# Contents

Preface: F. G. Bell, M. G. Culshaw, J. C. Cripps & M. A. Lovell ........................................... v
Obituary, Dr Roy Kenneth Taylor: P. B. Attewell ................................................................. vii
Organizing Committee ............................................................................................................... ix
Acknowledgements ................................................................................................................... ix

SESSION 1: INTRODUCTION

F. G. Bell, J. C. Cripps, M. G. Culshaw & M. A. Lovell: A review of ground movements due to civil and mining engineering operations .......... 3
R. J. Firman & M. A. Lovell: The geology of the Nottingham region: a review of some engineering and environmental aspects ................................................. 33

SESSION 2: GROUND MOVEMENTS DUE TO TUNNELLING

P. B. Attewell: An overview of site investigation and long-term tunnelling-induced settlement in soil ............................................................... 55
W. H. Ward: Ground movements due to tunnelling in hard rocks ................. 63
A. R. Selby: Surface movements caused by tunnelling in two-layer soil....... 71
W. J. Rankin: Ground movements resulting from urban tunnelling: predictions and effects ................................................................. 79
J. N. Shirlaw, S. Doran & B. Benjamin: A case study of two tunnels driven in the Singapore 'Boulder Bed' and in grouted coral sands .......... 93
A. R. Griffin: Tunnelling through frozen ground: a case history at Iver, Buckinghamshire ................................................................. 105

Discussion ................................................................................................................................. 113

SESSION 3: GROUND MOVEMENTS DUE TO DEEP EXCAVATIONS

I. F. Symons, J. A. Little & D. R. Carder: Ground movements and deflections of an anchored sheet pile wall in granular soil ...................................................... 117
G. G. Thomas & M. S. Mojabi: Ground losses during bored piling through weathered Keuper Sandstone in Bristol ........................................... 129

Discussion ................................................................................................................................. 149

SESSION 4: GROUND MOVEMENTS AND CONSTRUCTION OPERATIONS

B. J. Gregory, I. S. Venter & L. J. Kruger: Grouting-induced ground movements ................................................................. 153
K. J. L. Stone & D. M. Wood: Model studies of soil deformations over a moving basement ............................................................................... 159
G. G. Thomas: A cost-benefit analysis for stabilizing shallow Bath Stone mine workings at Corsham, Wiltshire ........................................ 167

Discussion ................................................................................................................................. 175

SESSION 5: GROUND MOVEMENTS DUE TO ABANDONED MINE WORKINGS

G. F. G. Garrard & R. K. Taylor: Collapse mechanisms of shallow coal-mine workings from field measurements ........................................... 181
SESSION 6: GROUND MOVEMENTS DUE TO LONGWALL MINING

Y. TSUR-LAVIE, S. A. DENEKAMP & G. FAINESTEIN: Surface subsidence associated with longwall mining: two and three dimensional boundary element model .......................................................... 225
A. K. ISAAC & I. L. FOLLINGTON: Geotechnical influences upon longwall mining ........................................... 233
J. N. VAN DER MERWE: A study of the effects on mining relatively shallow overlying longwall panels with staggered inter-panel pillars at Sigma Colliery, South Africa ......................................................................................... 243
G. H. ROSCOE: Saint Wilfrid's Church, Hickleton: mining subsidence and remedial works .......................................................... 257
F. G. BELL & J. M. COULTHARD: Subsidence prediction by the use of influence functions .......................................................... 265

SESSION 7: ABANDONED LIMESTONE MINES IN THE WEST MIDLANDS

P. A. BRAITHWAITE & K. L. SEAGO: Regional study of the West Midlands area to locate old limestone mine workings ...................................................... 279
A. FORSTER: The geology of Castlefields Mine, Dudley and its effect on the stability of the mine roof ..................................................................................... 287
J. A. RICHARDS & A. MILLER: Roof-fall observations at Castlefields Mine, Dudley .......................................................... 293
T. I. LONGWORTH: Monitoring of ground movement above an abandoned limestone mine ......................................................................................... 299
W. H. WARD: Full-scale mixing, pumping and surface spreading trials of rock paste for filling mines .......................................................... 307
A. MILLER, J. A. RICHARDS & D. M. McCANN: Microseismic monitoring of the infill trial at Castlefields Mine, Dudley .......................................................... 319

SESSION 8: INVESTIGATION OF GROUND MOVEMENTS

M. J. SMITH & J. A. SUTHERLAND: The monitoring of underground open mine workings beneath a major road construction ...................................................... 329
J. A. EVANS & M. S. LAWRENCE: A case study on past shortwall mining methods and the risk of ground subsidence in the Lanarkshire Coalfield, Scotland .......................................................... 337
M. J. BALDWIN & M. A. NEWMAN: Basal Permian Sand mines and associated surface movements in the Castleford and Ponteefract area of West Yorkshire ......................................................................................... 351

SESSION 9: GROUND MOVEMENTS DUE TO THE ABSTRACTION OR INJECTION OF FLUIDS

F. G. BELL: Subsidence associated with the abstraction of fluids .......................................................... 363
D. L. GUDGEON, M. F. WARNER & J. STOWELL: Prediction of settlement due to dewatering for deep excavations .......................................................... 377
A. H. COOPER: Subsidence resulting from the dissolution of Permian gypsum in the Ripon area; its relevance to mining and water abstraction .......................................................... 387

Discussion

SESSION 9: GROUND MOVEMENTS DUE TO THE ABSTRACTION OR INJECTION OF FLUIDS

F. G. BELL: Subsidence associated with the abstraction of fluids .......................................................... 363
D. L. GUDGEON, M. F. WARNER & J. STOWELL: Prediction of settlement due to dewatering for deep excavations .......................................................... 377
A. H. COOPER: Subsidence resulting from the dissolution of Permian gypsum in the Ripon area; its relevance to mining and water abstraction .......................................................... 387

Discussion

SESSION 9: GROUND MOVEMENTS DUE TO THE ABSTRACTION OR INJECTION OF FLUIDS

F. G. BELL: Subsidence associated with the abstraction of fluids .......................................................... 363
D. L. GUDGEON, M. F. WARNER & J. STOWELL: Prediction of settlement due to dewatering for deep excavations .......................................................... 377
A. H. COOPER: Subsidence resulting from the dissolution of Permian gypsum in the Ripon area; its relevance to mining and water abstraction .......................................................... 387

Discussion

SESSION 9: GROUND MOVEMENTS DUE TO THE ABSTRACTION OR INJECTION OF FLUIDS

F. G. BELL: Subsidence associated with the abstraction of fluids .......................................................... 363
D. L. GUDGEON, M. F. WARNER & J. STOWELL: Prediction of settlement due to dewatering for deep excavations .......................................................... 377
A. H. COOPER: Subsidence resulting from the dissolution of Permian gypsum in the Ripon area; its relevance to mining and water abstraction .......................................................... 387

Discussion

SESSION 9: GROUND MOVEMENTS DUE TO THE ABSTRACTION OR INJECTION OF FLUIDS

F. G. BELL: Subsidence associated with the abstraction of fluids .......................................................... 363
D. L. GUDGEON, M. F. WARNER & J. STOWELL: Prediction of settlement due to dewatering for deep excavations .......................................................... 377
A. H. COOPER: Subsidence resulting from the dissolution of Permian gypsum in the Ripon area; its relevance to mining and water abstraction .......................................................... 387

Discussion

SESSION 9: GROUND MOVEMENTS DUE TO THE ABSTRACTION OR INJECTION OF FLUIDS

F. G. BELL: Subsidence associated with the abstraction of fluids .......................................................... 363
D. L. GUDGEON, M. F. WARNER & J. STOWELL: Prediction of settlement due to dewatering for deep excavations .......................................................... 377
A. H. COOPER: Subsidence resulting from the dissolution of Permian gypsum in the Ripon area; its relevance to mining and water abstraction .......................................................... 387

Discussion
SESSION 10: INDUCED SEISMICITY

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. M. McCann</td>
<td>Induced seismicity in engineering</td>
<td>397</td>
</tr>
<tr>
<td>D. W. Redmayne</td>
<td>Mining induced seismicity in UK coalfields identified on the BGS National Seismograph Network</td>
<td>405</td>
</tr>
<tr>
<td>A. S. P. Green, R. Baria, A. Madge &amp; R. Jones</td>
<td>Fault-plane analysis of microseismicity induced by fluid injections into granite</td>
<td>415</td>
</tr>
<tr>
<td>P. Styles, S. J. Emsley &amp; T. Jowitt</td>
<td>Microseismic monitoring for the prediction of outbursts at Cynheidre Colliery, Dyfed, South Wales</td>
<td>423</td>
</tr>
<tr>
<td>R. Ciesielski</td>
<td>Dynamic surface effects of underground copper ore mining in the Legnica Copper District, Poland</td>
<td>435</td>
</tr>
</tbody>
</table>

Discussion                                                                 445

Subject index                                                             447

Index of authors and contributors to discussions                          454