

Norwegian Petroleum Society (NPF), Special Publication No. 3

Basin Modelling: Advances and Applications

Proceedings of the Norwegian Petroleum Society
Conference, 13–15 March 1991, Stavanger, Norway

Edited by

A.G. Doré et al.



ELSEVIER
Amsterdam – London – New York – Tokyo 1993

Contents

Preface	VII
Opening and Welcome	IX
List of Contributors	XI
I. Overview papers	
Basin modelling techniques — an overview	1
C. Hermanrud	
Theoretical aspects of problems in basin modelling	35
I. Lerche	
Future potential of basin modelling techniques (extended abstract)	67
M.A. Yukler and B. Dahl	
Stratigraphic basin modelling — recent advances	71
B. Levell and W. Leu	
II. Thermal modelling	
A recent Norwegian Shelf heating event — fact or fantasy?	85
R.P. Jensen and A.G. Doré	
Transient thermal effects of rapid subsidence in the Haltenbanken area	107
E. Vik and C. Hermanrud	
Optimization of temperature history — aspects of vitrinite reflectance and sterane isomerization	119
D. Hermansen	
Comparison of different models for vitrinite reflectance evolution using laboratory calibration and modelling of well data	127
T. Throndsen, B. Andresen and Å. Unander	
Thermal maturation and burial history of the Multiwell Experiment Site, Piceance Basin, Colorado: application of thermal indicator tomography	135
K. Zhao and I. Lerche	
Apatite fission-track analysis in sedimentary basins — a critical appraisal	147
N.D. Naeser	
Fluid inclusions and organic maturity parameters as calibration tools in basin modelling	161
K. Leischner, D.H. Welte and R. Littke	
A kinetic interpretation of the smectite-to-illite transformation	173
G. Vasseur and B. Velde	
Validation and first application of palaeotemperature models of isomerisation and NMR aro- matisation parameters	185
U. Ritter, M.B. Myhr, K. Aareskjold and L. Schou	

Distributed activation energy models from hydrous pyrolysis: towards a second-generation tool of thermal history analysis	201
U. Ritter, M.B. Myhr, K. Aareskjold, H.H. Ganz, A. Mostafa and L. Schou	
Anisotropy of thermal conductivity in clayey formations	209
L. Demongodin, G. Vasseur and F. Brigaud	
III. Controls on hydrocarbon generation and expulsion	
Modelling of petroleum generation and expulsion — an update to recent reviews	219
P. Ungerer	
Critical study of kinetic modelling parameters	233
J. Espitalié, F. Marquis and S. Drouet	
Kerogen typing concepts designed for the quantitative geochemical evaluation of petroleum potential	243
B. Horsfield, S.J. Düppenbecker, H.J. Schenk and R.G. Schaefer	
An inverse method for determining kinetic parameters for kerogens from routine pyrolysis data, and application to the Peace River arch area, Alberta, Canada	251
K. Nakayama and S. Cao	
Fast Monte Carlo simulation of hydrocarbon generation	265
S.B. Nielsen	
Experimental measurement of the molecular migration of light hydrocarbons in source rocks at elevated temperatures	277
B.M. Krooss, D. Hanebeck and D. Leythaeuser	
Relative permeabilities and hydrocarbon expulsion from source rocks	293
A. Okui and D.W. Waples	
IV. Porosity, fluid flow and secondary migration	
Modelling porosity reduction as a series of chemical and physical processes	303
D.W. Waples and H. Kamata	
Compaction coefficients of argillaceous sediments: their implications, significance and determination	321
X. Luo, F. Brigaud and G. Vasseur	
Modelling overpressures by effective-stress/porosity relationships in low-permeability rocks: empirical artifice or physical reality?	333
F. Schneider, J. Burrus and S. Wolf	
Quantitative approach to geochemical processes in the Dogger aquifer (Paris Basin): from water analyses to the calculation of porosity evolution	343
P. Gouze and A. Coudrain-Ribstein	
Effects of convection-currents on heat transfer in sedimentary basins	353
A. Ludvigsen, K. Gran, E. Palm and K. Bjørlykke	
Thermal disturbances arising from fluid circulation through thin and inclined aquifers	361
L. Demongodin and G. Vasseur	
Predicting tectonic fractures and fluid flow through fractures in basin modelling	373
K.W. Larson, D.W. Waples, H. Fu and K. Kodama	
New techniques and their applications in the analysis of secondary migration	385
Ø. Sylta	
Closure vs. seal capacity — a fundamental control on the distribution of oil and gas	399
J.K. Sales	

V. Case studies, Norway

Application of basin modelling on the Norwegian Shelf (extended abstract)	415
B. Nyland	
The influence of Tertiary and Quaternary sedimentation and erosion on hydrocarbon generation in Norwegian offshore basins	419
B. Dahl and J.H. Augustson	
Impact of data integration on basin modelling in the Barents Sea	433
N.J. Theis, H.H. Nielsen, J.K. Sales and G.J. Gail	
Mineralogical and diagenetic control on the thermal conductivity of the sedimentary sequences in the Bjørnøya Basin, Barents Sea	445
W. Fjeldskaar, E. Prestholm, C. Guargena and M. Stephenson	
Issues in 3D sedimentary basin modelling and application to Haltenbanken, offshore Norway ..	455
D. Grigo, B. Maragna, M.T. Arienti, M. Fiorani, A. Parisi, M. Marrone, P. Sguazzero and A.S. Uberg	
Modelling the hydrocarbon system of the North Viking Graben: a case study	469
F.W. Schroeder and Ø. Sylta	
History of hydrocarbon emplacement in the Oseberg Field determined by fluid inclusion microthermometry and temperature modelling	485
O. Walderhaug and W. Fjeldskaar	
Modelling of expulsion and secondary migration along the southwestern margin of the Horda Platform	499
A. Skjervøy and Ø. Sylta	
Basin modelling of hydrocarbon charge in the Egersund Basin, Norwegian North Sea: pre- and post-drilling assessments	539
H. Irwin, C. Hermanrud, E.M. Carlsen, J. Vollset and I. Nordvall	
Isostatic and tectonic subsidence of the Egersund Basin	549
W. Fjeldskaar, E. Prestholm, C. Guargena and N. Gravdal	
The importance of kinetic parameters in modelling generation by cracking of oil to gas — a case study in 1D from well 2/4-14	563
P. Andresen, N. Mills, H.-J. Schenk and B. Horsfield	

VI. Case studies, worldwide

Basin modelling in an overthrust area of Austria	573
F. Schmidt and L.T. Erdogan	
Geological-geochemical model of hydrocarbon systems generation in the deepest formations of the western Siberian Basin	583
N.N. Nemchenko, A.S. Rovenskaya and L.Sh. Girshorn	
Main factors controlling regional oil and gas potential in the West Arctic, former USSR	591
B.K. Ostisty and S.I. Cheredeev	
The petroleum systems of the South Caspian Basin	599
A.A. Narimanov	
Inverse elastic flexural modelling of sedimentary basins: a case study from the Colville Trough, National Petroleum Reserve, Alaska	609
J. Cogan, I. Lerche and B. Russell	
Analysis of the Beaufort-MacKenzie Basin, Canada: burial, thermal and hydrocarbon histories	623
J. Tang and I. Lerche	

Palaeohydrology of the Gulf of Mexico Basin: development of compactional overpressure and timing of hydrocarbon migration relative to cementation	641
L.L. Summa, R.J. Pottorf, T.F. Schwarzer and W.J. Harrison	
References index	657
Subject index	667