

CURRICULUM VITAE

THOMAS GENTZIS

EDUCATION

- 1981 Bachelor of Science in Geology, University of Calgary, Calgary, Alberta, Canada.
- 1985 Master of Science in Geology, specialization in Coal Geology and Petrography, University of Alberta, Edmonton, Alberta, Canada.
- 1991 Doctor of Philosophy in Geology, specialization in Organic Petrology (Major) and Organic Geochemistry (Minor), University of Newcastle-upon-Tyne, Newcastle Research Group in Fossil Fuels and Environmental Geochemistry Great Britain – Professor Duncan G. Murchison, FRS (Edinburgh) Supervisor.

PROFESSIONAL EXPERIENCE AND EXPERTISE

- Sixteen years professional experience with unconventional gas resources. Coal and claystone/mudstone (shale) as a source and reservoir rock; coalbed methane exploration and production from vertical pilots and from single and multiple horizontal wellbores.
- Geological, tectonic, and hydrological controls on methane sorption capacity and gas content of unconventional gas reservoirs (coals and shales); isotopic composition of produced gas; stress dependent permeability and volumetric strain of coal during production.
- Effect of maceral composition and fabric on coal reservoir characteristics in the Plains and Foothills/mountains regions of western Canada and the US Rockies.
- Thirty years of experience in petrology and thermal maturation of dispersed organic matter (kerogen and bitumen); hydrocarbon generation and expulsion from organic-rich shales; source rock evaluation in sedimentary basins.
- Applications of Rock-Eval pyrolysis/TOC data and organic geochemistry (biomarkers) in hydrocarbon exploration (source and migration), reservoir continuity, and allocation of commingled oils from multiple reservoirs using GC/MS data.
- Trace element geochemistry of coals; impact studies of coal-fired power plant emissions on the environment.
- Subsurface sequestration of greenhouse gas emissions; disposal of carbon dioxide in coal seams for enhancing the production of methane.
- Applications of hot-stage microscopy in the thermal treatment of bitumen and heavy oil-based feedstocks; investigation of the effect of catalysts on the fluid catalytic cracking of petroleum.
- Applications of reflected and transmitted light microscopy and image analysis to coking and fouling of hydrocarbons; optical texture of coke and impact on process severity.
- Accomplished technical writer, with 130 publications, mostly in peer-reviewed journals.

EMPLOYMENT HISTORY

- July 2009-Present **Core Laboratories, Houston, TX, U.S.A.**
 - Current position: Geological Advisor and Organic Petrologist in charge of the Organic Petrology and Geochemistry laboratories.
 - Responsible for vitrinite reflectance (VRo) measurements of kerogen in source and reservoir rocks, identification of organic matter type and quantity, and interpretation of Rock-Eval pyrolysis/TOC and thermal maturity data.

- October 2008-June 2009
Aloe Resources Group, LLC; EuroEnergy Resources; Earth Energy Reserves, Inc., Dallas, Texas, U.S.A.
 - Unconventional Resources Geoscientist – Independent Consultant Geologist.
 - Provide consulting services on the Barnett shale play in Texas that is in the oil window, in Shackelford and Stephens counties.
 - Review technical data and reserves reports on the Marcellus shale in Pennsylvania and coalbed methane plays in northern Appalachia. Provide expert advice for joint venture and/or acquisition opportunities in Texas, Kentucky, and Oklahoma.

- January 2007-October 2008
Petron Resources L.P., Frisco, Texas, U.S.A.
 - Vice President of Geology and Petrology.
 - Performed prospect identification, evaluation, ranking, and prioritization. Identified drilling locations for coalbed methane (CBM) and gas shale plays in various basins in North America. The basins that were evaluated include: Greater Green River (Steele/Niobrara shales and Fort Union coals), Fort Worth basin (western extension of the Barnett shale), Forest City basin (CBM), and Alberta basin (Horseshoe Canyon coals and Belly River sands).
 - Led the evaluation of hydrocarbon potential and provided technical recommendations on prospect evaluation, reserve assessment, and associated uncertainties and risks in a number of international projects that included the following regions of the world: Botswana (Kalahari-Karoo coals), Peru (Marañon Basin; conventional unconventional gas reservoirs), Mexico, Ukraine and Kazakhstan (CBM/CMM or coal mine methane), France (CBM and gas shales), UK (CBM), Argentina (San Jorge Basin and Neuquén Basin), Paraguay (Chaco Basin), and Congo (offshore Congo Basin) (conventional reservoirs).
 - Visited data rooms and provided QC of data. Reviewed acquisition and divestiture packages, and made recommendations for the pursuit of joint ventures.

- May 2001-January 2007

CDX Canada, Co., Calgary, Alberta, Canada

- Senior Scientist (May 2001-January 2007).
- Supervised scientific R&D activities related to CBM and gas shale exploration and production, including conventional core, sidewall core and drill cuttings description and analysis, gas isotope and composition analysis, adsorption isotherms, produced water chemistry, and sampling of shales for TOC/Rock-Eval and thermal maturity analysis.
- Spent time in the field during directional drilling operations. Collaborated with drilling engineers on fluid formulation and effect on coal permeability, horizontal borehole stability, disaggregation of coal and impact on liner design; geomechanical testing of coals at in-situ conditions of stress.
- Supervised well data acquisition during drilling. Reviewed all analytical data from field operations (desorption/adsorption data) and laboratory analyses as well as all technical reports prepared by consultants; ensured that recommendations were implemented in field operations.
- Worked with consultants on history matching and numerical simulation of horizontal wellbore drilling and production scenarios, optimum well spacing and effective drainage area, stimulation methods, regional stress/permeability studies, coal permeability enhancement, and formation micro-imaging.
- Acted as a technical advisor to CDX Gas LLC (USA) on coalbed methane (Arkoma basin), in Colorado (Snake CBM prospect), in Louisiana (Wilcox coals), in New Mexico (Mancos shale and Menefee coals), in Oregon (Coos Bay CBM prospect), in Sabinas basin (Mexico – CBM/coal mine methane), and to CDX International (India – technical evaluation of CBM blocks for bidding purposes).
- Recommended drilling locations in the Mannville coals in Alberta. Played a key role in the drilling of the first commercial horizontal CBM well in Canada, with production rates in excess of 1.2 Mmcf/day.

- November 1997-May 2001

Natural Resources Canada, National Centre for Upgrading Technology (NCUT), Devon, Alberta, Canada.

- Physical Scientist 3, in charge of the Hot-Stage Microscopy and Image Analysis laboratories.
- Initiated research projects studying the mechanisms and reduction of coking (in Delayed and Fluid Coking operations) and fouling (in Fractionation Towers).
- Supported activities in the area of heavy oil and bitumen primary upgrading (hydrocracking, catalytic cracking, hydrotreating and visbreaking) and selection of fluid cracking catalysts to upgrade oil sands-derived vacuum gas oils.

- April 1988-November 1997

**Alberta Research Council, Inc.
Department of Coal & Hydrocarbon Processing, Devon, Alberta, Canada.
Division of Environmental Technologies, Edmonton, Alberta, Canada.**

- Assistant Research Officer (April 1988 - June 1991) and Associate Research Officer (June 1991- November 1997).
 - Supervisor of the Optical Microscopy and Organic Petrology laboratories.
 - Applied research in coal and hydrocarbon processing, coalbed methane and sequestration of greenhouse gases in deep coal beds.
 - Petrological and mineralogical characterization of thermal feed coals, their ashes and emitted particles.
 - Studied the thermal maturity of dispersed organic matter in Canadian sedimentary basins (Sverdrup Basin, Williston Basin, WCSB), timing of hydrocarbon generation and expulsion from source rocks, petroleum generation systems, and basin analysis.
- May 1983-April 1988
- Natural Resources Canada, Geological Survey of Canada, Calgary, Alberta, Canada.**
- Employed initially as summer student, and, later, as a contract employee.

Membership/Affiliations in Associations & Societies:

- The Society for Organic Petrology (TSOP) (USA) (2006-Present): Vice President (2015-Present); Will become TSOP President in 2017 for a 2-year term; Also, Chair of the TSOP Promotion and Outreach Committee (2009-2015)
- International Committee for Coal Petrology (ICCP) (1984-Present)
- American Chemical Society (ACS), Divisions of Fuel Chemistry and Petroleum Chemistry (1998-2009)
- Member of the Technical Committee, Canadian Society for Unconventional Gas (CSUG) (2002-2007)
- Treasurer of the Canadian Society of Coal Science and Organic Petrology (CSCOP) (1993-2004), and Publications Editor (2004-2008).

Awards Received/Conference Organization:

- Member of the organizing committee of the TSOP/AASP/ICCP Joint Conference in Houston, TX, September 18-23, 2016.
- Canadian Society of Petroleum Geologists (CSPG) - Volunteer Award (2005) for organizing the William Gussow Conference in Canmore, AB, Canada.
- Japan Industrial Technology Association (JITA) Fellowship (1992) – Spent one month at the Government Industrial Research Institute (GIRIK), near Fukuoka, Kyushu Island, Japan.

Editorial Board of Scientific Journals:

- *Marine and Petroleum Geology* (2010-Present) (Associate Editor)
- *International Journal of Coal Geology* (2009-2011) (Associate Editor; 3-year appointment)
- *Energy Sources* (2001-2013)
- *Reviews in Process Chemistry and Engineering* (1999-2000)

BOOK CHAPTERS

- Chapter 5 entitled “*Organic Petrology Characteristics of Selected Shale Oil and Shale Gas Reservoirs in the USA: Examples from “The Magnificent Nine”*”, in: “The Role of Organic Petrology in the Exploration of Conventional and Unconventional Hydrocarbon Systems, I. Suárez-Ruiz and J. G. Mendonça-Filho (Eds.), to be published in 2017 by Bentham Science Publishers, Sharjah, United Arab Emirates.
- Chapter 17 entitled “*Coalbed Natural Gas Activity in Western Canada: The Emergence of Major Unconventional Gas Industry in an Established Conventional Province*”, in: COALBED METHANE NATURAL GAS: *ENERGY AND ENVIRONMENT*, K.J. Reddy (Ed.), published in 2010 by Nova Science Publishers, Inc. New York, NY (ISBN 978-1-61668-036-7), p. 377-399.
- Chapter 19 entitled “*The Chemistry of Bitumen and Heavy Oil Processing*”, Vol. 2 “Practical Advances in Petroleum Processing”, C.S. Hsu and P.R. Robinson (Eds.), published in 2007 by Springer, New York, NY (ISBN 0-387-25811-6), p. 597-634.

SELECTED REFEREED PUBLICATIONS

Hirsh Index 20

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Goodarzi, F., **Gentzis, T.**, and Bustin, R.M., 1988 Reflectance and petrology profile of a partially combusted and coked bituminous coal seam from British Columbia, *Fuel*, vol. 67, p. 1218-1222.

Goodarzi, F., **Gentzis, T.**, Feinstein, S., and Snowdon, L.R., 1988 Effect of maceral subtypes and mineral matrix on measured reflectance of subbituminous coals and dispersed organic matter, *International Journal of Coal Geology*, vol. 10, p. 383-398.

Gentzis, T., and Goodarzi, F., 1989 Organic petrology of a self-burning coal wastepile from Coleman, Alberta, Canada, *International Journal of Coal Geology*, vol. 11, p. 257-271.

Macdonald, D.E., Langenberg, C.W., and **Gentzis, T.**, 1989 A regional evaluation of coal quality in the Foothills/Mountains region of Alberta, Alberta Research Council Earth Sciences Report 89-2, 58 pp.

Goodarzi, F., and **Gentzis, T.**, 1990 The lateral and vertical reflectance and petrological variation of a heat-affected bituminous coal seam from southeastern British Columbia, Canada, *International Journal of Coal Geology*, vol. 15, p. 317-339.

Gentzis, T., and Goodarzi, F., 1990 A review of the use of bitumen reflectance in hydrocarbon exploration with examples from Arctic Canada, In: “*Applications of Thermal Maturity Studies to Energy Exploration*”, V.F. Nuccio and C.E. Barker (Editors), Rocky Mountain Section-Society of Economic Paleontologists and Mineralogists, Special Publication, p. 23-36.

Gentzis, T., and Goodarzi, F., 1990 Petrology, depositional environment and utilization potential of Upper Paleocene coals from the Obed-Marsh deposit, west-central Alberta, Canada, *International Journal of Coal Geology*, vol. 16, p. 287-308.

Feinstein, S., Williams, G.K., Snowdon, L.R., Brooks, P.W., Fowler, M.G., Goodarzi, F., and **Gentzis, T.**, 1991 Organic geochemical characterization and hydrocarbon generation potential of Mid-Late Devonian Horn River bituminous shales, southern Northwest Territories, Canada, *Bulletin of Canadian Petroleum Geology*, vol. 39, no. 2, p. 192-202.

Feinstein, S., Brooks, P.W., **Gentzis, T.**, Aizenshtat, Z., and Slager, J., 1991 Petrological and geochemical characterization of hydrogen-rich coaly matter in the Agur 1 drillhole, Negev, Israel, *Energy Sources*, vol. 13, no. 3, p. 389-405.

Fowler, M.G., **Gentzis, T.**, Goodarzi, F., and Foscolos, A.E., 1991 The hydrocarbon potential of some Tertiary lignites from northern Greece as determined using pyrolysis and organic petrological techniques, *Organic Geochemistry*, vol. 17, no. 6, p. 805-826.

Fowler, M.G., Goodarzi, F., **Gentzis, T.**, and Brooks, P.W., 1991 Hydrocarbon generating potential of Middle and Upper Devonian coals from Melville Island, Arctic Canada, *Organic Geochemistry*, vol. 17, no. 6, p. 681-694.

Feinstein, S., Williams, G.K., Snowdon, L.R., Goodarzi, F., and **Gentzis, T.**, 1991 Thermal maturation of organic matter in the Middle Devonian to Tertiary section, Fort Norman Area (Central Mackenzie Plain), *Canadian Journal of Earth Sciences*, vol. 28, p. 1009-1018.

Gentzis, T., and Goodarzi, F., 1991 Thermal maturity and source-rock potential of the sedimentary succession from the Hecla field in Sverdrup Basin, Arctic Canada, *International Journal of Coal Geology*, vol. 19, p. 483-517.

Stasiuk, L.D., Osadetz, K.G., Goodarzi, F., and **Gentzis, T.**, 1991 Organic microfacies and basinal tectonic control on source rock accumulation; a microscopic approach with examples from an intracratonic and extensional basin, *International Journal of Coal Geology*, vol. 19, p. 457-481.

Goodarzi, F., **Gentzis, T.**, Harrison, J.C., and Thorsteinsson, R., 1992 The significance of graptolite reflectance in regional thermal maturity studies, Queen Elizabeth Islands, Arctic Canada, *Organic Geochemistry*, vol. 18, no. 3, p. 347-357.

Gentzis, T., Goodarzi, F., and McFarlane, R.A., 1992 Molecular structure of reactive coals during oxidation, carbonization and hydrogenation: An infrared photoacoustic and optical microscopic study, *Organic Geochemistry*, vol. 18, no. 3, p. 249-258.

Gentzis, T., and Goodarzi, F., 1992 Regional thermal maturity and source-rock potential in northwestern Melville Island, Arctic Canada, *Energy Sources*, vol. 14, p. 423-442.

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Goodarzi, F., **Gentzis, T.**, Mossman, D.J., and Nagy, B., 1993 Petrography and genesis of organic matter in the Paleoproterozoic uraniferous conglomerates of the Elliot Lake region, Canada, *Energy Sources*, vol. 15, p. 339-358.

Goodarzi, F., **Gentzis, T.**, Jackson, G., and Macqueen, R.W., 1993 Optical characteristics of heat-affected bitumens from the Nanisivik mine, N.W. Baffin Island, Arctic Canada, *Energy Sources*, vol. 15, p. 359-376.

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Goodarzi, F., **Gentzis, T.**, Snowdon, L.R., Bustin, R.M., Feinstein, S., and Labonte, M., 1993 The effect of mineral matrix and seam thickness on reflectance of vitrinite in high- to low-volatile bituminous coals: An enigma, *Marine and Petroleum Geology*, vol. 10, p. 162-171.

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Gentzis, T., and Goodarzi, F., 1995 Enrichment and depletion of elements in a subbituminous coal and in its 120°C, 400°C and 800°C ashes, *Energy Sources*, vol.17, no. 1, p. 41-55.

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Gentzis, T., Parker, R.J., and Simpson, P.L., 1995 Liquefaction of Black Thunder coal -1. Petrographic examination of residues, *Fuel*, vol. 74, no. 11, p. 1599-1610.

Parker, R.J., Carson, D.W., **Gentzis, T.**, and Simpson, P.L., 1995 Liquefaction of Black Thunder coal - 2. Process severity, gas composition and catalyst selection, *Fuel*, vol. 74, no. 11, p. 1611-1617.

Gentzis, T., Hirosue, H., and Sakaki, T., 1996 Relationship between density and swelling ratio in a subbituminous and a high-volatile bituminous coal, *Energy Sources*, vol. 18, no. 2, p. 119-129.

Gentzis, T., Hirosue, H., and Sakaki, T., 1996 Effect of rank and petrographic composition on the swelling behaviour of coals, *Energy Sources*, vol. 18, no. 2, p. 131-141.

Gentzis, T., Iacchelli, A., Whaley, H., Deshpande, D.P., and Özümlü, B., 1996 Combustion reactivity of Smoky River coal mine by-products, *Energy Sources*, vol. 18, no. 2, p. 151-166.

Gentzis, T., Goodarzi, F., and Hickinbotham, A., 1996 Trace element geochemistry of the Whitewood Mine coals in Alberta, *Energy Sources*, vol. 18, no. 4, p. 419-445.

Gentzis, T., Goodarzi, F., Koukouzas, C.N., and Foscolos, A.E., 1996 Petrology and geochemistry of lignites from Crete, Greece, *International Journal of Coal Geology*, vol. 30, nos. 1-2, p. 131-150.

Gentzis, T., de Freitas, T., Goodarzi, F., Melchin, M., and Lenz, A., 1996 Thermal maturity of Lower Paleozoic sedimentary successions in Arctic Canada, *American Association of Petroleum Geologists Bulletin*, vol. 80, no. 7, p. 1065-1084.

Gentzis, T., Goodarzi, F., and Embry, A.F., 1996 Thermal maturation, potential source rocks and hydrocarbon generation in Mesozoic rocks, Loughheed Island area, central Canadian Arctic Archipelago, *Marine and Petroleum Geology*, vol. 13, no. 8, p. 879-905.

Gentzis, T., and Goodarzi, F., 1996 Relationship between coal ash chemistry and electrostatic precipitator opacity, *Energy Sources*, vol. 18, no. 5, p. 585-601.

Karayigit, A.I., Goodarzi, F., Akdag, Y., and **Gentzis, T.**, 1996 Rank and petrology of the Upper Karapinar lignites in southeast Turkey, *Energy Sources*, vol. 18, no. 8, p. 903-916.

Gentzis, T., Goodarzi, F., and Foscolos, A.E., 1997 Geochemistry and mineralogy of Greek lignites from the Ioannina basin, *Energy Sources*, vol. 19, no. 2, p. 111-128.

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Gentzis, T., and Goodarzi, F., 1997 Trace element geochemistry of brackish-water coals in the central Alberta Plains, Canada, *Energy Sources*, vol. 19, no. 5, p. 493-505.

Gunter, W.D., **Gentzis, T.**, Rottenfusser, B.A., and Richardson, R.J.H., 1997 Deep coalbed methane in Alberta, Canada: A fuel resource with the potential of zero greenhouse gas emissions, *Energy Conversion & Management*, vol. 38, Suppl., p. S217-S222.

Gentzis, T., and Goodarzi, F., 1997 Trace element geochemistry of the Obed Mountain deposit coals, Alberta, Canada, *Fuel*, vol. 76, nos. 14/15, p. 1491-1501.

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Gentzis, T., and Goodarzi, F., 1998 Petrology and geochemistry of subbituminous coals from the Red Deer River valley, Alberta Plains, Canada, *Energy Sources*, vol. 20, no. 9, p. 839-855.

Gentzis, T., Goodarzi, F., and Mukhopadhyay, P. K. 1998 Regional maturation study in the King Christian Island area, Arctic Canada, *Energy Sources*, vol. 20, no. 10, p. 891-912.

Gentzis, T., and Goodarzi, F., 1998 Thermal maturation in the Ellef Ringnes Island and surrounding area, Sverdrup basin, *Energy Sources*, vol. 20, no. 10, p. 913-934.

Hitchon, B., Gunter, W.D., **Gentzis, T.**, and Bailey, R.T., 1999 Sedimentary basins and greenhouse gases: a serendipitous association, *Energy Conversion & Management*, vol. 40, p. 825-843.

Gentzis, T., and Goodarzi, F., 1999 Chemical fractionation of trace elements in coal and coal ash, *Energy Sources*, vol. 21, no. 3, p. 233-256.

Rahimi, P., **Gentzis, T.**, and Cottè, E., 1999 Investigation of the thermal behavior and interaction of Venezuelan heavy oil fractions obtained by Ion Exchange Chromatography, *Energy & Fuels*, vol.13, no. 3, p. 694-701.

Rahimi, P., **Gentzis, T.**, and Fairbridge, C., 1999 Interaction of clay additives with mesophase formed during thermal treatment of solid-free Athabasca bitumen fraction, *Energy & Fuels*, vol. 13, no. 4, p. 817-825.

Rahimi, P., **Gentzis, T.**, Kubo, J., Fairbridge, C., and Khulbe, C., 1999 Coking propensity of Athabasca bitumen vacuum bottoms in the presence of H-donors – Formation and dissolution of mesophase from a hydrotreated petroleum stream (H-donor), *Fuel Processing Technology*, vol. 60, no. 2, p. 157-170.

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Gentzis, T. 2000 Subsurface sequestration of carbon dioxide – An overview from an Alberta (Canada) perspective, *International Journal of Coal Geology*, vol. 43, nos.1/4, p. 287-305.

Gentzis, T., and Goodarzi, F. 2000 Effect of geological processes on coal quality and utilization potential: Review with examples from western Canada, *Journal of Hazardous Materials*, vol. 74, nos.1/2, p. 109-124.

Gentzis, T., Parker, R.J., and McFarlane, R.A. 2000 Microscopy of fouling deposits in bitumen furnaces, *Fuel*, vol. 79, no. 10, p. 1173-1184.

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Rahimi, P., **Gentzis, T.**, Taylor, E., Carson, D., Nowlan, V., and Cottè, E. 2001 The impact of cut point on the processability of Athabasca bitumen, *Fuel*, vol. 80, p. 1147-1154.

Gentzis, T., Rahimi, P., Malhotra, R., and Hirschon, A.S. 2001 The effect of carbon additives on the mesophase induction period of Athabasca bitumen, *Fuel Processing Technology*, vol. 69, p. 191-203.

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