Coalbed Methane and Coal Geology
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Contents

Preface vii

Coalbed methane resources in USA and Europe

MURRAY, D. K. Coalbed methane in the USA: analogues for worldwide development 1
FAILS, T. G. Coalbed methane potential of some Variscan foredeep basins 13
MACCARTHY, F. J., TISDALE, R. M. & AYERS, JR. W. B. Geological controls on coalbed gas prospectivity in part of the North Staffordshire Coalfield, UK 27
KNIGHT, J. L., SHEVLIN, B. J., EDGAR, D. C. & DOLAN, P. Coal thickness distributions on the UK continental shelf 43
JUCH, D. Assessment of the West German hardcoal resources and its relation to coalbed methane 59
FREUDENBERG, U., LOU, S., SCHLÜTER, R., SCHÜTZ, K. & THOMAS, K. Main factors controlling coalbed methane distribution in the Ruhr district, Germany 67
MARSHALL, J. S., PILCHER, R. C. & BIBLER, C. J. Opportunities for the development and utilization of coalbed methane in three coal basins in Russia and Ukraine 89

Coal as a reservoir

GAYER, R. A., PEŠEK, J., SYKOROVÁ, I. & VALTEROVÁ, P. Coal clasts in the upper Westphalian sequence of the South Wales coal basin: implications for the timing of maturation and fracture permeability 103
HATHAWAY, T. M. & GAYER, R. A. Thrust-related permeability in the South Wales Coalfield 121
PATTISON, C. I., FIELDING, C. R., McWATTERS, R. H. & HAMILTON, L. H. Nature and origin of fractures in Permian coals from the Bowen Basin, Queensland, Australia 133
GAMSON, P., BEAMISH, B. & JOHNSON, D. Coal microstructure and secondary mineralization: their effect on methane recovery 165
HARRIS, I. H., DAVIES, G. A., GAYER, R. A. & WILLIAMS, K. Enhanced methane desorption characteristics from South Wales anthracites affected by tectonically induced fracture sets 181
LEVINE, J. R. Model study of the influence of matrix shrinkage on absolute permeability of coal bed reservoirs 197
DAVIDSON, M. I., BRYANT, R., & WILLIAMS, D. J. A. Characterization of anthracite 213
KONECHNY, P. & KOZUSNIKOVA, A. Measurement of gas permeability of coal and clastic sedimentary rocks under triaxial stress conditions 227
KOŽUŠNÍKOVÁ, A. Relationship between the hydrogen content of coal and the lithological characteristics of rocks overlying the coal seam 231

Coal geological studies related to coalbed methane

LESTER, E., ALLEN, M., CLOKE, M. & ATKIN, B. Analysis of the problems associated with the use of image analysis for microlithotype analysis on solid coal mounts 237
SYKOROVÁ, I., NOVOTNÁ, J., PAVLIKOVÁ, H. & MACHOVIČ, V. Petrological and spectroscopic structural characteristics of Bohemian and Moravian coals and their possible relation to gas proneness 249
NOWAK, G. J. Petrological coal seam accumulation model for the Zacler Formation of the Lower Silesian coal basin, southwestern Poland 261

BARRAZA, J., GILFILLAN, A., CLOKE, M. & CLIFT, D. Minerals and major elements in density-separated coal fractions from Point of Ayr coal, Wales, UK 287

KOSTOVA, I., PETROV, O. & KORTENSKI, J. Mineralogy, geochemistry and pyrite content of Bulgarian subbituminous coals, Pernik Basin 301

MCLEAN, D. & MURRAY, I. Subsurface correlation of Carboniferous coal seams and inter-seam sediments using palynology: application to exploration for coalbed methane 315

KARAYIGIT, A. I., ERIŞ, E. & CİÇİOĞLU, E. Coal geology, chemical and petrographical characteristics, and implications for coalbed methane development of subbituminous coals from the Sorgun and Suluova Eocene basins, Turkey 325

Index 339
Preface

Resources of coalbed methane (CBM), i.e. methane trapped within the porous system of coal, may be as high as $250 \times 10^{12} \text{ m}^3$ worldwide, many times greater than the collective reserves of all the known conventional gas fields. Yet only in the United States is this energy source produced commercially, and that largely due to enlightened federal tax concessions that encouraged the research into the exploration and production techniques necessary to establish a viable industry. Unlike the situation in conventional hydrocarbon plays, with CBM coal acts as both the source rock and the reservoir for the gas. This relationship leads to a major paradox whereby, in order for gas sourced by the coal not to have migrated, the coal must either be sealed or possess very low permeability. And yet for the coal bed to be an effective reservoir the gas must readily migrate into the well bore when the coal is penetrated by a production well. The solution to this paradox lies in a wide-ranging understanding of the geology of coal, and this volume aims to provide some answers.

The 24 papers in the volume are written by experts in CBM and coal geology from a range of countries in which CBM is either currently being produced commercially (USA) or in which there is active exploration (Europe and Australia). The first group of contributions covers CBM resources, from a coal geology perspective, in the United States and Europe, including the potential from the UK continental shelf and the exciting prospects of Russia and the Ukraine. The coverage also includes a geological assessment of the Appalachian and Variscan coal-bearing foreland basins in which CBM potential ranges from excellent to poor, and detailed appraisals of individual case studies that can be enhanced significantly by using a computerized database (e.g. the Ruhr).

The second and largest section contains papers that discuss aspects of coal as a gas reservoir, particularly in relation to permeability—the key to successful CBM production. Treatment ranges from in-depth studies of reservoir fracture systems that give the principal permeability pathway in coal, through the effects of coal microstructures on methane release, and models of matrix shrinkage during methane desorption, to adverse effects on reservoir permeability caused by mineralization. The theoretical treatments of the various contributions are supported by detailed case studies in South Wales, the Czech Upper Silesian coal basin, and the Bowen basin of Queensland.

The last section of the volume contains a range of papers covering aspects of traditional coal geology, relating key features to a fuller understanding of CBM. Thus the maceral content of a coal determines: (i) the amount of gas generated during its maturation, with liptinite and vitrinite being the greatest contributors; (ii) the amount of gas stored in the coal, with the micropore structure of inertinite providing the greatest storage capacity; and (iii) the speed of methane release to the well bore, facilitated by the meso-pore structure of fusain and the enhanced cleat development in vitrinite. Papers directly relevant to assessing the maceral composition of coals include discussion of a depositional model related to maceral content of the Lower Silesian coal basin in Poland, an automated method for microlithotype analysis of coal, and organic geochemical studies related to gas proneness. The section also contains papers investigating the mineral matter in coal, particularly pyrite, and the use of palynology in down-the-hole correlation of coal seams.
The CBM industry is relatively young and only now are exploratory wells being sunk in the UK, Europe and elsewhere in the World. There is a dearth of texts describing the geology of CBM and this volume will help to fill this gap. It will appeal to geologists involved with the CBM industry, and also to those connected with coal and conventional hydrocarbon resources, as well as to lecturers and students.

The editors would like to thank all those involved with the preparation of the volume, including the secretarial staff in the Department of Earth Sciences at Cardiff. We particularly thank the authors and referees of the 24 original papers.

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