draffin, C.W., and others, 1979, *Underground coal conversion - program description: USDOE ET-0100*, 68 p.
- Drobniak, A., M. Mastalerz, J. Rupp, and N. Eaton, 2004, Evaluation of coalbed gas potential of the Seelyville coal member, Indiana, USA: *International Journal of Coal Geology*, v. 57, p. 265-282.
- Du, Y., X. Chen, L. Li, and P. Wang, 2018, Characteristics of methane desorption and diffusion in coal within a negative pressure environment: *Fuel*, v. 217, p. 111-121.
- Duan, Y., T. Sun, Y. Qian, J. He, X. Zhang, L. Xu, and B. Wu, 2012, Pyrolysis experiments of forest marsh peat samples with different maturities: An attempt to understand the isotopic fractionation of coalbed methane during staged accumulation: *Fuel*, v. 94, p. 480-485.
- DuBois, G., S. Kravits, J. Kirley, D. Conklin, and J. Reilly, 2014, Plugging in-mine boreholes and CBM wells drilled from surface, *in* P. Thakur, K. Aminian, and S. Schatzel, eds., *Coal bed methane: from prospect to pipeline: New York, Elsevier*, p. 241-260.
- Dudzińska, A., 2014, Investigation of adsorption and desorption of acetylene on hard coal samples from Polish mines: *International Journal of Coal Geology*, v. 128-129, p. 24-31.
- Dudzińska, A., J. Cygankiewicz, and M. Włodarek, 2017, Natural content of gases: Carbon monoxide, carbon dioxide, hydrogen and unsaturated hydrocarbons of ethylene, propylene and ecetylene in selected bituminous coal seams: *International Journal of Coal Geology*, v. 178, p. 110-121.
- Duey, R., 2013, *CBM aids Asian markets: Hart Energy Publishing, E&P*, v. 86, no. 8, p. 82, 84-85.

- Dugan, T.A., and B.L. Williams, 1988, History of gas produced from coal seams in the San Juan Basin, *in* J.E. Fassett, ed., *Geology and coalbed methane resources of the northern San Juan Basin, Colorado and New Mexico*: Denver, Rocky Mountain Association of Geologists, p. 1-9.
- Dunlop, E.C., D.S. Warner, P.E.R. Warner, and L.R. Coleshill, 2017, Ultra-deep Permian coal gas reservoirs of the Cooper Basin: Insights from new studies: *APPEA Journal*, v. 57, p. 218-262. (Australia)
- Durand, B., A.Y. Huc, and J.L. Oudin, 1987, Oil saturation and primary migration: observations from the Kerbau wells, Mahakam delta, Indonesia, *in* B. Doligez, ed., *Migration of hydrocarbons in sedimentary basins*: Paris, Editions Technip, Collection Colloques et Seminaires, v. 45, p. 173-195.
- Dutta, P., S. Harpalani, and B. Prusty, 2008, Modeling of CO₂ sorption on coal: *Fuel*, v. 87, p. 2023-2036.
- Dutta, P., S. Bhowmik, and S. Das, 2011, Methane and carbon dioxide sorption on a set of coals from India: *International Journal of Coal Geology*, v. 85, p. 289-299.
- Eaton, S.R., 2006, Coalbed gas frontier being tapped: *AAPG Explorer*, v. 27, no. 11, p. 20, 24. (http://www.aapg.org/explorer/2006/11nov/horseshoe_canyon.cfm)
- Eaton, S.R., 2006, Cleats are keys to solid footing: *AAPG Explorer*, v. 27, no. 11, p. 22. (http://www.aapg.org/explorer/2006/11nov/horseshoe_side.cfm)
- Ebers, M.L., 2009, Kansas CBM well flow rates correlate to coal gas content: *Oil & Gas Journal*, v. 107.24, p. 34-40.
- Eble, C.F., 2012, Organic petrology of Carbondale Formation coal beds and marine roof shales in western Kentucky, eastern Interior (Illinois) Basin, USA: *International Journal of Coal Geology*, v. 104, p. 60-69.
- Echols, J.B., 2000, Coalbed methane: Louisiana's unexplored energy resource: Louisiana State University, Basin Research Institute (BRI) Bulletin, v. 9, p. 18-27.
- EIA, 2007, U.S. coalbed methane status map: http://www.eia.doe.gov/oil_gas/rpd/cbmusa1.pdf
- EIA, 2007, U.S. coalbed methane: past, present and future: http://www.eia.doe.gov/oil_gas/rpd/cbmusa2.pdf
- Ekundayo, J.M., and R. Rezaee, 2019, Effect of equation of states on high-pressure volumetric measurements of methane-coal sorption isotherms—Part 1: Volumes of free space and methane adsorption isotherms: *Energy & Fuels*, v. 33, p. 1029-1036.
- Elder, C.H. and M. Deul, 1974, Degasification of the Mary Lee coalbed near Oak Grove, Jefferson County, Alabama, by vertical borehole in advance of mining: U.S. Bureau of Mines Report of Investigations 7968, 21 p.
- Elder, C.H., and M. Deul, 1975, Hydraulic stimulation increases degasification rate of coal beds: U.S. Bureau of Mines Report of Investigations 8047, 17 p.
- Elder, C.H., 1977, Effects of hydraulic stimulation on coalbeds and associated strata: U.S. Bureau of Mines Report of Investigations 8260, 20 p.
- Ellenbecker, S., 2009, Technology key in directional program: *American Oil & Gas Reporter*, v. 52, no. 12, p. 70-71.
- Ely, J., S.A. Holditch, and R.H. Carter, 1988, Improved hydraulic fracturing strategy for Fruitland Formation coal-bed methane recovery, San Juan basin, New Mexico and Colorado, *in* J.E. Fassett, ed., *Geology and coal-bed methane resources of the northern San Juan basin, Colorado and New Mexico*: Denver, Rocky Mountain Association of Geologists Guidebook, p. 155-158.
- Ely, J.W., and S.A. Holditch, 1990, Fracturing techniques depend on coal seam characteristics: *Oil & Gas Journal*, v. 88, no. 30, p. 33-37.
- Enever, J., D. Casey, and M. Bocking, 1999, The role of in-situ stress in coalbed methane exploration, *in* M. Mastalerz, M. Glikson, and S.D. Golding, eds.,

- Coalbed methane: scientific, environmental and economic evaluation: Boston, Kluwer Academic Publishers, p. 297-303.
- EPA, 2004, Evaluation of impacts to underground sources of drinking water by hydraulic fracturing of coalbed methane reservoirs: U.S. Environmental Protection Agency, EPA 816-R-04-003, 29 p. (<http://www.epa.gov/safewater/uic/cbmstudy/docs.html>)
- EPA, 2005, Global coal mine methane utilization: promising opportunities: U.S. Environmental Protection Agency, Coalbed Methane Extra, June 2005, EPA-430-N-00-004, p. 1-7. (<http://www.epa.gov/coalbed>)
- Ertekin, T., W. Sung, and H.I. Bilgesu, 1991, Structural properties of coal that control coalbed methane production, in D.C. Peters, ed., Geology in coal resource utilization: Fairfax, VA, Techbooks, p. 105-124.
- Espinoza, D.N., J.-M. Pereira, M. Vandamme, P. Dangla, and S. Vidal-Gilbert, 2015, Desorption-induced shear failure of coal bed seams during gas depletion: International Journal of Coal Geology, v. 137, p. 142-151.
- Espinoza, D.N., I. Skovkun, O. Makni, and N. Lenoir, 2016, Natural and induced fractures in coal cores imaged through X-ray computed microtomography — Impact on desorption time: International Journal of Coal Geology, v. 154-155, p. 165-175.
- Espinoza, D.N., M. Vandamme, P. Dangla, J.-M. Pereira, and S. Vidal-Gilbert, 2016, Adsorptive-mechanical properties of reconstituted granular coal: Experimental characterization and poromechanical modeling: International Journal of Coal Geology, v. 162, p. 158-168.
- Ettinger, I., I.L. Lidin, A.M. Dmitriev, and E.S. Zhupakhina, 1958, Systematic handbook for the determination of methane content of coal seams from the seam pressure of the gas and the methane capacity of the coal: Institute of Mining, Academy of Sciences, USSR, USBM Translation No. 1505.
- Ettinger, I., I. Eremin, B. Zimakov, and M. Yanovskaya, 1966, Natural factors influencing coal sorption properties: I. Petrography and sorption properties of coals: Fuel, v. 45, p. 267-275.
- Ettinger, I., I. Eremin, B. Zimakov, and M. Yanovskaya, 1967, Natural factors influencing coal sorption properties: II. Gas capacity of coals found in weathering zone of coal deposits: Fuel, v. 45, p. 277-282.
- Faiz, M.M., 1993, Geological controls on the distribution of coal seam gases in the southern Sydney Basin: University of Wollongong, unpublished PhD thesis, 326 p.
- Faiz, M.M., A. Saghafi, and N. Sherwood, 1999, Higher hydrocarbon gases in southern Sydney Basin coals, in M. Mastalerz, M. Glikson, and S.D. Golding, eds., Coalbed methane: scientific, environmental and economic evaluation: Boston, Kluwer Academic Publishers, p. 233-255.
- Faiz, M., L. Stalker, N. Sherwood, A. Saghafi, M. Wold, S. Barclay, J. Choudhury, W. Barker, and I. Wang, 2003, Bio-enhancement of coal bed methane resources in the southern Sydney Basin: APPEA Journal, v. 43, part 1, p. 595-610.
- Faiz, M.M., 2004, Microbial influences on coal seam gas reservoirs—a review, in Proceedings of the Bac-Min Conference: The Australian Institute of Mining and Metallurgy Publication Series 6, p. 133-142.
- Faiz, M., and P. Hendry, 2006, Significance of microbial activity in Australian coal bed methane reservoirs—a review: Bulletin of Canadian Petroleum Geology, v. 54, p. 261-272.
- Faiz, M., A. Saghafi, N. Sherwood, and I. Wang, 2007, The influence of petrological properties and burial history on coal seam methane reservoir characterization, Sydney Basin, Australia: International Journal of Coal Geology, v. 70, p. 193-208.

- Faiz, M., and P. Henry, 2007, Significance of microbial activity in Australian coal bed methane reservoirs: a review: *Bulletin of Canadian Petroleum Geology*, v. 54, p. 261-272.
- Fallgren, P.H., C. Zeng, Z. Ren, A. Lu, S. Ren, and S. Jin, 2013, Feasibility of microbial production of new natural gas from non-gas-producing lignite: *International Journal of Coal Geology*, v. 115, p. 79-84.
- Fallgren, P.H., S. Jin, C. Zeng, A. Lu, and P.J.S. Colberg, 2013, Comparison of coal rank for enhanced biogenic natural gas production: *International Journal of Coal Geology*, v. 115, p. 92-96.
- Fan, J., Y. Ju, Q. Hou, Y. Wu, and X. Li, 2012, Characterization of coal reservoirs in two major coal fields in northern China: Implications for coalbed methane development: *Journal of Geological Research*, v. 2012, 10 p.
- Fang, C., J. Dai, W. Wu, D. Liu, and Z. Feng, 2016, The Late Paleozoic relative gas fields of coal measure in China and their significances on the natural gas industry: *Journal of Natural Gas Geoscience*, v. 1, p. 457-469.
- Faraj, B.S.M., C.R. Fielding, and I.D.R. MacKinnon, 1996, Cleat mineralization of Upper Permian Baralaba/Rangal coal measures, Bowen Basin, Australia: *Geological Society of London, Special Publication 109*, p. 151-164.
- Faraj, B., A. Hatch, D. Krivak, and P. Smolarchuk, 2004, Mechanism of hydrogen generation in coalbed methane desorption canisters: causes and remedies: *GasTIPS*, v. 10, no. 2, p. 15-19.
- Fassett, J.E., 1987, Geometry and depositional environments of Fruitland Formation coalbeds, San Juan basin, New Mexico and Colorado: anatomy of a giant coalbed methane deposit: Tuscaloosa, Alabama, *Proceedings of the 1987 Coalbed Methane Symposium*, paper 8712, p. 19-35.
- Fassett, J.E., ed., 1988, *Geology and coal-bed methane resources of the northern San Juan basin, Colorado and New Mexico*: Denver, Rocky Mountain Association of Geologists Guidebook, 351 p.
- Fassett, J.E., 1989, Coal-bed methane - a contumacious, free-spirited bridge; the geologic handmaiden of coal beds, *in* J.C. Lorenz and S.G. Lucas, eds., *Energy frontiers in the Rockies*: Albuquerque Geological Society, p. 131-146.
- Fassett, J.E., and B.C. Boyce, 2005, Fractured-sandstone gas reservoirs, San Juan Basin, New Mexico and Colorado: With an overview of Fruitland Formation coalbed methane, *in* M.G. Bishop, S.P. Cumella, J.W. Robinson, and M.R. Silverman, eds., *Gas in low-permeability reservoirs of the Rocky Mountain region*: Rocky Mountain Association of Geologists 2005 Guidebook, p. 109-185.
- Fathi, E., and I.Y. Akkutlu, 2008, Counter-diffusion and competitive adsorption effects during CO₂ injection and coalbed methane production: *SPE Paper 115482*, 15 p.
- Fathi, E., and I.Y. Akkutlu, 2009, Matrix heterogeneity effects on gas transport and adsorption in coalbed and shale gas reservoirs: *Transport in Porous Media*, v. 80, p. 281-304.
- Feng, Q., J. Zhang, X. Zhang, and A. Hu, 2012, Optimizing well placement in a coalbed methane reservoir using the particle swarm optimization algorithm: *International Journal of Coal Geology*, v. 104, p. 34-45.
- Feng, Q., J. Zhang, X. Zhang, C. Shu, S. Wen, S. Wang, and J. Li, 2014, The use of alternating conditional expectation to predict methane sorption capacity on coal: *International Journal of Coal Geology*, v. 121, p. 137-147.
- Feng, Q., J. Liu, Z. Huang, and M. Tian, 2018, Study on the optimization of fracturing parameters and interpretation of CBM fractured wells: *Journal of Natural Gas Geoscience*, v. 3, p. 109-117.
- Feng, R., J. Liu, S. Chen, and S. Bryant, 2018, Effect of gas compressibility on permeability measurement in coalbed methane formations: Experimental investigation and flow modeling: *International Journal of Coal Geology*, v. 198, p. 144-155.

- Feng, Z., D. Zhou, Y. Zhao, and T. Cai, 2016, Study on microstructural changes of coal after methane adsorption: *Journal of Natural Gas Science and Engineering*, v. 30, p. 28-37.
- Feng, Z.-C., T.-T. Cai, D. Zhou, D. Zhao, Y.-S. Zhao, and C. Wang, 2017, Temperature and deformation changes in anthracite coal after methane adsorption: *Fuel*, v. 192, p. 27-34.
- Fensky, C., and M. Yakimov, 2013, Improving evaluation efficiency in CBM formations: Hart Energy Publishing, *E&P*, v. 86, no. 4, p. 70, 72.
- Field, T. W., 2004, Surface to in-seam drilling – the Australian experience: Tuscaloosa, Alabama, University of Alabama, College of Continuing Studies, 2004 International Coalbed Methane Symposium Proceedings, paper 0408, 10 p.
- Fields, H.H., J.H. Perry, and M. Deul, 1975, Commercial-quality gas from a multipurpose borehole located in the Pittsburgh coalbed: U.S. Bureau of Mines, Report of Investigations 8025, 14 p.
- Findley, M., and K. Shirley, 2006, Options for CBM production: Hart Energy Publishing, *E&P*, v. 79, no. 1, p. 70, 72, 74.
- Fisher, J., 2005, CBM is the place to be: *Supplement to Oil and Gas Investor*, v. 25, no. 12, p. 2-7.
- Fisher, J., 2005, CBM technology on the rise: *Supplement to Oil and Gas Investor*, v. 25, no. 12, p. 8-13.
- Fisk, J.C., 2010, Correlating deliverability to seismic attributes in coalbed-methane exploitation: Norman, Oklahoma, University of Oklahoma, unpublished M.S. thesis, 69 p.
- Fitzgerald, J.E., Z. Pan, M. Sudibandriyo, R.L. Robinson, Jr., K.A.M. Gasem, and S. Reeves, 2005, Adsorption of methane, nitrogen, carbon dioxide and their mixtures on wet Tiffany coal: *Fuel*, v. 84, p. 2351-2363.
- Flanery, S.O., and R.J. Morgan, 2014, Legal issues associated with coalbed methane development, in P. Thakur, K. Aminian, and S. Schatzel, eds., *Coal bed methane: from prospect to pipeline*: New York, Elsevier, p. 273-296.
- Flores, R.M., 1993, Coal-bed and related depositional environments in methane gas-producing sequences, in B.E. Law and D.D. Rice, eds., *Hydrocarbons from coal: AAPG Studies in Geology* 38, p. 13-37.
- Flores, R.M., 1998, Coalbed methane: from hazard to resource, in R.M. Flores, ed., *Coalbed methane: from coal-mine outbursts to a gas resource*: International Journal of Coal Geology, v. 35, p. 3-26.
- Flores, R.M., G.D. Stricker, and S.A. Kinney, 2003, Alaska coal resources and coalbed methane potential: U.S. Geological Survey Bulletin 2198, 4 p.
<http://pubs.usgs.gov/bul/b2198/>
- Flores, R.M., 2004, Coalbed methane in the Powder River Basin, Wyoming and Montana: an assessment of the Tertiary-Upper Cretaceous coalbed methane total petroleum system: U.S. Geological Survey, Digital Data Series, DDS-69-c, chapter 2, 56 p.
- Flores, R.M., G.D. Stricker, and S.A. Kinney, 2004, Alaska coal geology, resources, and coalbed methane potential: U.S. Geological Survey Digital Data Series DDS-77, CD-ROM.
- Flores, R.M., C.A. Rice, G.D. Stricker, A. Warden, and M.S. Ellis, 2008, Methanogenic pathways of coal-bed gas in the Powder River Basin, United States: The geologic factor: *International Journal of Coal Geology*, v. 76, p. 52-75.
- Flores, R.M., B.D. Spear, S.A. Kinney, P.A. Purchase, and C.M. Gallagher, 2010, After a century—Revised Paleogene coal stratigraphy, correlation, and deposition, Powder River Basin, Wyoming and Montana: U.S. Geological Survey Professional Paper 1777, 97 p.
- Flores, R.M., 2013, *Coal and coalbed gas, fueling the future*: Elsevier Science, 717 p.

- Forgotson, J.M., and S.A. Friedman, 1993, Arkoma basin (Oklahoma) coal-bed methane resource base and development (abstract): AAPG Annual Convention Official Program, p. 103.
- Formolo, M., A. Martini, and S. Petsch, 2008, Biodegradation of sedimentary organic matter associated with coalbed methane in the Powder River and San Juan basins, U.S.A.: *International Journal of Coal Geology*, v. 76, p. 86-97.
- Freudenberg, U., S. Lou, R. Schlutz, and K. Thomas, 1996, Main factors controlling coalbed methane distribution in the Ruhr District, Germany, *in* R. Gayer and I. Harris, eds., *Coalbed methane and coal geology*: London, Geological Society Special Publication 109, p. 67-88.
- Friedman, S.A., 1982, Determination of reserves of methane from coal beds for use in rural communities in eastern Oklahoma: OGS Special Publication 82-3, 32 p.
- Friedman, S.A., 1989, Coal-bed methane resources in Arkoma basin, southeastern Oklahoma (abstract): *AAPG Bulletin*, v. 73, p. 1046.
- Friedman, S.A., 1991, Fracture and structure of principal coal beds related to coal mining and coalbed methane, Arkoma basin, eastern Oklahoma: AAPG EMD trip 2, AAPG Annual Convention, Dallas, Texas.
- Friedman, S.A., 1997, Coal-bed methane resources and reserves of Osage County, Oklahoma (abstract): *AAPG Bulletin*, v. 81, p. 1350.
- Frost, C.D., B.N. Pearson, K.M. Ogle, E.L. Heffern, and R.M. Lyman, 2002, Sr isotope tracing of aquifer interactions in an area of accelerating coal-bed methane production, Powder River Basin, Wyoming: *Geology*, v. 30, p. 923-926. (water)
- Fu, H., D. Tang, T. Xu, H. Xu, S. Tao, S. Li, Z. Yin, B. Chen, C. Zhang, and L. Wang, 2017, Characteristics of pore structure and fractal dimension of low-rank coal: A case study of Lower Jurassic Xishanyao coal in the southern Junggar Basin, NW China: *Fuel*, v. 193, p. 254-264.
- Fu, H., D. Tang, T. Xu, H. Xu, S. Tao, J. Zhao, B. Chen, and Z. Yin, 2017, Preliminary research on CBM enrichment models of low-rank coal and its geological controls: A case study in the middle of the southern Junggar Basin, NW China: *Marine and Petroleum Geology*, v. 83, p. 97-110.
- Fu, H., D. Tang, Z. Pan, D. Yan, S. Yang, X. Zhuang, G. Li, X. Chen, and G. Wang, 2019, A study of hydrogeology and its effect on coalbed methane enrichment in the southern Junggar Basin, China: *AAPG Bulletin*, v. 103, p. 189-213.
- Fu, X., Y. Qin, G.G.X. Wang, and V. Rudolph, 2009, Evaluation of gas content of coalbed methane reservoirs with the aid of geophysical logging technology: *Fuel*, v. 88, p. 2269-2277.
- Fu, X., Y. Qin, G.G.X. Wang, and V. Rudolph, 2009, Evaluation of coal structure and permeability with the aid of geophysical logging technology: *Fuel*, v. 88, p. 2278-2285.
- Fuertes, J., V. Nguyen, J.D. McLennan, D.J. Adams, K.-B. Han, and T.D. Sparks, 2017, Optimization of biogenic methane production from coal: *International Journal of Coal Geology*, v. 183, p. 14-24.
- Fuertes, J., G. Córdoba, J.D. McLennan, D.J. Adams, and T.D. Sparks, 2018, Potential application of developed methanogenic microbial consortia for coal biogasification: *International Journal of Coal Geology*, v. 188, p. 165-180.
- Furmann, A., A. Schimmelmann, S.C. Brassell, M. Mastalerz, and F. Picardal, 2013, Chemical compound classes supporting microbial methanogenesis in coal: *Chemical Geology*, v. 339, p. 226-241.
- Fuyuan, M., Z. Weizhi, Z. Xianliang, C. Changbo, C. Yanpeng, Z. Jie, and W. Bo, 2015, Strategies for the development of CBM gas industry in China: *Natural Gas Industry B*, v. 2, p. 383-389.
- Gaddy, D.E., 1999, Coalbed methane production shows wide range of variability: *Oil & Gas Journal*, v. 97, no. 17, p. 41-42.

- Gal, N.L., V. Lagneau, and A. Charmoille, 2012, Experimental characterization of CH₄ release from coal at high hydrostatic pressure: *International Journal of Coal Geology*, v. 96-97, p. 82-92.
- Gallagher, L.K., A.W. Glossner, L.L. Landkamer, L.A. Figueroa, K.W. Mandernack, and J. Munakata-Marr, 2013, The effect of coal oxidation on methane production and microbial community structure in Powder River Basin coal: *International Journal of Coal Geology*, v. 115, p. 71-78.
- Gamson, P.D., B.B. Beamish, and D.P. Johnson, 1993, Coal microstructure and micropermeability and their effects on natural gas recovery: *Fuel*, v. 72, p. 87-99.
- Gamson, P., B. Beamish, and D. Johnson, 1996, Coal microstructure and secondary mineralization: their effect on methane recovery, in R. Gayer and I. Harris, eds., *Coalbed methane and coal geology*: London, Geological Society Special Publication 109, p. 165-179.
- Gan, H., S.P. Nandi, and P.L. Walker, Jr., 1972, Nature of porosity in American coals: *Fuel*, v. 51, p. 272-277.
- Gao, L., S.C. Brassell, M. Mastalerz, and A. Schimmelmann, 2013, Microbial degradation of sedimentary organic matter associated with shale gas and coalbed methane in eastern Illinois Basin (Indiana), USA: *International Journal of Coal Geology*, v. 107, p. 152-164.
- Gao, L., M. Mastalerz, and A. Schimmelmann, 2014, The origin of coalbed methane, in P. Thakur, K. Aminian, and S. Schatzel, eds., *Coal bed methane: from prospect to pipeline*: New York, Elsevier, p. 7-29.
- García, C.P., M.I. Álvarez Fernández, C. González Nicieza, A.E. Álvarez Vigil, and F. López Gayarre, 2010, Storage of N₂, He and CH₄ in coal: Study and application in a practical case in the central Asturian coal basin (northern Spain): *International Journal of Coal Geology*, v. 81, p. 53-63.
- Garcia-Gonzalez, M., D.B. MacGowan, and R.C. Surdam, 1993, Coal as a source rock of petroleum and gas - a comparison between natural and artificial maturation of the Almond Formation coals, Greater Green River basin in Wyoming, in D.G. Howell, ed., *The future of energy gases*: USGS Professional Paper 1570, p. 405-437.
- Garner, C., G. Fiqueneisel, T. Zimny, Z. Pokryszka, S. Lafortune, P.D.C. Défossez, and E.C. Gaucher, 2011, Selection of coals of different maturities for CO₂ storage by modeling of CH₄ and CO₂ adsorption isotherms: *International Journal of Coal Geology*, v. 87, p. 80-86.
- Garrison, T., J.M.K. O'Keefe, K.R. Henke, G.C. Copley, D.R. Blake, and J.C. Hower, 2017, Gaseous emissions from the Lotts Creek coal mine fire: Perry County, Kentucky: *International Journal of Coal Geology*, v. 180, p. 57-66.
- Gasem, K.A.M., J.E. Fitzgerald, Z. Pan, M. Sudibandriyo, and R.L. Robinson, 2002, Modeling of gas adsorption on coalbeds (abstract): AAPG Annual Convention Official Program, v. 11, p. A60-61.
- Gash, B.W., 1991, Measurement of "rock properties" in coal for coalbed methane production: SPE paper 22909.
- Gaschnitz, R., B.M. Krooss, and R. Littke, 1997, Coalbed methane: adsorptive gas storage capacity of coal seams in the Upper Carboniferous of the Ruhr basin, Germany (extended abstract): TSOP, Abstracts and Program, v. 14, p. 42-44.
- Gatnar, K., and A. Tor, 2003, Drainage and economic utilization of methane from coal seams in the Jastrzebie mining field: *Applied Energy*, v. 74, p. 331-341.
- Gayer, R. and I. Harris, eds., 1996, *Coalbed methane and coal geology*: London, Geological Society Special Publication 109, 344 p.
- Gensterblum, Y., A. Merkel, A. Busch, B.M. Krooss, and R. Littke, 2014, Gas saturation and CO₂ enhancement potential of coalbed methane reservoirs as a function of depth: AAPG Bulletin, v. 98, p. 395-420. (CO₂-ECBM)

- Gensterblum, Y., A. Merkel, A. Busch, and B.M. Krooss, 2013, High-pressure CH₄ and CO₂ sorption isotherms as a function of coal maturity and the influence of moisture: *International Journal of Coal Geology*, v. 118, p. 45-57.
- Gentzis, T., 2000, Subsurface sequestration of carbon dioxide — an overview from an Alberta (Canada) perspective: *International Journal of Coal Geology*, v. 43, p. 287-305.
- Gentzis, T., 2006, Economic coalbed methane production in the Canadian Foothills: solving the puzzle: *International Journal of Coal Geology*, v. 65, p. 79-92.
- Gentzis, T., D. Schoderbek, and S. Pollock, 2006, Evaluating the coalbed methane potential of the Gething coals in NE British Columbia, Canada: an example from the Highhat area, Peace River coalfield: *International Journal of Coal Geology*, v. 68, p. 135-150.
- Gentzis, T., K. Murray, R. Klinger, and M. Santillan, 2006, Horizontal degasification and characterization of coals in the Sabinas sub-basin, Mexico: implications for CBM production: *Bulletin of Canadian Petroleum Geology*, v. 54, p. 221-237.
- Gentzis, T., N. Deisman, and R.J. Chalaturnyk, 2007, Geomechanical properties and permeability of coals from the Foothills and Mountain regions of western Canada: *International Journal of Coal Geology*, v. 69, p. 153-164.
- Gentzis, T., and D. Bolen, 2008, The use of numerical simulation in predicting coalbed methane producibility from the Gates coal, Alberta Inner Foothills, Canada: Comparison with Mannville coal CBM production in the Alberta Syncline: *International Journal of Coal Geology*, v. 74, p. 215-236.
- Gentzis, T., F. Goodarzi, F.K. Cheung, and F. Laggoun-Défarge, 2008, Coalbed methane producibility from the Mannville coals in Alberta, Canada: A comparison of two areas: *International Journal of Coal Geology*, v. 74, p. 237-249.
- Gentzis, T., 2009, Stability analysis of a horizontal coalbed methane well in the Rocky Mountain Front Ranges of southeast British Columbia, Canada: *International Journal of Coal Geology*, v. 77, p. 328-337.
- Gentzis, T., N. Deisman, and R.J. Chalaturnyk, 2009, A method to predict geomechanical properties and model well stability in horizontal boreholes: *International Journal of Coal Geology*, v. 78, p. 149-160.
- Gentzis, T., N. Deisman, and R.J. Chalaturnyk, 2009, Effect of drilling fluids on coal permeability: Impact on horizontal wellbore stability: *International Journal of Coal Geology*, v. 78, p. 177-191.
- Gentzis, T., 2010, Coalbed natural gas activity in western Canada: The emergence of major unconventional gas industry in an established conventional province, *in* K.J. Reddy, ed., *Coalbed natural gas, energy and environment*: New York, Nova Science Publishers, p. 377-399.
- Gentzis, T., 2013, Coalbed methane potential of the Paleocene Fort Union coals in south-central Wyoming, USA: *International Journal of Coal Geology*, v. 108, p. 27-34.
- George, J.D.St., and M.A. Barakat, 2001, The change in effective stress associated with shrinkage from gas desorption in coal: *International Journal of Coal Geology*, v. 45, p. 105-113.
- Gerami, A., P. Mostaghimi, R.T. Armstrong, A. Zamani, and M. Ebrahimi Warkiani, 2016, A microfluidic framework for studying relative permeability in coal: *International Journal of Coal Geology*, v. 159, p. 183-193.
- Ghosh, S., P. Jha, and A.S. Vidyarthi, 2014, Unraveling the microbial interactions in coal organic fermentation for generation of methane — A classical to metagenomic approach: *International Journal of Coal Geology*, v. 125, p. 36-44.
- Ghosh, S., S.D. Golding, A.K. Varma, and K.A. Baublys, 2018, Stable isotopic composition of coal bed gas and associated formation water samples from

- Raniganj Basin, west Bengal, India: *International Journal of Coal Geology*, v. 191, p. 1-6.
- Giffin, S., R. Littke, J. Klaver, and J.L. Urai, 2013, Application of BIB-SEM technology to characterize macropore morphology in coal: *International Journal of Coal Geology*, v. 114, p. 85-95.
- Gilleland, K., 2008, Growing coalbed assets: An Investor's Guide to Unconventional Gas: Shales and Coalbed Methane, Supplement to *Oil & Gas Investor*, January 2008, p. 32-37.
- Ginsberg, S., 2012, EPA considers rule for shale gas and CBM water discharges: *American Oil & Gas Reporter*, v. 55, no. 1, p. 27.
- Glass, G.B., and R.M. Lyman, 1998, Geology of Wyoming's Powder River Basin coalfield: *Mining Engineering*, v. 50, no. 7, p. 33-39.
- Glikson, M., C.J. Boreham, and D.S. Thiede, 1999, Coal composition and mode of maturation, a determining factor in quantifying hydrocarbon species generated, *in* M. Mastalerz, M. Glikson, and S.D. Golding, eds., *Coalbed methane: scientific, environmental and economic evaluation*: Boston, Kluwer Academic Publishers, p. 155-185. (bitumen)
- Glossner, A.W., L.K. Gallagher, L. Landkamer, L. Figueroa, J. Munakata-Marr, and K.W. Mandernack, 2016, Factors controlling the co-occurrence of microbial sulfate reduction and methanogenesis in coal bed reservoirs: *International Journal of Coal Geology*, v. 165, p. 121-132. (biogenic)
- Golding, S.D., K.A. Baublys, M. Glikson, I.T. Uysal, and C.J. Boreham, 1999, Source and timing of coal seam gas generation in Bowen basin coals, *in* M. Mastalerz, M. Glikson, and S.D. Golding, eds., *Coalbed methane: scientific, environmental and economic evaluation*: Boston, Kluwer Academic Publishers, p. 257-269. (carbon isotope composition)
- Golding, S.D., C.J. Boreham, and J.S. Esterle, 2013, Stable isotope geochemistry of coal bed and shale gas and related production waters: A review: *International Journal of Coal Geology*, v. 120, p. 24-40.
- Golombok, M., and D. Nikolic, 2008, Assessing contaminated gas: *Hart's E&P*, v. 81, no. 6, p. 73-75.
- Gong, D., Y. Wang, M. Yuan, C. Liu, J. Mi, S. Lu, and L. Zhao, 2017, Genetic types and origins of natural gases from eastern Fukang sub-depression of the Junggar Basin, NW China: Implication for low-mature coal-derived gases: *Journal of Natural Gas Geoscience*, v. 2, p. 179-189.
- Gong, D., J. Li, I. Ablimit, W. He, S. Lu, D. Liu, and C. Fang, 2018, Geochemical characteristics of natural gases related to Late Paleozoic coal measures in China: *Marine and Petroleum Geology*, v. 96, p. 474-500.
- Goodman, A.L., A. Busch, G.J. Duffy, J.E. Fitzgerald, K.A.M. Gasem, Y. Gensterblum, B.M. Krooss, J. Levy, E. Ozdemir, Z. Pan, R.L. Robinson, Jr., K. Schroeder, M. Sudibandriyo, and C. White, 2004, An inter-laboratory comparison of CO₂ isotherms measured on Argonne premium coal samples: *Energy and Fuels*, v. 18, p. 1175-1182.
- Gossling, J.M., 1994, Coalbed methane potential of the Hartshorne coals in parts of Haskell, Latimer, LeFlore, McIntosh, and Pittsburg Counties, Oklahoma: Norman, University of Oklahoma, unpublished M.S. thesis, 155 p.
- Gray, I., 1992, Reservoir engineering in coal seams: Part 1 — the physical process of gas storage and movement in coal seams, *in* *Coalbed methane*: Society of Petroleum Engineers, Reprint Series 35, p. 7-13.
- Gray, I., 1987, Reservoir engineering in coal seam: Part 2 — observations of gas movement in coal seams: *SPE Reservoir Engineering*, v. 2, p. 35-40.

- GRI, 1989, GRI publications on coalbed methane: GRI Quarterly Review of Methane from Coal Seams Technology, v. 7, nos. 1-2, p. 13-19.
- GRI, 1989, Coalbed methane information sources: GRI Quarterly Review of Methane from Coal Seams Technology, v. 7, nos. 1-2, p. 20-26.
- GRI, 1991, Cherokee basin, Kansas and Oklahoma: Quarterly Review of Methane from Coal Seams Technology, v. 8, no. 2, p. 2.
- GRI, 1992, Arkoma basin, Oklahoma and Arkansas: Quarterly Review of Methane from Coal Seams Technology, v. 9, nos. 3-4, p. 2.
- GRI, 1992, Cherokee basin, Kansas and Oklahoma: Quarterly Review of Methane from Coal Seams Technology, v. 9, nos. 3-4, p. 5.
- GRI, 1993, Western Interior coal region (Arkoma, Cherokee, and Forest City basins): Quarterly Review of Methane from Coal Seams Technology, v. 11, no. 1, p. 43-48.
- GRI, 1994, Open-hole cavity completions, fracturing, and restimulation: Quarterly Review of Methane from Coal Seams Technology, v. 11, nos. 3-4, 55 p.
- Grau, R.H., III, and J.C. LaScola, 1984, Methane emissions from U.S. coal mines in 1980: U.S. Bureau of Mines Information Circular 8987, 13 p.
- Graves, S.L., A.F. Patton, and W.M. Beavers, 1983, Multiple zone coal degasification potential in the Warrior coal field of Alabama: Gulf Coast Association of Geological Societies Transactions, v. 33, p. 275-280.
- Gray, I., 1987, Reservoir engineering in coal seams: part 1. The physical process of gas storage and movement in coal seams: SPE Reservoir Engineering, v. 2, p. 28-34.
- Green, M.S., K.C. Flanagan, and P.C. Gilcrease, 2008, Characterization of a methanogenic consortium enriched from a coalbed methane well in the Powder River Basin, U.S.A.: International Journal of Coal Geology, v. 76, p. 34-45.
- Grimm, R.P., K.A. Eriksson, N. Ripepi, C. Eble, and S.F. Greb, 2012, Seal evaluation and confinement screening criteria for beneficial carbon dioxide storage with enhanced coal bed methane recovery in the Pocahontas Basin, Virginia: International Journal of Coal Geology, v. 90-91, p. 110-125.
- Groshong, R. H., Jr., M. H. Cox, J. C. Pashin, and M. R. McIntyre, 2003, Relationship between gas and water production and structure in southeastern Deerlick Creek coalbed methane field, Black Warrior basin, Alabama: Tuscaloosa, Alabama, University of Alabama College of Continuing Studies, 2003 International Coalbed Methane Symposium Proceedings, Paper 0306, 12 p.
- Grout, M.A., 1991, Cleats in coalbeds of southern Piceance basin, Colorado - correlation with regional and local fracture sets in associated clastic rocks, in S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., Coalbed methane of western North America: Denver, Rocky Mountain Association of Geologists, p. 35-47.
- Grubb, W.A., 2003, 'Purpose-fit' technologies key part of equation for CBM production economics: American Oil & Gas Reporter, v. 46, no. 1, p. 131-135.
- Grzybek, I., 1999, Residual gas content of coal in the light of observations from the Upper Silesian coal basin, Poland, in M. Mastalerz, M. Glikson, and S.D. Golding, eds., Coalbed methane: scientific, environmental and economic evaluation: Boston, Kluwer Academic Publishers, p. 139-153.
- Guan, C., S. Liu, C. Li, Y. Wang, and Y. Zhao, 2017, The temperature effect on the methane and CO₂ adsorption capacities of Illinois coal: Fuel, v. 211, p. 241-250.
- Guanhua, N., D. Kai, L. Shang, and S. Qian, 2019, Gas desorption characteristics effected by the pulsating hydraulic fracturing in coal: Fuel, v. 236, p. 190-200.
- Guo, H., R. Liu, Z. Yu, H. Zhang, J. Yun, Y. Li, X. Lu, and J. Pan, 2012, Pyrosequencing reveals the dominance of methylotrophic methanogenesis in a coal bed methane reservoir associated with eastern Ordos Basin in China: International Journal of Coal Geology, v. 93, p. 56-61.

- Guo, H., Z. Yu, and H. Zhang, 2015, Phylogenetic diversity of microbial communities associated with coalbed methane gas from eastern Ordos Basin, China: *International Journal of Coal Geology*, v. 150-151, p. 120-126.
- Guo, J., T. Kang, J. Kang, Z. Chai, and G. Zhao, 2014, Accelerating methane desorption in lump anthracite modified by electrochemical treatment: *International Journal of Coal Geology*, v. 131, p. 392-399.
- Guo, J.-C., R.-S. Nie, and Y.-L. Jia, 2014, Unsteady-state diffusion modeling of gas in coal matrix for horizontal well production: *American Association of Petroleum Geologists Bulletin*, v. 98, p. 1669-1697.
- Guo, X., Q. Yan, and A. Wang, 2019, Evaluation of relative permeability in coalbed methane reservoirs based on production data: A case study in Qinshui Basin, China: *Natural Resources Research*, v. 28, p. 187-198.
- Guo, Z., F. Hussain, and Y. Cinar, 2015, Permeability variation associated with fines production from anthracite coal during water injection: *International Journal of Coal Geology*, v. 147-148, p. 46-57.
- Guo, Z., P.N.H. Vu, and F. Hussain, 2018, A laboratory study of the effect of creep and fines migration on coal permeability during single-phase flow: *International Journal of Coal Geology*, v. 200, p. 61-76.
- Guoyi, H., L. Jin, S. Xiuqin, and H. Zhongxi, 2010, The origin of natural gas and the hydrocarbon charging history of the Yulin gas field in the Ordos Basin, China: *International Journal of Coal Geology*, v. 81, p. 381-391.
- Guoyi, H., Z. Shuichang, L. Jin, L. Jijun, and H. Zhongxi, 2010, The origin of natural gas in the Hutubi gas field, southern Junggar foreland sub-basin, NW China: *International Journal of Coal Geology*, v. 84, p. 301-310.
- Gurba, L.W., and C.R. Ward, 1999, The influence of depositional and maturation factors on the three-dimensional distribution of coal rank indicators and hydrocarbon source potential in the Gunnedah basin, New South Wales, in M. Mastalerz, M. Glikson, and S.D. Golding, eds., *Coalbed methane: scientific, environmental and economic evaluation*: Boston, Kluwer Academic Publishers, p. 493-515.
- Gurba, L.W., and C.R. Weber, 2000, Coal petrology and coalbed methane occurrence in the Gloucester basin, NSW, Australia (abstract): *TSOP Abstracts and Program*, v. 17, p. 47.
- Gurba, L.W., and C.R. Weber, 2001, The relevance of coal petrology to coalbed methane evaluation, using the Gloucester basin, Australia as a model: Tuscaloosa, Alabama, *Proceedings, International Coalbed Methane Symposium*, Paper 147, p. 371-382.
- Gurba, L.W., and C.R. Weber, 2001, Effects of igneous intrusions on coalbed methane potential, Gunnedah basin, Australia: *International Journal of Coal Geology*, v. 46, p. 113-131.
- Gürdal, G., and M.N. Yalçın, 2000, Gas adsorption capacity of Carboniferous coals in the Zonguldak basin (NW Turkey) and its controlling factors: *Fuel*, v. 79, p. 1913-1924.
- Gürdal, G., and M.N. Yalçın, 2001, Pore volume and surface area of the Carboniferous coals from the Zonguldak basin (NW Turkey) and their variations with rank and maceral composition: *International Journal of Coal Geology*, v. 48, p. 133-144.
- Gutierrez-Zamora, M.-L., M. Lee, M. Manefield, and T. Thomas, 2015, Biotransformation of coal linked to nitrification: *International Journal of Coal Geology*, v. 137, p. 136-141. (biogenic methane)
- Hackley, P.C., and P.D. Warwick, 2005, Organic petrography of coals from a coalbed methane test well, Ouachita Parish, Louisiana: *USGS Open-File Report 2005-1134*, 20 p.

- Hackley, P.C., P.D. Warwick, and F.C. Breland Jr., 2007, Organic petrology and coalbed gas content, Wilcox Group (Paleocene-Eocene), northern Louisiana: *International Journal of Coal Geology*, v. 71, p. 54-71.
- Hackley, P.C., E.H. Guevara, T.F. Hentz, and R.W. Hook, 2009, Thermal maturity and organic composition of Pennsylvanian coals and carbonaceous shales, north-central Texas: Implications for coalbed gas potential: *International Journal of Coal Geology*, v. 77, p. 294-309.
- Hackley, P.C., P.D. Warwick, R.W. Hook, H. Alimi, M. Mastalerz, and S.M. Swanson, 2012, Organic geochemistry and petrology of subsurface Paleocene-Eocene Wilcox and Claiborne Group coal beds, Zavala County, Maverick Basin, Texas, USA: *Organic Geochemistry*, v. 46, p. 137-153.
- Hacquebard, P.A., 2002, Potential coalbed methane resources in Atlantic Canada: *International Journal of Coal Geology*, v. 52, p. 3-28.
- Hagler, C., and N.P. Boyaci, 2010, New hydraulic lift system overcomes beam pump challenges in CBM wells: *World Oil*, v. 231, no. 10, p. 77-82.
- Hakimi, M.H., W.H. Abdullah, S.-G. Sia, and Y.M. Makeen, 2013, Organic geochemical and petrographic characteristics of Tertiary coals in the northwest Sarawak, Malaysia: Implications for palaeoenvironmental conditions and hydrocarbon generation potential: *Marine and Petroleum Geology*, v. 48, p. 31-46.
- Hamilton, S.K., J.S. Esterle, and S.D. Golding, 2012, Geological interpretation of gas content trends, Walloon Subgroup, eastern Surat Basin, Queensland, Australia: *International Journal of Coal Geology*, v. 101, p. 21-35.
- Hamilton, S.K., S.D. Golding, K.A. Baublys, and J.S. Esterle, 2014, Stable isotopic and molecular composition of desorbed coal seam gases from the Walloon Subgroup, eastern Surat Basin, Australia: *International Journal of Coal Geology*, v. 122, p. 21-36.
- Hamilton, S.K., S.D. Golding, K.A. Baublys, and J.S. Esterle, 2015, Conceptual exploration targeting for microbially enhanced coal bed methane (MECoM) in the Walloon Subgroup, eastern Surat Basin, Australia: *International Journal of Coal Geology*, v. 138, p. 68-82.
- Han, F., A. Busch, N. van Wageningen, J. Yang, Z. Liu, and B.M. Krooss, 2010, Experimental study of gas and water transport processes in the inter-cleat (matrix) system of coal: anthracite from Qinshui Basin, China: *International Journal of Coal Geology*, v. 81, p. 128-138.
- Han, F., G. Chen, Z. Liu, and J. Yang, 2016, Correlation of swelling and sorption properties of block coal sample: *Fuel*, v. 188, p. 452-461. (ECBM)
- Haq, S.R., S. Tamamura, A. Ueno, S. Tamazawa, N. Aramaki, T. Murakami, A.K.M. Badrul Alam, T. Igarashi, and K. Kaneko, 2018, Biogenic methane generation using solutions from column reactions of lignite with hydrogen peroxide: *International Journal of Coal Geology*, v. 197, p. 66-73.
- Harpalani, S., and X. Zhao, 1989, An investigation of the effect of gas desorption on coal permeability: *Proceedings of the 1989 Coalbed Methane Symposium*, paper 8923, p. 57-64.
- Harpalani, S., and R. Schraufnagel, 1990, Shrinkage of coal matrix with release of gas and its impact on permeability of coal: *Fuel*, v. 69, p. 551-556.
- Harpalani, S., and X. Zhao, 1991, Microstructure of coal and its influence on flow of gas: *Energy Sources*, v. 13, p. 229-242.
- Harpalani, S., and G. Chen, 1992, Effect of gas production on porosity and permeability of coal, in B.B. Beamish, and P.D. Gamson, eds., *Symposium on coalbed methane: Townsville, Australia*, v. 4, p. 67.
- Harpalani, S., and G. Chen, 1993, Gas slippage and matrix shrinkage effects on coal permeability: Tuscaloosa, Alabama, *Proceedings of the 1993 International Coalbed Methane Symposium*, paper 9325, p. 285-294.

- Harpalani, S., and G. Chen, 1997, Influence of gas production induced volumetric strain on permeability of coal: *Geotechnical and Geological Engineering*, v. 15, p. 303-325.
- Harper, D., 1991, Coalbed methane in Indiana: *Indiana Geological Survey Occasional Paper 56*, 18 p.
- Harris, L.A., and C.S. Yost, 1976, Transmission electron microscope observation of porosity in coal: *Fuel*, v. 55, p. 233-236.
- Harris, S.H., R.L. Smith, and C.E. Barker, 2008, Microbial and chemical factors influencing methane production in laboratory incubations of low-rank subsurface coals: *International Journal of Coal Geology*, v. 76, p. 46-51.
- Harrison, S.M., T. Gentzis, and M. Payne, 2006, Hydraulic, water quality, and isotopic characterization of Late Cretaceous-Tertiary Ardley coal waters in a key test-well, Pembina-Warburg exploration area, Alberta, Canada: *Bulletin of Canadian Petroleum Geology*, v. 54, p. 238-260.
- Hatch, J.R., 1992, Hydrocarbon source-rock evaluation of Desmoinesian (Middle Pennsylvanian) coals from part of the Western Region of the Interior Coal Province, U.S.A. (abstract): *AAPG 1992 Annual Convention Official Program*, p. 53.
- Hatch, J.R., and M.J. Pawlewicz, 2007, Petroleum assessment of the Pottsville Coal Total Petroleum System, Black Warrior Basin, Alabama and Mississippi: *U.S. Geological Survey Digital Data Series DDS-69-I*, chapter 4, 33 p.
- Hathaway, T. M., and R. A. Gayer, 1996, Thrust-related permeability in the South Wales coalfield: *Geological Society of London Special Publication 109*, p. 121-132.
- He, M.C., C.G. Wang, J.L. Feng, D.J. Li, and G.Y. Zhang, 2010, Experimental investigations on gas desorption and transport in stressed coal under isothermal conditions: *International Journal of Coal Geology*, v. 83, p. 377-386.
- Heim, S., S.A. Jurisch, B.M. Krooss, P. Weniger, and R. Littke, 2012, Systematics of pyrolytic N₂ and CH₄ release from peat and coals of different thermal maturity: *International Journal of Coal Geology*, v. 89, p. 84-94.
- Hemborg, H.T., 1998, Spanish Peak field, Las Animas County, Colorado: geologic setting and early development of a coalbed methane reservoir in the central Raton basin: *Colorado Geological Survey, Resource Series 33*, 34 p.
- Hemish, L.A., 2002, Surface to subsurface correlation of methane-producing coal beds, northeast Oklahoma shelf: *OGS Special Publication 2002-2*, 22 p.
- Hemza, P., M. Sivek, and J. Jirásek, 2009, Factors influencing the methane content of coal beds of the Czech part of the Upper Silesian coal basin, Czech Republic: *International Journal of Coal Geology*, v. 79, p. 29-39.
- Henderson, J.D., 1991, Evaluation of coalbed methane potential of Recluse Muddy field, Campbell County, Wyoming, in S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., *Coalbed methane of western North America*: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 191-200.
- Henry, M.E., and T.M. Finn, 2003, Evaluation of undiscovered natural gas in the Upper Cretaceous Ferron coal/Wasatch Plateau total petroleum system, Wasatch Plateau and Castle Valley, Utah: *International Journal of Coal Geology*, v. 56, p. 3-37.
- Heriawan, M.N., and K. Koike, 2015, Coal quality related to microfractures identified by CT image analysis: *International Journal of Coal Geology*, v. 140, p. 97-110.
- Hewitt, J.L., 1984, Geologic overview, coal, and coalbed methane resources of the Warrior basin, Alabama and Mississippi, in C.T. Rightmire, G.E. Eddy, and J.N. Kirr, eds., *Coalbed methane resources of the United States: AAPG Studies in Geology 17*, p. 73-104.

- Higgs, M.D., 1986, Laboratory studies into the generation of natural gas from coals, in J. Brooks, J.C. Goff, and B. van Hoorn, eds., *Habitat of Paleozoic gas in N.W. Europe: Geological Society Special Publication 23*, p. 113-120.
- Hildenbrand, A., B.M. Krooss, A. Busch, and R. Gaschnitz, 2006, Evolution of methane sorption capacity of coal seams as a function of burial history—a case study from the Campine Basin, NE Belgium: *International Journal of Coal Geology*, v. 66, p. 179-203.
- Hill, D.G., C.R. Nelson, and C.F. Brandenburg, 2000, Coalbed methane “frontier” expanding: *American Oil & Gas Reporter*, v. 43, no. 5, p. 83-85.
- Hill, R., 2002, CBM: converting a resource into energy: *World Coal*, v. 11, p. 50-51, 53.
- Hoffman, G.K., and B.S. Brister, 2003, New Mexico’s Raton Basin coalbed methane play: *New Mexico Geology*, v. 25, no. 4, p. 95-110.
- Hol, S. C.J. Peach, and C.J. Spiers, 2011, Applied stress reduces the CO₂ sorption capacity of coal: *International Journal of Coal Geology*, v. 85, p. 128-142.
- Hol, S., Y. Gensterblum, and P. Massarotto, 2014, Sorption and changes in bulk modulus of coal—experimental evidence and governing mechanisms for CBM and ECBM applications: *International Journal of Coal Geology*, v. 128-129, p. 119-133.
- Holder, D., 2006, Illinois Basin’s mature areas yielding new potential: *American Oil & Gas Reporter*, v. 49, no. 6, p. 133-136.
- Holder, D., 2006, Eastern Kansas coals hold years of production: *American Oil & Gas Reporter*, v. 49, no. 11, p. 129-131.
- Holder, D., 2007, Admiral Bay finds the compression key that is unlocking eastern Kansas coals: *American Oil & Gas Reporter*, v. 50, no. 5, p. 104-114.
- Holditch, S.A., R.H. Carter, and J.W. Ely, 1989, Coal seam stimulation manual: Gas Research Institute, Topical Report, GRI Contract No. 5087-214-1469.
- Holditch, S.A., 1992, Completion methods in coal seam reservoirs, in *Coalbed methane: Society of Petroleum Engineers, Reprint Series 35*, p. 102-111.
- Holditch, S.A., J.W. Ely, M.E. Semmelbeck, R.H. Carter, J. Hinkel, and R.G. Jeffrey, Jr., 1992, Enhanced recovery of coalbed methane through hydraulic fracturing, in *Coalbed methane: Society of Petroleum Engineers, Reprint Series 35*, p. 147-155.
- Hollub, V.A., and P.S. Schafer, 1992, A guide to coalbed methane operations: Gas Research Institute, 366 p.
- Holz, M., W. Kalkreuth, and S.B.A. Rolim, 2010, Extension of the Paraná Basin to offshore Brazil: Implications for coalbed methane evaluation: *Marine and Petroleum Geology*, v. 27, p. 1119-1132.
- Hoşgörmez, H., M.N. Yalçın, B. Cramer, P. Gerling, E. Faber, R.G. Schaefer, and U. Mann, 2002, Isotopic and molecular composition of coal-bed gas in the Amasra region (Zonguldak basin—western Black Sea): *Organic Geochemistry*, v. 33, p. 1429-1439.
- Hoth, P., B. Mingram, V. Lüders, and E.P. Müller, 2002, New indications for the genesis and migration of nitrogen-rich gases in northern Germany—fluid inclusion and nitrogen geochemistry studies of Permo-Carboniferous rocks: *Erdöl Erdgas Kohle*, v. 118, p. 566-571. (English abstract)
- Hou, Q., Y. Ju, J. Aitchison, H. Zhang, and Y. Wu, 2012, Tectonic history and coalbed gas genesis: *Journal of Geological Research*, v. 2012, 1 p.
- Hou, S., X. Wang, X. Wang, Y. Yuan, X. Zhuang, and X. Wang, 2016, Geological controls on gas saturation in the Yanchuannan coalbed methane field, southeastern Ordos Basin, China: *Marine and Petroleum Geology*, v. 78, p. 254-270.

- Hou, S., X. Wang, X. Wang, Y. Yuan, S. Pan, and X. Wang, 2017, Pore structure characterization of low volatile bituminous coals with different particle size and tectonic deformation using low pressure gas adsorption: *International Journal of Coal Geology*, v. 183, p. 1-13.
- Hu, G., W. Peng, and C. Yu, 2017, Insight into the C8 light hydrocarbon compositional differences between coal-derived and oil-associated gases: *Journal of Natural Gas Geoscience*, v. 2, p. 157-163.
- Huang, F., Y. Kang, L. You, X. Li, and Z. You, 2018, Massive fines detachment induced by moving gas-water interfaces during early stage two-phase flow in coalbed methane reservoirs: *Fuel*, v. 222, p. 193-206.
- Huang, H., J. Yang, Y. Yang, and X. Du, 2004, Geochemistry of natural gases in deep strata of the Songliao Basin, NE China: *International Journal of Coal Geology*, v. 58, p. 231-244.
- Huang, H., S. Sang, Y. Miao, Z. Dong, and H. Zhang, 2017, Trends of ionic concentration variations in water coproduced with coalbed methane in the Tiefa Basin: *International Journal of Coal Geology*, v. 182, p. 32-41.
- Huang, S., X. Fang, D. Liu, C. Fang, and T. Huang, 2015, Natural gas genesis and sources in the Zizhou gas field, Ordos Basin, China: *International Journal of Coal Geology*, v. 152, p. 132-143.
- Huang, S., D. Liu, Y. Cai, and Q. Gan, 2019, *In situ* stress distribution and its impact on CBM reservoir properties in the Zhengzhuang area, southern Qinshui Basin, north China: *Journal of Natural Gas Science and Engineering*, v. 61, p. 83-96.
- Huang, Z., M.A. Urynowicz, and P.J.S. Colberg, 2013, Bioassay of chemically treated subbituminous coal derivatives using *Pseudomonas putida* F1: *International Journal of Coal Geology*, v. 115, p. 97-105.
- Humphrey, H.B., 1959, Historical summary of coal-mine explosions in the United States: U.S. Bureau of Mines Information Circular 7900, 275 p.
- Huy, P.Q., K. Sasaki, Y. Sugai, and S. Ichikawa, 2010, Carbon dioxide gas permeability of coal core samples and estimation of fracture aperture width: *International Journal of Coal Geology*, v. 83, p. 1-10.
- Hyman, L.A., M.L. Brugler, D.H. Daneshjou, and H.A. Ohen, 1992, Advances in laboratory measurement techniques of relative permeability and capillary pressure for coal seams: *Quarterly Review of Methane from Coal Seams Technology*, v. 9, no. 2, p. 9-16.
- Iannacchione, A.T., and D.G. Puglio, 1979, Geology of the Lower Kittanning coalbed and related mining and methane emission problems in Cambria County, Pa: U.S. Bureau of Mines, Report of Investigations 8354, 31 p.
- Iannacchione, A.T., and D.G. Puglio, 1979, Methane content and geology of the Hartshorne coalbed in Haskell and Le Flore Counties, Oklahoma: U.S. Bureau of Mines Report of Investigations 8407, 14 p.
- Iannacchione, A.T., and D.G. Puglio, 1979, Geological association of coalbed gas and natural gas from the Hartshorne Formation in Haskell and Le Flore Counties, Oklahoma, in A.T. Cross, ed., *Compte Rendu*, v. 4, Economic geology: coal, oil, and gas: IXICC, Carbondale, Southern Illinois University Press, p. 739-752.
- Iannacchione, A.T., C.A. Kertis, D.W. Houseknecht, and J.H. Perry, 1983, Problems facing coal mining and gas production in the Hartshorne coalbeds of the western Arkoma basin, Oklahoma: U.S. Bureau of Mines Report of Investigations 8795, 25 p.
- l'Anson, A., I. Deighton, R.D. Müller, A. Dutkiewicz, and C. Heine, 2018, Burial and exhumation history of the Galilee Basin, Australia: Implications for unconventional hydrocarbon prospectivity: *AAPG Bulletin*, v. 102, p. 483-507.
- Ibrahim, A.F., and H.A. Nasr-EI-Din, 2015, A comprehensive model to history match and predict gas/water production from coal seams: *International Journal of Coal Geology*, v. 146, p. 79-90.

- ICF Resources, Inc., 1990, The United States coalbed methane resource: Quarterly Review of Methane from Coal Seams Technology, v. 7, no. 3, p. 10-28. (Arkoma basin, 4 tcf, p. 12)
- IOGCC, 2002, Collected studies: coal seam natural gas: Oklahoma City, Interstate Oil and Gas Compact Commission, 396 p.
- Irani, M.C., E.D. Thimons, T.G. Bobick, M. Deul, and M.G. Zabetakis, 1972, Methane emission from U.S. coal mines, a survey: U.S. Bureau of Mines Information Circular 8558, 58 p.
- Irani, M.C., P.W. Jeran, and M. Deul, 1974, Methane emission from U.S. coal mines in 1973, a survey. A supplement to IC 8558: U.S. Bureau of Mines Information Circular 8659, 47 p.
- Irani, M.C., J.H. Jansky, P.W. Jeran, and G.L. Hassett, 1977, Methane emission from U.S. coal mines in 1975, a survey: a supplement to Information Circulars 8558 and 8659: U.S. Bureau of Mines Information Circular 8733, 55 p.
- Islam, M.R., and D. Hayashi, 2008, Geology and coal bed methane resource potential of the Gondwana Barapukuria coal basin, Dinajpur, Bangladesh: International Journal of Coal Geology, v. 75, p. 127-143.
- Izadi, G., S. Wang, D. Elsworth, J. Liu, Y. Wu, and D. Pone, 2011, Permeability evolution of fluid-infiltrated coal containing discrete fractures: International Journal of Coal Geology, v. 85, p. 202-211. (swelling-induced sorption of CO₂)
- Izart, A., J. Barbarand, R. Michels, and V.A. Privalov, 2016, Modelling of the thermal history of the Carboniferous Lorraine coal basin: Consequences for coal bed methane: International Journal of Coal Geology, v. 168, p. 253-274.
- Jansen, G.J., 1987, Petrography studies can aid in coal mine planning and in estimating methane yields in coal beds: Mining Engineering, v. 39, no. 9, p. 849-852.
- Jenkins, C.D., W.C. Riese, and R.A. Lamarre, 2002, The value of core description in characterizing coal bed methane reservoirs (abstract): AAPG Annual Convention Official Program, v. 11, p. A86.
- Jenkins, C.D., and C.M. Boyer, 2008, Coalbed and shale gas reservoirs: Journal of Petroleum Technology, v. 60, no. 2, p. 92-99.
- Jenkins, C., 2009, Estimating resources and reserves in coal-bed methane and shale gas reservoirs, *in* T. Carr, T. D'Agostino, W. Ambrose, J. Pashin, and N.C. Rosen, eds., Unconventional energy resources: making the unconventional conventional: 29th Annual GCSSEPM Foundation Bob F. Perkins Research Conference, CD-ROM, p. 282-302.
- Jeran, P.W., D.H. Lawhead, and M.C. Irani, 1976, Methane emissions from an advancing coal mine section in the Pittsburgh coalbed: U.S. Bureau of Mines Report of Investigations 8132, 10 p.
- Jiang, B., Z. Qu, G.G.X. Wang, and M. Li, 2010, Effects of structural deformation on formation of coalbed methane reservoirs in Huaibei coalfield, China: International Journal of Coal Geology, v. 82, p. 175-183.
- Jin, H., A. Schimmelmann, M. Mastalerz, J. Pope, and T.A. Moore, 2010, Coalbed gas desorption in canisters: Consumption of trapped atmospheric oxygen and implications for measured gas quality: International Journal of Coal Geology, v. 81, p. 64-72.
- Jin, K., Y. Cheng, L. Wang, J. Dong, P. Guo, F. An, and L. Jiang, 2015, The effect of sedimentary redbeds on coalbed methane occurrence in the Xutuan and Zhaoji coal mines, Huaibei coalfield, China: International Journal of Coal Geology, v. 137, p. 111-123.
- Jing, Y., R.T. Armstrong, H.L. Ramandi, and P. Mostaghimi, 2016, Coal cleat reconstruction using micro-computed tomography imaging: Fuel, v. 181, p. 286-299.

- Jing, Y., R.T. Armstrong, and P. Mostaghimi, 2017, Rough-walled discrete fracture network modelling for coal characterization: *Fuel*, v. 191, p. 442-453.
- Jing, Z., S.A. Mahoney, S. Rodrigues, R.D. Balucan, J. Underschultz, J.S. Esterle, T.E. Rufford, and K.M. Steel, 2018, A preliminary study of oxidant stimulation for enhancing coal seam permeability: Effects of sodium hypochlorite oxidation on subbituminous and bituminous Australian coals: *International Journal of Coal Geology*, v. 200, p. 36-44.
- Johnson, D.J., and P.L. Scholes, 1991, Predicting cleat in coal seams from mineral and maceral composition with wireline logs, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, *Coalbed methane of western North America*: Rocky Mountain Association of Geologists, p. 123-136.
- Johnson, R.C., C.E. Barker, M.J. Pawlewicz, B.L. Crysdale, A.C. Clark, and D.D. Rice, 1991, Preliminary results of a coalbed methane assessment of the Wind River Indian Reservation, Wyoming, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., *Coalbed methane of western North America*: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 273-284.
- Johnson, R.C., A.C. Clark, C.E. Barker, B.L. Crysdale, D.K. Higley, Jr., R.J. Szmajter, and T.M. Finn, 1993, Coalbed methane potential of the Upper Cretaceous Mesaverde and Meeteetse formations, Wind River Reservation, Wyoming, *in* W.R. Keefer and others, eds., *Wyoming Geological Association special symposium on oil and gas and other resources of the Wind River basin*, Wyoming: Casper, Wyoming Geological Association, p. 215-242.
- Johnson, R.C., and R.M. Flores, 1993, Stratigraphy, areal distribution, and paleodepositional environments of Fort Union Formation coal beds, Wind River Reservation, Wyoming; implications for coalbed methane development, *in* W.R. Keefer and others, eds., *Wyoming Geological Association special symposium on oil and gas and other resources of the Wind River basin*, Wyoming: Casper, Wyoming Geological Association, p. 281-294.
- Johnson, R.C., and D.D. Rice, 1993, Variations in composition and origins of gases from coal bed and conventional reservoirs, Wind River basin, Wyoming, *in* W.R. Keefer and others, eds., *Wyoming Geological Association special symposium on oil and gas and other resources of the Wind River basin*, Wyoming: Casper, Wyoming Geological Association, p. 319-335.
- Johnson, R.C., and R.M. Flores, 1998, Developmental geology of coalbed methane from shallow to deep in Rocky Mountain basins and in Cook Inlet — Matanuska basin, Alaska, U.S.A. and Canada, *in* R.M. Flores, ed., *Coalbed methane: from coal-mine outbursts to a gas resource*: *International Journal of Coal Geology*, v. 35, p. 241-282.
- Johnson, T.A., 2004, Stratigraphy, depositional environment, and coalbed gas potential of Middle Pennsylvanian (Desmoinesian Stage) coal—Bourbon Arch region, eastern Kansas: Kansas Geological Survey, Open-File Report 2004-38. (http://www.kgs.ku.edu/PRS/publication/2004/OFR04_38/index.html)
- Johnson, T.A., 2004, Isopach mapping of Desmoinesian coals—Bourbon Arch region, eastern Kansas: Kansas Geological Survey, Open-File Report 2004-39. (http://www.kgs.ku.edu/PRS/publication/2004/OFR04_39/index.html)
- Johnson, V.G., D.L. Graham, and S.P. Reidel, 1993, Methane in Columbia River basalt aquifers: isotopic and geohydrologic evidence for a deep coal-bed gas source in the Columbia basin, Washington: *AAPG Bulletin*, v. 77, p. 1192-1207.
- Johnston, D.J., and P.L. Scholes, 1991, Predicting cleats in coal seams from mineral and maceral composition with wireline logs, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., *Coalbed methane of western North America*: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 123-136.
- Jones, A.H., G.J. Bell, and R.A. Schraufnagel, 1988, A review of the physical and mechanical properties of coal with implications for coal-bed methane well

- completion and production, in J.E. Fassett, ed., *Geology and coal-bed methane resources of the northern San Juan basin, Colorado and New Mexico*: Denver, Rocky Mountain Association of Geologists Guidebook, p. 169-181.
- Jones, E.J.P., M.A. Voytek, P.D. Warwick, M.D. Corum, A. Cohn, J.E. Bunnell, A.C. Clark, and W.H. Orem, 2008, Bioassay for estimating the biogenic methane-generating potential of coal samples: *International Journal of Coal Geology*, v. 76, p. 138-150.
- Jones, E.J.P., M.A. Voytek, M.D. Corum, and W.H. Orem, 2010, Stimulation of methane generation from a non-productive coal by addition of nutrients or a microbial consortia: *Applied and Environmental Microbiology*, v. 76, p. 7013-7022.
- Jones, E.J.P., S.H. Harris, E.P. Barnhart, W.H. Orem, A.C. Clark, M.D. Corum, J.D. Kirshtein, M.S. Varonka, and M.A. Voytek, 2013, The effect of coal bed dewatering and partial oxidation on biogenic methane potential: *International Journal of Coal Geology*, v. 115, p. 54-63.
- Jones, N.R., R.M. Lyman, and R.H. De Bruin, 2004, Coalbed methane update: *Wyoming Geo-notes*, no. 79, p. 16-18.
- Jones, N.R., R.M. Lyman, and R.H. De Bruin, 2004, Coalbed methane update: *Wyoming Geo-notes*, no. 81, p. 21-24.
- Jones, R.W., and R.H. DeBruin, 1990, Coalbed methane in Wyoming: *Geological Survey of Wyoming Public Information Circular 30*, 15 p.
- Jordan, G., 1990, Desorption, diffusion and coal testing for coalbed methane, in S. Stuhlec, compiler, *Introduction to coal sampling techniques for the petroleum industry*: Alberta Research Council, Coal-bed Methane Information Series 111, p. 3-15.
- Joubert, J.I., C.T. Grein, and D. Bienstock, 1973, Sorption of methane in moist coal: *Fuel*, v. 52, p. 181-185.
- Joubert, J.I., C.T. Grein, and D. Bienstock, 1974, Effect of moisture on the methane capacity of American coals: *Fuel*, v. 53, p. 186-191.
- Ju, W., B. Jiang, Q. Miao, J. Wang, Z. Qu, and M. Li, 2018, Variation of in situ stress regime in coal reservoirs, eastern Yunnan region, South China: Implications for coalbed methane production: *AAPG Bulletin*, v. 102, p. 2283-2303.
- Ju, W., B. Jiang, Y. Qin, C. Wu, G. Wang, Z. Qu, and M. Li, 2019, The present-day in-situ stress field within coalbed methane reservoirs, Yuwang Block, Laochang Basin, south China: *Marine and Petroleum Geology*, v. 102, p. 61-73.
- Ju, Y., Q. Zhang, J. Zheng, J. Wang, C. Chang, and F. Gao, 2017, Experimental study on CH₄ permeability and its dependence on interior fracture networks of fractured coal under different excavation stress paths: *Fuel*, v. 202, p. 483-493.
- Jüntgen, H., and J. Karweil, 1966, Formation and storage of gases in bituminous coals, part 1. Gas formation (English abstract): *Erdöl und Kohle-Erdgas-Petrochemie*, v. 19, p. 251-264.
- Jüntgen, H., and J. Karweil, 1966, Formation and storage of gases in bituminous coals, part 2. Gas storage (English abstract): *Erdöl und Kohle-Erdgas-Petrochemie*, v. 19, p. 339-344.
- Jurich, D., and M.A. Adams, 1984, Geologic overview, coal, and coalbed methane resources of Raton Mesa region, in C.T. Rightmire, G.E. Eddy, and J.N. Kirr, eds., *Coalbed methane resources of the United States*: AAPG Studies in Geology 17, p. 163-184.
- Jurisch, S.A., S. Heim, B.M. Krooss, and R. Litke, 2012, Systematics of pyrolytic gas (N₂, CH₄) liberation from sedimentary rocks: Contribution of organic and inorganic rock constituents: *International Journal of Coal Geology*, v. 89, p. 95-107.
- Kaiser, W.R., R. Tyler, W.A. Ambrose, A.R. Scott, and D.G. Patchen, 1992, Geologic evaluation of critical production parameters for coalbed methane resources:

- Quarterly Review of Methane from Coal Seams Technology, v. 9, nos. 3-4, p. 19-24.
- Kaiser, W.R., D.S. Hamilton, and D.G. Patchen, 1993, Geologic and hydrologic controls on coalbed methane production: Quarterly Review of Methane from Coal Seams Technology, v. 10, no. 3, p. 26-29.
- Kaiser, W.R., 1993, Hydrogeology of coalbed reservoirs, *in* W.B. Ayers, Jr., W.R. Kaiser, and J.R. Levine, Coal as source rock and gas reservoir: Birmingham, Alabama, 1993 Coalbed Methane Symposium, Short Course 1, p. 188-257.
- Kaiser, W.R., D.S. Hamilton, A.R. Scott, R. Tyler, and R.J. Finley, 1994, Geological and hydrological controls on the producibility of coalbed methane: Journal of the Geological Society, London, v. 151, part 3, p. 417-420.
- Kaiser, W.R., A.R. Scott, D.S. Hamilton, R. Tyler, R.G. McMurry, N. Zhou, and C. M. Tremain, 1994, Geologic and hydrologic controls on coalbed methane: Sand Wash basin, Colorado and Wyoming: Colorado Geological Survey Resource Series 30 (Bureau of Economic Geology, Report of Investigations 220), 151 p.
- Kaiser, W.R., A.R. Scott, and R. Tyler, 1995, Geology and hydrology of coalbed methane producibility in the United States: analogs for the world: Tuscaloosa, Alabama, Intergas '95 Short Course, 516 p.
- Kaji, R., Y. Muranaka, K. Otsuka, and Y. Hishinuma, 1986, Water absorption by coals: effects of pore structure and surface oxygen: Fuel, v. 65, p. 288-291.
- Kalaitzidis, S., H.K. Karapanagioti, K. Christanis, A. Bouzinos, and E. Iliopoulou, 2006, Evaluation of peat and lignite phenanthrene sorption properties in relation to coal petrography: the impact of inertinite: International Journal of Coal Geology, v. 68, p. 30-38.
- Kalkreuth, W.D., M. Dawson, and J.D. Hughes, 1994, Geological Survey of Canada coalbed methane research - CBM potential of coals from the western Canada sedimentary basin: Newcastle NSW Australia, Twenty Eighth Newcastle Symposium on Advances in the study of the Sydney basin, p. 126-133.
- Kalkreuth, W., H. Abercrombie, and K. Burchard, 1994, The coalbed methane potential of Jurassic/Cretaceous coals from the Fernie basin, British Columbia, Canada: Erdol und Kohle - Erdgas - Petrochemie, v. 47, no. 4, p. 134-139.
- Kalkreuth, W., M. Dawson, and D. Hughes, 1995, Geological Survey of Canada coalbed methane research, *in* J.A. Pajares and J.M.D. Tascon, eds., Coal science: New York, Elsevier, Coal Science and Technology 24, v. 1, p. 31-34.
- Kang, Y., F. Huang, L. You, X. Li, and B. Gao, 2016, Impact of fracturing fluid on multi-scale mass transport in coalbed methane reservoirs: International Journal of Coal Geology, v. 154-155, p. 123-135.
- Kang, Y.-S., J.-P. Ye, C.-L. Yuan, Y.Z. Ma, Y.-P. Li, J. Han, S.-R. Zhang, Q. Zhao, J. Chen, B. Zhang, and D.-L. Mao, 2016, Coalbed methane evaluation and development: An example from Qinshui Basin in China, *in* Y.Z. Ma and S.A. Holditch, eds., Unconventional oil and gas resources handbook; evaluation and development: New York, Elsevier, p. 475-494.
- Haq, S.R., S. Tamamura, T. Igarashi, and K. Kaneko, 2018, Characterization of organic substances in lignite before and after hydrogen peroxide treatment: Implications for microbially enhanced coalbed methane: International Journal of Coal Geology, v. 185, p. 1-11.
- Karacan, C.Ö., and E. Okandan, 2000, Fracture/cleat analysis of coals from Zonguldak basin (northwestern Turkey) relative to the potential of coalbed methane production: International Journal of Coal Geology, v. 44, p. 109-125.
- Karacan, C.Ö., and E. Okandan, 2000, Assessment of energetic heterogeneity of coals for gas adsorption and its effect on mixture predictions for coalbed methane studies: Fuel, v. 79, p. 1963-1974.

- Karacan, C.Ö., and G.D. Mitchell, 2003, Behavior and effect of different coal microlithotypes during gas transport for carbon dioxide sequestration into coal seams: *International Journal of Coal Geology*, v. 53, p. 201-217.
- Karacan, C.Ö., G.S. Esterhuizen, S.J. Schatzel, and W.P. Diamond, 2007, Reservoir simulation-based modeling for characterizing longwall methane emissions and gob gas venthole production: *International Journal of Coal Geology*, v. 71, p. 225-245.
- Karacan, C.Ö., 2009, Reservoir rock properties of coal measure strata of the Lower Monongahela Group, Greene County (southwestern Pennsylvania), from methane control and production perspectives: *International Journal of Coal Geology*, v. 78, p. 47-64.
- Karacan, C.Ö., R.A. Olea, and G. Goodman, 2012, Geostatistical modeling of the gas emission zone and its in-place gas content for Pittsburgh-seam mines using sequential Gaussian simulation: *International Journal of Coal Geology*, v. 90-91, p. 50-71.
- Karacan, C.Ö., A. Drobniak, and M. Mastalerz, 2014, Coal bed reservoir simulation with geostatistical property realizations for simultaneous multi-well production history matching: A case study from Illinois Basin, Indiana, USA: *International Journal of Coal Geology*, v. 131, p. 71-89.
- Karacan, C.Ö., and R.A. Olea, 2015, Stochastic reservoir simulation for the modeling of uncertainty in coal seam degasification: *Fuel*, v. 148, p. 87-97.
- Karayiğit, A.İ., M. Mastalerz, R.G. Oskay, X. Querol, and N.R. Lieberman, 2018, Meso- and microporosity of the subbituminous kM2 coal seam (Soma, Turkey) and its relationship with coal characteristics: *International Journal of Coal Geology*, v. 184, p. 73-87.
- Kędzior, S., 2009, Accumulation of coal-bed methane in the south-west part of the Upper Silesian coal basin (southern Poland): *International Journal of Coal Geology*, v. 80, p. 20-34.
- Kędzior, S., 2011, The occurrence of a secondary zone of coal-bed methane in the southern part of the Upper Silesian coal basin (southern Poland): Potential for methane exploitation: *International Journal of Coal Geology*, v. 86, p. 157-168.
- Kędzior, S., M.J. Kotarba, and Z. Pękała, 2013, *International Journal of Coal Geology*, v. 105, p. 24-35.
- Kędzior, S., and I. Jelonek, 2013, Reservoir parameters and maceral composition of coal in different Carboniferous lithostratigraphical series of the Upper Silesian coal basin, Poland: *International Journal of Coal Geology*, v. 111, p. 98-105.
- Kędzior, S., 2015, Methane contents and coal-rank variability in the Upper Silesian Coal Basin, Poland: *International Journal of Coal Geology*, v. 139, p. 152-164.
- Kędzior, S., 2019, Distribution of methane contents and coal rank in the profiles of deep boreholes in the Upper Silesian coal basin, Poland: *International Journal of Coal Geology*, v. 202, p. 190-208.
- Keim, S.A., K.D. Luxbacher, and M. Karmis, 2011, A numerical study on optimization of multilateral horizontal wellbore patterns for coalbed methane production in southern Shanxi Province, China: *International Journal of Coal Geology*, v. 86, p. 306-317.

- Kelso, B.S., and J.A. Kelafant, 1989, A strategy for coalbed methane production development part I: geologic characterization: Proceedings of the 1989 Coalbed Methane Symposium, paper 8911, p. 3-9.
- Kelso, B.S., W.G. Leel, Jr., and D.L. Carr, 1991, Coalbed methane resource and producibility potential of the Rock Springs Formation, Great Divide Basin, Wyoming, in S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., Coalbed methane of western North America: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 201-208.
- Kelso, B.S., 1994, Geologic controls on open-hole cavity completions in the San Juan basin: Quarterly Review of Methane from Coal Seams Technology, v. 11, nos. 3 & 4, p. 1-6.
- Kelso, B.S., T.E. Lombardi, and J.A. Kuuskraa, 1996, Drilling and production statistics for major U.S. coalbed methane and gas shale reservoirs: Des Plaines, Illinois, Gas Technology Institute, Report GRI-96/0052, 59 p.
- Kemp, J.H., and K.M. Petersen, 1988, Coal-bed gas development in the San Juan basin: a primer for the lawyer and landman, in J.E. Fassett, ed., Geology and coal-bed methane resources of the northern San Juan basin, Colorado and New Mexico: Denver, Rocky Mountain Association of Geologists Guidebook, p. 257-279.
- Keshavarz, A., Y. Yang, A. Badalyan, R. Johnson, and P. Bedrikovetsky, 2014, Laboratory-based mathematical modelling of graded proppant injection in CBM reservoirs: International Journal of Coal Geology, v. 136, p. 1-16.
- Keshavartz, A., R. Sakurovs, M. Grigore, and M. Sayyafzadeh, 2017, Effect of maceral composition and coal rank on gas diffusion in Australian coals: International Journal of Coal Geology, v. 173, p. 65-75.
- Khavari-Khorasani, G., and J.K. Michelsen, 1999, Coal bed gas content and gas undersaturation, in M. Mastalerz, M. Glikson, and S.D. Golding, eds., Coalbed methane: scientific, environmental and economic evaluation: Boston, Kluwer Academic Publishers, p. 207-231.
- Khodaverdian, M.F., 1994, Coalbed methane stimulation techniques: Mechanisms and applicability: Gas Research Institute, Topical Report, GRI-95/0003, 97 p.
- Khodaverdian, M., J. McLennan, I. Palmer, and H. Vaziri, 1996, Coalbed cavity completion analysis suggests improvements: Gas Tips, v. 2, no. 1, p. 22-30.
- Kiani, A., R. Sakurovs, M. Grigore, and A. Sokolova, 2018, Gas sorption capacity, gas sorption rates and nanoporosity in coals: International Journal of Coal Geology, v. 200, p. 77-86.
- Kidd, J.T., B.S. Camp, L.K. Lottman-Craig, T.E. Osborne, J.L. Smith, J.L. Saulsberry, P.F. Steidl, and P.B. Stubbs, 1992, Geologic manual for the evaluation and development of coalbed methane: GRI Topical Report GRI 91-0110, 110 p.
- Kim, A.G., and L.J. Douglas, 1972, Hydrocarbon gases produced in a simulated swamp environment: U.S. Bureau of Mines Report of Investigations 7690, 15 p.
- Kim, A.G., 1973, The composition of coalbed gas: U.S. Bureau of Mines Report of Investigations 7762, 9 p.
- Kim, A.G., and L.J. Douglas, 1973, Gases desorbed from five coals of low gas content: U.S. Bureau of Mines Report of Investigations 7768, 9 p.
- Kim, A.G., 1974, Low-temperature evolution of hydrocarbon gases from coal: U.S. Bureau of Mines Report of Investigations 7965, 23 p.
- Kim, A.G., 1974, Methane in the Pittsburgh coalbed, Washington County, Pa.: U.S. Bureau of Mines Report of Investigations 7969, 16 p.
- Kim, A.G., 1975, Methane in the Pittsburgh coalbed, Greene County, Pa.: U.S. Bureau of Mines Report of Investigations 8026, 10 p.
- Kim, A.G., 1977, Estimating methane content of bituminous coalbeds from adsorption data: U.S. Bureau of Mines Report of Investigations 8245, 22 p.

- Kim, A.G., 1978, Experimental studies on the origin and accumulation of coalbed gas: U.S. Bureau of Mines Report of Investigations 8317, 18 p.
- Kim, A.G., and F.N. Kissell, 1988, Methane formation and migration in coalbeds, in M. Deul and A.G. Kim, Methane control research: summary of results, 1964-80: U.S. Bureau of Mines Bulletin 687, p. 18-25.
- Kinnon, E.C.P., S.D. Golding, C.J. Boreham, K.A. Baublys, and J.S. Esterle, 2010, Stable isotope and water quality analysis of coal bed methane production waters and gases from the Bowen Basin, Australia: International Journal of Coal Geology, v. 82, p. 219-231.
- Kissell, F.N., 1972, Methane migration characteristics of the Pocahontas No. 3 coalbed: U.S. Bureau of Mines Report of Investigations 7649.
- Kissell, F.N., 1972, The methane migration and storage characteristics of the Pittsburgh, Pocahontas no. 3, and Oklahoma Hartshorne coalbeds: U.S. Bureau of Mines Report of Investigations 7667, 22 p.
- Kissell, F.N., C.M. McCulloch, and C.H. Elder, 1973, The direct method of determining methane content of coalbeds for ventilation design: U.S. Bureau of Mines Report of Investigations 7767, 17 p.
- Kissell, F.N., and J.C. Edwards, 1975, Two-phase flow in coalbeds: U.S. Bureau of Mines, Report of Investigations 8066, 16 p.
- Klein, A., K. Buck and S. Ruhl, 2004, Helper field: An integrated approach to coalbed methane development, Uinta Basin, Utah: AAPG Studies in Geology 50, p.541-550.
- Klein, D.A., R.M. Flores, C. Venot, K. Gabbert, R. Schmidt, G.D. Stricker, A. Pruden, and K. Mandernack, 2008, Molecular sequences derived from Paleocene Fort Union Formation coals vs. associated produced waters: Implications for CBM regeneration: International Journal of Coal Geology, v. 76, p. 3-13.
- Knox, L.M., and J. Hadro, 2001, Canister desorption techniques: variation and reliability: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 123, p. 319-329.
- Koen, A.D., 1991, U.S. tax credits spurring coal seam, tight sands boom amid controversy: Oil & Gas Journal, v. 89, no. 41, p. 19-24.
- Koenig, R.A., and G.J. Bell, 1985, Design of single phase flow tests for water-saturated coalbed methane reservoirs: Gas Research Institute, Quarterly Review of Methane from Coal Seams Technology, v. 3, no. 1, p. 17-22.
- Koenig, R.A., and R.A. Schraufnagel, 1992, Application of the slug test in coalbed methane testing, in Coalbed methane: Society of Petroleum Engineers, Reprint Series 35, p. 79-89.
- Kopp, O.C., M.E. Bennett, III, and C.E. Clark, 2000, Volatiles lost during coalification: International Journal of Coal Geology, v. 44, p. 69-84.
- Kotarba, M.J., 2001, Composition and origin of coalbed gases in the upper Silesian and Lublin basins, Poland: Organic Geochemistry, v. 32, p. 163-180.
- Kotarba, M.J., and D.D. Rice, 2001, Composition and origin of coalbed gases in the lower Silesian basin, southwest Poland: Applied Geochemistry, v. 16, p. 895-910.
- Kotarba, M.J., and J.D. Lewan, 2004, Characterizing thermogenic coalbed gas from Polish coals of different ranks by hydrous pyrolysis: Organic Geochemistry, v. 35, p. 615-646.
- Koval, E., and J. Pope, 2006, Seeing a reservoir's character from solution gas: World Oil, v. 227, no. 11, p. 144, 146.
- Kravits, S., and G. DuBois, 2014, Horizontal coalbed methane wells drilled from surface, in P. Thakur, K. Aminian, and S. Schatzel, eds., Coal bed methane: from prospect to pipeline: New York, Elsevier, p. 137-153.

- Krickovic, S., and C. Findlay, 1971, Methane emission rate studies in a central Pennsylvania mine: U.S. Bureau of Mines, report of Investigations 7591, 9 p.
- Krooss, B.M., F. van Bergen, Y. Gensterblum, N. Siemons, H.J.M. Pagnier, and P. David, 2002, High-pressure methane and carbon dioxide adsorption on dry and moisture-equilibrated Pennsylvanian coals: *International Journal of Coal Geology*, v. 51, p. 69-92.
- Kumar, H., E. Lester, S. Kingman, R. Bourne, C. Avila, A. Jones, J. Robinson, P.M. Halleck, and J.P. Mathews, 2011, Inducing fractures and increasing cleat apertures in a bituminous coal under isotropic stress via application of microwave energy: *International Journal of Coal Geology*, v. 88, p. 75-82.
- Kumar, H., D. Elsworth, J.P. Mathews, J. Liu, and D. Pone, 2014, Effect of CO₂ injection on heterogeneously permeable coalbed reservoirs: *Fuel*, v. 135, p. 509-521.
- Kumar, J., V.A. Mendhe, A.D. Kamble, M. Bannerjee, S. Mishra, B.D. Singh, V.K. Mishra, P.K. Singh, and H. Singh, 2018, Coalbed methane reservoir characteristics of coal seams of south Karanpura coalfield, Jharkhand, India: *International Journal of Coal Geology*, v. 196, p. 185-200.
- Kuuskraa, V.A., and C.M. Boyer, II, 1993, Economic and parametric analysis of coalbed methane, *in* B.E. Law and D.D. Rice, eds., *Hydrocarbons from coal: AAPG Studies in Geology* 38, p. 373-394.
- Lamarre, R. A., and T. D. Burns, 1997, Drunkard's Wash Unit: Coalbed methane production from Ferron Coals in east-central Utah, *in* E. B. Coalson, J. C. Osmond and E. T. Williams, eds., *Innovative applications of petroleum technology in the Rocky Mountain area: RMAG*, p.47-60.
- Lamarre, R.A., 2002, Hydrodynamic and stratigraphic controls for a large coalbed methane accumulation in Ferron coals of east-central Utah, *in* S.D. Schwochow and V.F. Nuccio, eds., *Coalbed methane of North America, II: Rocky Mountain Association of Geologists*, p. 71-82.
- Lamarre, R.A., and T.J. Pratt, 2002, Reservoir characterization study: calculation of gas-in-place in Ferron coals at Drunkard's Wash Unit, Carbon and Emery Counties, Utah: *The Mountain Geologist*, v. 39, p. 41-51.
- Lamarre, R.A., 2003, Hydrodynamic and stratigraphic controls for a large coalbed methane accumulation in Ferron coals of east-central Utah: *International Journal of Coal Geology*, v. 56, p. 97-110.
- Lamarre, R.A., 2006, Coalbed methane production from Ferron coals in east-central Utah: *The Mountain Geologist*, v. 43, no. 3, p. 207-211.
- Lamarre, R.A., compiler, 2006, Coalbed methane: A compendium of influential papers: AAPG Datapages Getting Started No. 3, CD.
- Lamberson, M.N., and R.M. Bustin, 1993, Coalbed methane characteristics of Gates Formation coals, northeastern British Columbia: effect of maceral composition: *AAPG Bulletin*, v. 77, p. 2062-2076.
- Lambert, S.W., and T.E. Lombardi, 2002, Illinois basin coal gas, unlocking a new frontier using old keys (abstract): *AAPG Annual Convention Official Program*, v. 11, p. A98.
- Lambert, S.W., 2014, United States lower 48 coalbed methane — benchmark (2010), *in* P. Thakur, K. Aminian, and S. Schatzel, eds., *Coal bed methane: from prospect to pipeline*: New York, Elsevier, p. 311-349.
- Landis, E.R., T.J. Rohrbacher, C.E. Barker, B. Fodor, and G. Gombar, 2003, Coalbed gas in the Mecsek Basin, Hungary: *International Journal of Coal Geology*, v. 54, p. 41-55.

- Langenberg, W., W. Kalkreuth, J. Levine, R. Strobl, T. Demchuk, G. Hoffman, and T. Jerzykiewicz, 1990, Coal geology and its application to coal-bed methane reservoirs, lecture notes for short course: Alberta Research Council Information Series 109, 159 p.
- Langenberg, W., 1991, Coalification patterns and coalbed methane potential in the Cadomin area, Alberta, Canada, *in* R.B. Finkelman and D. C. Peters, eds., Practical applications of coal geology: *Journal of Coal Quality*, v. 10, p. 89-95.
- Langenberg, W., A. Beaton, and M. Berhane, 2002, Regional evaluation of the CBM potential of the foothills/mountains of Alberta, Canada (abstract): AAPG Annual Convention Official Program, v. 11, p. A99.
- Langenberg, C.W., A. Beaton, and H. Berhane, 2006, Regional evaluation of the coalbed-methane potential of the Foothills/Mountains of Alberta, Canada: *International Journal of Coal Geology*, v. 65, p. 114-128.
- Langhus, B.G., D. Arthur, J. Halvorson, and T. Richmond, 2002, Managing coal bed methane produced waters to minimize present costs and environmental liabilities (abstract): AAPG Annual Convention Official Program, v. 11, p. A99.
- Larsen, J.W., 2004, The effects of dissolved CO₂ on coal structure and properties: *International Journal of Coal Geology*, v. 57, p. 63-70.
- Lau, H.C., H. Li, and S. Huang, 2017, Challenges and opportunities of coalbed methane development in China: *Energy Fuels*, v. 31, p. 4588-4602.
- Laubach, S.E., C.M. Tremain, and W.B. Ayers, Jr., 1991, Coal fracture studies: guides for coalbed methane exploration and development, *in* R.B. Finkelman and D.C. Peters, eds., Practical applications of coal geology: *Journal of Coal Quality*, v. 10, p. 81-88.
- Laubach, S.E., and C.M. Tremain, 1994, Fracture swarms: potential targets for methane exploration in Upper Cretaceous sandstone and coal, northern San Juan basin: *New Mexico Bureau of Mines and Mineral Resources, Bulletin 146*, p. 9-12.
- Laubach, S.E., R.A. Marrett, J.E. Olson, and A.R. Scott, 1998, Characteristics and origins of coal cleat: a review, *in* R.M. Flores, ed., Coalbed methane: from coal-mine outbursts to a gas resource: *International Journal of Coal Geology*, v. 35, p. 175-207.
- Law, B.E., 1988, Coal-bed methane, *in* L.B. Magoon, ed., Petroleum systems of the United States: *USGS Bulletin 1870*, p. 52-53.
- Law, B.E., D.D. Rice, and R.M. Flores, 1991, Coalbed gas accumulations in the Paleocene Fort Union Formation, Powder River Basin, Wyoming, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., Coalbed methane of western North America: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 179-190.
- Law, B.E., 1992, Coalbed methane, *in* L.B. Magoon, ed., The petroleum system -- status of research and methods, 1992: *U.S. Geological Survey Bulletin 2007*, p. 20-21.
- Law, B.E., 1993, The relationship between coal rank and cleat spacing: implications for the prediction of permeability in coal: *Proceedings of the 1993 International CBM Symposium*, paper 9341, p. 435-442.
- Law, B.E., and D.D. Rice, 1993, Coalbed methane - new perspectives on an old source of energy, *in* S.-H. Chiang, ed., Coal - energy and the environment: Tenth Annual International Pittsburgh Coal Conference, *Proceedings*, p. 316-319.
- Law, B.E., and D.D. Rice, eds., 1993, Hydrocarbons from coal: *AAPG Studies in Geology 38*, 400 p.
- Lawrence, A.W., 1993, Coalbed methane produced-water treatment and disposal options: *Quarterly Review of Methane from Coal Seams Technology*, v. 11, no. 2, p. 6-17.

- Laxminarayana, C., and P.J. Crosdale, 1999, Role of coal type and rank on methane sorption characteristics of Bowen basin, Australia coals: *International Journal of Coal Geology*, v. 40, p. 309-325.
- Laxminarayana, C., and P.J. Crosdale, 2001, Heat of methane adsorption of coal: implications for pore structure development: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 114, p. 151-162.
- Laxminarayana, C., and P.J. Crosdale, 2002, Controls on methane sorption capacity of Indian coals: *AAPG Bulletin*, v. 86, p. 201-212.
- Lee, J.A., B.S.M. Faraj, B.W. McKinstry, and G.R. Sloan, 2004, Program planning and field operations protocols for coalbed methane and shale gas reservoirs in Canada: *GasTIPS*, v. 10, no. 4, p. 18-21.
- Leidecker, M.V., 2014, Production engineering design, *in* P. Thakur, K. Aminian, and S. Schatzel, eds., *Coal bed methane: from prospect to pipeline*: New York, Elsevier, p. 185-199.
- Lemons, B.N., and L. Nemirow, 1989, Maximizing the Section 29 credit in coal seam methane transactions: *Journal of Taxation*, v. 70, p. 238-245.
- Levine, J.R., 1987, Influence of coal composition on the generation and retention of coalbed natural gas: Tuscaloosa, Alabama, Proceedings of the 1987 Coalbed Methane Symposium, paper 8711, p. 15-18.
- Levine, J.R., 1990, Generation, storage and migration of natural gas in coal bed reservoirs, *in* W. Langenberg, W. Kalkreuth, J. Levine, R. Strobl, T. Demchuk, G. Hoffman, and T. Jerzykiewicz, *Coal geology and its application to coal-bed methane reservoirs*: Alberta Research Council, Information Series 109, p. 84-130.
- Levine, J.R., 1991, New methods for assessing gas resources in thin-bedded, high-ash coals: Tuscaloosa, Alabama, Proceedings of the 1991 Coalbed Methane Symposium, paper 9125, p. 115-125.
- Levine, J.R., 1991, The impact of oil formed during coalification on generation and storage of natural gas in coalbed reservoir systems: Tuscaloosa, Alabama, Proceedings of the 1991 Coalbed Methane Symposium, paper 9126, p. 307-315.
- Levine, J.R., 1992, Five common misconceptions regarding coalbed gas reservoir systems: *Quarterly Review of Methane from Coal Seams Technology*, v. 9, nos. 3-4, p. 36.
- Levine, J.R., 1992, Oversimplifications can lead to faulty coalbed gas reservoir analysis: *Oil & Gas Journal*, v. 90, no. 47, p. 63-69.
- Levine, J.R., 1993, Coalification: the evolution of coal as source rock and reservoir rock for oil and gas, *in* B.E. Law and D.D. Rice, eds., *Hydrocarbons from coal*: AAPG Studies in Geology 38, p. 39-77.
- Levine, J.R., 1996, Model study of the influence of matrix shrinkage on absolute permeability of coal bed reservoirs, *in* R. Gayer and I. Harris, eds., *Coalbed methane and coal geology*: London, Geological Society Special Publication 109, p. 197-212.
- Levy, J.H., S.J. Day, and J.S. Killingley, 1997, Methane capacities of Bowen basin coals related to coal properties: *Fuel*, v. 76, p. 813-819.
- Lewan, M.D., and M.J. Kotarba, 2014, Thermal-maturity limit for primary thermogenic-gas generation from humic coals as determined by hydrous pyrolysis: *AAPG Bulletin*, v. 98, p. 2581-2610. (generation of primary gas ends before 2.0% VRo)
- Lewis, R.T., 1999, Coalbed methane production of the Buck Knob anticline field, Wise County, Virginia (abstract): *AAPG Bulletin*, v. 83, p. 1370.
- Li, D., P. Hendry, and M. Faiz, 2008, A survey of the microbial populations in some Australian coalbed methane reservoirs: *International Journal of Coal Geology*, v. 76, p. 14-24.

- Li, D., Q. Liu, P. Weniger, Y. Gensterblum, A. Busch, and B.M. Krooss, 2009, High-pressure sorption isotherms and sorption kinetics of CH₄ and CO₂ on coals: *Fuel*, v. 89, p. 569-580.
- Li, E., C. Pan, S. Yu, X. Jin, and J. Liu, 2013, Hydrocarbon generation from coal, extracted coal and bitumen rich coal in confined pyrolysis experiments: *Organic Geochemistry*, v. 64, p. 58-75.
- Li, H., H.C. Lau, and S. Huang, 2018, China's coalbed methane development: A review of the challenges and opportunities in subsurface and surface engineering: *Journal of Petroleum Science and Engineering*, v. 166, p. 621-635.
- Li, J., D. Liu, Y. Yao, Y. Cai, and Y. Chen, 2013, Evaluation and modeling of gas permeability changes in anthracite coals: *Fuel*, v. 111, p. 606-612.
- Li, J., S. Lu, Y. Cai, H. Xue, and J. Cai, 2017, Impact of coal ranks on dynamic gas flow: An experimental investigation: *Fuel*, v. 194, p. 17-26.
- Li, P., X. Zhang, and S. Zhang, 2018, Structures and fractal characteristics of pores in low volatile bituminous deformed coals by low-temperature N₂ adsorption after different solvents treatments: *Fuel*, v. 224, p. 661-675.
- Li, S., D. Tang, Z. Pan, H. Xu, and W. Huang, 2013, Characterization of the stress sensitivity of pores for different rank coals by nuclear magnetic resonance: *Fuel*, v. 111, p. 746-754.
- Li, S., D. Tang, Z. Pan, H. Xu, and L. Guo, 2015, Evaluation of coalbed methane potential of different reservoirs in western Guizhou and eastern Yunnan, China: *Fuel*, v. 139, p. 257-267.
- Li, W., Y.-P. Cheng, and L. Wang, 2011, The origin and formation of CO₂ gas pools in the coal seam of the Yaojie coalfield in China: *International Journal of Coal Geology*, v. 85, p. 227-236.
- Li, W., H. Liu, and X. Song, 2015, Multifractal analysis of Hg pore size distributions of tectonically deformed coals: *International Journal of Coal Geology*, v. 144-145, p. 138-152.
- Li, W., Y.-M. Zhu, and Y. Liu, 2018, Gas evolution and isotopic fractionations during pyrolysis on coals of different ranks: *International Journal of Coal Geology*, v. 188, p. 136-144.
- Li, W., T. Ren, A. Busch, S.A.M. den Hartog, Y. Cheng, W. Qiao, and B. Li, 2018, Architecture, stress state and permeability of a fault zone in Jiulishan coal mine, China: Implication for coal and gas outbursts: *International Journal of Coal Geology*, v. 198, p. 1-13.
- Li, X., and Z.-M. Fang, 2014, Current status and technical challenges of CO₂ storage in coal seams and enhanced coalbed methane recovery: an overview: *International Journal of Coal Science Technology*, v. 1, p. 93-102. (ECBM)
- Li, X., B.M. Krooss, P. Weniger, and R. Littke, 2015, Liberation of molecular hydrogen (H₂) and methane (CH₄) during non-isothermal pyrolysis of shales and coals: Systematics and quantification: *International Journal of Coal Geology*, v. 137, p. 152-164.
- Lincoln, D.L., and S.W. Shin, 2008, Measuring performance in the Powder River Basin: An Investor's Guide to Unconventional Gas: Shales and Coalbed Methane, Supplement to Oil & Gas Investor, January 2008, p. 26-29.
- Littke, R., and D. Leythaeuser, 1993, Migration of oil and gas in coals, in B.E. Law and D.D. Rice, eds., *Hydrocarbons from coal: AAPG Studies in Geology* 38, p. 219-236.
- Liu, A., X. Fu, K. Wang, H. An, and G. Wang, 2013, Investigation of coalbed methane potential in low-rank coal reservoirs—Free and soluble gas contents: *Fuel*, v. 112, p. 14-22.

- Liu, C., C. Che, J. Zhu, and H. Yang, 2010, China's endowment—2. China assesses unconventional land oil shale, oil sands, coal gas resources: *Oil & Gas Journal*, v. 108.15, p. 36-39.
- Liu, C.L., X.H. Wang, K. Liu, J. Wang, H. Guo, and Z.Q. Sun, 2014, Occurrence features of coalbed methane in inclined coal seam of Junggar Basin, Xinjiang: *Advanced Materials Research*, v. 868, p. 696-699.
- Liu, D., Y. Yao, D. Tang, S. Tang, Y. Che, and W. Huang, 2009, Coal reservoir characteristics and coalbed methane resource assessment in Huainan and Huaibei coalfields, southern north China: *International Journal of Coal Geology*, v. 79, p. 97-112.
- Liu, J., Z. Chen, D. Elsworth, X. Miao, and X. Mao, 2010, Evaluation of stress-controlled coal swelling processes: *International Journal of Coal Geology*, v. 83, p. 446-455.
- Liu, J., Z. Chen, D. Elsworth, X. Miao, and X. Mao, 2010, Linking gas-sorption induced changes in coal permeability to directional strains through a modulus reduction ratio: *International Journal of Coal Geology*, v. 83, p. 21-30.
- Liu, J., Z. Chen, D. Elsworth, H. Qu, and D. Chen, 2011, Interactions of multiple processes during CBM extraction: a critical review: *International Journal of Coal Geology*, v. 87, p. 175-189.
- Liu, J., J. Wang, Z. Chen, S. Wang, D. Elsworth, and Y. Jiang, 2011, Impact of transition from local swelling to macro swelling on the evolution of coal permeability: *International Journal of Coal Geology*, v. 88, p. 31-40.
- Liu, J., C.J. Spiers, C.J. Peach, S. Vidal-Gilbert, 2016, Effect of lithostatic stress on methane sorption by coal: Theory vs. experiment and implications for predicting in-situ coalbed methane content: *International Journal of Coal Geology*, v. 167, p. 48-64.
- Liu, J., C.J. Peach, and C.J. Spiers, 2016, Anisotropic swelling behaviour of coal matrix cubes exposed to water vapour: Effects of relative humidity and sample size: *International Journal of Coal Geology*, v. 167, p. 119-135.
- Liu, P., Y. Qin, S. Liu, and Y. Hao, 2018, Non-linear gas desorption and transport behavior in coal matrix: Experiments and numerical modeling: *Fuel*, v. 214, p. 1-13.
- Liu, S., S. Harpalani, and M. Pillalamarry, 2012, Laboratory measurement and modeling of coal permeability with continued methane production: Part 2 – Modeling results: *Fuel*, v. 94, p. 117-124.
- Liu, S., and S. Harpalani, 2013, Permeability prediction of coalbed methane reservoirs during primary depletion: *International Journal of Coal Geology*, v. 113, p. 1-10.
- Liu, S., J. Ma, S. Sang, T. Wang, Y. Du, and H. Fang, 2018, The effects of supercritical CO₂ on mesopore and macropore structure in bituminous and anthracite coal: *Fuel*, v. 223, p. 32-43. (ECBM)
- Liu, S., R. Zhang, Z. Karpyn, H. Yoon, and T. Dewers, 2019, Investigation of accessible pore structure evolution under pressurization and adsorption for coal and shale using small-angle neutron scattering: *Energy & Fuels*, v. 33, p. 837-847.
- Liu, X., and C. Wu, 2017, Simulation of dynamic changes of methane state based on NMR during coalbed methane output: *Fuel*, v. 194, p. 188-194.
- Liu, X., D. Song, X. He, B. Nie, Q. Wang, R. Sun, and D. Sun, 2018, Coal macromolecular structural characteristic and its influence on coalbed methane adsorption: *Fuel*, v. 222, p. 687-694.
- Liu, Y., M.A. Urynowicz, and D.M. Bagley, 2013, Ethanol conversion to methane by a coal microbial community: *International Journal of Coal Geology*, v. 115, p. 85-91.
- Liu, Y., Y. Zhu, S. Liu, and W. Li, 2018, A hierarchical methane adsorption characterization through a multiscale approach by considering the

- macromolecular structure and pore size distribution: *Marine and Petroleum Geology*, v. 96, p. 304-314.
- Liu, Y., H. Xu, D. Tang, J.P. Mathews, Y. Zhai, W. Hou, S. Li, S. Tao, X. Xiong, and W. Wang, 2019, The impact of the coal macrolithotype on reservoir productivity, hydraulic fracture initiation and propagation: *Fuel*, v. 239, p. 471-483.
- Liu, Y., Y. Zhu, S. Liu, S. Chen, W. Li, and Y. Wang, 2018, Molecular structure controls on micropore evolution in coal vitrinite during coalification: *International Journal of Coal Geology*, v. 199, p. 19-30.
- Liu, Z., Y. Cheng, J. Dong, J. Jiang, L. Wang, and W. Li, 2018, Master role conversion between diffusion and seepage on coalbed methane production: Implications for adjusting suction pressure on extraction borehole: *Fuel*, v. 223, p. 373-384.
- Liu, Z., Y. Cheng, L. Wang, H. Wang, J. Jiang, and W. Li, 2018, Analysis of coal permeability rebound and recovery during methane extraction: Implications for carbon dioxide storage capability assessment: *Fuel*, v. 230, p. 298-307.
- Logan, T.L., 1988, Horizontal drainhole drilling techniques used in Rocky Mountain coal seams, in J.E. Fassett, ed., *Geology and coal-bed methane resources of the northern San Juan basin, Colorado and New Mexico*: Denver, Rocky Mountain Association of Geologists Guidebook, p. 133-141.
- Logan, T.L., W.F. Clark, and R.A. McBane, 1992, Comparing openhole cavity and cased hole hydraulic fracture completion techniques, San Juan basin, New Mexico, in *Coalbed methane*: Society of Petroleum Engineers, Reprint Series 35, p. 139-146.
- Logan, T.L., 1993, Drilling techniques for coalbed methane, in B.E. Law and D.D. Rice, eds., *Hydrocarbons from coal: AAPG Studies in Geology* 38, p. 269-285.
- Lombardi, T., L. Baez, W. Drexler, and C. Hoffman, 2004, Western Interior Coal Region, geologic overview and corehole results: Tuscaloosa, Alabama, University of Alabama, College of Continuing Studies, 2004 International Coalbed Methane Symposium Proceedings, paper 0430, 16 p.
- Longyi, S., H. Haihai, T. Yue, L. Jing, Q. Haijun, W. Xuetian, and Z. Jiaqiang, 2015, Selection of strategic replacement areas for CBM exploration and development in China: *Natural Gas Industry B*, v. 2, p. 211-221.
- Lough, K., and S. Jewell, 2007, CBM grows in Scotland: An entrepreneur seeks to tap Scotland's coals for methane: *Hart's E&P*, v. 80, no. 6, p. 95-96.
- Lu, M., and L. Connell, 2016, Coal failure during primary and enhanced coalbed methane production — Theory and approximate analyses: *International Journal of Coal Geology*, v. 154-155, p. 275-285.
- Lu, T., H. Yu, T. Zhou, J. Mao, and B. Guo, 2009, Improvement of methane drainage in high gassy coal seam using waterjet technique: *International Journal of Coal Geology*, v. 79, p. 40-48.
- Lu, X., R.T. Armstrong, and P. Mostaghimi, 2018, High-pressure X-ray imaging to interpret coal permeability: *Fuel*, v. 226, p. 573-582.
- Lu, Y., F. Yang, Z. Ge, Q. Wang, and S. Wang, 2017, Influence of viscoelastic surfactant fracturing fluid on permeability of coal seams: *Fuel*, v. 194, p. 1-6.
- Luo, D., and Y. Dai, 2009, Economic evaluation of coalbed methane production in China: *Energy Policy*, v. 37, no. 10, p. 3883-3889.
- Luo, D., Y.J. Dai, and L.Y. Xia, 2011, Economic evaluation based policy analysis for coalbed methane industry in China: *Energy*, v. 36, p. 360-368.
- Lv, Y., D. Tang, H. Xu, and H. Luo, 2012, Production characteristics and the key factors in high-rank coalbed methane fields: A case study on the Fanzhuang Block, southern Qinshui Basin, China: *International Journal of Coal Geology*, v. 96-97, p. 93-108.
- Lyle, D., 2007, Maturity encourages refinement: No longer a new play, coalbed methane technology spreads worldwide: *Hart's E&P*, v. 80, no. 6, p. 91-92.

- Lyman, R.M., 2001, Pyrophoricity (spontaneous combustion) of Powder River basin coals — considerations for coalbed methane development: Wyoming Geo-Notes, number 69, p. 18-22.
- Lyons, P.C., and R.T. Ryder, 1995, Selected bibliography of Appalachian coalbed methane: U.S. Geological Survey, Open-File Report 95-572.
- Lyons, P.C., 1996, Coalbed methane potential in the Appalachian states of Pennsylvania, West Virginia, Maryland, Ohio, Virginia, Kentucky, and Tennessee — an overview: U.S. Geological Survey Open-File Report 96-735 (available on the internet; discusses ownership of coalbed methane)
- Lyons, P.C., 1998, The central and northern Appalachian basin — a frontier region for coalbed methane development, in P.C. Lyons, ed., Special issue: Appalachian coalbed methane: *International Journal of Coal Geology*, v. 38, p. 61-87.
- Lyons, W.S., 2001, Seismic maps Ferron coalbed sweetspots: *AAPG Explorer*, v. 22, no. 12, p. 32-37.
- Ma, Q., S. Harpalani, and S. Liu, 2011, A simplified permeability model for coalbed methane reservoirs based on matchstick strain and constant volume theory: *International Journal of Coal Geology*, v. 85, p. 43-48.
- Ma, T., J. Rutqvist, C.M. Oldenburg, and W. Liu, 2017, Coupled thermal-hydrological-mechanical modeling of CO₂-enhanced coalbed methane recovery: *International Journal of Coal Geology*, v. 179, p. 81-91.
- Ma, X., Y. Song, S. Liu, L. Jiang, and F. Hong, 2016, Experimental study on history of methane adsorption capacity of Carboniferous-Permian coal in Ordos Basin, China: *Fuel*, v. 184, p. 10-17.
- Macuda, J., A. Nodzeński, M. Wagner, and L. Zawisza, 2011, Sorption of methane on lignite from Polish deposits: *International Journal of Coal Geology*, v. 87, p. 41-48. (biogenic methane)
- Mahoney, S.A., T.E. Rufford, V. Rudolph, K.-Y. Liu, S. Rodrigues, and K.M. Steel, 2015, Creation of microchannels in Bowen Basin coals using UV laser and reactive ion etching: *International Journal of Coal Geology*, v. 144-145, p. 48-57. (model cleats)
- Maiti, D., P.K. Mazumdar, and S. Sarkar, 2014, Optimization of drilling parameters in Raniganj Formation, Essar Coal Bed Methane Block — a case study: *Journal of Unconventional Oil and Gas Resources*, v. 6, p. 28-33.
- Majewska, Z., and J. Ziętek, 2007, Changes of acoustic emission and strain in hard coal during gas sorption–desorption cycles: *International Journal of Coal Geology*, v. 70, p. 305-312.
- Maksoud, J., 2008, Raising the Cherokee Basin's CBM profile: *Hart's E&P*, v. 81, no. 6, p. 77-79.
- Mallants, D., R. Jeffrey, X. Zhang, B. Wu, J. Kear, Z. Chen, B. Wu, E. Bekele, M. Raiber, S. Apte, and B. Gray, 2018, Review of plausible chemical migration pathways in Australian coal seam gas basins: *International Journal of Coal Geology*, v. 195, p. 280-303.
- Malone, P.G., F.H. Briscoe, B.S. Camp, and C.M. Boyer, II, 1987, Methods of calculating coalbed methane reserves with insight into the advantages and disadvantages of each method: Tuscaloosa, Alabama, Proceedings of the 1987 Coalbed Methane Symposium, paper 8716, p. 73-79.
- Malone, P.G., L.K. Lottman, B.S. Camp, and J.L. Smith, 1989, An investigation of parameters affecting desorption rates of Warrior basin coals: Tuscaloosa, Alabama, Proceedings of the 1989 Coalbed Methane Symposium, paper 8921, p. 35.
- Malone, R.D., and C.W. Byrer, 1981, Methane recovery from coalbeds well description and field activities log procedures manual: USDOE Morgantown Energy Technology Center, Technical Progress Report 82-3, 73 p.

- Mardon, S.M., C.F. Eble, J.C. Hower, K. Takacs, M. Mastalerz, and R.M. Bustin, 2014, Organic petrology, geochemistry, gas content and gas composition of Middle Pennsylvanian age coal beds in the Eastern Interior (Illinois) Basin: Implications for CBM development and carbon sequestration: *International Journal of Coal Geology*, v. 127, p. 56-74.
- Mares, T.E., and T.A. Moore, 2008, The influence of macroscopic texture on biogenically-derived coalbed methane, Huntly coalfield, New Zealand: *International Journal of Coal Geology*, v. 76, p. 175-185.
- Mares, T.E., T.A. Moore, and C.R. Moore, 2009, Uncertainty of gas saturation estimates in a subbituminous coal seam: *International Journal of Coal Geology*, v. 77, p. 320-327.
- Markowski, A.K., 1993, Coalbed methane: new energy from an old scourge: Pennsylvania Geological Survey, *Pennsylvania Geology*, v. 24, no. 2, p. 8-14.
- Markowski, A.K., 1995, Reconnaissance of gas contents and geologic aspects of the coalbed methane resources of Pennsylvania: Pennsylvania Geological Survey, 4th ser., Open-File Report 95-09, p. 125-140.
- Markowski, A.K., 1998, Coalbed methane resource potential and current prospects in Pennsylvania, in P.C. Lyons, ed., Special issue: Appalachian coalbed methane: *International Journal of Coal Geology*, v. 38, p. 137-159.
- Markowski, A.K., and J.A. Harper, 1998, Geological aspects of coalbed methane in the northern Appalachian coal basin, southwestern Pennsylvania and north-central West Virginia: Pennsylvania Bureau of Topographic and Geologic Survey, Open-File Report 98-13, 72 p.
- Markowski, A.K., 2000, Pennsylvania coalbed methane wells spreadsheet: Pennsylvania Geological Survey, 4th ser., Open-File Report 00-01, 580 p.
- Markowski, A.K., 2001, Reconnaissance of the coal-bed methane resources in Pennsylvania: Pennsylvania Geological Survey, 4th ser., Mineral Resource Report 95, 134 p.
- Markowski, A.K., 2004, Coal-bed methane—Energy within reach: Pennsylvania Geological Survey, *Pennsylvania Geology*, v. 34, no. 1, p. 2-9.
http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_006834.pdf
- Markowski, A.K., 2005, Energy bills getting you down? Maybe coal and unconventional energy sources can help: Pennsylvania Geological Survey, *Pennsylvania Geology*, v. 35, no. 2, p. 2-9.
http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_006839.pdf
- Markowski, A.K., compiler, 2011, Pennsylvania coalbed methane wells database: Pennsylvania Geological Survey, 4th ser., Open-File Report OFOG 11-01.0, Microsoft Access database.
<http://www.dcnr.state.pa.us/topogeo/cbm/ofreport1101.aspx>
- Markowski, A.K., 2014, The state of Pennsylvania's coalbed methane resources: Pennsylvania Geological Survey, *Pennsylvania Geology*, v. 44, no. 1, p. 12-13.
http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_20029447.pdf
- Marroquin, I.D., and B.S. Hart, 2004, Seismic attribute-based characterization of coalbed methane reservoirs: an example from the Fruitland Formation, San Juan Basin, New Mexico: *AAPG Bulletin*, v. 88, p. 1603-1621.
- Martini, A.M., K. Nüsslein, and S.T. Petsch, 2005, Enhancing microbial gas from unconventional reservoirs: *GasTIPS*, v. 11, no. 2, p. 3-7.
- Masoudian, M.S., D.W. Airey, and A. El-Zein, 2014, Experimental investigations on the effect of CO₂ on mechanics of coal: *International Journal of Coal Geology*, v. 128-129, p. 12-23.

- Massarotto, P., 1999, Cost benefit analysis of coalbed methane recovery activities in Australia and New Zealand — implications for commercial projects and government policy, *in* M. Mastalerz, M. Glikson, and S.D. Golding, eds., *Coalbed methane: scientific, environmental and economic evaluation*: Boston, Kluwer Academic Publishers, p. 33-54.
- Masszi, D., 1991, Cavity stress-relief method for recovering methane from coal seams, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., *Coalbed methane of western North America*: Denver, Rocky Mountain Association of Geologists, p. 149-154. (new stimulation technique)
- Mastalerz, M., and E.P. Kvale, 1998, Coal-bed gas potential in Daviess County, Indiana: Indiana Geological Survey, Open-File Study 98-7.
- Mastalerz, M., and E.P. Kvale, 2000, Coal quality variation and coalbed gas content in boreholes SDH-383 and SDH-384 in Posey County, Indiana: Indiana Geological Survey, Open-File Study 00-5, 30 p.
- Mastalerz, M., H. Gluskoter, and J. Rupp, 2004, Carbon dioxide and methane sorption in high volatile bituminous coals from Indiana, USA: *International Journal of Coal Geology*, v. 60, p. 43-55.
- Mastalerz, M., A. Drobniak, D. Strapoć, W.S. Acosta, and J. Rupp, 2008, Variations in pore characteristics in high volatile bituminous coals: Implications for coal bed gas content: *International Journal of Coal Geology*, v. 76, p. 205-216.
- Mastalerz, M., A. Drobniak, and A. Schimmelmann, 2009, Changes in optical properties, chemistry, and micropore and mesopore characteristics of bituminous coal at the contact with dikes in the Illinois Basin: *International Journal of Coal Geology*, v. 77, p. 310-319.
- Mastalerz, M., W. Solano-Acosta, A. Schimmelmann, and A. Drobniak, 2009, Effects of coal storage in air on physical and chemical properties of coal and on gas adsorption: *International Journal of Coal Geology*, v. 79, p. 167-174.
- Mastalerz, M., 2014, Coal bed methane: reserves, production and future outlook, *in* T.M. Letcher, ed., *Future energy*, second edition: New York, Elsevier, p. 145-158.
- Mastalerz, M., L. Hampton, A. Drobniak, and H. Loope, 2017, Significance of analytical particle size in low-pressure N₂ and CO₂ adsorption of coal and shale: *International Journal of Coal Geology*, v. 178, p. 122-131.
- Matthews, C.B., 2005, Horizontal drilling the Lower Hartshorne coal, Arkoma Basin, Oklahoma: techniques and results, *in* B.J. Cardott, ed., *Unconventional energy resources in the southern Midcontinent, 2004 symposium*: Oklahoma Geological Survey Circular 110, p. 117-122.
- Mavor, M.J., R. Dhir, J.D. McLennan, and J.C. Close, 1991, Evaluation of hydraulic fracture stimulation of the Colorado 32-7 well, San Juan basin, *in* S.D. Schwochow, ed., *Coalbed methane of western North America*: Rocky Mountain Association of Geologists, p. 241-248.
- Mavor, M.J., and J.C. Close, 1992, Formation evaluation of coalbed methane wells: GRI, Topical Report GRI 91-0334, 36 p.
- Mavor, M.J., J.C. Close, and R.A. McBane, 1992, Formation evaluation of exploration coalbed methane wells, *in* *Coalbed methane: Richardson, Texas*, Society of Petroleum Engineers, SPE Reprint Series 35, p. 27-45.
- Mavor, M.J., L.B. Owen, and T.J. Pratt, 1992, Measurement and analysis of sorption isotherm data: GRI, Topical Report GRI 91-0335, 25 p.
- Mavor, M.J., J.C. Close, and R.A. McBane, 1992, Formation evaluation of exploration coalbed methane wells, *in* *Coalbed methane*: Society of Petroleum Engineers, Reprint Series 35, p. 27-45.
- Mavor, M.J., and T.L. Logan, 1994, Recent advances in coal gas-well openhole well completion technology: *Journal of Petroleum Technology*, v. 46, p. 587-593.

- Mavor, M.J., T.J. Pratt, and C.R. Nelson, 1995, Quantify the accuracy of coal seam gas content: *Petroleum Engineer International*, v. 68, no. 10, p. 37-42.
- Mavor, M., and C.R. Nelson, 1997, Coalbed reservoir gas-in-place analysis: Gas Research Institute, 148 p.
- Mavor, M., T. Pratt, and R. DeBruyn, 1999, Study quantifies Powder River coal seam properties: *Oil & Gas Journal*, v. 97, no. 17, p. 35-40.
- Mayo, S., M. Josh, D. Kasperczyk, J. Kear, J. Zhang, J. Dautriat, M. Pervukhina, M.B. Clennell, R. Sakurovs, N. Sherwood, A. Maksimenko, and C. Hall, 2018, Dynamic micro-CT study of gas uptake in coal using Xe, Kr and CO₂: *Fuel*, v. 212, p. 140-150.
- Mazumder, S., K.-H.A.A. Wolf, K. Elewaut, and R. Ephraim, 2006, Application of X-ray computed tomography for analyzing cleat spacing and cleat aperture in coal samples: *International Journal of Coal Geology*, v. 68, p. 205-222.
- Mazumder, S., and K.H. Wolf, 2008, Differential swelling and permeability change of coal in response to CO₂ injection for ECBM: *International Journal of Coal Geology*, v. 74, p. 123-138.
- Mazumber, S., M. Scott, and J. Jiang, 2012, Permeability increase in Bowen Basin coal as a result of matrix shrinkage during primary depletion: *International Journal of Coal Geology*, v. 96-97, p. 109-119.
- McCabe, P.J., D.L. Gautier, M.D. Lewan, and C. Turner, 1993, The future of energy gases: USGS Circular 1115, 58 p.
- McCallister, T., 2000, Impact of unconventional gas technology in the annual energy outlook 2000: Energy Information Administration.
http://www.eia.doe.gov/oiaf/analysispaper/unconventional_gas.html
- McClanahan, E.A., 1995, Coalbed methane: myths, facts and legends of its history and the legislative and regulatory climate into the 21st century: *Oklahoma Law Review*, v. 48, no. 3, p. 471-561.
- McCord, J.P., 1984, Geologic overview, coal, and coalbed methane resources of the greater Green River coal region—Wyoming and Colorado, *in* C.T. Rightmire, G.E. Eddy, and J.N. Kirr, eds., *Coalbed methane resources of the United States: AAPG Studies in Geology* 17, p. 271-293.
- McCulloch, C.M., and M. Deul, 1973, Geologic factors causing roof instability and methane emission problems: the Lower Kittanning coalbed, Cambria County, Pa.: U.S. Bureau of Mines Report of Investigations 7769, 25 p.
- McCulloch, C.M., M. Deul, and P.W. Jeran, 1974, Cleat in bituminous coalbeds: U.S. Bureau of Mines Report of Investigations 7910, 25 p.
- McCulloch, C.M., J.R. Levine, F.N. Kissell, and M. Deul, 1975, Measuring the methane content of bituminous coalbeds: U.S. Bureau of Mines Report of Investigations 8043, 22 p.
- McCulloch, C.M., S.W. Lambert, and J.R. White, 1976, Determining cleat orientation of deeper coalbeds from overlying coals: U.S. Bureau of Mines Report of Investigations 8116, 19 p.
- McCulloch, C.M., and M. Deul, 1977, Methane from coal, *in* D.K. Murray, ed., *Geology of Rocky Mountain coal, 1976 symposium: Colorado Geological Survey Resources Series* 1, p. 121-136.
- McCulloch, C.M., and W.P. Diamond, 1979, Inexpensive method helps predict methane content of coal beds, *in* *Planbook of coal mining*: New York, McGraw-Hill, Inc., *Coal Age*, p. 76-80.
- McCune, D., 2002, Fundamentals of coalbed methane production: Lawrence, University of Kansas, Tertiary Oil Recovery Project, 70 p.
- McElhiney, J.E., G.W. Paul, G.B.C. Young, and J.A. McCartney, 1993, Reservoir engineering aspects of coalbed methane, *in* B.E. Law and D.D. Rice, eds., *Hydrocarbons from coal: AAPG Studies in Geology* 38, p. 361-372.

- McIntosh, J., A. Martini, S. Petsch, R. Huang, and K. Nüsslein, 2008, Biogeochemistry of the Forest City Basin coalbed methane play: *International Journal of Coal Geology*, v. 76, p. 111-118.
- McIntyre, M. R., R. H. Groshong, Jr., and J. C. Pashin, 2003, Structure of Cedar Cove and Peterson coalbed methane fields and correlation to gas and water production: Tuscaloosa, Alabama, University of Alabama College of Continuing Studies, 2003 International Coalbed Methane Symposium Proceedings, Paper 0312, 14 p.
- McKee, C.R., A.C. Bumb, S.C. Way, R.A. Koenig, J.M. Reverand, and D.F. Brandenburg, 1986, Using permeability-vs-depth correlations to assess the potential for producing gas from coal seams: *Quarterly Review of Methane from Coal Seams Technology*, v. 4, no. 1, p. 15-26.
- McKee, C.R., A.C. Bumb, and R.A. Koenig, 1988, Stress-dependent permeability and porosity of coal, *in* J.E. Fassett, ed., *Geology and coal-bed methane resources of the northern San Juan basin, Colorado and New Mexico*: Denver, Rocky Mountain Association of Geologists Guidebook, p. 143-153.
- McKinnon, I., 2002, Canadian coalbed methane: *Oil and Gas Investor*, v. 22, no. 3, p. 56-59.
- McLaughlin, J.F., C.D. Frost, and S. Sharma, 2011, Geochemical analysis of Atlantic Rim water, Carbon County, Wyoming: new applications for characterizing coalbed natural gas reservoirs: *AAPG Bulletin*, v. 95, p. 191-217.
- McLennan, J.D., P.S. Schafer, and T.J. Pratt, 1995, A guide to determining coalbed gas content: Gas Research Institute, 181 p.
- Medina, J.C., S.J. Butala, C.H. Bartholomew, and M.L. Lee, 2000, Low temperature iron- and nickel-catalyzed reactions leading to coalbed gas formation: *Geochimica et Cosmochimica Acta*, v. 64, p. 643-649.
- Medina, J.C., S.J. Butala, C.H. Bartholomew, and M.L. Lee, 2000, Iron catalyzed CO₂ hydrogenation as a mechanism for coalbed gas formation: *Fuel*, v. 79, p. 89-93.
- Meissner, F.F., 1984, Cretaceous and lower Tertiary coals as source for gas accumulations in the Rocky Mountain area, *in* J. Woodward, F.F. Meissner, and J.L. Clayton, eds., *Hydrocarbon source rocks of the Greater Rocky Mountain Region*: Rocky Mountain Association of Geologists, p. 401-431.
- Meissner, F.F., 1987, Mechanisms and patterns of gas generation, storage expulsion-migration and accumulation associated with coal measures, Green River and San Juan basins, Rocky Mountain region, USA, *in* B. Doligez, ed., *Migration of hydrocarbons in sedimentary basins*: Paris, Editions Technip, Collection Colloques et Seminaires, v. 45, p. 79-112.
- Melnichenko, Y.B., L. He, R. Sakurovs, A.L. Kholodenko, T. Blach, M. Mastalerz, A.P. Radliński, G. Cheng, and D.F.R. Mildner, 2011, Accessibility of pores in coal to methane and carbon dioxide: *Fuel*, v. 91, p. 200-208.
- Meng, Y., and Z. Li, 2016, Experimental study on diffusion property of methane gas in coal and its influencing factors: *Fuel*, v. 185, p. 219-228.
- Merkel, A., Y. Gensterblum, B.M. Krooss, and A. Amann, 2015, Competitive sorption of CH₄, CO₂ and H₂O on natural coals of different rank: *International Journal of Coal Geology*, v. 150-151, p. 181-192.
- Meszaros, G., P. Boonen, and M. Hale, 2007, New tools enable CBM horizontal drilling: *Hart's E&P*, v. 80, no. 7, p. 60-61.
- Mi, J., S. Zhang, and K. He, 2014, Experimental investigations about the effect of pressure on gas generation from coal: *Organic Geochemistry*, v. 74, p. 116-122.
- Mi, J., S. Zhang, J. Chen, K. He, K. Liu, X. Li, and L. Bi, 2015, Upper thermal maturity limit for gas generation from humic coal: *International Journal of Coal Geology*, v. 152, p. 123-131.

- Michael, K., and S. Bachu, 2002, Coalbed methane producibility in the Cretaceous succession of the Alberta basin as affected by hydrogeology and stress regime (abstract): AAPG Annual Convention Official Program, v. 11, p. A121.
- Michelsen, J.K., and G. Khavari-Khorasani, 1999, The physics and efficiency of petroleum expulsion from coal, *in* M. Mastalerz, M. Glikson, and S.D. Golding, eds., Coalbed methane: scientific, environmental and economic evaluation: Boston, Kluwer Academic Publishers, p. 517-543.
- Midgley, D.J., P. Hendry, K.L. Pinetown, D. Fuentes, S. Gong, D.L. Mitchell, and M. Faiz, 2010, Characterisation of a microbial community associated with a deep, coal seam methane reservoir in the Gippsland Basin, Australia: *International Journal of Coal Geology*, v. 82, p. 232-239.
- Milici, R.C., 2002, Coalbed methane production in the Appalachian Basin: U.S. Geological Survey, Open-File Report 02-105. (<http://pubs.usgs.gov/of/2002/of02-105/>)
- Mililci, R.C., 2004, The Pennsylvania anthracite district—a frontier area for the development of coalbed methane?, *in* P.D. Warwick, ed., Selected presentations on coal-bed gas in the eastern United States: U.S. Geological Survey Open File Report 2004-1273, p. 37-59. (<http://pubs.usgs.gov/of/2004/1273/>)
- Milici, R.C., J.R. Hatch, and M.J. Pawlewicz, 2010, Coalbed methane resources of the Appalachian Basin, eastern USA: *International Journal of Coal Geology*, v. 82, p. 160-174.
- Milici, R.C., and D.E. Polyak, 2014, Coalbed-methane production in the Appalachian Basin, chap. G.2, *in* L.F. Ruppert, and R.T. Ryder, eds., Coal and petroleum resources in the Appalachian Basin: Distribution, geologic framework, and geochemical character: U.S. Geological Survey Professional Paper 1708, 25 p. [42 chapters] <http://pubs.usgs.gov/pp/1708/>
- Miller, M.J., and D.A. Watson II, 2014, Economic analysis of coalbed methane projects, *in* P. Thakur, K. Aminian, and S. Schatzel, eds., Coal bed methane: from prospect to pipeline: New York, Elsevier, p. 261-272.
- Miller, R.D., and J.G. Clough, 2002, Delineation of coal beds for coalbed methane using high-resolution seismic reflection at Ft. Yukon, Alaska (abstract): AAPG Annual Convention Official Program, v. 11, p. A122-123.
- Mitchell, T.E., and S.P. Pappajohn, 1991, Coalbed methane production potential in complex geologic settings, *in* D.C. Peters, ed., Geology in coal resource utilization: Fairfax, VA, Techbooks, p. 137-151.
- Mitariten, M., 2002, Adsorption advances: *World Coal*, v. 11, p. 57-58, 60-61.
- Mitariten, M., 2014, Coalbed and coal mine methane gas purification, *in* P. Thakur, K. Aminian, and S. Schatzel, eds., Coal bed methane: from prospect to pipeline: New York, Elsevier, p. 201-218.
- Mitra, A., S. Harpalani, and S. Liu, 2012, Laboratory measurement and modeling of coal permeability with continued methane production: Part 1 – Laboratory results: *Fuel*, v. 94, p. 110-116.
- Miyazaki, S., and R.J. Korsch, 1993, Coalbed methane resources in the Permian of eastern Australia and their tectonic setting: *APEA Journal*, v. 33, part 1, p. 161-175.
- Miyazaki, S., 2005, Coalbed methane growing rapidly as Australia gas supply diversifies: *Oil & Gas Journal*, v. 103.28, p. 32-36.
- Moffat, D.H., and K.E. Weale, 1955, Sorption by coal of methane at high pressure: *Fuel*, v. 34, p. 449-462.
- Mohanty, D., S. Chattaraj, and A.K. Singh, 2018, Influence of coal composition and maturity on methane storage capacity of coals of Raniganj coalfield, India: *International Journal of Coal Geology*, v. 196, p. 1-18.
- Mohr, S.H., and G.M. Evans, 2007, Model proposed for world conventional, unconventional gas: *Oil & Gas Journal*, v. 105.47, p. 46-51.

- Montgomery, S.L., 1986, Coalbed methane: an old hazard becomes a new resource: Petroleum Information, Petroleum Frontiers series, v. 3, 65 p.
- Montgomery, S.L., 1999, Powder River basin, Wyoming: an expanding coalbed methane (CBM) play: AAPG Bulletin, v. 83, p. 1207-1222.
- Montgomery, S.L., D.E. Tabet, and C.E. Barker, 2001, Upper Cretaceous Ferron Sandstone: major coalbed methane play in central Utah: AAPG Bulletin, v. 85, p. 199-219.
- Montgomery, S.L., and C.E. Barker, 2003, Coalbed methane, Cook Inlet, south-central Alaska: a potential giant gas resource: AAPG Bulletin, v. 87, p. 1-13.
- Moore, T.A., R.M. Flores, R.W. Stanton, and G.D. Stricker, 2002, The role of macroscopic texture in determining coal bed methane variability in the Anderson-Wyodak coal seam, Powder River basin, Wyoming (abstract): TSOP Abstracts and Program, v. 18, p. 85-88.
- Moore, T.A., 2012, Coalbed methane: a review: International Journal of Coal Geology, v. 101, p. 36-81.
- Moore, T.A., M. Bowe, and C. Nas, 2014, High heat flow effects on a coalbed methane reservoir, east Kalimantan (Borneo), Indonesia: International Journal of Coal Geology, v. 131, p. 7-31.
- Morris, G.D.L., 2011, CBM development regs give industry balance: American Oil & Gas Reporter, v. 54, no. 11, p. 158-159.
- Moschovidis, Z.A., J.R. Cameron, and I.D. Palmer, 2005, Methodology and examples of wellbore stability in coalbed methane wells: 2005 International Coalbed Methane Symposium, Tuscaloosa, AL, Paper 0517, 13 p.
- Mosgrove, J.H., 1973, Mine gases, in S.M. Cassidy, ed., Elements of practical coal mining: New York, Society of Mining Engineers of the American Institute of Mining, Metallurgical, and Petroleum Engineers, p. 187-205.
- Mosher, K., J. He, Y. Liu, E. Rupp, and J. Wilcox, 2013, Molecular simulation of methane adsorption in micro- and mesoporous carbons with applications to coal and gas shale systems: International Journal of Coal Geology, v. 109-110, p. 36-44.
- Mroz, T.H., J.G. Ryan, and C.W. Byrer, eds., 1983, Methane recovery from coalbeds - a potential energy source: USDOE Morgantown Energy Technology Center Report DOE/METC/83-76, 458 p.
- Mukhopadhyay, P. K. and Hatcher, P. G., 1993, Composition of coal, in B.E. Law and D.D. Rice, eds., Hydrocarbons from coal: American Association of Petroleum Geologists Studies in Geology, v. 38, p. 79-118.
- Mukhopadhyay, P. K, Calder, J. H. and Hatcher, P. G., 1993, Geological and physicochemical constraints on methane and C6+ hydrocarbon generating capabilities and quality of Carboniferous coals, Cumberland Basin, Nova Scotia, Canada: Proc. 10th Annual International Pittsburgh Coal Conference, p. 1074-1079.
- Mukhopadhyay, P. K., MacDonald, D. J. and Calder, J. H., 1995, Evaluation of coalbed methane potential of the Stellarton Basin, Nova Scotia, Canada, based on geological, physical, and geochemical properties: Proceedings International Gas Conference (INTERGAS '95), Tuscaloosa, Alabama, Paper 9505, p. 311-320.
- Mukhopadhyay, P.K., MacDonald, D.J, Calder, J. H., Hughes, J. D., and Hatcher, P.G., 1997, Relationship between methane generation/adsorption potential, micropore system, and permeability with composition and maturation – Examples from Carboniferous coals of Nova Scotia, eastern Canada: Proc. International Coalbed Methane Symposium, Tuscaloosa, Alabama, Paper 9733, p. 183-193.

- Mullen, M.J., 1988, Log evaluation in wells drilled for coal-bed methane, *in* J.E. Fassett, ed., *Geology and coal-bed methane resources of the northern San Juan basin, Colorado and New Mexico*: Denver, Rocky Mountain Association of Geologists Guidebook, p. 113-124.
- Mullen, M.J., 1991, Cleat detection in coalbeds using the microlog, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., *Coalbed methane of western North America*: Denver, Rocky Mountain Association of Geologists, p. 137-147.
- Murray, D.K., 1991, Coalbed methane: natural gas resources from coal seams, *in* D.C. Peters, ed., *Geology in coal resource utilization*: Fairfax, VA, Techbooks, p. 97-103.
- Murray, D.K., 1996, Coalbed methane in the USA: analogues for worldwide development, *in* R. Gayer and I. Harris, eds., *Coalbed methane and coal geology*: London, Geological Society Special Publication 109, p. 1-12.
- Murray, D.K., 2000, CBM in the United States: *World Coal*, March, p. 61-64.
- Murray, D.K., 2001, Anthracite: a potentially significant producer of coalbed methane, *in* M.R. Silverman, ed., *Emerging coalbed methane plays of North America*: Denver, CO, *Petroleum Frontiers*, v. 18, no. 3, p. 51-60.
- Murray, D.K., 2002, Deep coals hold big part of resource: *American Oil & Gas Reporter*, v. 45, no. 5, p. 73-74, 76-81.
- Murray, D. K., 2003, Natural gas from deep coal beds: a promising resource of worldwide importance: Tuscaloosa, Alabama, University of Alabama, College of Continuing Studies, 2003 International Coalbed Methane Symposium Proceedings, paper 0335, 14 p.
- Murray, J., 2012, Australia extends gas development to CBM: *Hart Energy Publishing, E&P*, v. 85, no. 2, p. 37-38.
- Murrie, G.W., W.P. Diamond, and S.W. Lambert, 1976, *Geology of the Mary Lee group of coalbeds, Black Warrior coal basin, Alabama*: U.S. Bureau of Mines Report of Investigations 8189, 49 p.
- Murrie, G.W., 1977, Coal and gas resources of the Lower Hartshorne coalbed in Le Flore and Haskell Counties, Oklahoma (abstract): *GSA Abstracts with Programs*, v. 9, no. 1, p. 65-66.
- Mutmansky, J.M., 1999, *Guidebook on coalbed methane drainage for underground coal mines*: U.S. Environmental Protection Agency, Coalbed Methane Outreach Program, Document No. 60938, 46 p.
- Narasimhan, K.S., A.K. Mukherjee, S. Sengupta, S.M. Singh, and M.M. Alam, 1998, Coalbed methane potential in India: *Fuel*, v. 22, p. 1865-1866.
- National Petroleum Council, 1980, *Unconventional gas sources, v.2, coal seams*: National Petroleum Council, 46 p.
- Natras, T., I. McIlreath, S. Segal, and D. Bourgeois, 2007, Drill better CBM wells: *Hart's E&P*, v. 80, no. 6, p. 103-105.
- Naveen, P., M. Asif, and K. Ojha, 2018, Integrated fractal description of nanopore structure and its effect on CH₄ adsorption on Jharia coals, India: *Fuel*, v. 232, p. 190-204.
- Nelson, C.R., 1997, Advances in coalbed reservoir gas-in-place analysis: *GRI Gas Tips*, v. 4, no. 1, p. 14-19.
- Nelson, C.R., M.J. Mavor, T.J. Pratt, and T.A. Casey, 1997, Protocol ups coal seam gas analysis: *American Oil & Gas Reporter*, v. 40, p. 86-89.
- Nelson, C.R., 1999, Gem in the rough; technology, economics putting new shine on coalbed methane: *American Oil & Gas Reporter*, v.42, no. 3, p. 84-92.
- Nelson, C.R., 1999, Common sources of error in coalbed gas resource and reservoir gas-in-place values (abstract): *AAPG Bulletin*, v. 83, p. 1372.

- Nelson, C.R., 1999, Changing perceptions regarding the size and production potential of coalbed methane resources: *GTI Gas Tips*, v. 5, no. 2, p. 4-11.
- Nelson, C.R., 2000, Coalbed methane potential of the U.S. Rocky Mountain region: *GTI Gas Tips*, v. 6, no. 3, p. 4-12.
- Nelson, C.R., 2000, New methods for coalbed reservoir gas-in-place analysis: results from case studies in the San Juan, Powder River, Black Warrior, and central Appalachian basins: Gas Research Institute, 12 p.
- Nelson, C.R., and T.J. Pratt, 2001, In coalbed gas plays, reservoir variables key to success: *American Oil & Gas Reporter*, v. 44, no. 3, p. 78-87.
- Nelson, C.R., 2001, Geologic controls on effective cleat porosity variation in San Juan basin Fruitland Formation coalbed reservoirs: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 108, p. 11-19.
- Nelson, C. R., 2003, Reservoir property analysis methods for low gas content, subbituminous coals: Tuscaloosa, Alabama, University of Alabama, College of Continuing Studies, 2003 International Coalbed Methane Symposium Proceedings, paper 0326, 14 p.
- Nelson, C. R., 2004, Effect of vertical degasification wells on coal seam gas content reduction at the Oak Grove Field, Black Warrior basin, Alabama: Tuscaloosa, Alabama, University of Alabama, College of Continuing Studies, 2004 International Coalbed Methane Symposium Proceedings, paper 0428, 14 p.
- Newell, K.D, 2002, Analysis of Cherokee Group cuttings samples for gas content--Colt Energy #1 Honeycutt well (sec. 6-T.31S.-R.17E), Montgomery County, Kansas: Kansas Geological Survey, Kansas Geological Survey, Open-file Report 2002-72, 16p.
- Newell, K.D., L.L. Brady, J.P. Lange, and T.R. Carr, 2002, Coalbed gas play emerges in eastern Kansas basins: *Oil & Gas Journal*, v. 100.52, p. 36-41.
- Newell, K.D., and L.M. Magnuson, 2003, Regional trends in coalbed gas composition and thermal maturation in eastern Kansas: implications for predicting quality and location of coalbed gas: Kansas: Kansas Geological Survey Open-File Report 2003-58. (<http://www.kgs.ku.edu/PRS/publication/2003/ofr2003-58.pdf>)
- Newell, K.D., 2003, Analysis of Cherokee Group cuttings samples for gas content--Devon Energy #35-1 R. John well (sec. 35-T.29S.-R.18E), Neosho County, Kansas: Kansas Geological Survey, Open-file Report 2003-83, 23p.
- Newell, K.D., and L.M. Magnuson, 2003, Regional trends in coalbed gas composition and thermal maturation in eastern Kansas: implications for predicting quality and location of coalbed gas (abstract): AAPG Mid-Continent Section Meeting, Official Program Book, p.39. (*Oklahoma Geology Notes*, v. 63, p. 97)
- Newell, K.D., T.A. Johnson, W.M. Brown, J.P. Lange, and T.R. Carr, 2004, Geological and geochemical factors influencing the emerging coalbed gas play in the Cherokee and Forest City Basins in eastern Kansas: Kansas Geological Survey Open-File Report 2004-17. (<http://www.kgs.ku.edu/PRS/publication/2004/AAPG/Coalbed/P1-02.html>)
- Newell, K.D., L.M. Magnuson, and G. Gagnon, 2004, Analysis of Kansas City, Marmaton and Cherokee Group core samples for gas content—Osborne Energy Rose Hill #1-6 (sec. 6-T.16S.-R.24E.) Miami County, Kansas: Kansas Geological Survey Open-File Report 2004-23, 32p.
- Newell, K.D., and D. Grisafe, 2004, Density, ash content, and moisture content of selected eastern Kansas Pennsylvanian coals and shales: Kansas Geological Survey Open-File Report 2004-42. (http://www.kgs.ku.edu/PRS/publication/2004/OFR04_42/index.html)
- Newell, K.D., and Lange, J.P., 2004, Analysis of Cherokee Group cuttings samples for gas content--Gene M. Bailey #12 Kimball (NE NE SW sec. 19-T.30S.-R.16E.),

- Wilson County, Kansas: Kansas Geological Survey Open-File Report 2004-50, 16p.
- Newell, K.D., T.R. Carr, and G. Gagnon, 2004, Analysis of Pleasanton, Marmaton, and Cherokee Group core samples for gas content—Osborn Energy #1-22 Smith (sec. 22-T.44N.-R.33W.), Cass County, Missouri: Kansas Geological Survey, Open-file Report 2004-51, 51p.
- Newell, K.D., 2004, Analysis of Cherokee Group cuttings samples for gas content--Meritage KCM #6-32 Broyles (SW SE 6.T.23S.-R.22E), Linn County, Kansas: Kansas Geological Survey, Open-file Report 2004-52, 35p.
- Newell, D.D., J.P. Lange, and T.A. Johnson, 2004, Analysis of Marmaton and Cherokee Group core samples for gas content--Layne Christensen #3-9 Scott well, (S2 NE NW Sec. 9-T.33S.-R.16E.) Montgomery County, Kansas: Kansas Geological Survey Open-File Report 2004-53, 58p.
- Newell, K.D., 2004, Analysis of Marmaton and Cherokee Group core samples for gas content--Dart Cherokee Basin Operating Company, Butler #A3-35; sec. 35-T.33S.-R.14E; Montgomery County, Kansas: Kansas Geological Survey, Open-file Report 2004-54, 23p.
- Newell, K.D., T.R. Carr, and W.M. Brown, 2005, Eastern Kansas CBNG shows promise: *American Oil & Gas Reporter*, v. 48, no. 8, p. 135-138.
- Newell, K.D., 2007, Wellsite, laboratory, and mathematical techniques for determining sorbed gas content of coals and gas shales utilizing well cuttings: *Natural Resources Research*, v. 16, p. 55-66.
- Newell, K.D., and T.R. Carr, 2009, Coal-bed natural gas production and gas content of Pennsylvanian coal units in eastern Kansas, in T. Carr, T. D'Agostino, W. Ambrose, J. Pashin, and N.C. Rosen, eds., *Unconventional energy resources: making the unconventional conventional: 29th Annual GCSSEPM Foundation Bob F. Perkins Research Conference*, CD-ROM, p. 353-387.
- Newell, K.D., 2010, Fall may be imminent for Kansas Cherokee basin coalbed methane gas output: *Oil & Gas Journal*, v. 108.5, p. 33-40.
- Newell, K.D., and R.L. Yoakum, 2010, Kansas coalbed methane, in D.F. Merriam, ed., *New plays and ways: Kansas Geological Society, Kansas Oil and Gas Fields*, v. 6, p. 105-128.
- Newell, K.D., R.S. Sawin, and L.L. Brady, 2012, Natural gas from coal in eastern Kansas: Kansas Geological Survey, Public Information Circular 19, 4 p. <http://www.kgs.ku.edu/Publications/pic19/PIC19.pdf>
- Ni, Y., J. Dai, C. Zou, F. Liao, Y. Shuai, and Y. Zhang, 2013, Geochemical characteristics of biogenic gases in China: *International Journal of Coal Geology*, v. 113, p. 76-87.
- Ni, Y., J. Dai, G. Zhu, S. Zhang, D. Zhang, J. Su, X. Tao, F. Liao, W. Wu, D. Gong, and Q. Liu, 2013, Stable hydrogen and carbon isotopic ratios of coal-derived and oil-derived gases: A case study in the Tarim Basin, NW China: *International Journal of Coal Geology*, v. 116-117, p. 302-313.
- Ni, Y., D. Zhang, F. Liao, D. Gong, P. Xue, F. Yu, J. Yu, J. Chen, C. Zhao, J. Hu, and Y. Jin, 2015, Stable hydrogen and carbon isotopic ratios of coal-derived gases from the Turpan-Hami Basin, NW China: *International Journal of Coal Geology*, v. 152, p. 144-155.
- Ni, Y., J. Gao, J. Chen, F. Liao, J. Liu, and D. Zhang, 2018, Gas generation and its isotope composition during coal pyrolysis: Potential mechanism of isotope rollover: *Fuel*, v. 231, p. 387-395.
- Nie, R.-S., Y.-F. Meng, J.-C. Guo, and Y.-L. Jia, 2012, Modeling transient flow behavior of a horizontal well in a coal seam: *International Journal of Coal Geology*, v. 92, p. 54-68.

- Nikols, D.J., and B.A. Rottenfusser, 1991, Coalbed methane — a Canadian resource for the 1990s, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., Coalbed methane of western North America: Denver, Rocky Mountain Association of Geologists, p. 249-253.
- Niu, Y., P. Mostaghimi, I. Shikhov, Z. Chen, and R.T. Armstrong, 2018, Coal permeability: Gas slippage linked to permeability rebound: *Fuel*, v. 215, p. 844-852.
- Nodzenski, A., 1998, Sorption and desorption of gases (CH₄, CO₂) on hard coal and active carbon at elevated pressures: *Fuel*, v. 77, p. 1243-1246.
- Nolde, J.E., and D. Spears, 1998, A preliminary assessment of in place coalbed methane resources in the Virginia portion of the central Appalachian basin, *in* P.C. Lyons, ed., Special issue: Appalachian coalbed methane: *International Journal of Coal Geology*, v. 38, p. 115-136.
- Nowak, H.C., 1991, Depositional environments and stratigraphy of Mesaverde Formation, southeastern Piceance Basin, Colorado—Implications for coalbed methane exploration, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., Coalbed methane of western North America: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 1-20.
- Nuccio, V.F., 2000, Coal-bed methane: potential and concerns: U.S. Geological Survey Fact Sheet FS-123-00.
- Nuccio, V.F., 2002, Coalbed methane — What is it? Where is it? And why all the fuss?, *in* S.D. Schwochow and V.F. Nuccio, eds., Coalbed methane of North America, II: Rocky Mountain Association of Geologists, p. 1-6.
- Ogbe, D.O., J.B. Packer, and J.G. Clough, 2002, Risk-weighted volumetric analysis to estimate gas reserves and evaluate coalbed methane potential of the Lower matanuska valley, Cook Inlet basin, Alaska (abstract): *AAPG Bulletin*, v. 86, p. 1155-1156.
- Ohm, S.E., and D.A. Karlsen, 2007, Biogenic gas (?) in fluid inclusions from sandstones in contact with oil-mature coals: *AAPG Bulletin*, v. 91, p. 715-739.
- Oil & Gas Journal, 2003, Coiled-tubing fracturing effectively stimulates multiple coal seams: *Oil & Gas Journal*, v. 101.10, p. 47-48.
- Okolo, G.N., R.C. Everson, H.W.J.P. Neomagus, M.J. Roberts, and R. Sakurovs, 2015, Comparing the porosity and surface areas of coal as measured by gas adsorption, mercury intrusion and SAXS techniques: *Fuel*, v. 141, p. 293-304.
- Okuszkó, K., and B. Gault, 2007, Analyze CBM decline performance: *Hart's E&P*, v. 80, no. 6, p. 99-101.
- Olague, N.E., and D.M. Smith, 1989, Diffusion of gases in American coals: *Fuel*, v. 68, p. 1381-1387.
- Oldaker, P.R., 1991, Hydrogeology of the Fruitland Formation, San Juan basin, Colorado and New Mexico, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., Coalbed methane of western North America: Denver, Rocky Mountain Association of Geologists, p. 61-66.
- Oliver, S., 2002, Methane enrichment: *World Coal*, v. 11, p. 53-55. (CMM)
- Olson, M., T. Smith, and B. Fehn, 2004, Optimized flow device eliminates CBM lift equipment, reduces costs: *World Oil*, v. 225, no. 5, p. 70-71.
- Olszewski, A.J., and R.A. Schraufnagel, 1992, Development of formation evaluation technology for coalbed methane development: *Quarterly Review of Methane from Coal Seams Technology*, v. 10, no. 2, p. 29-35; v. 10, no. 3, p. 32-36.
- O'Neil, P.E., S.C. Harris, M.F. Mettee, T.E. Shepard, and S.W. McGregor, 1993, Surface discharge of wastewaters from the production of methane from coal seams in Alabama, the Cedar Cove model: *Alabama Geological Survey Bulletin* 155, 259 p.
- Opara, A., D.J. Adams, M.L. Free, J. McLennan, and J. Hamilton, 2012, Microbial production of methane and carbon dioxide from lignite, bituminous coal, and coal

- waste materials: *International Journal of Coal Geology*, v. 96-97, p. 1-8.
(biogenic methane)
- Orem, W., 2013, Microbial production of natural gas from coal and organic-rich shale: U.S. Geological Survey Fact Sheet 2012-3109, 2 p.
<http://pubs.usgs.gov/fs/2012/3109>
- Osborne, T.E., D.K. Moore, J.T. Kidd, and F.T. Pescatore, Jr., 1991, Coalbed methane potential of the northern Coosa basin in Alabama, *in* R.B. Finkelman and D.C. Peters, eds., *Practical applications of coal geology: Journal of Coal Quality*, v. 10, p. 95-103.
- Osborne, T. E., 1997, Stratigraphy and structure of sections 1 and 12, T. 16 S., R. 3 E., of the Coal City Basin within the Coosa synclinorium of Alabama, *in* D.N. Bearce, J. C. Pashin, and W. E. Osborne, eds., *Geology of the Coosa Coalfield: Alabama Geological Society 34th Annual Field Trip Guidebook*, p. 39-49.
- Ou, C.H., C.C. Li, J. He, and S.Y. Hou, 2015, Low-rank coalbed methane enrichment characteristics in the eastern zone of Junggar Basin: *Advanced Materials Research*, v. 1092-1093, p. 1416-1419.
- Ou, C., C. Li, D. Zhi, L. Xue, and S. Yang, 2018, Coupling accumulation model with gas-bearing features to evaluate low-rank coalbed methane resource potential in the southern Junggar Basin, China: *AAPG Bulletin*, v. 102, p. 153-174.
- Oyler, D.C., W.P. Diamond, and P.W. Jeran, 1979, Directional drilling for coalbed degasification: U.S. Bureau of Mines Report of Investigations 8380, 15 p.
- Oyler, D.C., and W.P. Diamond, 1982, Drilling a horizontal coalbed methane drainage system from a directional surface borehole: U.S. Bureau of Mines Report of Investigations 8640, 50 p.
- Oyler, D.C., and R.B. Stubbs, 1985, Measuring formation pressures and the degree of gas drainage in a large coalbed gas drainage field: U.S. Bureau of Mines Report of Investigations 8986, 15 p.
- Owskiacki, G., and G. Payie, 2000, Coalbed methane potential in British Columbia: British Columbia Ministry of Energy and Mines, GeoFile 2000-7, 44 p.
- Palmer, I.D., and D.P. Sparks, 1992, Measurement of induced fractures by downhole TV camera in Black Warrior basin coalbeds, *in* *Coalbed methane: Society of Petroleum Engineers, Reprint Series 35*, p. 167-175.
- Palmer, I.D., M.W. Davids, and S.J. Leu, 1992, Analysis of unconventional behavior observed during coalbed fracturing treatments, *in* *Coalbed methane: Society of Petroleum Engineers, Reprint Series 35*, p. 176-196.
- Palmer, I.D., S.W. Lambert, and J.L. Spitler, 1993, Coalbed methane well completions and stimulations, *in* B.E. Law and D.D. Rice, eds., *Hydrocarbons from coal: AAPG Studies in Geology 38*, p. 303-339.
- Palmer, I., and J. Mansoori, 1998, How permeability depends on stress and pore pressure in coalbeds: a new model: *Society of Petroleum Engineers Reservoir Evaluation and Engineering*, Paper SPE 52607, p. 539-544.
- Palmer, I. D., 2004, Permeability changes in a CBM reservoir during production: an update and implications for CO₂ injection: Tuscaloosa, Alabama, University of Alabama, College of Continuing Studies, 2004 International Coalbed Methane Symposium Proceedings, paper 0403, 25 p.
- Palmer, I.D., J.R. Cameron, and Z.A. Moschovidis, 2005, Looking for permeability loss or gain during coalbed methane production: 2005 International Coalbed Methane Symposium, Tuscaloosa, AL, Paper 0515, 19 p.
- Palmer, I.D., J.R. Cameron, and Z.A. Moschovidis, 2006, Permeability changes affect CBM production predictions: *Oil & Gas Journal*, v. 104.28, p. 43-50.
- Palmer, I., 2009, Getting natural gas out of shales and coals, *in* T. Carr, T. D'Agostino, W. Ambrose, J. Pashin, and N.C. Rosen, eds., *Unconventional energy resources: making the unconventional conventional: 29th Annual GCSSEPM Foundation Bob F. Perkins Research Conference*, CD-ROM, p. 306-328.

- Palmer, I., 2010, Coalbed methane completions: a world view: *International Journal of Coal Geology*, v. 82, p. 184-195.
- Pan, J., Q. Hou, Y. Ju, H. Bai, and Y. Zhao, 2012, Coalbed methane sorption related to coal deformation structures at different temperatures and pressures: *Fuel*, v. 102, p. 760-765.
- Pan, J., K. Wang, Q. Hou, Q. Niu, H. Wang, and Z. Ji, 2015, Micro-pores and fractures of coals analysed by field emission scanning electron microscopy and fractal theory: *Fuel*, v. 164, p. 277-285.
- Pan, J., M. Lv, Q. Hou, Y. Han, and K. Wang, 2019, Coal microcrystalline structural changes related to methane adsorption/desorption: *Fuel*, v. 239, p. 13-23.
- Pan, Z., and L. Connell, 2007, A theoretical model for gas adsorption-induced coal swelling: *International Journal of Coal Geology*, v. 69, p. 243-252.
- Pan, Z., L.D. Connell, M. Camilleri, and L. Connelly, 2010, Effects of matrix moisture on gas diffusion and flow in coal: *Fuel*, v. 89, p. 3207-3217.
- Pan, Z., L.D. Connell, and M. Camilleri, 2010, Laboratory characterization of coal reservoir permeability for primary and enhanced coalbed methane recovery: *International Journal of Coal Geology*, v. 82, p. 252-261.
- Pan, Z., and L.D. Connell, 2011, Modelling of anisotropic coal swelling and its impact on permeability behavior for primary and enhanced coalbed methane recovery: *International Journal of Coal Geology*, v. 85, p. 257-267.
- Pan, Z., and L.D. Connell, 2012, Modelling permeability for coal reservoirs: A review of analytical models and testing data: *International Journal of Coal Geology*, v. 92, p. 1-44.
- Pan, Z., and D.A. Wood, 2015, Virtual special issue: Coalbed methane (CBM) exploration, reservoir characterization, production, and modelling: A collection of published research (2009-2015): *Journal of Natural Gas Science and Engineering*, v. 26, p. 1491-1494.
- Pandey, R., and S. Harpalani, 2018, An imaging and fractal approach towards understanding reservoir scale changes in coal due to bioconversion: *Fuel*, v. 230, p. 282-297. (microbially enhanced CBM)
- Pandey, R., and S. Harpalani, 2019, Impact of bioconversion on matrix strain response of coal reservoirs: Part 1-Experimental insights: *Fuel*, v. 239, p. 1363-1375. (microbially enhanced CBM)
- Pandey, R., and S. Harpalani, 2019, Impact of bioconversion on matrix strain response of coal reservoirs: Part 2-Reservoir insights: *Fuel*, v. 239, p. 1376-1387. (microbially enhanced CBM)
- Pant, L.M., H. Huang, M. Secanell, S. Larter, and S.K. Mitra, 2015, Multi scale characterization of coal structure for mass transport: *Fuel*, v. 159, p. 315-323.
- Papendick, S.L., K.R. Downs, K.D. Vo, S.K. Hamilton, G.K.W. Dawson, S.D. Golding, and P.C. Gilcrease, 2011, Biogenic methane potential for Surat Basin, Queensland coal seams: *International Journal of Coal Geology*, v. 88, p. 123-134.
- Pappajohn, S.P., and T.E. Mitchell, 1991, Delineation of prospective coalbed methane trends in western and central Washington state, in S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., *Coalbed methane of western North America*: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 163-178.
- Park, S.Y., and Y. Liang, 2016, Biogenic methane production from coal: A review on recent research and development on microbially enhanced coalbed methane (MECBM): *Fuel*, v. 166, p. 258-267.
- Parks, K., and L. Andriashek, 2009, Preliminary investigation of potential, natural hydraulic pathways between the Scollard and Paskapoo Formations in Alberta: Implications for coalbed methane production: *Energy Resources Conservation*

- Board/ Alberta Geological Survey Open File Report 2009-16, 66 p.
http://www.ags.gov.ab.ca/publications/OFR/PDF/OFR_2009_16.PDF
- Pashin, J.C., and J.C. Sarnecki, 1990, Coal-bearing strata near Oak Grove and Brookwood coalbed-methane fields, Black Warrior Basin, Alabama: Guidebook for field trip 5, 39th Annual Meeting, Southeastern Section, Geological Society of America, 37 p. <http://www.gsa.state.al.us/gsa/pubs/onlinepubs/Guidebooks/GB3-5.pdf>
- Pashin, J.C., W.E. Ward II, R.B. Winston, R.V. Chandler, D.E. Bolin, K.E. Richter, W.E. Osborne, and J.C. Sarnecki, 1991, Regional analysis of the Black Creek-Cobb coalbed-methane target interval, Black Warrior basin, Alabama: Geological Survey of Alabama Bulletin 145, 127 p.
<http://www.gsa.state.al.us/gsa/pubs/onlinepubs/Bulletins/B145.pdf>)
- Pashin, J. C., and R. M. Mink, 1992, Pennsylvanian coalbed methane—Alabama, *in* D.G. Bebout, W. A. White, C. M. Garrett, Jr., and T. F. Henz, eds., Atlas of major central and eastern Gulf Coast gas reservoirs: Austin, Texas, Gas Research Institute and Texas Bureau of Economic Geology, p. 82-83.
- Pashin, J.C., 1994, Coal-body geometry and synsedimentary detachment folding in Oak Grove coalbed methane field, Black Warrior basin, Alabama: AAPG Bulletin, v. 78, p. 960-980.
- Pashin, J.C., R.H. Groshong, Jr., and S. Wang, 1995, Thin-skinned structures influence gas production in Alabama coalbed methane fields, *in* InterGas '95 proceedings: Tuscaloosa, University of Alabama, p. 39-52.
- Pashin, J. C., 1997, Productivity of coalbed methane wells in Alabama: Tuscaloosa, Alabama, University of Alabama, College of Continuing Studies, 1997 International Coalbed Methane Symposium Proceedings, p. 65-74.
- Pashin, J.C., and F. Hinkle, 1997, Coalbed methane in Alabama: Alabama Geological Survey, Circular 192, 71 p.
- Pashin, J.C., 1998, Stratigraphy and structure of coalbed methane reservoirs in the United States: an overview, *in* R.M. Flores, ed., Coalbed methane: from coal-mine outbursts to a gas resource: International Journal of Coal Geology, v. 35, p. 209-240.
- Pashin, J.C., and R.H. Groshong, Jr., 1998, Structural control of coalbed methane production in Alabama, *in* P.C. Lyons, ed., Special issue: Appalachian coalbed methane: International Journal of Coal Geology, v. 38, p. 89-113.
- Pashin, J.C., R.E. Carroll, J.R. Hatch, and M.B. Goldhaber, 1999, Mechanical and thermal control of cleating and shearing in coal: examples from the Alabama coalbed methane fields, USA, *in* M. Mastalerz, M. Glikson, and S.D. Golding, eds., Coalbed methane: scientific, environmental and economic evaluation: Boston, Kluwer Academic Publishers, p. 305-327.
- Pashin J. C., and R. E. Carroll, eds., 1999, Geology of the Cahaba coalfield: Alabama Geological Society 36th Annual Field Trip Guidebook, 98 p.
- Pashin, J. C., R. E. Carroll, J. R. Hatch, and M. B. Goldhaber, 1999, Interplay among cleating, maturation, and mineralization in coalbed methane reservoirs of the Black Warrior Basin: Tuscaloosa, Alabama, University of Alabama, College of Continuing Studies, 1999 International Coalbed Methane Symposium Proceedings, p. 367-375.
- Pashin, J.C., R.H. Groshong, Jr., and R.E. Carroll, 2001, Carbon sequestration potential of coalbed methane reservoirs in the Black Warrior basin: a preliminary look: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 143, p. 51-62.
- Pashin, J.C., R.H. Groshong, Jr., and R.E. Carroll, 2001, Enhanced coalbed methane recovery through sequestration of carbon dioxide: potential for a market-based environmental solution in the Black Warrior basin of Alabama: National Energy

- Technology Laboratory First National Conference on Carbon Sequestration, 14 p. http://www.netl.doe.gov/publications/proceedings/01/carbon_seq/3a2.pdf
- Pashin, J.C., R.E. Carroll, R.H. Groshong, Jr., D.E. Raymond, M. McIntyre, and W.J. Payton, 2002, Geologic screening criteria for sequestration of CO₂ in coal: quantifying potential of the Black Warrior coalbed methane fairway, Alabama: U.S. Department of Energy, National Technology Laboratory, Annual Technical Progress Report. <http://www.gsa.state.al.us/gsa/CO2PAGE/CO2page.htm>
- Pashin, J.C., J.W. Payton, and G. Jin, 2002, Application of discrete fracture network models to coalbed methane reservoirs in the Black Warrior basin (abstract): AAPG Annual Convention Official Program, v. 11, p. A137.
- Pashin, J.C., and R.E. Carroll, 2002, Influence of coal quality on the carbon sequestration potential of coalbed methane reservoirs in the Black Warrior basin (abstract): AAPG Annual Convention Official Program, v. 11, p. A137.
- Pashin, J.C., and M.R. McIntyre, 2003, Temperature-pressure conditions in coalbed methane reservoirs of the Black Warrior basin: implications for carbon sequestration and enhanced coalbed methane recovery: International Journal of Coal Geology, v. 54, p. 167-183.
- Pashin, J. C., R. E. Carroll, R. H. Groshong, Jr., D. E. Raymond, M. R. McIntyre, and J. W. Payton, 2004, Geologic screening criteria for sequestration of CO₂ in coal: quantifying potential of the Black Warrior coalbed methane fairway, Alabama: Final Technical Report, U.S. Department of Energy, National Technology Laboratory, contract DE-FC26-00NT40927, 254 p. <http://www.gsa.state.al.us/gsa/CO2PAGE/40927R03.pdf>
- Pashin, J.C., 2004, Geologic heterogeneity and coalbed methane production—experience from the Black Warrior Basin, in P.D. Warwick, ed., Selected presentations on coal-bed gas in the eastern United States: U.S. Geological Survey Open File Report 2004-1273, p. 61-92. (<http://pubs.usgs.gov/of/2004/1273/>)
- Pashin, J. C., G. Jin, and J. W. Payton, 2004, Three-dimensional computer models of natural and induced fractures in coalbed methane reservoirs of the Black Warrior Basin: Alabama Geological Survey Bulletin 174, 62 p.
- Pashin, J. C., and D. E. Raymond, 2004, Glacial-eustatic control of coalbed methane reservoir distribution (Pottsville Formation; Lower Pennsylvanian) in the Black Warrior Basin of Alabama: Tuscaloosa, Alabama, University of Alabama College of Continuing Studies, 2004 International Coalbed Methane Symposium Proceedings, Paper 0413, 15 p.
- Pashin, J. C., 2005, Coalbed methane exploration in thrust belts: experience from the southern Appalachians, USA: Tuscaloosa, Alabama, University of Alabama, College of Continuing Studies, 2005 International Coalbed Methane Symposium Proceedings, Paper 0519, 14 p.
- Pashin, J., 2007, Hydrodynamics of coalbed methane reservoirs in the Black Warrior Basin: key to understanding reservoir performance and environmental issues: Applied Geochemistry, v. 22, p. 2257-2272.
- Pashin, J.C., 2008, Coal as a petroleum source rock and reservoir rock, in I. Suárez-Ruiz and J.C. Crelling, eds., Applied coal petrology: the role of petrology in coal utilization: New York, Academic Press, p. 227-262.
- Pashin, J.C., 2009, Implications of variable gas saturation in coalbed methane reservoirs of the Black Warrior Basin, in T. Carr, T. D'Agostino, W. Ambrose, J. Pashin, and N.C. Rosen, eds., Unconventional energy resources: making the unconventional conventional: 29th Annual GCSSEPM Foundation Bob F. Perkins Research Conference, CD-ROM, p. 329-352.

- Pashin, J.C., 2010, Variable gas saturation in coalbed methane reservoirs of the Black Warrior Basin: implications for exploration and production: *International Journal of Coal Geology*, v. 82, p. 135-146.
- Pashin, J. C., 2010, Mature coalbed natural gas reservoirs and operations in the Black Warrior basin of Alabama, in K.J. Reddy, ed., *Coalbed natural gas: energy and environment*: Haupage, New York, Nova Science Publishers, p. 31-57.
- Pashin, J.C., M.R. McIntyre-Redden, S.D. Mann, D.C. Kopaska-Merkel, M. Varonka, and W. Orem, 2014, Relationships between water and gas chemistry in mature coalbed methane reservoirs of the Black Warrior Basin: *International Journal of Coal Geology*, v. 126, p. 92-105.
- Pashin, J.C., 2014, Geology of North American coalbed methane reservoirs, *in* P. Thakur, K. Aminian, and S. Schatzel, eds., *Coal bed methane: from prospect to pipeline*: New York, Elsevier, p. 31-61.
- Pashin, J.C., P.E. Clark, M.R. McIntyre-Redden, R.E. Carroll, R.A. Esposito, A.Y. Oudinot, and G.J. Koperna, Jr., 2015, SECARB CO₂ injection test in mature coalbed methane reservoirs of the Black Warrior Basin, Blue Creek field, Alabama: *International Journal of Coal Geology*, v. 144-145, p. 71-87. (ECBM)
- Patching, T.C., 1970, The retention and release of gas in coal — a review: *Canadian Institute of Mining and Metallurgy, CIM Transactions*, v. 63, p. 1302-1308.
- Patience, R.L., 2003, Where did all the coal gas go?: *Organic Geochemistry*, v. 34, p. 375-387.
- Pattison, C.I., C.R. Fielding, R.H. McWatters, and L.H. Hamilton, 1996, Nature and origin of fractures in Permian coals from the Bowen basin, Queensland, Australia, *in* R. Gayer and I. Harris, eds., *Coalbed methane and coal geology*: London, Geological Society Special Publication 109, p. 133-150.
- Paul, S., and R. Chatterjee, 2011, Determination of in-situ stress direction from cleat orientation mapping for coal bed methane exploration in south-eastern part of Jharia coalfield, India: *International Journal of Coal Geology*, v. 87, p. 87-96.
- Paul, S., and R. Chatterjee, 2011, Mapping of cleats and fractures as an indicator of in-situ stress orientation, Jharia coalfield, India: *International Journal of Coal Geology*, v. 88, p. 113-122.
- Peng, C., C. Zou, T. Zhou, K. Li, Y. Yang, G Zhang, and W Wang, 2017, Factors affecting coalbed methane (CBM) well productivity in the Shizhuangnan block of southern Qinshui Basin, north China: Investigation by geophysical log, experiment and production data: *Fuel*, v. 191, p. 427-441.
- Peng, Y., J. Liu, W. Zhu, Z. Pan, and L. Connell, 2014, Benchmark assessment of coal permeability models on the accuracy of permeability prediction: *Fuel*, v. 132, p. 194-203.
- Peng, Y., J. Liu, M. Wei, Z. Pan, and L.D. Connell, 2014, Why coal permeability changes under free swellings: New insights: *International Journal of Coal Geology*, v. 133, p. 35-46.
- Penner, T.J., J.M. Foght, and K. Budwill, 2010, Microbial diversity of western Canadian subsurface coal beds and methanogenic coal enrichment cultures: *International Journal of Coal Geology*, v. 82, p. 81-93. (biogenic)
- Penny, G.S., M.W. Conway, S.W. Almond, R. Himes, and K.E. Nick, 1996, The mechanisms and impact of damage resulting from hydraulic fracturing: Gas Research Institute, Topical Report, GRI-96/0183, variously paginated.
- Perry, J.H., G.N. Aul, and J. Cervik, 1978, Methane drainage study in the Sunnyside coalbed, Utah: U.S. Bureau of Mines, Report of Investigations 8323.
- Perry, J.H., L.J. Prosser, Jr., and S.W. Lambert, 1980, Degasification of the Mary Lee coal bed, Brookwood, Alabama: U.S. Bureau of Mines Report of Investigations 8669, 13 p.

- Perry, K.F., 2005, Technology key in unconventional gas: American Oil & Gas Reporter, v. 48, no. 5, p. 73-77.
- Petersen, K.M., 1991, Coalbed gas development in the western United States—an update, in S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., Coalbed methane of western North America: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 297-312.
- Petroleum Frontiers, 1986, Coalbed methane - an old hazard becomes a new resource: Petroleum Frontiers, v. 3, no. 4, 65 p.
- Petroleum Frontiers, 2001, Emerging coalbed methane plays of North America: Petroleum Frontiers, v. 18, no. 3 60 p.
- Petzet, A., 2003, Coal gas down under: Oil & Gas Journal, v. 101.8, p. 17.
- Petzet, A., 2005, Resource plays, CBM to fuel drilling upturns in US, Canada: Oil & Gas Journal, v. 103.3, p. 32-34.
- Petzet, A., 2007, The rise of coalbed methane: Oil & Gas Journal, v. 105.47, p. 19.
- Picciano, L., 1994, Coalbed methane research: selected bibliography: Gas Research Institute, Topical Report, GRI-94/0473, 49 p.
- Pickett, A., 2007, Mid-Continent operators finding new methods to exploit old plays: American Oil & Gas Reporter, v. 50, no. 8, p. 122-129.
- Pierce, B., 1993, Coalbed methane in the Forest City basin: U.S. Geological Survey, Fact Sheet. <http://energy.usgs.gov/factsheets/Forest/forest.html>
- Pilcher, R.C., R.C. Collings, and J.S. Marshall, 2000, An overview of emerging practices and models used in coal mine methane resource estimation and reserve evaluation: Second International Methane Mitigation Conference, Novosibirsk, Russia, June 2000, 7 p. (available at Raven Ridge web site: www.ravenridge.com)
- Pillalamarry, M., S. Harpalani, and S. Liu, 2011, Gas diffusion behavior of coal and its impact on production from coalbed methane reservoirs: International Journal of Coal Geology, v. 86, p. 342-348.
- Pinsker, L.M., 2002, Coalbed methane: the future of U.S. natural gas?: Geotimes, v. 47, no. 11, p. 34-35.
- Pitman, J.K., J.C. Pashin, J.R. Hatch, and M.B. Goldhaber, 2003, Origin of minerals in joint and cleat systems of the Pottsville Formation, Black Warrior basin, Alabama: implications for coalbed methane generation and production: AAPG Bulletin, v. 87, p. 713-731.
- Plaizier, R.R., and V.J. Hucka, 1991, In situ determination of desorbable methane content by use of three decay functions, in S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., Coalbed methane of western North America: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 77-86.
- Pone, J.D.N., P.M. Halleck, and J.P. Mathews, 2010, 3D characterization of coal strains induced by compression, carbon dioxide sorption, and desorption at in-situ stress conditions: International Journal of Coal Geology, v. 82, p. 262-268.
- Pope, J.M., 2005, Same day downhole critical gas content without the core (abstract): 2005 AAPG Mid-Continent Section Meeting, Final Announcement and Meeting Program, p. 25.
- Pope, J.M., D. Buttry, R. Lamarre, B. Noecker, S. MacDonald, B. LaReau, P. Malone, N. Van Lieu, D. Petroski, M. Accurso, D. Harak, R. Kutz, S. Luker, and R. Martin, 2005, Downhole geochemical analysis of gas content and critical desorption pressure for carbonaceous reservoirs, in P. Lufholm and D. Cox, eds., 2005 WTGS Fall Symposium: West Texas Geological Society, Publication No. 05-115, p. 115-122.
- Pope, J.M., 2006, Get accurate, CBM reservoir data: Hart's E&P, v. 79, no. 9, p. 127-128.

- Pope, J.M., 2006, New technology supports increased E&P success in coalbed natural gas: *GasTIPS*, v. 12, no. 3, p. 6-8.
- Pope, J.M., 2009, Best practices for multi-zone coalbed methane completions: 2009 International Coalbed & Shale Gas Symposium, Tuscaloosa, AL, Paper 0933.
- Popp, J.T., and C.M. McCulloch, 1976, Geological factors affecting methane in the Beckley coalbed: U.S. Bureau of Mines Report of Investigations 8137, 35 p.
- Popp, J.T., D.D. Coleman, and R.A. Deogh, 1979, Investigations of the gas content of coal seams in the vicinity of Charleston, Illinois: Illinois Institute of Natural Resources, Document 79-38.
- Pratt, T.J., M.J. Mavor, and R.P. De Bruin, 1999, Coal gas resource and production potential of subbituminous coal in the Powder River Basin, *in* Proceedings of the 1999 International Coalbed Methane Symposium: Tuscaloosa, Alabama, University of Alabama College of Continuing Studies, p. 23-34.
- Pratt, T., and M. Mavor, 2005, An overview of coal gas reservoir properties: core holes from Western Interior Coal Region, *in* B.J. Cardott, ed., Unconventional energy resources in the southern Midcontinent, 2004 symposium: Oklahoma Geological Survey Circular 110, p. 83-103.
- Preusse, A., 1997, Coalbed methane in the Ruhr Carboniferous, *in* M. Podemski, S. Dybowa-Jachowicz, K. Jaworowski, J. Jureczka, and R. Wagner, eds., Proceedings of the XIII International Congress on the Carboniferous and Permian: Warsaw, Polish Geological Institute, Prace, v. 157, pt. 2, p. 379-386.
- Price, P.H., and J.W. Headlee, 1943, Natural coal gas in West Virginia: *AAPG Bulletin*, v. 27, p. 529-537.
- Priestman, A., 2009, Gas supply, coalbed methane matures: *Oil and Gas Investor*, v. 29, no. 6, p. 53-54.
- Prior, W.L., and B. White, 2001, Arkansas coal geology and potential for coalbed methane, *in* Oklahoma coalbed-methane workshop 2001: Oklahoma Geological Survey Open-File Report 2-2001, p. 44-71.
- Prior, W.L., 2005, Natural gas potential of Arkansas coals (abstract), *in* B.J. Cardott, ed., Unconventional energy resources in the southern Midcontinent, 2004 symposium: Oklahoma Geological Survey Circular 110, p. 67.
- Puri, R., and D. Yee, 1990, Enhanced coalbed methane recovery: *Soc. Petroleum Engineers Paper SPE 20732*.
- Puri, R., J.C. Evanoff, and M.L. Brugler, 1992, Measurement of coal cleat porosity and relative permeability characteristics, *in* Coalbed methane: Society of Petroleum Engineers, Reprint Series 35, p. 56-67.
- Puri, R., and J.P. Seidle, 1992, Measurement of stress-dependent permeability in coal and its influence on coalbed methane production: *In Situ*, v. 16, p. 183-202.
- Qajar, A., H. Daigle, and M. Prodanović, 2015, The effects of pore geometry on adsorption equilibrium in shale formations and coal-beds: Lattice density functional theory study: *Fuel*, v. 163, p. 205-213.
- Qajar, A., H. Daigle, and M. Prodanović, 2015, Methane dual-site adsorption in organic-rich shale-gas and coalbed systems: *International Journal of Coal Geology*, v. 149, p. 1-8.
- Qin, L., C. Zhai, S. Liu, J. Xu, G. Yu, and Y. Sun, 2017, Changes in the petrophysical properties of coal subjected to liquid nitrogen freeze-thaw—A nuclear magnetic resonance investigation: *Fuel*, v. 194, p. 102-114.
- Qin, S., F. Li, W. Li, Z. Zhou, and G. Zhou, 2018, Formation mechanism of tight coal-derived-gas reservoirs with medium-low abundance of Xujiahe Formation, central Sichuan Basin, China: *Marine and Petroleum Geology*, v. 89, p. 144-154.
- Qingzhong, Z., Z. Yinqing, and Y. Yanhui, 2015, How to solve the technical problems in CBM development: A case study of a CBM gas reservoir in the southern Qinshui Basin: *Natural Gas Industry B*, v. 2, p. 277-281.

- Qu, P., R. Shen, L. Fu, and Z. Wang, 2011, Time delay effect due to pore pressure changes and existence of cleats on borehole stability in coal seam: *International Journal of Coal Geology*, v. 85, p. 212-218.
- Quick, J.C., and D.E. Tabet, 2003, Suppressed vitrinite reflectance in the Ferron coalbed gas fairway, central Utah: possible influence of overpressure: *International Journal of Coal Geology*, v. 56, p. 49-67.
- Quillinan, S.A., and C.D. Frost, 2014, Carbon isotope characterization of Power River Basin coal bed waters: Key to minimizing unnecessary water production and implications for exploration and production of biogenic gas: *International Journal of Coal Geology*, v. 126, p. 106-119.
- Rach, N.M., 2004, New rotating magnet ranging systems useful in oil sands, CBM developments: *Oil & Gas Journal*, v. 102.8, p. 47-49.
- Rach, N.M., 2006, Stealth ventures drilling for Nova Scotia CBM: *Oil & Gas Journal*, v. 104, no. 31, p. 46-48.
- Radlinski, A.P., and E.Z. Radlinska, 1999, The microstructure of pore space in coals of different rank, in M. Mastalerz, M. Glikson, and S.D. Golding, eds., *Coalbed methane: scientific, environmental and economic evaluation*: Boston, Kluwer Academic Publishers, p. 329-365.
- Radlinski, A.P., M. Mastalerz, A.L. Hinde, M. Hainbuchner, H. Rauch, M. Baron, J.S. Lin, L. Fan, and P. Thiyagarajan, 2004, Application of SAXS and SANS in evaluation of porosity, pore size distribution and surface area of coal: *International Journal of Coal Geology*, v. 59, p. 245-271.
- Ramandi, H.L., P. Mostaghimi, R.T. Armstrong, M. Saadatfar, and W. Val Pinczewski, 2016, Porosity and permeability characterization of coal: a micro-computed tomography study: *International Journal of Coal Geology*, v. 154-155, p. 57-68.
- Ramaswamy, G., 2001, Advances key for coalbed methane: *American Oil & Gas Reporter*, v. 44, no. 10, p. 71, 73.
- Ramaswamy, G., 2002, A field evidence for mineral-catalyzed formation of gas during coal maturation: *Oil & Gas Journal*, v. 100.38, p. 32-36.
- Ramaswamy, S., W.B. Ayers, and S.A. Holditch, 2008, Best drilling, completion and stimulation methods for CBM reservoirs: *World Oil*, v. 229, no. 10, p. 125-132.
- Ranathunga, A.S., M.S.A. Perera, P.G. Ranjith, and C.H Wei, 2016, An experimental investigation of applicability of CO₂ enhanced coal bed methane recovery to low rank coal: *Fuel*, v. 189, p. 391-399. (ECBM)
- Ranathunga, A.S., M.S.A. Perera, and P.G. Ranjith, 2016, Influence of CO₂ adsorption on the strength and elastic modulus of low rank Australian coal under confining pressure: *International Journal of Coal Geology*, v. 167, p. 148-156. (ECBM)
- Rathi, R., A. Priya, M. Vohra, M. Lavania, B. Lal, and P.M. Sarma, 2015, Development of a microbial process for methane generation from bituminous coal at thermophilic conditions: *International Journal of Coal Geology*, v. 147-148, p. 25-34.
- Reddy, K.J., ed., 2010, *Coalbed natural gas: energy and environment*: New York, Nova Science Publishers, Inc., Energy Science, Engineering and Technology Series, 511 p.
- Reddy, K.J., C. Helmericks, A. Whitman, and D. Legg, 2014, Geochemical processes controlling trace elemental mobility in coalbed natural gas (CBNG) disposal ponds in the Powder River Basin, WY: *International Journal of Coal Geology*, v. 126, p. 120-127.
- Reeves, S., 2001, Geologic sequestration of CO₂ in deep, unmineable coalbeds: an integrated research and commercial-scale demonstration project: National Energy Technology Laboratory First National Conference on Carbon Sequestration.
http://www.netl.doe.gov/publications/proceedings/01/carbon_seq/3a1.pdf

- Reeves, S., 2002, Field studies of enhanced methane recovery and CO₂ sequestration in coal seams: *World Oil*, v. 223, no. 12, p. 56-58, 60.
- Reilly, J., 2014, Permitting coalbed methane wells, *in* P. Thakur, K. Aminian, and S. Schatzel, eds., *Coal bed methane: from prospect to pipeline*: New York, Elsevier, p. 297-309.
- Reinecke, K.M., D.D. Rice, and R.C. Johnson, 1991, Characteristics and development of fluvial sandstone and coalbed reservoirs of Upper Cretaceous Mesaverde Group, Grand Valley field, Colorado, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., *Coalbed methane of western North America*: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 209-225.
- Ren, J., L. Zhang, S. Ren, J. Lin, S. Meng, G. Ren, and T. Gentzis, 2014, Multi-branched horizontal wells for coalbed methane production: Field performance and well structure analysis: *International Journal of Coal Geology*, v. 131, p. 52-64.
- Ren, P., H. Xu, D. Tang, Y. Li, C. Sun, S. Tao, S. Li, F. Xin, and L. Cao, 2018, The identification of coal texture in different rank coal reservoirs by using geophysical logging data in northwest Guizhou, China: Investigation by principal component analysis: *Fuel*, v. 230, p. 258-265.
- Reucroft, P.J., and K.B. Patel, 1986, Surface area and swelling in coal: *Fuel*, v. 62, p. 279-284.
- Reucroft, P.J., and A.R. Sethuraman, 1987, Effect of pressure on carbon dioxide induced coal swelling: *Energy Fuels*, v. 1, p. 72-75.
- Rice, C.A., and V. Nuccio, 2000, Water produced with coal-bed methane: U.S. Geological Survey, Fact Sheet FS-156-00, 2 p.
(<http://pubs.usgs.gov/products/books/factsheet/2000.html>)
- Rice, C.A., M.S. Ellis, and J.H. Bullock, Jr., 2000, Water co-produced with coalbed methane in the Powder River basin, Wyoming: preliminary compositional data: U.S. Geological Survey Open-File Report 00-372, 18 p.
(<http://greenwood.cr.usgs.gov/energy/CBmethane/OF00-372/index.html>)
- Rice, C.A., T.T. Bartos, and M.S. Ellis, 2002, Chemical and isotopic composition of water in the Fort Union and Wasatch Formations of the Powder River basin, Wyoming and Montana: implications for coalbed methane development, *in* S.D. Schwochow and V.F. Nuccio, eds., *Coalbed methane of North America, II*: Rocky Mountain Association of Geologists, p. 53-70.
- Rice, C.A., 2003, Production waters associated with the Ferron coalbed methane fields, central Utah: chemical and isotopic composition and volumes: *International Journal of Coal Geology*, v. 56, p. 141-169.
- Rice, C.A., R.M. Flores, G.D. Stricker, and M.S. Ellis, 2008, Chemical and stable isotopic evidence for water/rock interaction and biogenic origin of coalbed methane, Fort Union Formation, Powder River Basin, Wyoming and Montana U.S.A.: *International Journal of Coal Geology*, v. 76, p. 76-85.
- Rice, D.D., J.L. Clayton, and M.J. Pawlewicz, 1989, Characterization of coal-derived hydrocarbons and source rock potential of coal beds, San Juan basin, New Mexico and Colorado, USA, *in* P.C. Lyons and B. Alpern, eds., *Coal: classification, coalification, mineralogy, trace-element chemistry, and oil and gas potential*: *International Journal of Coal Geology*, v. 13, p. 597-626.
- Rice, D.D., J.L. Clayton, R.M. Flores, B.E. Law, and R.W. Stanton, 1992, Some geologic controls of coalbed gas generation, accumulation, and production, western United States: U.S. Geological Survey Circular 1074.
- Rice, D.D., 1993, Composition and origins of coalbed gas, *in* B.E. Law and D.D. Rice, eds., *Hydrocarbons from coal: AAPG Studies in Geology* 38, p. 159-184.
- Rice, D.D., B.E. Law, and J.L. Clayton, 1993, Coalbed gas - an undeveloped resource, *in* D.G. Howell, ed., *The future of energy gases*: USGS Professional Paper 1570, p. 389-404.

- Rice, D.D., T.M. Finn, and J.R. Hatch, 1995, Geologic framework and description of coalbed gas plays: U.S. Geological Survey Digital Data Series DDS-30, p. 28-30.
- Rice, D.D., 1996, Geologic framework and description of coalbed gas plays, *in* D.L. Gautier and others, eds., 1995 National assessment of United States oil and gas resources -- results, methodology, and supporting data: U.S. Geological Survey Digital Data Series DDS-30, release 2, CD-ROM.
- Rice, D.D., G.B.C. Young, and G.W. Paul, 1996, Methodology for assessment of technically recoverable resources of coalbed gas, *in* D.L. Gautier and others, eds., 1995 National assessment of United States oil and gas resources -- results, methodology, and supporting data: U.S. Geological Survey Digital Data Series DDS-30, release 2, CD-ROM.
- Rice, D.D., 1997, Coalbed methane—an untapped energy resource and an environmental concern: U.S. Geological Survey, Fact Sheet FS-019-97.
- Richardson, R.J.H., 1991, Coal resources and coalbed methane potential of a major Alberta coal zone, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., Coalbed methane of western North America: Denver, CO, Rocky Mountain Association of Geologists Guidebook, p. 255-263.
- Rieb, B., 2006, Proppants raise the curve for coalbed methane production: *World Oil*, v. 226, no. 8, p. 71-74.
- Rieke, H.H., and J.N. Kirr, 1984, Geologic overview, coal, and coalbed methane resources of the Arkoma basin - Arkansas and Oklahoma, *in* C.T. Rightmire, G.E. Eddy, and J.N. Kirr, eds., Coalbed methane resources of the United States: AAPG Studies in Geology 17, p. 135-161.
- Rieke, H.H., and J.N. Kirr, 1984, Geologic overview, coal, and coalbed methane resources of the Wind River Basin—Wyoming, *in* C.T. Rightmire, G.E. Eddy, and J.N. Kirr, eds., Coalbed methane resources of the United States: AAPG Studies in Geology 17, p. 295-334.
- Riese, W.C., W.L. Pelzmann, and G.T. Snyder, 2005, New insights on the hydrocarbon system of the Fruitland Formation coal beds, northern San Juan Basin, Colorado and New Mexico, USA, *in* P.D. Warwick, ed., Coal systems analysis: Geological Society of America Special Paper 387, p. 73-111.
- Riesterberg, D., R. Ferguson, and V.A. Kuuskraa, 2007, Unconventional gas—3. New plays, prospects, resources continue to emerge: *Oil & Gas Journal*, v. 105.36, p. 48-54.
- Rightmire, C.T., G.E. Eddy, and J.N. Kirr, eds., 1984, Coalbed methane resources of the United States: AAPG Studies in Geology 17, 378 p.
- Rightmire, C.T., 1984, Coalbed methane resource, *in* C.T. Rightmire, G.E. Eddy, and J.N. Kirr, eds., Coalbed methane resources of the United States: AAPG Studies in Geology 17, p. 1-13.
- Rightmire, C.T., and R. Choate, 1986, Coal-bed methane and tight gas sands interrelationships, *in* C.W. Spencer and R.F. Mast, eds., Geology of tight gas reservoirs: AAPG Studies in Geology 24, p. 87-110.
- Ritter, D., D. Vinson, E. Barnhart, D.M. Akob, M.W. Fields, A.B. Cunningham, W. Orem, and J.C. McIntosh, 2015, Enhanced microbial coalbed methane generation: A review of research, commercial activity, and remaining challenges: *International Journal of Coal Geology*, v. 146, p. 28-41.
- Ritter, U., and A. Grover, 2005, Adsorption of petroleum compounds in vitrinite: implications for petroleum expulsion from coal: *International Journal of Coal Geology*, v. 62, p. 183-191.
- Robbins, S.J., P.N. Evans, J.S. Esterle, S.D. Golding, and G.W. Tyson, 2016, The effect of coal rank on biogenic methane potential and microbial composition: *International Journal of Coal Geology*, v. 154-155, p. 205-212.

- Robeck, E., and D. Huo, 2016, A more accurate method for estimating in situ coal density and mineral matter from ash and specific energy determinations: *International Journal of Coal Geology*, v. 168, p. 237-252.
- Roberts, S.B., compiler, 2008, Geologic assessment of undiscovered, technically recoverable coalbed-gas resources in Cretaceous and Tertiary rocks, North Slope and adjacent state waters, Alaska: U.S. Geological Survey Digital Data Series DDS-69-S, CD-ROM. <http://pubs.usgs.gov/dds/dds-069/dds-069-s/>
- Robertson, R.D., 2003, A frontier Upper Cretaceous coalbed methane play in the Albuquerque Basin, New Mexico, in M.R. Silverman, ed., *Emerging coalbed methane plays of North America (part 3): Petroleum Frontiers*, v. 19, no. 2, p. 20-30.
- Robinson, B.M., and S.A. Holditch, 1999, Coal gas requires unique stimulation: *American Oil & Gas Reporter*, v. 42, no. 12, p. 64, 66-68, 79.
- Rodrigues, C.F., and M.J. Lemos de Sousa, 2002, The measurement of coal porosity with different gases: *International Journal of Coal Geology*, v. 48, p. 245-251.
- Rodvelt, G., S. Willis, D. Mullins, and R. Toothman, 2002, CT fracturing: multiple coals, one trip: *American Oil & Gas Reporter*, v. 45, no. 5, p. 83-87.
- Rodvelt, G., M. Blauch, R.D. Rickman, J.A. Ringhisen, L.E. East, and G. Wylie, 2008, Unconventional gas technology—conclusion. Life-cycle approach improves coalbed methane production: *Oil & Gas Journal*, v. 106.3, p. 55-60.
- Rodvelt, G., 2014, Vertical well construction and hydraulic fracturing for CBM completions, in P. Thakur, K. Aminian, and S. Schatzel, eds., *Coal bed methane: from prospect to pipeline*: New York, Elsevier, p. 101-135.
- Rogers, R.E., 1994, *Coalbed methane: principles and practice*: Englewood Cliffs, NJ, Prentice Hall, 345 p.
- Román-Colón, Y.A., and L.F. Ruppert, 2014, Central Appalachian Basin natural gas database: Distribution, composition, and origin of natural gases: U.S. Geological Survey Open-File Report 2014-1207, 13 p.
- Rottenfusser, B., C.W. Langenberg, G.B. Mandryk, R.J.H. Richardson, B.J. Fildes, J. Olic, S.A. Stewart, D.R. Eccles, C. Evans, M. Spelrem, B. Sprecher, M. Brulotte, T. Gentzis, D.A. Wynne, and L.P. Yuan, 2002, Regional evaluation of the coal bed methane potential in the Plains and Foothills of Alberta, stratigraphy and rank study: Alberta Energy and Utilities Board, Alberta Geological Survey, EUB/AGS Special Report 7 (digital version), 248 p. http://ags.aer.ca/publications/SPE_007.html
- Rozak, A.T., and R.M. Bustin, 2001, Measuring permeability in coals utilizing well log data and LogFAC analysis: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 111, p. 121-131.
- Ruppel, T.C., C.T. Grein, and D. Bienstock, 1972, Adsorption of methane/ethane mixtures on dry coal at elevated pressures: *Fuel*, v. 51, p. 297-303.
- Ruppert, L.F., N. Fedorko, P.D. Warwick, W.C. Grady, R.D. Crangle, and J.Q. Britton, 2004, Results of coal bed methane drilling, Mylan Park, Monongalia County, West Virginia: U.S. Geological Survey Open-File Report 2004-1402, 44 p.
- Ruppert, L.F., and R.T. Ryder, eds., 2014, *Coal and petroleum resources in the Appalachian Basin: Distribution, geologic framework, and geochemical character*: U.S. Geological Survey Professional Paper 1708—A.1 through I.1 [42 chapters] <http://pubs.usgs.gov/pp/1708/>
- Ryan, B.D., 2002, Note on desorption results of Comox Formation coals, Courtenay area, Vancouver Island, British Columbia: Geological Fieldwork 2001: B.C. Ministry of Energy and Mines, Paper 2002-1, p. 319-330.
- Ryan, B., 2003, Overview of the coalbed methane potential of Tertiary coal basins in the interior of British Columbia: British Columbia Ministry of Energy and Mines, Geological Fieldwork 2002, Paper 2003-1, p. 1-23.

- Ryan, B.D., 2003, Pseudovitrinite: possible implications for gas saturation in coals and surrounding rocks: B.C. Ministry of Energy and Mines, Geological Fieldwork 2002, Paper 2003-1, p. 203-211.
- Ryan, B., 2003, Cleat development in some British Columbia coals: B.C. Ministry of Energy and Mines, Geological Fieldwork 2002, Paper 2003-1, p. 237-255.
<http://www2.gov.bc.ca/gov/topic.page?id=A6684705252E4FB1A305496A0E93FD5A>
- Ryan, B., 2003, A summary of coalbed methane potential in British Columbia: British Columbia Ministry of Energy and Mines, Oil & Gas Report 2003-3, 15 p.
<http://www2.gov.bc.ca/gov/topic.page?id=A6684705252E4FB1A305496A0E93FD5A>
- Rychlicki, S., K. Twardowski, J. Kwarcinski, and M. Karwasiecka, 1997, Analysis of inaccuracy of methane content evaluations in the Upper Silesian coal basin, *in* M. Podemski, S. Dybowa-Jachowicz, K. Jaworowski, J. Jureczka, and R. Wagner, eds., Proceedings of the XIII International Congress on the Carboniferous and Permian: Warsaw, Polish Geological Institute, Prace, v. 157, pt. 2, p. 387-394.
- Saghafi, A., M. Faiz, and D. Roberts, 2007, CO₂ storage and gas diffusivity properties of coals from Sydney Basin, Australia: *International Journal of Coal Geology*, v. 70, p. 240-254.
- Saghafi, A., K.L. Pinetown, P.G. Grobler, and J.H.P. van Heerden, 2008, CO₂ storage potential of South African coals and gas entrapment enhancement due to igneous intrusions: *International Journal of Coal Geology*, v. 73, p. 74-87.
- Saghafi, A., 2010, Potential for ECBM and CO₂ storage in mixed gas Australian coals: *International Journal of Coal Geology*, v. 82, p. 240-251.
- Sakurovs, R., S. Day, S. Weir, and G. Duffy, 2008, Temperature dependence of sorption gases by coals and charcoals: *International Journal of Coal Geology*, v. 73, p. 250-258.
- Sakurovs, R., S. Weir, D. French, and S. Day, 2011, Effect of impurity gases in carbon dioxide on sorption behavior and mineral matter in an Australian bituminous coal: *International Journal of Coal Geology*, v. 86, p. 367-371.
- Sakurovs, R., L. He, Y.B. Melnichenko, A.P. Radlinski, T. Blach, H. Lemmel, and D.F.R. Mildner, 2012, Pore size distribution and accessible pore size distribution in bituminous coals: *International Journal of Coal Geology*, v. 100, p. 51-64.
- Sakurovs, R., L. Koval, M. Grigore, A. Sokolova, L.F. Ruppert, and Y.B. Melnichenko, 2018, Nanometre-sized pores in coal: Variations between coal basins and coal origin: *International Journal of Coal Geology*, v. 186, p. 126-134. (inertinite porosity)
- Salazar, J., D.A. McVay, and W.J. Lee, 2010, Development of an improved methodology to assess potential unconventional gas resources: *Natural Resources Research*, v. 19, p. 253-268.
- Salmachi, A., M. Sayyafzadeh, and M. Haghghi, 2013, Infill well placement optimization in coal bed methane reservoirs using genetic algorithm: *Fuel*, v. 111, p. 248-258.
- Salmachi, A., M.R. Bonyadi, M. Sayyafzadeh, and M. Haghghi, 2014, Identification of potential locations for well placement in developed coalbed methane reservoirs: *International Journal of Coal Geology*, v. 131, p. 250-262.
- Salmachi, A., and Z. Yarmohammadtooski, 2015, Production data analysis of coalbed methane wells to estimate the time required to reach to peak of gas production: *International Journal of Coal Geology*, v. 141-142, p. 33-41.
- Salmachi, A., M. Rajabi, P. Reynolds, Z. Yarmohammadtooski, and C. Wainman, 2016, The effect of magmatic intrusions on coalbed methane reservoir characteristics:

- A case study from the Hoskissons coalbed, Gunnedah Basin, Australia: *International Journal of Coal Geology*, v. 165, p. 278-289.
- Salmachi, A., E. Dunlop, M. Rajabi, Z. Yarmohammadtooski, and S. Begg, 2019, Investigation of permeability change in ultradeep coal seams using time-lapse pressure transient analysis: A pilot project in the Cooper Basin, Australia: *AAPG Bulletin*, v. 103, p. 91-107.
- Salvador, A., 2005, Coalbed methane, *in* *Energy: A historical perspective and 21st century forecast: AAPG Studies in Geology* 54, p. 68-72.
- Sampath, K.H.S.M., M.S.A. Perera, D. Elsworth, P.G. Ranjith, S.K. Matthai, T. Rathnaweera, and G. Zhang, 2019, Effect of coal maturity on CO₂-based hydraulic fracturing process in coal seam gas reservoirs: *Fuel*, v. 236, p. 179-189.
- Sampath, K.H.S.M., M.S.A. Perera, P.G. Ranjith, and S.K. Matthai, 2019, CO₂ interaction induced mechanical characteristics alterations in coal: *International Journal of Coal Geology*, v. 204, p. 113-129. (enhanced CBM)
- Sanderson, G.A., and L.W. Berggren, 1998, White paper: update on application of §29 tax credit to coal seam gas: U.S. Environmental Protection Agency, 16 p.
- Sanfilippo, J.R., P.D. Warwick, C.E. Barker, L.R.H. Biewick, and R.W. Stanton, 2000, A show of methane from shallow low-rank coal in the Gulf Coast of Texas, and its implications for basin-wide commercial potential (abstract): *TSOP Abstracts and Program*, v. 17, p. 77-78.
- Sang, F., 2016, Research on current situation of global development of coalbed methane at low rank coal mines and it's potential in China: *China Coalbed Methane*, v. 12, no. 3, p. 7-9.
- Sang, S., H. Xu, L. Fang, G. Li, and H. Huang, 2010, Stress relief coalbed methane drainage by surface vertical wells in China: *International Journal of Coal Geology*, v. 82, p. 196-203.
- Sato, T., 1981, Methane recovery from coalbeds: surface and physical properties of western United States coals: Albuquerque, University of New Mexico, unpublished M.S. thesis, 78 p.
- Saulsbury, J.L., R.A. Schraufnagel, and A.H. Jones, 1992, Fracture height growth and production from multiple reservoirs, *in* *Coalbed methane: Society of Petroleum Engineers, Reprint Series 35*, p. 197-207.
- Saulsbury, J.L., S.D. Spafford, P.F. Steidl, L.A. Litzinger, A.H. Durden, C.L. Rochester, V.A. Kuuskraa, and G.B.C. Young, 1994, Effective completions for shallow coal seams: Gas Research Institute, Topical Report, GRI-93/0366, 77 p.
- Saulsbury, J.L., P.S. Schafer, and R.A. Schraufnagel, eds., 1996, A guide to coalbed methane reservoir engineering: Chicago, Gas Research Institute, variously paginated.
- Saunders, J.T., B.M.C. Tsai, and R.T. Yang, 1985, Adsorption of gases on coals and heat-treated coals at elevated temperatures and pressure: 2. Adsorption from hydrogen-methane mixtures: *Fuel*, v. 64, p. 621-626.
- Saurabh, S., S. Harpalani, and V.K. Singh, 2016, Implications of stress re-distribution and rock failure with continued gas depletion in coalbed methane reservoirs: *International Journal of Coal Geology*, v. 162, p. 183-192.
- Saurabh, S., and S. Harpalani, 2018, Stress path with depletion in coalbed methane reservoirs and stress based permeability modeling: *International Journal of Coal Geology*, v. 185, p. 12-22.
- Saurabh, S., and S. Harpalani, 2018, Modeling of microbial methane generation from coal and assessment of its impact on flow behavior: *Fuel*, v. 216, p. 274-283.
- Saurabh, S., and S. Harpalani, 2019, Anisotropy of coal at various scales and its variation with sorption: *International Journal of Coal Geology*, v. 201, p. 14-25.
- Sawin, R.S., and L.L. Brady, 2001, Natural gas from coal in eastern Kansas: Kansas Geological Survey, Public Information Circular 19, 4 p.

- Saxby, J.D., and M. Shibaoka, 1986, Coal and coal macerals as source rocks for oil and gas: *Applied Geochemistry*, v. 1, p. 25-36.
- Sayers, A.C., C.M. Boyer, II, T.J. Frenzel, and R.A. Rodgers, 2004, Technologies key deep CBM success: *American Oil & Gas Reporter*, v. 47, no. 3, p. 79, 81-85.
- Schenk, C.J., V.F. Nuccio, R.M. Flores, R.C. Johnson, S.B. Roberts, T.M. Finn, and J. Ridgley, 2003, Coal-bed gas resources of the Rocky Mountain region: U.S. Geological Survey Fact Sheet FS 0158-02, 2 p. <http://pubs.usgs.gov/fs/fs-158-02/>
- Schenk, C.J., T.R. Klett, M.E. Tennyson, T.J. Mercier, M.E. Brownfield, J.K. Pitman, S.B. Gaswirth, and T.M. Finn, 2016, Assessment of coalbed gas resources of the Central and South Sumatra Basin Provinces, Indonesia, 2016: U.S. Geological Survey Fact Sheet 2016-3089, 2 p. <https://pubs.er.usgs.gov/publication/fs20163089>
- Schenk, C.J., M.E. Brownfield, M.E. Tennyson, T.R. Klett, T.J. Mercier, S.J. Hawkins, S.B. Gaswirth, K.R. Marra, T.M. Finn, P.A. Le, and H.M. Leathers-Miller, 2016, Assessment of Permian coalbed gas resources of the Karoo Basin Province, South Africa and Lesotho, 2016: U.S. Geological Survey Fact Sheet 2016-3103, 2 p. <https://pubs.er.usgs.gov/publication/fs20163103>
- Schenk, C.J., T.J. Mercier, P.A. Le, M.E. Tennyson, T.M. Finn, M.E. Brownfield, K.R. Marra, S.B. Gaswirth, H.M. Leathers-Miller, J.K. Pitman, and R.M. Drake II, 2018, Assessment of coalbed gas resources in the Kutei and Barito Basin Provinces, Indonesia, 2018: U.S. Geological Survey, Fact Sheet 2018-3055, 2 p. <https://pubs.er.usgs.gov/publication/fs20183055>
- Scholes, P.L., and D. Johnston, 1993, Coalbed methane applications of wireline logs, *in* B.E. Law and D.D. Rice, eds., *Hydrocarbons from coal: AAPG Studies in Geology* 38, p. 287-302.
- Schraufnagel, R.A., 1992, Multiple seam completion and production experience at Rock Creek, *in* *Coalbed methane: Society of Petroleum Engineers, Reprint Series* 35, p. 120-130.
- Schraufnagel, R.A., 1993, Coalbed methane production, *in* B.E. Law and D.D. Rice, eds., *Hydrocarbons from coal: AAPG Studies in Geology* 38, p. 341-359.
- Schroeder, K., and E. Ozdemir, 2001, Sequestration of carbon dioxide in coal seams: National Energy Technology Laboratory First National Conference on Carbon Sequestration, 10 p. http://www.netl.doe.gov/publications/proceedings/01/carbon_seq/3a4.pdf
- Schweitzer, H., D. Ritter, J. McIntosh, E. Barnhart, A.B. Cunningham, D. Vinson, W.H. Orem, and M.W. Fields, 2019, Changes in microbial communities and associated water and gas geochemistry across a sulfate gradient in coal beds: Powder River Basin, USA: *Geochimica et Cosmochimica Acta*, v. 245, p. 495-513.
- Schwochow, S.D., D.K. Murray, and M.F. Fahy, eds., 1991, *Coalbed methane of western North America*: Denver, Rocky Mountain Association of Geologists, 336 p.
- Schwochow, S.D., and S.H. Stevens, eds., 1993, *Coal-seam water: production, treatment, and disposal: Quarterly Review of Methane from Coal Seams Technology*, v. 11, no. 2, p. 1-31.
- Schwochow, S.D., and V.F. Nuccio, eds., 2002, *Coalbed methane of North America, II: Rocky Mountain Association of Geologists*, 108 p.
- Schwochow, S.D., 2006, Coalbed gas plays, west and east — A study in contrasts: An investor's guide to coalbed methane, A supplement to *Oil and Gas Investor*, v. 26, no. 12, p. 2-7.
- Scott, A.R., W.R. Kaiser, and W.B. Ayers, Jr., 1991, Composition, distribution, and origin of Fruitland Formation and Pictured Cliffs Sandstone gases, San Juan basin, Colorado and New Mexico, *in* S.D. Schwowchow, D.K. Murray, and M.F.

- Fahy, eds., Coalbed methane of western North America: Denver, Rocky Mountain Association of Geologists, p. 93-108.
- Scott, A.R., 1994, Composition of coalbed gases: In Situ, v. 18, p. 185-208.
- Scott, A.R., W.R. Kaiser, and W.B. Ayers, Jr., 1994, Thermogenic and secondary biogenic gases, San Juan basin, Colorado and New Mexico -- implications for coalbed gas producibility: AAPG Bulletin, v. 78, no. 8, p. 1186-1209.
- Scott, A.R., 1995, Factors affecting gas content distribution in coal beds, *in* W.R. Kaiser, A.R. Scott, and R. Tyler, eds., Geology and hydrology of coalbed methane producibility in the United States: Analogs for the World: Tuscaloosa, Alabama, The University of Alabama, INTERGAS'95 Short Course Notes, p. 205-250.
- Scott, A.R., N. Zhou, and J.R. Levine, 1995, A modified approach to estimating coal and coal gas resources: example from the Sand Wash Basin, Colorado: AAPG Bulletin, v. 79, p. 1320-1336.
- Scott, A.R., and W.R. Kaiser, 1996, Factors affecting gas-content distribution in coal beds: a review: AAPG Rocky Mountain Section Meeting, Expanded abstracts volume, p. 101-106.
- Scott, A.R., H.S. Nance, and M.Z. Beltran, 1997, Heterogeneity of water and coal gas production in the northern San Juan basin, Colorado and New Mexico: International Coalbed Methane Symposium, Paper 9739, 11 p.
- Scott, A.R., 1997, Timing of cleat development in coal beds (abstract): AAPG Annual Convention Official Program, v. 6, p. A104.
- Scott, A.R., 1999, Improving coal gas recovery with microbially enhanced coalbed methane, *in* M. Mastalerz, M. Glikson, and S.D. Golding, eds., Coalbed methane: scientific, environmental and economic evaluation: Boston, Kluwer Academic Publishers, p. 89-110.
- Scott, A.R., and R. Tyler, 2000, Evaluating coalbed methane potential in Texas (abstract): AAPG Bulletin, v. 84, no. 10, p. 1691.
- Scott, A.R., 2001, Coal and coalbed methane resources of Texas (abstract): AAPG Bulletin, v. 85, p. 389.
- Scott, A.R., 2002, Hydrogeologic factors affecting gas content distribution in coal beds: International Journal of Coal Geology, v. 50, p. 363-387.
- Scott, A.R., 2003, Coalbed methane potential of the Gulf Coast region, *in* M.R. Silverman, ed., Emerging coalbed methane plays of North America (part 2): Denver, CO, Petroleum Frontiers, v. 18, no. 4, p. 38-46.
- Scott, A.R., 2009, Developing exploration strategies for coal-bed methane and shale gas reservoirs, *in* T. Carr, T. D'Agostino, W. Ambrose, J. Pashin, and N.C. Rosen, eds., Unconventional energy resources: making the unconventional conventional: 29th Annual GCSSEPM Foundation Bob F. Perkins Research Conference, CD-ROM, p. 303-305.
- Scott, S., B. Anderson, P. Crosdale, J. Dingwall, and G. Leblang, 2007, Coal petrology and coal seam gas contents of the Walloon subgroup—Surat Basin, Queensland, Australia: International Journal of Coal Geology, v. 70, p. 209-222.
- Sechman, H., M.J. Kotarba, S. Kędzior, M. Dzieniewicz, T. Romanowski, and A. Twaróg, 2019, Distribution of methane and carbon dioxide concentrations in the near-surface zone, genetic implications, and evaluation of gas flux around abandoned shafts in the Jastrzębie-Pszczyna area (southern part of the Upper Silesian coal basin, Poland): International Journal of Coal Geology, v. 204, p. 51-69.
- Seidle, J.P., 2002, Lessons learned, lessons lost — review of selected coalbed methane pilots, *in* S.D. Schwochow and V.F. Nuccio, eds., Coalbed methane of North America, II: Rocky Mountain Association of Geologists, p. 7-16.
- Seidle, J., 2011, Fundamentals of coalbed methane reservoir engineering: Tulsa, OK, PennWell Books, 401 p.

- Selden, R.F., 1934, The occurrence of gases in coals: U.S. Bureau of Mines Report of Investigations 3233, 64 p.
- Semmelbeck, M.E., and W.J. Lee, 1992, Well test requirements for evaluation of coalbed methane development potential, *in* Coalbed methane: Society of Petroleum Engineers, Reprint Series 35, p. 90-101.
- Sever, M., 2006, Coalbed gas enters the energy mix: *Geotimes*, v. 51, no. 9, p. 30-33.
- Shah, S., and K. Totlani, 2014, Difficulties and prospects of coalbed methane in India as compared to North America: *Journal of Unconventional Oil and Gas Resources*, v. 6, p. 48-53.
- Shan, C., T. Zhang, J. Guo, Z. Zhang, and Y. Yang, 2015, Characterization of the micropore systems in high-rank coal reservoirs of the southern Sichuan Basin, China: *AAPG Bulletin*, v. 99, p. 2099-2119.
- Shan, C., T. Zhang, X. Liang, Z. Zhang, H. Zhu, W. Yang, and K. Zhang, 2018, Influence of chemical properties on CH₄ adsorption capacity of anthracite derived from southern Sichuan Basin, China: *Marine and Petroleum Geology*, v. 89, p. 387-401.
- Shao, P., A. Wang, and W. Wang, 2018, Experimental simulation of biogenic coalbed gas generation from lignite and high-volatile bituminous coals: *Fuel*, v. 219, p. 111-119.
- Sharma, A., A. Jagarapu, C. Micale, D. Walia, S. Jackson, and P.S. Dhurjati, 2018, Modeling framework for biogenic methane formation from coal: *Energy & Fuels*, v. 32, p. 8453-8461. (in situ biodegradation; microorganisms)
- Shen, J., Y. Qin, G.X. Wang, X. Fu, C. Wei, and B. Lei, 2011, Relative permeabilities of gas and water for different rank coals: *International Journal of Coal Geology*, v. 86, p. 266-275.
- Shen, J., J. Zhao, Y. Qin, Y. Shen, and G. Wang, 2017, Water imbibition and drainage of high rank coals in Qinshui Basin, China: *Fuel*, v. 211, p. 48-59.
- Shewchuk, C., 2006, Managing logistics of CBM extraction: *Hart's E&P*, v. 79, no. 9, p. 17-19.
- Shi, J., S. Wang, H. Zhang, Z. Sun, C. Hou, Y. Chang, and Z. Xu, 2018, A novel method for formation evaluation of undersaturated coalbed methane reservoirs using dewatering data: *Fuel*, v. 229, p. 44-52.
- Shi, J., Y. Chang, S. Wu, X. Xiong, C. Liu, and K. Feng, 2018, Development of material balance equations for coalbed methane reservoirs considering dewatering process, gas solubility, pore compressibility and matrix shrinkage: *International Journal of Coal Geology*, v. 195, p. 200-216.
- Shi, J., S. Wang, K. Wang, C. Liu, S. Wu, and K. Sepehrnoori, 2019, An accurate method for permeability evaluation of undersaturated coalbed methane reservoirs using early dewatering data: *International Journal of Coal Geology*, v. 202, p. 147-160.
- Shi, J.-Q., and S. Durucan, 2001, Application of conventional oil reservoir productivity equations to horizontal coalbed methane wells: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 134, p. 221-232.
- Shi, J.-Q., and S. Durucan, 2001, Identifying the key factors controlling openhole cavity completions at the San Juan basin — a numerical study: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 135, p. 233-244.
- Shi, J.-Q., S. Durucan, and I.C. Sinka, 2002, Key parameters controlling coalbed methane cavity well performance: *International Journal of Coal Geology*, v. 49, p. 19-31.
- Shi, J.-Q., and S. Durucan, 2003, A bidisperse pore diffusion model for methane displacement desorption in coal by CO₂ injection: *Fuel*, v. 82, p. 1219-1229.

- Shi, J.-Q., S. Durucan, and S. Shimada, 2014, How gas adsorption and swelling affects permeability of coal: A new modelling approach for analyzing laboratory test data: *International Journal of Coal Geology*, v. 128-129, p. 134-142.
- Shi, J.-Q., and S. Durucan, 2014, Modelling laboratory horizontal stress and coal permeability data using S&D permeability model: *International Journal of Coal Geology*, v. 131, p. 172-176.
- Shi, J.-Q., Z. Pan, and S. Durucan, 2014, Analytical models for coal permeability changes during coalbed methane recovery: Model comparison and performance evaluation: *International Journal of Coal Geology*, v. 136, p. 17-24.
- Shi, J.-Q., and S. Durucan, 2018, Variation in horizontal stress with pore pressure depletion in coal under uniaxial strain conditions: An update on the modelling of laboratory data: *International Journal of Coal Geology*, v. 187, p. 94-97.
- Shi, X., J. Pan, Q. Hou, Y. Jin, Z. Wang, Q. Niu, and M. Li, 2018, Micrometer-scale fractures in coal related to coal rank based on micro-CT scanning and fractal theory: *Fuel*, v. 212, p. 162-172.
- Shirley, K., 1999, Exceptional economics, potential drive coalbed methane plays: *American Oil & Gas Reporter*, v. 42, no. 7, p. 113-119. (Rocky Mountain basins)
- Shirley, K., 2002, Operators continue to expand coalbed methane's geographic diversity: *American Oil & Gas Reporter*, v. 45, no. 3, p. 88-103.
- Shovkun, I., and D.N. Espinoza, 2017, Coupled fluid flow-geomechanics simulation in stress-sensitive coal and shale reservoirs: Impact of desorption-induced stresses, shear failure, and fines migration: *Fuel*, v. 195, p. 260-272.
- Si, G., S. Durucan, S. Jamnikar, J. Lazar, K. Abraham, A. Korre, J.-Q. Shi, S. Zavšek, G. Mutke, and A. Lurka, 2015, Seismic monitoring and analysis of excessive gas emissions in heterogeneous coal seams: *International Journal of Coal Geology*, v. 149, p. 41-54.
- Siemons, N., and A. Busch, 2007, Measurement and interpretation of supercritical CO₂ sorption on various coals: *International Journal of Coal Geology*, v. 69, p. 229-242.
- Silverman, M.R., ed., 2001, Emerging coalbed methane plays of North America: Denver, CO, IHS Energy Group, *Petroleum Frontiers*, v. 18, no. 3, 60 p.
- Silverman, M.R., 2001, Emerging coalbed methane plays of North America, in M.R. Silverman, ed., *Emerging coalbed methane plays of North America: Denver, CO, Petroleum Frontiers*, v. 18, no. 3, p. 1-10.
- Silverman, M.R., 2003, Emerging coalbed methane plays of North America, in M.R. Silverman, ed., *Emerging coalbed methane plays of North America (part 2): Denver, CO, Petroleum Frontiers*, v. 18, no. 4, p. vi-viii.
- Silverman, M.R., ed., 2003, *Emerging coalbed methane plays of North America (part 3): Petroleum Frontiers*, v. 19, no. 2, 38 p.
- Sinayuc, C., J.-Q. Shi, C.E. Imrie, S.A. Syed, A. Korre, and S. Durucan, 2011, Implementation of horizontal well CBM/ECBM technology and the assessment of effective CO₂ storage capacity in a Scottish coalfield: *Energy Procedia*, v. 4, p. 2150-2156.
- Sinclair, J.F., 2005, Coalbed-methane potential in Osage County, Oklahoma (abstract), in B.J. Cardott, ed., *Unconventional energy resources in the southern Midcontinent, 2004 symposium: Oklahoma Geological Survey Circular 110*, p. 105.
- Siregar, I., Y. Niu, P. Mostaghimi, and R.T. Armstrong, 2017, Coal ash content estimation using fuzzy curves and ensemble neural networks for well log analysis: *International Journal of Coal Geology*, v. 181, p. 11-22.
- Siriwardane, H.J., B.D. Bowes, G.S. Bromhal, R.K. Gondle, A.W. Wells, and B.R. Strazisar, 2012, Modeling of CBM production, CO₂ injection, and tracer movement at a field CO₂ sequestration site: *International Journal of Coal Geology*, v. 96-97, p. 120-136.

- Sloan, G.R., B.W. McKinstry, P.G. Gagnon, F.M. Dawson, and J.A. Lee, 2003, Coalbed methane in western Canada, *in* M.R. Silverman, ed., *Emerging coalbed methane plays of North America, part 1: Petroleum Frontiers*, v. 18, no. 3, p. 11-28.
- Sloss, L.L., 2015, Potential for enhanced coalbed methane recovery: IEA Clean Coal Centre, CCC/252, 41 p. (ECBM)
- Smirnov, V.G., A.Y. Manakov, E.A. Ukraintseva, G.V. Villevald, T.D. Karpova, V.V. Dyrdin, S.Y. Lyrshchikov, Z.R. Ismagilov, I.S. Terekhova, and A.G. Ogienko, 2016, Formation and decomposition of methane hydrate in coal: *Fuel*, v. 166, p. 188-195.
- Smistad, E., 2013, Environmental impacts in gas production monitored by NETL: *World Oil*, v. 234, no. 9, p. 119-122.
- Smith, D.M., and F.L. Williams, 1984, Diffusion models for gas production from coals – application to methane content determination: *Fuel*, v. 63, p. 251-255.
- Smith, D.M., and F.L. Williams, 1984, Diffusion models for gas production from coals – determination of diffusion parameters: *Fuel*, v. 63, p. 256-261.
- Smith, D.M., and F.L. Williams, 1984, Direct method of determining the ethane content of coal: a modification: *Fuel*, v. 63, p. 425-426.
- Smith, J.W. and R.J. Pallasger, 1996, Microbial origin of Australian coalbed methane: *AAPG Bulletin*, v. 80, p. 891-897.
- Smith, J.W., 1999, The development of an understanding of the origins of the Sydney and Bowen basin gases, *in* M. Mastalerz, M. Glikson, and S.D. Golding, eds., *Coalbed methane: scientific, environmental and economic evaluation*: Boston, Kluwer Academic Publishers, p. 271-277.
- Smith, J.W., and R.J. Pallasger, 2001, Comment on Boreham et al. (1998), “Factors controlling the origin of gas in Australian Bowen basin coals”: *Organic Geochemistry*, v. 32, p. 205-206.
- Smyth, M., and M.J. Buckley, 1993, Statistical analysis of the microlithotype sequences in the Bulli seam, Australia, and relevance to permeability for coal gas: *International Journal of Coal Geology*, v. 22, p. 167-187.
- Snyder, R.E., 2005, North American coalbed methane development moves forward: *World Oil*, v. 226, no. 8, p. 57-59.
- Soeder, D.J., 1991, The effects of overburden stress on coalbed methane production, *in* D.C. Peters, ed., *Geology in coal resource utilization*: Fairfax, VA, Techbooks, p. 125-135.
- Solano-Acosta, W., M. Mastalerz, and A. Schimmelmann, 2007, Cleats and their relation to geologic lineaments and coalbed methane potential in Pennsylvanian coals in Indiana: *International Journal of Coal Geology*, v. 72, p. 187-208.
- Solano-Acosta, W., A. Schimmelmann, M. Mastalerz, and I. Arango, 2008, Diagenetic mineralization in Pennsylvanian coals from Indiana, USA: $^{13}\text{C}/^{12}\text{C}$ and $^{18}\text{O}/^{16}\text{O}$ implications for cleat origin and coalbed methane generation: *International Journal of Coal Geology*, v. 73, p. 219-236.
- Song, C., and D. Elsworth, 2018, Strengthening mylonitized soft-coal reservoirs by microbial mineralization: *International Journal of Coal Geology*, v. 200, p. 166-172.
- Song, Y., S. Liu, F. Hong, L. Jiang, and X. Ma, 2013, Coalbed methane, chapter 4 in *Unconventional petroleum geology*: New York, Elsevier, p. 111-147.
- Sööt, P.M., 1988, Non-conventional fuel tax credit, *in* J.E. Fassett, ed., *Geology and coal-bed methane resources of the northern San Juan basin, Colorado and New Mexico*: Denver, Rocky Mountain Association of Geologists Guidebook, p. 253-255.
- Sööt, P.M., 1991, Tax incentives spur development of coalbed methane: *Oil & Gas Journal*, v. 89, no. 23, p. 40-42.

- Sööt, P.M., 1991, Western United States coalbed methane gas content correlations, in S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., Coalbed methane of western North America: Denver, Rocky Mountain Association of Geologists, p. 87-92.
- Sosrowidjojo, I.B., and A. Saghafi, 2009, Development of the first coal seam gas exploration program in Indonesia: Reservoir properties of the Muaraenim Formation, south Sumatra: *International Journal of Coal Geology*, v. 79, p. 145-156.
- Sparks, D. P., S. W. Lambert, and T. H. McLendon, 1993, Coalbed gas well flow performance controls, Cedar Cove area, Warrior Basin, U.S.A.: Tuscaloosa, Alabama, University of Alabama, 1993 International Coalbed Methane Symposium Proceedings, p. 529-548.
- SPE, 1992, Coalbed methane: Society of Petroleum Engineers, Reprint Series 35, 237 p.
- Spears, D.A., and S.A. Caswell, 1986, Mineral matter in coals: cleat minerals and their origin in some coals from the English midlands: *International Journal of Coal Geology*, v. 6, p. 107-125.
- Specht, R.W., 2001, Coalbed methane potential of the Williston Basin, North Dakota, in M.R. Silverman, ed., Emerging coalbed methane plays of North America: Denver, CO, *Petroleum Frontiers*, v. 18, no. 3, p. 40-50.
- Squaret, J., and M. Dawson, 2006, Coalbed methane expands in Canada: *Oil & Gas Journal*, v. 104, no. 28, p. 37-50.
- Staib, G., R. Sakurovs, and E.M.A. Gray, 2014, Kinetics of coal swelling in gases: Influence of gas pressure, gas type and coal type: *International Journal of Coal Geology*, v. 132, p. 117-122.
- Staib, G., R. Sakurovs, and E.M.A. Gray, 2015, Dispersive diffusion of gases in coals. Part I: Model development: *Fuel*, v. 143, p. 612-619.
- Staib, G., R. Sakurovs, and E.M.A. Gray, 2015, Dispersive diffusion of gases in coals. Part II: An assessment of previously proposed physical mechanisms of diffusion in coal: *Fuel*, v. 143, p. 620-629.
- Stanton, R., R. Flores, P.D. Warwick, H. Gluskoter, and G.D. Stricker, 2001, Coal bed sequestration of carbon dioxide: National Energy Technology Laboratory First National Conference on Carbon Sequestration, 12 p.
http://www.netl.doe.gov/publications/proceedings/01/carbon_seq/3a3.pdf
- Stanton, R.W., R.M. Flores, P.D. Warwick, and H.J. Gluskoter, 2002, Sequestration of carbon dioxide in low-rank coals (abstract): *TSOP Abstracts and Program*, v. 18, p. 111.
- Stark, P., and L.K. Smith, 2017, Giant oil and gas fields of the 2000s: A new century ushers in deeper water, unconventional, and more gas, in R.K. Merrill and C.A. Sternbach, eds., Giant fields of the decade 2000–2010: AAPG Memoir 113, p. 15-28. (3 CBM fields in Australia/China included in giant international unconventional gas discoveries during 2000-2009; p. 27)
- Stasiuk, L.D., P.D. Warwick, and E.M. Caddel, eds., 2006, Proceedings from coal bed methane—Back to the basics of coal geology: *Bulletin of Canadian Petroleum Geology*, v. 54, p. 195-297.
- Stayton, R.J., 2002, Horizontal wells boost CBM recovery: *American Oil & Gas Reporter*, v. 45, no. 8, p. 71-75.
- Stayton, R.J., 2005, Drilling technologies optimize development of unconventional plays: *American Oil & Gas Reporter*, v. 48, no. 9, p. 64-69.

- Steidl, P.F., 1978, Foam stimulation to enhance production from degasification wells in the Pittsburgh coalbed: U.S. Bureau of Mines, Report of Investigations 8286, 10 p.
- Steidl, P.F., 1991, Observations of induced fractures intercepted by mining in the Warrior basin, Alabama: Gas Research Institute, Topical Report, GRI-91/0327.
- Stell, J., 2007, Appalachian transfer: Oil and Gas Investor, v. 27, no. 12, p. 71-72.
- Stell, J., 2009, U.S. gas supply, San Juan Basin revisited: Oil and Gas Investor, v. 29, no. 8, p. 81-83.
- Stenberg, E., and T. Doll, A review of the Powder River Basin coalbed methane play: The Mountain Geologist, v. 43, no. 3, p. 247-250.
- Stępniewska, Z., A. Pytlak, and A. Kuźniar, 2013, Methanotrophic activity in Carboniferous coalbed rocks: International Journal of Coal Geology, v. 106, p. 1-10. (secondary biogenic methane)
- Stępniewska, Z., A. Pytlak, and A. Kuźniar, 2014, Distribution of the methanotrophic bacteria in the western part of the Upper Silesian Coal Basin (Borynia-Zofiów and Budryk coal mines): International Journal of Coal Geology, v. 130, p. 70-78.
- Stevens, S.H., T.E. Lombardi, B.S. Kelso, and J.M. Coates, 1992, A geologic assessment of natural gas from coal seams in the Raton and Vermejo Formations, Raton Basin: Gas Research Institute, Topical Report GRI 92/0345, 84 p.
- Stevens, S.H., B.S. Kelso, T.E. Lombardi, and J.-M. Coates, 1993, Raton basin assessment of coalbed methane resources: Quarterly Review of Methane from Coal Seams Technology, v. 10, no. 3, p. 7-13.
- Stevens, S.H., K. Sani, and S. Hardjosuwiryo, 2001, Indonesia's 337 tcf CBM resource a low-cost alternative to gas, LNG: Oil & Gas Journal, v. 99, no. 43, p. 40-45.
- Stevens, S.H., J.D. Nations, and S.L. Rauzi, 2002, Black Mesa coal basin, northeastern Arizona: an overlooked Rocky Mountain coalbed methane play (abstract): AAPG Annual Convention Official Program, v. 11, p. A168.
- Stoeckinger, B.T., 1989, Coal-bed methane production in eastern Kansas: its potential and restraints (abstract): AAPG Bulletin, v. 73, p. 1051.
- Stoeckinger, W.T., 1989, Methane from coal in southeast Kansas: the rebirth of an old industry: Proceedings of the 1989 Coalbed Methane Symposium, paper 8964, p. 211-224.
- Stoeckinger, W.T., 1990, Kansas coalbed methane comes on stream: Oil & Gas Journal, v. 88, no. 23, p. 88-90.
- Stoeckinger, W.T., 1990, Coalbed methane comes on stream: Kansas Geological Society, Bulletin, v. 66, no. 2, p. 8-12.
- Stoeckinger, W.T., 1990, Coal gas blooms in southeast Kansas: Oil News Service, Eastern Kansas Edition, v. 44, issue 187, 2 p. (originally printed in American Oil & Gas Reporter, v. 33, no. 9)
- Stoeckinger, W.T., 1991, Methods to measure directly the gas content of coals, in Midcontinent core workshop, integrated studies of petroleum reservoirs in the Midcontinent: Kansas Geological Survey Open-File Report 91-52, p. 111-124.
- Stoeckinger, W.T., 1992, Coalbed methane production base established in southeast Kansas: Oil & Gas Journal, v. 90, no. 15, p. 90-91.
- Stott, J., 2001, Canadian coalbed methane activity intensifies: Oil & Gas Journal, v. 99, no. 47, p. 37.
- Strąpoć, D., A. Schimmelmann, and M. Mastalerz, 2006, Carbon isotopic fractionation of CH₄ and CO₂ during canister desorption of coal: Organic Geochemistry, v. 37, p. 152-164.
- Strąpoć, D., M. Mastalerz, C. Eble, and A. Schimmelmann, 2007, Characterization of the origin of coalbed gases in southeastern Illinois Basin by compound-specific carbon and hydrogen stable isotope ratios: Organic Geochemistry, v. 38, p. 267-287.

- Strapoć, D., M. Mastalerz, A. Schimmelmann, A. Drobniak, and S. Hedges, 2008, Variability of geochemical properties in a microbially dominated coalbed gas system from the eastern margin of the Illinois Basin, USA: *International Journal of Coal Geology*, v. 76, p. 98-110.
- Strapoć, D., F.W. Picardal, C. Turich, I. Schaperdoth, J.L. Macalady, J.S. Lipp, Y.S. Lin, T.F. Ertefai, F. Schubotz, K.U. Hinrichs, M. Mastalerz, and A. Schimmelmann, 2008, Methane-producing microbial community in a coal bed of the Illinois Basin: *Applied and Environmental Microbiology*, v. 74, p. 2424-2432.
- Strapoć D., M. Mastalerz, K. Dawson, J. Macalady, A.V. Callaghan, B. Wawrik, C. Turich, and M. Ashby, 2011, Biogeochemistry of microbial coal-bed methane: *Annual Review of Earth and Planetary Sciences*, v. 39, p. 617-656.
- Stuhec, S., compiler, 1990, Introduction to coal sampling techniques for the petroleum industry: Alberta Research Council, Coal Bed Methane Seminar Series, Information Series 11, 223 p.
- Stutz, L., and K. Fisher, 2004, Fracture mapping and modeling optimize CBM fracture treatments: *World Oil*, v. 225, no. 6, p. 63-64.
- Su, X., Y. Feng, J. Chen, and J. Pan, 2001, The characteristics and origins of cleat in coal from western North China: *International Journal of Coal Geology*, v. 47, p. 51-62.
- Su, X., Y. Feng, J. Chen, and J. Pan, 2001, The annealing mechanisms of cleats in coal: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 130, p. 351-356.
- Su, X., L. Zhang, and R. Zhang, 2003, The abnormal pressure regime of the Pennsylvanian No. 8 coalbed methane reservoir in Liulin–Wupu District, eastern Ordos Basin, China: *International Journal of Coal Geology*, v. 53, p. 227-239.
- Su, X., X. Lin, M. Zhao, Y. Song, and S. Liu, 2005, The upper Paleozoic coalbed methane system in the Qinshui Basin, China: *AAPG Bulletin*, v. 89, p. 81-100.
- Su, X., X. Lin, S. Liu, M. Zhao, and Y. Song, 2005, Geology of coalbed methane reservoirs in the southeast Qinshui Basin of China: *International Journal of Coal Geology*, v. 62, p. 197-210. (shear fracture permeability in anthracite)
- Su, X., Q. Wang, H. Lin, J. Song, and H. Guo, 2018, A combined stimulation technology for coalbed methane wells: Part 1. Theory and technology: *Fuel*, v. 233, p. 592-603.
- Su, X., Q. Wang, H. Lin, J. Song, and H. Guo, 2018, A combined stimulation technology for coalbed methane wells: Part 2. Application: *Fuel*, v. 233, p. 539-551.
- Sun, Q., B. Chen, Y. Li, G. Yuan, Z. Xu, X. Guo, X. Li, W. Lan, and L. Yang, 2019, Enhanced separation of coal bed methane via bioclathrates formation: *Fuel*, v. 243, p. 10-14.
- Sun, W., Y. Feng, C. Jiang, and W. Chu, 2015, Fractal characterization and methane adsorption features of coal particles taken from shallow and deep coalmine layers: *Fuel*, v. 155, p. 7-13.
- Sun, Z., X. Li, J. Shi, P. Yu, L. Huang, J. Xia, F. Sun, T. Zhang, and D. Feng, 2017, A semi-analytical model for drainage and desorption area expansion during coalbed methane production: *Fuel*, v. 204, p. 214-226.
- Sun, Z., J. Shi, T. Zhang, K. Wu, D. Feng, F. Sun, L. Huang, C. Hou, and X. Li, 2018, A fully-coupled semi-analytical model for effective gas/water phase permeability during coal-bed methane production: *Fuel*, v. 223, p. 44-52.
- Susilawati, R., P.N. Evans, J.S. Esterle, S.J. Robbins, G.W. Tyson, S.D. Golding, and T.E. Mares, 2015, Temporal changes in microbial community composition during culture enrichment experiments with Indonesian coals: *International Journal of Coal Geology*, v. 137, p. 66-76. (biogenic methane)
- Susilawati, R., S.D. Golding, K.A. Baublys, J.S. Esterle, and S.K. Hamilton, 2016, Carbon and hydrogen isotope fractionation during methanogenesis: A laboratory

- study using coal and formation water: *International Journal of Coal Geology*, v. 162, p. 108-122.
- Sutton, T., 2014, Wireline logs for coalbed evaluation, *in* P. Thakur, K. Aminian, and S. Schatzel, eds., *Coal bed methane: from prospect to pipeline*: New York, Elsevier, p. 93-100.
- Švábová, M., Z. Weishauptová, and O. Příbyl, 2012, The effect of moisture on the sorption process of CO₂ on coal: *Fuel*, v. 92, p. 187-196. (enhanced CBM)
- Svenster, P.G., 1959, Diffusion of gases through coal: *Fuel*, v. 38, p. 403-418.
- Swanson, S.M., M.D. Mastalerz, M.A. Engle, B.J. Valentine, P.D. Warwick, P.C. Hackley, and H.E. Belkin, 2015, Pore characteristics of Wilcox Group coal, U.S. Gulf Coast Region: Implications for the occurrence of coalbed gas: *International Journal of Coal Geology*, v. 139, p. 80-94. (subbituminous; biogenic methane)
- Szafranek-Nakonieczna, A., Y. Zheng, M. Słowakiewicz, A. Pytlak, C. Polakowski, A. Kubaczyński, A. Bieganski, A. Banach, A. Wolińska, and Z. Stępniewska, 2018, Methanogenic potential of lignites in Poland: *International Journal of Coal Geology*, v. 196, p. 201-210. (microbial, biogenic)
- Tabet, D.E., and J.C. Quick, 2003, Frontier areas for coalbed-gas exploration in Utah: *Utah Geological Survey, Survey Notes*, v. 35, no. 2, p. 10-11.
- Taheri, A., F. Sereshki, F.D. Ardejani, and A. Mirzaghobanali, 2017, Simulation of macerals effects on methane emission during gas drainage in coal mines: *Fuel*, v. 210, p. 659-665.
- Takahashi, K.I., ed., 2001, U.S. Geological Survey coalbed methane field conference, May 9-10, 2001: U.S. Geological Survey, Open-File Report 01-0235, CD-ROM.
- Takahashi, K.U., N. Suzuki, and H. Saito, 2014, Compositional and isotopic changes in expelled and residual gases during anhydrous closed-system pyrolysis of hydrogen-rich Eocene subbituminous coal: *International Journal of Coal Geology*, v. 127, p. 14-23.
- Takahashi, K.U., and N. Suzuki, 2017, Semi-open and closed system pyrolysis of Paleogene coal for evaluating the timing of hydrocarbon gas expulsion: *International Journal of Coal Geology*, v. 178, p. 100-109.
- Tamamura, S., T. Murakami, N. Aramaki, A. Ueno, A. AKM Badrul, S.R. Haq, T. Igarashi, and K. Kaneko, 2016, Reaction of lignite with dilute hydrogen peroxide to produce substrates for methanogens at *in situ* subsurface temperatures: *International Journal of Coal Geology*, v. 167, p. 230-237. (biogenic)
- Tamamura, S., T. Murakami, N. Aramaki, A. Ueno, S. Tamazawa, A.A.K.M. Bardul, S.R. Haq, T. Igarashi, H. Aoyama, S. Yamaguchi, and K. Kaneko, 2019, The role of meteoric water recharge in stimulating biogenic methane generation: A case study from the Tempoku coal field, Japan: *International Journal of Coal Geology*, v. 202, p. 14-26.
- Tan, Y., Z. Pan, J. Liu, F. Zhou, L.D. Connell, W. Sun, and A. Haque, 2018, Experimental study of impact of anisotropy and heterogeneity on gas flow in coal. Part II: Permeability: *Fuel*, v. 230, p. 397-409.
- Tan, Y., Z. Pan, J. Liu, J. Kang, F. Zhou, L.D. Connell, and Y. Yang, 2018, Experimental study of impact of anisotropy and heterogeneity on gas flow in coal. Part I: Diffusion and adsorption: *Fuel*, v. 232, p. 444-453.
- Tan, Y., Z. Pan, X.-T. Feng, D. Zhang, L.D. Connell, and S. Li, 2019, Laboratory characterisation of fracture compressibility for coal and shale gas reservoir rocks: A review: *International Journal of Coal Geology*, v. 204, p. 1-17.
- Tang, Y., P.D. Jenden, and S.C. Teerman, 1991, Thermogenic methane formation in low-rank coals—published models and results from laboratory pyrolysis of lignite, *in* D.A.C. Manning, ed., *Organic geochemistry—Advances and applications in the Natural Environment*: Manchester, England, Manchester University Press, p. 329-331.

- Tang, Y., 1993, Secondary macropores and mosaic structure in a telemagmatic metamorphosed coal and their significance in exploration for natural gas, Henan, China: *Organic Geochemistry*, v. 20, p. 283-294.
- Tang, Y., P.D. Jenden, A. Nigrini, and S.C. Teerman, 1996, Modeling early methane generation in coal: *Energy and Fuels*, v. 10, p. 659-671.
- Tang, T.Q., P. Ji, G.-L. Lai, C.-Q. Chi, Z.-S. Liu, and X.-L. Wu, 2012, Diverse microbial community from the coalbeds of the Ordos Basin, China: *International Journal of Coal Geology*, v. 90-91, p. 21-33. (biogenic methane)
- Tang, Z., S. Yang, G. Xu, M. Sharifzadeh, and C. Zhai, 2018, Evolution law of adsorption and desorption characteristics of CH₄ in coal masses during coalbed methane extraction: *Energy & Fuels*, v. 32, p. 10540-10548.
- Tang, Z.Q., S.Q. Yang, C. Zhai, and Q. Xu, 2018, Coal pores and fracture development during CBM drainage: their promoting effects on the propensity for coal and gas outbursts: *Journal of Natural Gas Science Engineering*, v. 51, p. 9-17.
- Tao, M., B. Shi, J. Li, W. Wang, X. Li, and B. Gao, 2007, Secondary biological coalbed gas in the Xinji area, Anhui province, China: Evidence from the geochemical features and secondary changes: *International Journal of Coal Geology*, v. 71, p. 358-370.
- Tao, S., Y. Wang, D. Tang, H. Xu, Y. Lv, W. He, and Y. Li, 2012, Dynamic variation effects of coal permeability during the coalbed methane development process in the Qinshui Basin, China: *International Journal of Coal Geology*, v. 93, p. 16-22.
- Tao, S., D. Tang, H. Xu, L. Gao, and Y. Fang, 2014, Factors controlling high-yield coalbed methane vertical wells in the Fanzhuang Basin, southern Qinshui Basin: *International Journal of Coal Geology*, v. 134-135, p. 38-45.
- Tao, S., D. Tang, H. Xu, S. Li, Y. Geng, J. Zhao, S. Wu, Q. Meng, X. Kou, S. Yang, and C. Yi, 2017, Fluid velocity sensitivity of coal reservoir and its effect on coalbed methane well productivity: A case of Baode Block, northeastern Ordos Basin, China: *Journal of Petroleum Science and Engineering*, v. 152, p. 229-237.
- Tao, S., X. Zhao, D. Tang, C. Deng, Q. Meng, and Y. Cui, 2018, A model for characterizing the continuous distribution of gas storing space in low-rank coals: *Fuel*, v. 233, p. 552-557.
- Tao, S., Z. Pan, S. Tang, and S. Chen, 2019, Current status and geological conditions for the applicability of CBM drilling technologies in China: A review: *International Journal of Coal Geology*, v. 202, p. 95-108.
- Tedesco, S.A., 1992, Coalbed methane potential assessed in Forest City Basin: *Oil & Gas Journal*, v. 90, p. 68-72.
- Tedesco, S.A., 2003, Coalbed methane in the Western Interior Basin, in M.R. Silverman, ed., *Emerging coalbed methane plays of North America (part 2)*: Denver, CO, *Petroleum Frontiers*, v. 18, no. 4, p. 11-25.
- Tedesco, S.A., 2003, Coalbed methane in the Illinois Basin, in M.R. Silverman, ed., *Emerging coalbed methane plays of North America (part 2)*: Denver, CO, *Petroleum Frontiers*, v. 18, no. 4, p. 26-37.
- Tedesco, S.A., 2003, Positive factors dominate negatives for Illinois Basin coalbed methane: *Oil & Gas Journal*, v. 101.13, p. 28-32.
- Tedesco, S.A., 2003, Exploration strategies for coal bed methane in the Western Region of the Interior Coal Province (abstract): AAPG Mid-Continent Section Meeting, Official Program Book, p.44.
- Tedesco, S. A., 2004, Coalbed methane in the Illinois Basin: an update: Tuscaloosa, Alabama, University of Alabama, College of Continuing Studies, 2004 International Coalbed Methane Symposium Proceedings, paper 0420, 7 p.
- Tedesco, S. A., 2004, Stratigraphic framework and architecture of the deltas of Pennsylvanian age in the Forest City and Cherokee Basins and their impact on coalbed methane production: Tuscaloosa, Alabama, University of Alabama,

- College of Continuing Studies, 2004 International Coalbed Methane Symposium Proceedings, paper 0421, 9 p.
- Tedesco, S., 2015, The relationship between specific reservoir characteristics and the gas productive coals and carbonaceous mudstones in the Cherokee Basin: AAPG Search and Discovery Article #10789, 23 p.
- Telle, W.R., D.A. Thompson, L.K. Lottman, and P.G. Malone, 1987, Preliminary burial - thermal history investigations of the Black Warrior basin: implications for coalbed methane and conventional hydrocarbon development: Tuscaloosa, Alabama, Proceedings of the 1987 Coalbed Methane Symposium, paper 8713, p. 37-50.
- Telle, W. R., and D. A. Thompson, 1987, Preliminary characterization of the coalbed methane potential of the Cahaba coal field, central Alabama: Tuscaloosa, Alabama, University of Alabama, 1987 Coalbed Methane Symposium Proceedings, p. 141-151.
- Telle, W. R., and D. A. Thompson, 1988, The Cahaba coal field: a potential coalbed methane development area in central Alabama: Tuscaloosa, Alabama, University of Alabama, School of Mines and Energy Development Research Report 88-1, 174 p.
- Teng, J., Y. Yao, D. Liu, and Y. Cai, 2015, Evaluation of coal texture distributions in the southern Qinshui basin, North China: Investigation by a multiple geophysical logging method: International Journal of Coal Geology, v. 140, p. 9-22.
- Thakur, P., K. Aminian, and S. Schatzel, eds., 2014, Coal bed methane: from prospect to pipeline: New York, Elsevier, 440 p.
- Thakur, P., 2016, Advanced reservoir and production engineering for coal bed methane: Gulf Professional Publishing, 224 p.
- Thararoop, P., Z.T. Karpyn, and T. Ertekin, 2015, A production type-curve solution for coalbed methane reservoirs: Journal of Unconventional Oil and Gas Resources, v. 9, p. 136-152.
- Thararoop, P., Z.T. Karpyn, and T. Ertekin, 2015, Development of a material balance equation for coalbed methane reservoirs accounting for the presence of water in the coal matrix and coal shrinkage and swelling: Journal of Unconventional Oil and Gas Resources, v. 9, p. 153-162.
- Thomas, L., 2013, Coal geology (second edition): Hoboken, New Jersey, Wiley-Blackwell, 444 p. (Coal as an alternative energy source, p. 303-337)
- Thomson, S., D. Thomson, B. Khassen, and A. Zeinullin, 2018, Kazakhstan's Karaganda Basin offers CBM development prospects: Oil & Gas Journal, v. 116.1, p. 35-40.
- Thielemann, T., and R. Littke, 1999, Examples of the methane exchange between litho- and atmosphere: the coal bearing Ruhr basin, Germany, in M. Mastalerz, M. Glikson, and S.D. Golding, eds., Coalbed methane: scientific, environmental and economic evaluation: Boston, Kluwer Academic Publishers, p. 555-558.
- Thielemann, T., B.M. Krooss, R. Littke, and D.H. Welte, 2001, Does coal mining induce methane emissions through the lithosphere/atmosphere boundary in the Ruhr basin, Germany?: Journal of Geochemical Exploration, v. 74, p. 219-231.
- Thielemann, T., B. Cramer, and A. Schippers, 2004, Coalbed methane in the Ruhr Basin, Germany: a renewable energy resource?: Organic Geochemistry, v. 35, p. 1537-1549.
- Thimons, B., and F.N. Kissell, 1973, Diffusion of methane through coal: Fuel, v. 52, p. 274-280.

- Thomas, J., Jr., and H.H. Damberger, 1976, Porosity and internal surface area of Illinois agglomerating coals, *in* C.J. Smith, compiler, Proceedings of the coal agglomeration and conversion symposium: West Virginia Geological and Economic Survey, p. 25-36.
- Thomas, J., Jr., and H.H. Damberger, 1976, Internal surface area, moisture content, and porosity of Illinois coals: variations with coal rank: Illinois State Geological Survey Circular 493, 38 p.
- Thomas, M., 2013, Unlocking Indonesia's CBM potential: Hart Energy Publishing, E&P, v. 86, no. 2, p. 98-103.
- Tian, L., Y. Cao, X. Chai, T. Liu, P. Feng, H. Feng, D. Zhou, B. Shi, R. Oestreich, and G. Rodvelt, 2015, Best practices for the determination of low-pressure/permeability coalbed methane reservoirs, Yuwu coal mine, Luan mining area, China: Fuel, v. 160, p. 100-107.
- Tilton, J.G., 1976, Gas from coal deposits, *in* Natural gas from unconventional geologic sources: Washington, D.C., National Academy of Sciences, p. 206-229.
- Ting, F.T.C., 1977, Origin and spacing of cleats in coal beds: Journal of Pressure Vessel Technology, v. 99, p. 624-626.
- Ting, F.T.C., and P.B. Wang, 1984, Coal anisotropism and its relationship to methane concentration in coal (abstract): AAPG Bulletin, v. 68, p. 535.
- Ting, F.T.C., 1987, Optical anisotropism and its relationship with some physical and chemical properties of coal: Organic Geochemistry, v. 11, p. 403-405.
- Torkelson, D., 2009, Wyoming CBM permits slow to a trickle: American Oil & Gas Reporter, v. 52, no. 8, p. 121-123.
- Towler, B., M. Firouzi, J. Underschultz, W. Rifkin, A. Garnett, H. Schultz, J. Esterle, S. Tyson, and K. Witt, 2016, An overview of the coal seam gas developments in Queensland: Journal of Natural Gas Science and Engineering, v. 31, p. 249-271. (Australia)
- Tremain, C.M., and others, 1983, The coal bed methane resources of Colorado: Colorado Geological Survey Map Series 19, 1 plate.
- Tremain, C.M., 1990, Coalbed methane development in Colorado, September 1990: Colorado Geological Survey Information Series 32, 35 p.
- Tremain, C.M., S.E. Laubach, and N.H. Whitehead, III, 1991, Coal fracture (cleat) patterns in Upper Cretaceous Fruitland Formation, San Juan basin, Colorado and New Mexico - implications for coalbed methane exploration and development, *in* S.D. Schwochow, D.K. Murray, and M.F. Fahy, eds., Coalbed methane of western North America: Denver, Rocky Mountain Association of Geologists, p. 49-59.
- Tremain, C.M., S.E. Laubach, and N.H. Whitehead, III, 1994, Fracture (cleat) patterns in Upper Cretaceous Fruitland Formation coal seams, San Juan basin, *in* W.B. Ayers, Jr. and W.R. Kaiser, eds., Coalbed methane in the Upper Cretaceous Fruitland Formation, San Juan basin, New Mexico and Colorado: New Mexico Bureau of Mines and Mineral Resources, Bulletin 146, p. 87-102.
- Trippi, M.H., L.F. Ruppert, R.C. Milici, and S.A. Kinney, 2014, Coal and coalbed-methane resources in the Appalachian and Black Warrior Basins—Maps showing the distribution of coal fields, coal beds, and coalbed-methane fields, chap. D.1, *in* L.F. Ruppert, and R.T. Ryder, eds., Coal and petroleum resources in the Appalachian Basin: Distribution, geologic framework, and geochemical character: U.S. Geological Survey Professional Paper 1708, 21 p. [42 chapters] <http://pubs.usgs.gov/pp/1708/>
- Trost, P.B., 2003, Coalbed methane potential of the Bellingham Basin, Washington, *in* M.R. Silverman, ed., Emerging coalbed methane plays of North America (part 3): Petroleum Frontiers, v. 19, no. 2, p. 1-8.

- Tyler, R., N. Zhou, R.G. McMurray, M.L.W. Jackson, and C.M. Tremain, 1992, Selected references related to coalbed methane in the Greater Green River, Piceance, Powder River, Raton, and San Juan basins: Colorado Geological Survey Information Series 35, 77 p.
- Tyler, R., 1995, Structural setting and coal fracture patterns of foreland basins: controls critical to coalbed methane producibility, *in* W.R. Kaiser, A.R. Scott, and R. Tyler, eds., *Geology and hydrology of coalbed methane producibility in the United States: Analogs for the World*: Tuscaloosa, Alabama, The University of Alabama, INTERGAS'95 Short Course Notes, p. 1-50.
- Tyler, R., W.R. Kaiser, A.R. Scott, D.S. Hamilton, and W.A. Ambrose, 1995, Geologic and hydrologic assessment of natural gas from coal: Greater Green River, Piceance, Powder River, and Raton basins, western United States: Bureau of Economic Geology, Report of Investigations 228, 219 p.
- Tyler, R., W.R. Kaiser, A.R. Scott, and D.S. Hamilton, 1997, The potential for coalbed gas exploration and production in the Greater Green River Basin, southwest Wyoming and northwest Colorado: *The Mountain Geologist*, v. 34, no. 1, p. 7-24.
- Tyler, R., and A.R. Scott, 1997, Defining coalbed gas exploration fairways in low permeability, hydrocarbon overpressured basins: an example from the Piceance basin, northwest Colorado: International Coalbed Methane Symposium, Paper 9717, 13 p.
- Tyler, R., A.R. Scott, W.R. Kaiser, and R.G. McMurry, 1997, The application of a coalbed methane producibility model in defining coalbed methane exploration fairways and sweet spots: examples from the San Juan, Sand Wash, and Piceance basins: Austin, Texas, Bureau of Economic Geology, Report of Investigations 244, 59 p.
- Tyler, R., A.R. Scott, and W.R. Kaiser, 1999, Defining coalbed methane exploration fairways: an example from the Piceance basin, Rocky Mountain foreland, western United States, *in* M. Mastalerz, M. Glikson, and S.D. Golding, eds., *Coalbed methane: scientific, environmental and economic evaluation*: Boston, Kluwer Academic Publishers, p. 67-87.
- Ulery, J.P., 1988, Geologic factors influencing the gas content of coalbeds in southwestern Pennsylvania: U.S. Bureau of Mines, Report of Investigations 9195, 26 p.
- Ulrich, G., and S. Bower, 2008, Active methanogenesis and acetate utilization in Powder River Basin coals, United States: *International Journal of Coal Geology*, v. 76, p. 25-33.
- U.S. Environmental Protection Agency, 1998, Legal issues related to coalbed methane storage in abandoned coal mines in Virginia, West Virginia, Pennsylvania, Utah, Colorado and Alabama: U.S. Environmental Protection Agency, Coalbed Methane Outreach Program, Document No. 60933, 62 p.
- U.S.G.S., 2004, Total Petroleum System and assessment of coalbed gas in the Powder River Basin Province, Wyoming and Montana: U.S. Geological Survey Digital Data Series DDS-69-C, CD-ROM.
- U.S.G.S. National Assessment of Oil and Gas Resources Team and L.R.H. Biewick, 2014, Map of assessed coalbed-gas resources in the United States, 2014: U.S. Geological Survey Digital Data Series 69-ii. <http://pubs.usgs.gov/dds/dds-069/dds-069-ii/>
- U.S.G.S. U.S. Continuous Resources Assessment Team, 2015, U.S. Geological Survey assessments of continuous (unconventional) oil and gas resources, 2000-2011: U.S. Geological Survey Data Series 69-MM, 46 p. <http://pubs.er.usgs.gov/publication/ds69MM>
- U.S.G.S. Mexico Assessment Team, 2015, Geology and assessment of unconventional oil and gas resources of northeastern Mexico: U.S. Geological Survey Open-File Report 2015-1112. <http://pubs.usgs.gov/of/2015/1112/>

- Van Bergen, F., H.J.M. Pagnier, H.C.E. Schreurs, A.P.C. Paaij, C.N. Hamelinck, K.-H.A.A. Wolf, O.H. Barzandji, D. Jansen, and G.J. Ruijg, 2001, Inventory of the potential for enhanced coalbed methane production with carbon dioxide disposal in the Netherlands: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 117, p. 271-282.
- Van Hemert, P., K.-H.A.A. Wolf, and E.S.J. Rudolph, 2012, Output gas stream composition from methane saturated coal during injection of nitrogen, carbon dioxide, a nitrogen-carbon dioxide mixture and a hydrogen-carbon dioxide mixture: *International Journal of Coal Geology*, v. 89, p. 108-113.
- Van Voast, W.A., 2003, Geochemical signature of formation waters associated with coalbed methane: *AAPG Bulletin*, v. 87, p. 667-676.
- Varma, A.K., S. Biswal, B. Hazra, V.A. Mendhe, S. Misra, S.K. Samad, B.D. Singh, A.M. Dayal, and D. Mani, 2015, Petrographic characteristics and methane sorption dynamics of coal and shaly-coal samples from Ib Valley Basin, Odisha, India: *International Journal of Coal Geology*, v. 141-142, p. 51-62.
- Vessey, S.J., and R.M. Bustin, 1999, Coalbed methane characteristics of the Mist Mountain Formation, southern Canadian Cordillera: effect of shearing and oxidation, in M. Mastalerz, M. Glikson, and S.D. Golding, eds., *Coalbed methane: scientific, environmental and economic evaluation*: Boston, Kluwer Academic Publishers, p. 367-384.
- Vick, S.H.W., S.G. Tetu, N. Sherwood, K. Pinetown, S. Sestak, P. Vallotton, L.D.H. Elbourne, P. Greenfield, E. Johnson, D. Barton, D.J. Midgley, and I.T. Paulsen, 2016, Revealing colonization and biofilm formation of an adherent coal seam associated microbial community on a coal surface: *International Journal of Coal Geology*, v. 160-161, p. 42-50. (biogenic methane)
- Vick, S.H.W., P. Greenfield, N. Tran-Dinh, S.G. Tetu, D.J. Midgley, and I.T. Paulsen, 2018, The Coal Seam Microbiome (CSMB) reference set, a *lingua franca* for the microbial coal-to-methane community: *International Journal of Coal Geology*, v. 186, p. 41-50. (biogenic methane)
- von Schoenfeldt, H., J. Zupanik, and D. R. Wight, 2004, Unconventional drilling methods for unconventional reservoirs in the US and overseas: Tuscaloosa, Alabama, University of Alabama, College of Continuing Studies, 2004 International Coalbed Methane Symposium Proceedings, paper 0441, 10 p.
- Waechter, N.B., G.L. Hampton, III, S.D. Schwochow, and J.P. Seidle, 2004, Accurate gas content analysis improves coalbed gas resource estimation: *World Oil*, v. 225, no. 8, p. 47-51.
- Waechter, N.B., G.L. Hampton, and J.C. Shipps, 2004, Overview of coal and shale gas measurement: field and laboratory procedures: Proceedings of 2004 International Coalbed Methane Symposium, Tuscaloosa, Alabama, University of Alabama, 17 p.
- Wagman, D., 2005, The virtue of patience: *Supplement to Oil and Gas Investor*, v. 25, no. 12, p. 14-20.
- Walker, P.L., Jr., S.K. Verma, J. Rivera-Utrilla, and A. Davis, 1988, Densities, porosities and surface areas of coal macerals as measured by their interaction with gases, vapours, and liquids: *Fuel*, v. 67, p. 1615-1623.
- Walker, R., M. Glikson, and M. Mastalerz, 2001, Relations between coal petrology and gas content in the Upper Newlands seam, central Queensland, Australia: *International Journal of Coal Geology*, v. 46, p. 83-92.
- Wang, A., Y. Wei, Y. Yuan, C. Li, Y. Li, and D. Cao, 2017, Coalbed methane reservoirs' pore-structure characterization of different macrolithotypes in the southern Junggar Basin of northwest China: *Marine and Petroleum Geology*, v. 86, p. 675-688.

- Wang, A., P. Shao, F. Lan, and H. Jin, 2018, Organic chemicals in coal available to microbes to produce biogenic coalbed methane: A review of current knowledge: *Journal of Natural Gas Science and Engineering*, v. 60, p. 40-48.
- Wang, B., J. Li, Y. Zhang, H. Liu, G. Li, and J. Ma, 2009, Geological characteristics of low rank coalbed methane, China: *Shiyou Kantan Yu Kaifa/Petroleum Exploration and Development*, v. 36, no. 1, p. 30-34.
- Wang, B., F. Sun, D. Tang, Y. Zhao, Z. Song, and Y. Tao, 2014, Hydrological control rule on coalbed methane enrichment and high yield in FZ Block of Qinshui Basin: *Fuel*, v. 140, p. 568-577.
- Wang, B., C. Tai, L. Wu, L. Chen, J. Liu, B. Hu, and D. Song, 2017, Methane production from lignite through the combined effects of exogenous aerobic and anaerobic microflora: *International Journal of Coal Geology*, v. 173, p. 84-93. (biogenic methane)
- Wang, B., Z. Yu, Y. Zhang, and H. Zhang, 2019, Microbial communities from the Huaibei coalfield alter the physicochemical properties of coal in methanogenic bioconversion: *International Journal of Coal Geology*, v. 202, p. 85-94. (biogenic)
- Wang, C., J. Feng, J. Liu, M. Wei, C. Wang, and B. Gong, 2014, Direct observation of coal-gas interactions under thermal and mechanical loadings: *International Journal of Coal Geology*, v. 131, p. 274-287.
- Wang, C., J. Liu, J. Feng, M. Wei, C. Wang, and Y. Jiang, 2016, Effects of gas diffusion from fractures to coal matrix on the evolution of coal strains: *Experimental observations: International Journal of Coal Geology*, v. 162, p. 74-84.
- Wang, C., P. Zhai, Z. Chen, J. Liu, L. Wang, and J. Xie, 2017, Experimental study of coal matrix-cleat interaction under constant volume boundary condition: *International Journal of Coal Geology*, v. 181, p. 124-132.
- Wang, C., S. Yang, J. Li, X. Li, and C. Jiang, 2018, Influence of coal moisture on initial gas desorption and gas-release energy characteristics: *Fuel*, v. 232, p. 351-361.
- Wang, C., S. Yang, X. Li, J. Li, and C. Jiang, 2019, Comparison of the initial gas desorption and gas-release energy characteristics from tectonically-deformed and primary-undeformed coal: *Fuel*, v. 238, p. 66-74.
- Wang, G., T. Ren, K. Wang, and A. Zhou, 2014, Improved apparent permeability models of gas flow in coal with Klinkenberg effect: *Fuel*, v. 128, p. 53-61.
- Wang, G., T. Ren, Q. Qi, J. Lin, Q. Liu, and J. Zhang, 2017, Determining the diffusion coefficient of gas diffusion in coal: Development of numerical solution: *Fuel*, v. 196, p. 47-58.
- Wang, G.X., Z.T. Wang, V. Rudolph, P. Massarotto, and R.J. Finley, 2007, An analytical model of the mechanical properties of bulk coal under confined stress: *Fuel*, v. 86, p. 1873-1884.
- Wang, G.X., P. Massarotto, and V. Rudolph, 2009, An improved permeability model of coal for coalbed methane recovery and CO₂ geosequestration: *International Journal of Coal Geology*, v. 77, p. 127-136.
- Wang, G.X., X.R. Wei, K. wang, P. Massarotto, and V. Rudolph, 2010, Sorption-induced swelling/shrinkage and permeability of coal under stressed adsorption/desorption conditions: *International Journal of Coal Geology*, v. 83, p. 46-54.
- Wang, H., H. Lin, C.P. Rosewarne, D. Li, S. Gong, P. Hendry, P. Greenfield, N. Sherwood, and D.J. Midgley, 2016, Enhancing biogenic methane generation from a brown coal by combining different microbial communities: *International Journal of Coal Geology*, v. 154-155, p. 107-110.
- Wang, J., Q. Kang, L. Chen, and S.S. Rahman, 2017, Pore-scale lattice Boltzmann simulation of micro-gaseous flow considering surface diffusion effect: *International Journal of Coal Geology*, v. 169, p. 62-73.

- Wang, J.G., A. Kabir, J. Liu, and Z. Chen, 2012, Effects of non-Darcy flow on the performance of coal seam gas wells: *International Journal of Coal Geology*, v. 93, p. 62-74.
- Wang, J.G., J. Liu, and A. Kabir, 2013, Combined effects of directional compaction, non-Darcy flow and anisotropic swelling on coal seam gas extraction: *International Journal of Coal Geology*, v. 109-110, p. 1-14.
- Wang, K., J. Zang, G. Wang, and A. Zhou, 2014, Anisotropic permeability evolution of coal with effective stress variation and gas sorption: Model development and analysis: *International Journal of Coal Geology*, v. 130, p. 53-65.
- Wang, K., G. Wang, T. Ren, and Y. Cheng, 2014, Methane and CO₂ sorption hysteresis on coal: A critical review: *International Journal of Coal Geology*, v. 132, p. 60-80.
- Wang, L.L., M. Vandamme, J.M. Pereira, P. Dangla, and N. Espinoza, 2018, Permeability changes in coal seams: The role of anisotropy: *International Journal of Coal Geology*, v. 199, p. 52-64.
- Wang, M., Z. Li, W. Huang, J. Yang, and H. Xue, 2015, Coal pyrolysis characteristics by TG-MS and its late gas generation potential: *Fuel*, v. 156, p. 243-253.
- Wang, N., Q. Qin, L. Chen, Y. Bai, S. Zhao, and C. Zhang, 2014, Dynamic monitoring of coalbed methane reservoirs using Super-Low Frequency electromagnetic prospecting: *International Journal of Coal Geology*, v. 127, p. 24-41.
- Wang, S., D. Elsworth, and J. Liu, 2011, Permeability evolution in fractured coal: The roles of fracture geometry and water-content: *International Journal of Coal Geology*, v. 87, p. 13-25.
- Wang, T., W. Zhou, J. Chen, X. Xiao, Y. Li, and X. Zhao, 2014, Simulation of hydraulic fracturing using particle flow method and application in a coal mine: *International Journal of Coal Geology*, v. 121, p. 1-13.
- Wang, X., W. Liu, Y. Xu, U. Zheng, D. Zhang, and B. Shi, 2008, Pyrolytic simulation experiments on the role of water in natural gas generation from coal: *International Journal of Coal Geology*, v. 75, p. 105-112.
- Wang, X., Z. Wang, Q. Zeng, G. Yang, T. Chen, and X. Guo, 2015, Non-darcy effect on fracture parameters optimization in fractured CBM horizontal well: *Journal of Natural Gas Science and Engineering*, v. 27, p. 1438-1445.
- Wang, Y., S. Liu, and D. Elsworth, 2015, Laboratory investigations of gas flow behaviors in tight anthracite and evaluation of different pulse-decay methods on permeability estimation: *International Journal of Coal Geology*, v. 149, p. 118-128.
- Wang, Z., X. Ma, J. Wei, and N. Li, 2018, Microwave irradiation's effect on promoting coalbed methane desorption and analysis of desorption kinetics: *Fuel*, v. 222, p. 56-63.
- Wang, Z., Y. Cheng, K. Zhang, C. Hao, L. Wang, W. Li, and B. Hu, 2018, Characteristics of microscopic pore structure and fractal dimension of bituminous coal by cyclic gas adsorption/desorption: An experimental study: *Fuel*, v. 232, p. 495-505.
- Wang, Z., W. Su, X. Tang, and J. Wu, 2018, Influence of water invasion on methane adsorption behavior in coal: *International Journal of Coal Geology*, v. 197, p. 74-83.
- Wang, Z., and Y. Qin, 2019, Physical experiments of CBM coproduction: A case study in Laochang district, Yunnan province, China: *Fuel*, v. 239, p. 964-981.
- Ward, C.R., A. Crouch, and D.R. Cohen, 2001, Identification of potential for methane ignition by rock friction in Australian coal mines: *International Journal of Coal Geology*, v. 45, p. 91-103.
- Warwick, P.D., J.R. Sanfilippo, C.E. Barker, and L.E. Morris, 1999, Coal-bed methane in the Gulf Coastal Plain; a new frontier? (abstract): *GSA Abstracts with Programs*, v. 31, no. 7, p. 386.

- Warwick, P.D., C.E. Barker, J.R. SanFilipo, and L.E. Morris, 2000, Preliminary results from coal-bed methane drilling in Panola County, Texas: U.S. Geological Survey Open-File Report 00-0048, 30 p. (see <http://pubs.usgs.gov/openfile/of00-048/>)
- Warwick, P.D., C.E. Barker, J.R. SanFilipo, and L.R.H. Biewick, 2000, Preliminary evaluation of the coalbed methane resources of the Gulf Coastal Plain: U.S. Geological Survey, Open-File Report 00-0143. (see <http://pubs.usgs.gov/openfile/of00-143/>)
- Warwick, P.D., C.E. Barker, and J.R. SanFilipo, 2002, Preliminary evaluation of the coalbed methane potential of the Gulf Coastal Plain, USA and Mexico, in S.D. Schwochow and V.F. Nuccio, eds., Coalbed methane of North America, II: Rocky Mountain Association of Geologists, p. 99-107.
- Warwick, P.D., F.C. Breland, Jr., A.C. Clark, and J.C. Willett, 2004, Preliminary results from coal-bed methane drilling in Ouachita Parish, Louisiana: U.S. Geological Survey Open File Report 2004-1239, 4 p. (<http://pubs.usgs.gov/of/2004/1239/2004-1239.pdf>)
- Warwick, P.D., F.C. Breland, Jr., M.E. Ratchford, and P.C. Hackley, 2004, Coal gas resource potential of Cretaceous and Paleogene coals of the Gulf of Mexico Coastal Plain, in P.D. Warwick, ed., Selected presentations on coal-bed gas in the eastern United States: U.S. Geological Survey Open-File Report 2004-1273, p. 1-25. (<http://pubs.usgs.gov/of/2004/1273/2004-1273Warwick.pdf>)
- Warwick, P.D., 2005, Coal systems analysis: a new approach to the understanding of coal formation, coal quality and environmental considerations, and coal as a source rock for hydrocarbons, in P.D. Warwick, ed., Coal systems analysis: Geological Society of America Special Paper 387, p. 1-8.
- Warwick, P.D., F.C. Breland, Jr., and P.C. Hackley, 2008, Biogenic origin of coalbed gas in the northern Gulf of Mexico Coastal Plain, U.S.A.: International Journal of Coal Geology, v. 76, p.119-137.
- Wawrik, B., M. Mendivelso, V.A. Paris, J.M. Sufliata, I.A. Davidova, C.R. Marks, J.D. Van Nostrand, Y. Liang, J. Zhou, B.J. Huizinga, D. Strąpoć, and A.V. Callaghan, 2011, Field and laboratory studies on the bioconversion of coal to methane in the San Juan Basin: Federation of European Microbiological Societies (FEMS) Microbiology Ecology, v. 81, p. 26-42.
- Weatherl, B.D., 2005, Using traditional completion practices to optimize horizontal CBM wells in the Hartshorne coal, Arkoma Basin, Oklahoma (abstract), in B.J. Cardott, ed., Unconventional energy resources in the southern Midcontinent, 2004 symposium: Oklahoma Geological Survey Circular 110, p. 115.
- Weber, M., T.H. Wilson, B. Akwari, A.W. Wells, and G. Koperna, 2012, Impact of geological complexity of the Fruitland Formation on combined CO₂ enhanced recovery/sequestration at San Juan Basin pilot site: International Journal of Coal Geology, v. 104, p. 46-58.
- Weeden, S., 2013, Queensland LNG projects lead CBM developments worldwide: Hart's E&P, v. 86, no. 12, p. 68-73.
- Wei, C., Y. Qin, G.G.X. Wang, X. Fu, B. Jiang, and Z. Zhang, 2007, Simulation study on evolution of coalbed methane reservoir in Qinshui Basin, China: International Journal of Coal Geology, v. 72, p. 53-69.
- Wei, C., Y. Qin, G.G.X. Wang, X. Fu, and Z. Zhang, 2010, Numerical simulation of coalbed methane generation, dissipation and retention in SE edge of Ordos Basin, China: International Journal of Coal Geology, v. 82, p. 147-159.
- Wei, X., P. Massarotto, G. Wang, V. Rudolph, and S.D. Golding, 2010, CO₂ sequestration in coals and enhanced coalbed methane recovery: New numerical approach: Fuel, v. 89, p. 1110-1118.

- Weishauptová, Z., J. Medek, and J. Němec, 1999, Decrease of desorption intensity of coalbed methane due to hydraulic fracturing, *in* M. Mastalerz, M. Glikson, and S.D. Golding, eds., Coalbed methane: scientific, environmental and economic evaluation: Boston, Kluwer Academic Publishers, p. 385-393.
- Weishauptová, Z., J. Medek, and L. Ková, 2004, Bond forms of methane in porous system of coal II: Fuel, v. 83, p. 1759-1764.
- Weishauptová, and I. Sýkorová, 2011, Dependence of carbon dioxide sorption on the petrographic composition of bituminous coals from the Czech part of the Upper Silesian Basin, Czech Republic: Fuel, v. 90, p. 312-323.
- Weishauptová, Z., O. Příbyl, I. Sýkorová, and V. Machovič, 2015, Effect of bituminous coal properties on carbon dioxide and methane high pressure sorption: Fuel, v. 139, p. 115-124.
- Wen, G., W. Liu, C. Xu, L. Li, and X. Liu, 2011, Automated hydraulic correction technology for CBM horizontal wellbore: International Journal of Coal Geology, v. 85, p. 191-201.
- Wendell, J.H., Jr., 2001, Arkoma basin coalbed-methane potential and practices, *in* B.J. Cardott, compiler, Oklahoma coalbed-methane workshop 2001: OGS Open-File Report 2-2001, p. 119-139.
- Wendell, J.H., Jr., 2002, Arkoma Basin coalbed methane—potential and practices, *in* B.J. Cardott, ed., Revisiting old and assessing new petroleum plays in the southern Midcontinent, 2001 symposium: OGS Circular 107, p. 87-100.
- Wendell, J.H., Jr., 2003, Coalbed methane: smaller operations and economic analysis can improve potential profit (abstract): AAPG Mid-Continent Section Meeting, Official Program Book, p. 45.
- Wendell, J.H., Jr., 2005, Coalbed methane: what makes for economic success in the Arkoma Basin—methods and economics, *in* B.J. Cardott, ed., Unconventional energy resources in the southern Midcontinent, 2004 symposium: Oklahoma Geological Survey Circular 110, p. 107-114.
- Weniger, P., W. Kalkreuth, A. Busch, and B.M. Krooss, 2010, High-pressure methane and carbon dioxide sorption on coal and shale samples from the Paraná Basin, Brazil: International Journal of Coal Geology, v. 84, p. 190-205.
- Weniger, P., J. Francu, P. Hemza, and B.M. Krooss, 2012, Investigations on the methane and carbon dioxide sorption capacity of coals from the SW Upper Silesian coal basin, Czech Republic: International Journal of Coal Geology, v. 93, p. 23-39.
- Weniger, S., P. Weniger, and R. Littke, 2016, Characterizing coal cleats from optical measurements for CBM evaluation: International Journal of Coal Geology, v. 154-155, p. 176-192.
- Wheat, R.W., 1999, Coalbed methane potential, core and pilot program, Illinois basin (abstract): AAPG Bulletin, v. 83, p. 1374.
- Wheaton, J., and T. Donato, 2004, Coalbed-methane basics: Powder River Basin, Montana: Montana Bureau of Mines and Geology, Information Pamphlet 5, 20 p.
- White, C.M., D.H. Smith, K.L. Jones, A.L. Goodman, S.A. Jikich, R.B. LaCount, S.B. DuBose, E. Ozdemir, B.I. Morsi, and K.T. Schroeder, 2005, Sequestration of carbon dioxide in coal with enhanced coalbed methane recovery—a review: Energy & Fuel, v. 19, p. 659-724.
- Wicks, D.E., and M.D. Zuber, 1989, A strategy for coalbed methane production development part II: reservoir characterization: Tuscaloosa, Alabama, Proceedings of the 1989 Coalbed Methane Symposium, paper 8912, p. 11-18.
- Wight, D., 2004, Horizontal drilling adds value in CBG: The American Oil & Gas Reporter, v. 47, no. 5, p. 80-82, 85.
- Wilkinson, R., 2011, Eastern Australian coalbed methane supply rivals western offshore conventional resource: Oil & Gas Journal, v. 109.12, p. 56-64.

- Williams, P., 2002, Coalbed methane in the Cherokee Basin: *Oil and Gas Investor*, v. 22, no. 2, p. 49-51.
- Williams, P., 2004, Coalbed methane: *Oil and Gas Investor*, v. 24, no. 6, p. 30-38.
- Williams, P., 2004, More CBM basins to watch: *Oil and Gas Investor*, v. 24, no. 6, p. 107.
- Williams, P., 2004, Alberta's CBM: *Oil and Gas Investor*, v. 24, no. 6, p. C-9.
- Williams, P., 2005, Hartshorne horizontals: *Oil and Gas Investor*, v. 25, no. 5, p. 51-53.
- Williams, P., 2005, China: *Oil and Gas Investor*, v. 25, no. 6, p. 32-45. (China CBM opportunities, p. 38-39)
- Williams, P., 2005, Investing in CBM projects: *Oil and Gas Investor*, v. 25, no. 6, p. 79.
- Williams, P., 2006, Alabama hat trick: *Oil and Gas Investor*, v. 26, no. 3, p. 67-68.
- Williams, P., 2006, Virginia's CBM play: *Oil and Gas Investor*, v. 26, no. 3, p. 97.
- Williams, P., 2006, Western Canadian CBM: *Oil and Gas Investor*, v. 26, no. 9, p. 42-51.
- Williams, P., 2007, Powder River gas factory: *Oil and Gas Investor*, v. 27, no. 10, p. 149.
- Williams, P., 2007, Slater Dome: *Oil & Gas Investor*, v. 27, no. 12, p. 75.
- Williams, P., 2008, Illinois Basin CBM: *Oil and Gas Investor*, v. 28, no. 1, p. 127.
- Williams, P., 2010, Australian CBM on the verge: *Oil and Gas Investor*, v. 30, no. 11, p. 87.
- Wilson, T.H., H. Siriwardane, L. Zhu, R.A. Bajura, R.A. Winschel, J.E. Locke, and J. Bennett, 2012, Fracture model of the Upper Freeport coal: Marshall County West Virginia pilot ECBMR and CO₂ sequestration site: *International Journal of Coal Geology*, v. 104, p. 70-82.
- Wittenberg, K.W., and S.L. Aldridge, 2007, Colorado decision to shut down coal bed methane production?: *RMAG Outcrop*, v. 56, no. 10, p. 6-8.
- Wojtacha-Rychter, K., and A. Smoliński, 2018, Multi-component gas mixture transport through porous structure of coal: *Fuel*, v. 233, p. 37-44.
- Wolf, K.-H.A.A., R. Ephraim, W. Bertheux, and J. Bruining, 2001, Coal cleat classification and permeability estimation by image analysis on cores and drilling cuttings: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 102, p. 1-10.
- Wolf, K.-H.A.A., F. van Bergen, R. Ephraim, and H. Pagnier, 2008, Determination of the cleat angle distribution of the RECOPOL coal seams, using CT-scans and image analysis on drilling cuttings and coal blocks: *International Journal of Coal Geology*, v. 73, p. 259-272.
- Wong, S., K. MacLeod, M. Wold, W.D. Gunter, M.J. Mavor, and J. Gale, 2001, CO₂-enhanced coalbed methane recovery demonstration pilot — a case for Australia: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 148, p. 75-86.
- Wong, S., D. Law, X. Deng, J. Robinson, B. Kadatz, W.D. Gunter, Y. Jianping, F. Sanli, and F. Zhiqiang, 2007, Enhanced coalbed methane and CO₂ storage in anthracitic coals—Micro-pilot test at South Qinshui, Shanxi, China: *International Journal of Greenhouse Gas Control*, v. 1, no. 2, p. 215-222.
- Wong, S., D. Macdonald, S. Andrei, W.D. Gunter, X. Deng, D. Law, J. Ye, S. Feng, Z. Fan, and P. Ho, 2010, Conceptual economics of full scale enhanced coalbed methane production and CO₂ storage in anthracitic coals at South Qinshui Basin, Shanxi, China: *International Journal of Coal Geology*, v. 82, p. 280-286.
- Wray, L.L., and J.E. Schultz, 2001, Coal and coalbed methane in Colorado: Colorado Geological Survey, Special Publication 51, CD-ROM.
- Wray, L.L., N.V. Koenig, and J.P. Seidle, 2002, Preliminary assessment of coalbed methane potential of the low-rank Denver and Laramie Formation coals, Denver basin, Colorado (abstract): *AAPG Annual Convention Official Program*, v. 11, p. A193.

- Wu, C., Z. Yang, Y. Qin, J. Chen, Z. Zhang, and Y. Li, 2018, Characteristics of hydrogen and oxygen isotopes in produced water and productivity response of coalbed methane wells in western Guizhou: *Energy & Fuels*, v. 32, p. 11203-11211.
- Wu, J., J. Yu, Z. Wang, X. Fu, and W. Su, 2018, Experimental investigation on spontaneous imbibition of water in coal: Implications for methane desorption and diffusion: *Fuel*, v. 231, p. 427-437.
- Wyman, R.E., 1984, Gas resources in Elmworth coal seams, in J.A. Masters, ed., *Elmworth - a case study of a deep basin gas field: Canadian Society of Petroleum Geologists Memoir 38*, p. 173-187.
- Xiao, D., S. Peng, B. Wang, and X. Yan, 2013, Anthracite bio-degradation by methanogenic consortia in Qinshui Basin: *International Journal of Coal Geology*, v. 116-117, p. 46-52.
- Xie, J., S. Xue, W. Cheng, and G. Wang, 2011, Early detection of spontaneous combustion of coal in underground coal mines with development of an ethylene enriching system: *International Journal of Coal Geology*, v. 85, p. 123-127.
- Xu, B., X. Li, M. Haghight, X. Du, X. Yang, D. Chen, and Y. Zhai, 2013, An analytical model for desorption area in coal-bed methane production wells: *Fuel*, v. 106, p. 766-772. (well spacing)
- Xu, B., X. Li, M. Haghight, W. Ren, X. Du, D. Chen, and Y. Zhai, 2013, Optimization of hydraulically fractured well configuration in anisotropic coal-bed methane reservoirs: *Fuel*, v. 107, p. 859-865. (well spacing)
- Xu, B., X. Li, W. Ren, D. Chen, L. Chen, and Y. Bai, 2016, Dewatering rate optimization for coal-bed methane well based on the characteristics of pressure propagation: *Fuel*, v. 188, p. 11-18.
- Xu, H., D. Tang, J. Zhang, W. Yin, W. Zhang, and W. Lin, 2011, Factors affecting the development of the pressure differential in Upper Paleozoic gas reservoirs in the Sulige and Yulin areas of the Ordos Basin, China: *International Journal of Coal Geology*, v. 85, p. 103-111.
- Xu, H., D.Z. Tang, D.M. Liu, S.H. Tang, F. Yang, X.Z. Chen, W. He, and C.M. Deng, 2012, Study on coalbed methane accumulation characteristics and favorable areas in the Binchang area, southwestern Ordos Basin, China: *International Journal of Coal Geology*, v. 95, p. 1-11.
- Xu, H., D.Z. Tang, S.H. Tang, J.L. Zhao, Y.J. Meng, and S. Tao, 2014, A dynamic prediction model for gas-water effective permeability based on coalbed methane production data: *International Journal of Coal Geology*, v. 121, p. 44-52.
- Xu, H., D. Tang, J. Zhao, S. Li, and S. Tao, 2015, A new laboratory method for accurate measurement of the methane diffusion coefficient and its influencing factors in the coal matrix: *Fuel*, v. 158, p. 239-247.
- Xu, H., S. Sang, J. Yang, J. Jin, Y. Hu, H. Liu, P. Ren, and W. Gao, 2016, In-situ stress measurements by hydraulic fracturing and its implication on coalbed methane development in western Guizhou, SW China: *Journal of Unconventional Oil and Gas Resources*, v. 15, p. 1-10.
- Xu, H., D. Tang, J.P. Mathews, J. Zhao, B. Li, S. Tao, and S. Li, 2016, Evaluation of coal macrolithotypes distribution by geophysical logging data in the Hancheng Block, eastern margin, Ordos Basin, China: *International Journal of Coal Geology*, v. 165, p. 265-277.
- Xu, J., C. Zhai, S. Liu, L. Qin, and S. Wu, 2017, Pore variation of three different metamorphic coals by multiple freezing-thawing cycles of liquid CO₂ injection for coalbed methane recovery: *Fuel*, v. 208, p. 41-51.
- Xu, Z., Q. Liu, Q. Zheng, H. Cheng, and Y. Wu, 2016, Isotopic composition and content of coalbed methane production gases and waters in karstic collapse column

- area, Qinshui coalfield, China: *Journal of Geochemical Exploration*, v. 165, p. 94-101.
- Xue, S., and L. Yuan, 2017, The use of coal cuttings from underground boreholes to determine gas content of coal with direct desorption method: *International Journal of Coal Geology*, v. 174, p. 1-7.
- Yalçın, M.N., H.J. Schenk, and R.G. Schaefer, 1994, Modelling of gas generation in coals of the Zonguldak basin (northwestern Turkey): *International Journal of Coal Geology*, v. 25, p. 195-212.
- Yalçın, M.N., S. Inan, G. Gürdal, U. Mann, and R.G. Schaefer, 2002, Carboniferous coals of the Zonguldak basin (northwest Turkey): Implications for coalbed methane potential: *AAPG Bulletin*, v. 86, p. 1305-1328.
- Yalçın, M.N., S. Inan, H. Hoşgörmez, and S. Çetin, 2003, A new Carboniferous coal/shale driven gas play in the western Black Sea region (Turkey): *Marine and Petroleum Geology*, v. 19, p. 1241-1256.
- Yan, T., Y. Yao, and D. Liu, 2015, Critical tectonic events and their geological controls on gas generation, migration, and accumulation in the Weibei coalbed methane field, southeast Ordos Basin: *Journal of Natural Gas Science and Engineering*, v. 27, p. 1367-1380.
- Yang, R., Z. Huang, C. Hong, K. Sepehrnoori, and H. Wen, 2019, Modeling fishbones in coalbed methane reservoirs using a hybrid model formulation: Gas/water production performance in various lateral-cleat-network geometries: *Fuel*, v. 244, p. 592-612.
- Yang, R.T., and J.T. Saunders, 1985, Adsorption of gases on coals and heat-treated coals at elevated temperature and pressure: 1. Adsorption from hydrogen and methane as single gases: *Fuel*, v. 64, p. 616-620.
- Yang, T.H., T. Xu, H.Y. Liu, C.A. Tang, B.M. Shi, and Q.X. Yu, 2011, Stress-damage-flow coupling model and its application to pressure relief coal bed methane in deep coal seam: *International Journal of Coal Geology*, v. 86, p. 357-366.
- Yang, W., B.-Q. Lin, Y.-A. Qu, S. Zhao, C. Zhai, L.-L. Jia, and W.-Q. Zhao, 2011, Mechanism of strata deformation under protective seam and its application for relieved methane control: *International Journal of Coal Geology*, v. 85, p. 300-306.
- Yang, Y., S. Liu, W. Zhao, and L. Wang, 2019, Intrinsic relationship between Langmuir sorption volume and pressure for coal: Experimental and thermodynamic modeling study: *Fuel*, v. 241, p. 105-117.
- Yang, Z., S. He, X. Guo, Q. Li, Z. Chen, and Y. Zhao, 2016, Formation of low permeability reservoirs and gas accumulation process in the Daniudi gas field, northeast Ordos Basin, China: *Marine and Petroleum Geology*, v. 70, p. 222-236.
- Yao, Y., D. Liu, D. Tang, S. Tang, and W. Huang, 2008, Fractal characterization of adsorption-pores of coals from north China: An investigation on CH₄ adsorption capacity of coals: *International Journal of Coal Geology*, v. 73, p. 27-42.
- Yao, Y., D. Liu, D. Tang, S. Tang, Y. Che, and W. Huang, 2009, Preliminary evaluation of the coalbed methane production potential and its geological controls in the Weibei coalfield, southeastern Ordos Basin, China: *International Journal of Coal Geology*, v. 78, p. 1-15.
- Yao, Y., D. Liu, Y. Che, D. Tang, S. Tang, and W. Huang, 2010, Petrophysical characterization of coals by low-field nuclear magnetic resonance (NMR): *Fuel*, v. 89, p. 1371-1380.
- Yao, Y., and D. Liu, 2012, Effects of igneous intrusions on coal petrology, pore-fracture and coalbed methane characteristics in Hongyang, Handan and Huaibei coalfields, north China: *International Journal of Coal Geology*, v. 96-97, p. 72-81.

- Yao, Y., D. Liu, and Y. Qiu, 2013, Variable gas content, saturation, and accumulation characteristics of Weibei coalbed methane pilot-production field in the southeastern Ordos Basin, China: AAPG Bulletin, v. 97, p. 1371-1393.
- Yao, Y., D. Liu, and T. Yan, 2014, Geological and hydrogeological controls on the accumulation of coalbed methane in the Weibei field, southeastern Ordos Basin: International Journal of Coal Geology, v. 121, p. 148-159.
- Yao, Y., D. Liu, and S. Xie, 2014, Quantitative characterization of methane adsorption on coal using a low-field NMR relaxation method: International Journal of Coal Geology, v. 131, p. 32-40.
- Ye, Z., D. Chen, and J.G. Wang, 2014, Evaluation of the non-Darcy effect in coalbed methane production: Fuel, v. 121, p. 1-10.
- Yee, D., J.P. Seidle, and W.B. Hanson, 1993, Gas sorption on coal and measurement of gas content, in B.E. Law and D.D. Rice, eds., Hydrocarbons from coal: AAPG Studies in Geology 38, p. 203-218.
- Yi, J., I.Y. Akkutlu, and C.V. Deutsch, 2008, Gas transport in bidisperse coal particles: Investigation for an effective diffusion coefficient in coalbeds: Journal of Canadian Petroleum Technology, v. 47, no. 10, p. 1-7.
- Yi, J., I.Y. Akkutlu, C.Ö. Karacan, and C.R. Clarkson, 2009, Gas sorption and transport in coals: A poroelastic medium approach: International Journal of Coal Geology, v. 77, p. 137-144.
- Yin, G., B. Deng, M. Li, D. Zhang, W. Wang, W. Li, and D. Shang, 2017, Impact of injection pressure on CO₂-enhanced coalbed methane recovery considering mass transfer between coal fracture and matrix: Fuel, v. 196, p. 288-297.
- Yong, Q., and Y. Jianping, 2015, A review on development of CBM industry in China: AAPG Search and Discovery Article No. 90234, 5 p.
- Yong, Y., C. Shuqing, N. Yuanyong, W. Fengrui, Y. Yihan, and L. Shumin, 2014, A new attempt of a CBM tree-like horizontal well: A pilot case of Well ZS 1P-5H in the Qinshui Basin: Natural Gas Industry B, v. 1, p. 205-209.
- Yoon, S.-P., J.-Y. Jeon, and H.-S. Lim, 2016, Stimulation of biogenic methane generation from lignite through supplying an external substrate: International Journal of Coal Geology, v. 162, p. 39-44.
- Youjin, D., L. Dongkun, and X. Liangyu, 2010, Cash flow analysis assesses China's CBM resource viability: Oil & Gas Journal, v. 108.24, p. 45-49.
- Young, D.P., and T.J. Pratt, 2005, Coal gas reservoir assessment—WIC Region: GasTIPS, v. 11, no. 1, p. 9-13.
- Young, G.B.C., 1998, Computer modeling and simulation of coalbed methane resources, in R.M. Flores, ed., Coalbed methane: from coal-mine outbursts to a gas resource: International Journal of Coal Geology, v. 35, p. 369-379.
- Yu, H., G. Zhou, W. Fan, and J. Ye, 2007, Predicted CO₂ enhanced coalbed methane recovery and CO₂ sequestration in China: International Journal of Coal Geology, v. 71, p. 345-357.
- Yu, H., L. Zhou, W. Guo, J. Cheng, and Q. Hu, 2008, Predictions of the adsorption equilibrium of methane/carbon dioxide binary gas on coals using Langmuir and ideal adsorbed solution theory under feed gas conditions: International Journal of Coal Geology, v. 73, p. 115-129.
- Yu, H., J. Yuan, W. Guo, J. Cheng, and Q. Hu, 2008, A preliminary laboratory experiment on coalbed methane displacement with carbon dioxide injection: International Journal of Coal Geology, v. 73, p. 156-166.
- Zabetakis, M.G., T.D. Moore, Jr., A.E. Nagel, and J.E. Carpetta, 1972, Methane emission in coal mines: effects of oil and gas wells: U.S. Bureau of Mines Report of Investigations 7658, 9 p.
- Zabetakis, M.G., M. Deul, and M.L. Skow, 1973, Methane control in United States coal mines - 1972: U.S. Bureau of Mines Information Circular 8600, 22 p.

- Zang, J., K. Wang, and Y. Zhao, 2015, Evaluation of gas sorption-induced internal swelling in coal: *Fuel*, v. 143, p. 165-172.
- Zarębska, K., and G. Ceglarska-Stefańska, 2008, The change in effective stress associated with swelling during carbon dioxide sequestration on natural gas recovery: *International Journal of Coal Geology*, v. 74, p. 167-174.
- Zhang, C., Q. Qin, L. Chen, N. Wang, S. Zhao, and J. Hui, 2015, Rapid determination of coalbed methane exploration target region utilizing hyperspectral remote sensing: *International Journal of Coal Geology*, v. 150-151, p. 19-34.
- Zhang, C., J. Xu, S. Peng, Q. Li, F. Yan, and Y. Chen, 2018, Dynamic behavior of gas pressure and optimization of borehole length in stress relaxation zone during coalbed methane production: *Fuel*, v. 233, p. 816-824.
- Zhang, E., R.J. Hill, B.J. Katz, and Y. Tang, 2008, Modeling of gas generation from the Cameo coal zone in the Piceance Basin, Colorado: *AAPG Bulletin*, v. 92, p. 1077-1106.
- Zhang, J., 2014, Numerical simulation of hydraulic fracturing coalbed methane reservoir: *Fuel*, v. 136, p. 57-61.
- Zhang, J., and X. Bian, 2015, Numerical simulation of hydraulic fracturing coalbed methane reservoir with independent fracture grid: *Fuel*, v. 143, p. 543-546.
- Zhang, J., K. Liu, M.B. Clennell, D.N. Dewhurst, and M. Pervukhina, 2015, Molecular simulation of CO₂-CH₄ competitive adsorption and induced coal swelling: *Fuel*, v. 160, p. 309-317. (ECBM)
- Zhang, J., H. Liu, G. Yuan, and Y. Xia, 2015, Modeling ensures stability of Chinese CBM horizontal wells: *Oil & Gas Journal*, v. 113.10, p. 58-63.
- Zhang, J., D. Liu, Y. Cai, Z. Pan, Y. Yao, and Y. Wang, 2017, Geological and hydrological controls on the accumulation of coalbed methane within the No. 3 coal seam of the southern Qinshui Basin: *International Journal of Coal Geology*, v. 182, p. 94-111.
- Zhang, J., Z. Bi, and Y. Liang, 2018, Development of a nutrient recipe for enhancing methane release from coal in the Illinois Basin: *International Journal of Coal Geology*, v. 187, p. 11-19. (microbial)
- Zhang, J., C. Yip, C. Xia, and Y. Liang, 2019, Evaluation of methane release from coals from the San Juan basin and Powder River basin: *Fuel*, v. 244, p. 388-394.
- Zhang, L., X. Yan, X. Yang, and X. Zhao, 2015, An analytical model of coal wellbore stability based on block limit equilibrium considering irregular distribution of cleats: *International Journal of Coal Geology*, v. 152, Part B, p. 147-158.
- Zhang, L., S. Zhang, W. Jiang, Z. Wang, and L. Wang, 2018, An analytical model of wellbore strengthening considering complex distribution of cleat system: *Journal of Natural Gas Science and Engineering*, v. 60, p. 77-91.
- Zhang, M., and X. Fu, 2018, Characterization of pore structure and its impact on methane adsorption capacity for semi-anthracite in Shizhuangnan Block, Qinshui Basin: *Journal of Natural Gas Science and Engineering*, v. 60, p. 49-62.
- Zhang, R., S. Liu, J. Bahadur, D. Elsworth, Y. Melnichenko, L. He, and Y. Wang, 2015, Estimation and modeling of coal pore accessibility using small angle neutron scattering: *Fuel*, v. 161, p. 323-332.
- Zhang, R., and S. Liu, 2017, Experimental and theoretical characterization of methane and CO₂ sorption hysteresis in coals based on Langmuir desorption: *International Journal of Coal Geology*, v. 171, p. 49-60.
- Zhang, S., B. Zhang, G. Zhu, H. Wang, and Z. Li, 2011, Geochemical evidence for coal-derived hydrocarbons and their charge history in the Dabei gas field, Kuqa Thrust Belt, Tarim Basin, NW China: *Marine and Petroleum Geology*, v. 28, p. 1364-1375.
- Zhang, S., S. Tang, Z. Qian, Z. Pan, and Q. Guo, 2014, Evaluation of geological features for deep coalbed methane reservoirs in the Dacheng Salient, Jizhong Depression, China: *International Journal of Coal Geology*, v. 133, p. 60-71.

- Zhang, S., and Y. Shuai, 2015, Geochemistry and distribution of biogenic gas in China: *Bulletin of Canadian Petroleum Geology*, v. 63, no. 1, p. 53-65.
- Zhang, S., S. Tang, Z. Li, Q. Guo, and Z. Pan, 2015, Stable isotope characteristics of CBM co-produced water and implications for CBM development: The example of the Shizhuangnan block in the southern Qinshui Basin, China: *Journal of Natural Gas Science and Engineering*, v. 27, p. 1400-1411.
- Zhang, S., S. Tang, Z. Li, Z. Pan, and W. Shi, 2016, Study of hydrochemical characteristics of CBM co-produced water of the Shizhuangnan Block in the southern Qinshui Basin, China, on its implication of CBM development: *International Journal of Coal Geology*, v. 159, p. 169-182.
- Zhang, S., J. Liu, M. Wei, and D. Elsworth, 2018, Coal permeability maps under the influence of multiple coupled processes: *International Journal of Coal Geology*, v. 187, p. 71-82.
- Zhang, S., X. Zhang, G. Li, X. Liu, and P. Zhang, 2019, Distribution characteristics and geochemistry mechanisms of carbon isotope of coalbed methane in central-southern Qinshui basin, China: *Fuel*, v. 244, p. 1-12.
- Zhang, X., S. Zhang, Y. Yang, P. Zhang, and G. Wei, 2016, Numerical simulation by hydraulic fracturing engineering based on fractal theory of fracture extending in the coal seam: *Journal of Natural Gas Geoscience*, v. 1, p. 319-325.
- Zhang, X., P.G. Ranjith, A.S. Ranathunga, and D.Y. Li, 2019, Variation of mechanical properties of bituminous coal under CO₂ and H₂O saturation: *Journal of Natural Gas Science and Engineering*, v. 61, p. 158-168.
- Zhang, Y., M. Lebedev, M. Sarmadivaleh, A. Barifcani, T. Rahman, and S. Iglauer, 2016, Swelling effect on coal micro structure and associated permeability reduction: *Fuel*, v. 182, p. 568-576.
- Zhang, Y., Z. Zhang, M. Sarmadivaleh, M. Lebedev, A. Barifcani, H. Yu, and S. Iglauer, 2017, Micro-scale fracturing mechanisms in coal induced by adsorption of supercritical CO₂: *International Journal of Coal Geology*, v. 175, p. 40-50. (ECBM)
- Zhang, Y., J. Underschultz, L. Langhi, D. Mallants, and J. Strand, 2018, Numerical modelling of coal seam depressurization during coal seam gas production and its effect on the geomechanical stability of faults and coal beds: *International Journal of Coal Geology*, v. 195, p. 1-13.
- Zhao, J., H. Xu, D. Tang, J.P. Mathews, S. Li, and S. Tao, 2016, Coal seam porosity and fracture heterogeneity of macrolithotypes in the Hancheng Block, eastern margin, Ordos Basin, China: *International Journal of Coal Geology*, v. 159, p. 18-29.
- Zhao, J., D. Tang, W. Lin, Y. Qin, and H. Xu, 2019, In-situ stress distribution and its influence on the coal reservoir permeability in the Hancheng area, eastern margin of the Ordos Basin, China: *Journal of Natural Gas Science and Engineering*, v. 61, p. 119-132.
- Zhao, J.L., D.Z. Tang, H. Xu, Y.M. Lv, and S. Tao, 2015, High production indexes and the key factors in coalbed methane production: a case in the Hancheng block, southeastern Ordos Basin, China: *Journal of Petroleum Science Engineering*, v. 130, p. 55-67.
- Zhao, L., Y. Qin, C. Cai, Y. Xie, G. Wang, B. Huang, and C. Xu, 2017, Control of coal facies to adsorption-desorption divergence of coals: A case from the Xiqu

- drainage area, Gujiao CBM block, north China: *International Journal of Coal Geology*, v. 171, p. 169-184.
- Zhao, S., Y. Li, Y. Wang, Z. Ma, and X. Huang, 2019, Quantitative study on coal and shale pore structure and surface roughness based on atomic force microscopy and image processing: *Fuel*, v. 244, p. 78-90.
- Zhao, Y., Y. Feng, and X. Zhang, 2015, Molecular simulation of CO₂/CH₄ self- and transport diffusion coefficients in coal: *Fuel*, v. 165, p. 19-27. (CO₂-ECBM)
- Zheng, H., T. Chen, V. Rudolph, and S.D. Golding, 2017, Biogenic methane production from Bowen Basin coal waste materials: *International Journal of Coal Geology*, v. 169, p. 22-27.
- Zhi, S., D. Elsworth, J. Wang, Q. Gan, and S. Liu, 2018, Hydraulic fracturing for improving nutrient delivery in microbially-enhanced coalbed-methane (MECBM) production: *Journal of Natural Gas Science and Engineering*, v. 60, p. 294-311.
- Zhiming, W., and Z. Jian, 2009, CBM reservoir thickness affects production from horizontal wells: *Oil & Gas Journal*, v. 107.16, p. 42-46.
- Zhou, F., and G. Yao, 2014, Sensitivity analysis in permeability estimation using logging and injection-falloff test data for an anthracite coalbed methane reservoir in southeast Qinshui Basin, China: : *International Journal of Coal Geology*, v. 131, p. 41-51.
- Zhou, F., G. Yao, and S. Tyson, 2015, Impact of geological modeling processes on spatial coalbed methane resource estimation: *International Journal of Coal Geology*, v. 146, p. 14-27.
- Zhou, S., D. Liu, Y. Cai, and Y. Yao, 2017, Effects of the coalification jump on the petrophysical properties of lignite, subbituminous and high-volatile bituminous coals: *Fuel*, v. 199, p. 219-228.
- Zhou, S., D. Liu, Y. Cai, Y. Yao, and Z. Li, 2017, 3D characterization and quantitative evaluation of pore-fracture networks of two Chinese coals using FIB-SEM tomography: *International Journal of Coal Geology*, v. 174, p. 41-54.
- Zhou, S., D. Liu, Z.T. Karpyn, Y. Cai, and Y. Yao, 2018, Effect of coalification jumps on petrophysical properties of various metamorphic coals from different coalfields of China: *Journal of Natural Gas Science and Engineering*, v. 60, p. 63-76.
- Zhou, Z., C.J. Ballentine, R. Kipfer, M. Schoell, and S. Thibodeaux, 2005, Noble gas tracing of groundwater/coalbed methane interaction in the San Juan Basin, USA: *Geochimica et Cosmochimica Acta*, v. 69, p. 5413-5428.
- Zhu, S., A. Salmachi, and Z. Du, 2018, Two phase rate-transient analysis of a hydraulically fractured coal seam gas well: A case study from the Ordos Basin, China: *International Journal of Coal Geology*, v. 195, p. 47-60.
- Zhu, W.C., C.H. Wei, J. Liu, H.Y. Qu, and D. Elsworth, 2011, A model of coal-gas interaction under variable temperatures: *International Journal of Coal Geology*, v. 86, p. 213-221.
- Ziamba, L., 2009, Smarter technology reduces drill time: An investor's guide to unconventional gas, A supplement to *Oil and Gas Investor*, p. 20-24.
- Zou, C., and others, 2017, CBM, in *Unconventional petroleum geology*, second edition: Elsevier, p. 323-344.
- Zou, Y.-R., C. Zhao, Y. Wang, W. Zhao, P. Peng, and Y. Shuai, 2006, Characteristics and origin of natural gases in the Kuqa Depression of Tarim Basin, NW China: *Organic Geochemistry*, v. 37, p. 280-290.
- Zuber, M.D., V.A. Kuuskraa, and W.K. Sawyer, 1992, Optimizing well spacing and hydraulic-fracture design for economic recovery of coalbed methane, in *Coalbed methane*: Society of Petroleum Engineers, Reprint Series 35, p. 223-227.
- Zuber, M.D., and C. Hopkins, 1996, *Coalbed methane engineering methods*: SPE Short Course Manual, S.A. Holditch & Associates, Inc.

- Zuber, M.D., 1998, Production characteristics and reservoir analysis of coalbed methane reservoirs, *in* P.C. Lyons, ed., Special issue: Appalachian coalbed methane: International Journal of Coal Geology, v. 38, p. 27-45.
- Zuber, M.D., 1999, The use of Monte Carlo analysis to evaluate prospective coalbed methane properties, *in* M. Mastalerz, M. Glikson, and S.D. Golding, eds., Coalbed methane: scientific, environmental and economic evaluation: Boston, Kluwer Academic Publishers, p. 55-66.
- Zuber, M.D., and C.M. Boyer, II, 2001, Comparative analysis of coalbed methane production trends and variability — impact on exploration and production: Tuscaloosa, Alabama, Proceedings, International Coalbed Methane Symposium, Paper 136, p. 245-256.
- Zuber, M.D., and C.M. Boyer, II, 2001, Analysis optimizes CBM economics: American Oil & Gas Reporter, v. 44, no. 12, p. 62, 65-67.
- Zuber, M.D., and C.M. Boyer, II, 2002, Coalbed-methane evaluation techniques — the current state of the art: Journal of Petroleum Technology, v. 54, no. 2, p. 66-68.