Abstract

It has long been known that areas such as Cheshire, Lincolnshire and Essex were intensely exploited for salt in the Iron Age and Romano-British periods. Previous research has tended to focus on the eastern coast of Britain, with less attention being paid to other potential salt-producing areas.

In previous studies in southern Britain, much emphasis has been placed on the distribution of salt and the ‘equipment’ used to produce and potentially transport salt - briquetage. Much less attention has been paid to the production process.

This research project directly addresses this imbalance, by placing the emphasis on the study of the production sites, and by creating and analysing a new dataset to contextualise sites using a holistic perspective. The analysis of salt-production sites has redefined the archaeological terminology for salt production, and has critically evaluated how these sites have been incorporated into the archaeological record.

The re-categorisation of the archaeological remains on a site by site basis has enabled the formation of a comprehensive dataset for the first time. This has enabled a regional and chronological comparison of salt-production in southern Britain to be undertaken.

The analysis has shown that despite problems of incorrect perceptions of salt production practices, inconsistent recording and categorisation, and severe site damage by human and natural forces, it is possible, to inject concepts of ‘agency’ and ‘identity’ into these sites by exploring evidence of technological choice and use of space.

It was possible to identify distinctive ‘working areas’ containing features (hearth and brine tanks) where the main stages of salt-production were carried out.

New ‘Modes of Salt-Production’ have been created in order to compare different methods of organisation and ‘site management’ across time and space. These
modes enable a new approach about salt-production to be made set in the wider context of supply networks and specific consumer markets.

This research has shown that there were significant regional and chronological variations in salt-production; with three main areas of activity identified in Somerset, Dorset and Kent. The most significant chronological change was the substantial increase in salt-production during the 1st century AD, followed by its decline in the 2nd century AD in Kent and Dorset. However, this was not the case in Somerset, where the dominant period of salt-production occurred between the 2nd and 4th centuries AD.

The identification of regional trends in the scale and organisation of production, as well as the rich diversity of sites, shows that producers adapted to changes in the supply and consumption of salt over time. Considerably more salt would have been required to supply the growing population in the 1st century AD, and this encouraged the creation of many new production sites. However, the diversity in site character suggests that there was little tight control of coastal salt-production sites at that time. It is argued that instead, focus was placed upon the exploitation of salt from inland brine springs in Cheshire and Worcestershire. This is evidenced in the organisation, technology and creation of military supply bases close to these sites.

Instead, it is argued that the Roman invasion formalised and expanded existing supply networks from coastal salt-production sites, in addition to creating new inland networks. This resulted in the creation of more formal ‘production and/or distribution centres. It is also probable that the emergence of uniform salt-production sites in Somerset in the later Roman period, reflects that this area had become predominant for the supply of salt to major ‘consumer sites such as legionary fortresses and the larger towns.
Acknowledgements

This research project would not have been possible without the full postgraduate studentship bursary provided by Bournemouth University and the continued support and encouragement from the department of Applied Science.

As is the way with these things, there are so many people that have helped me along the way, from those who have stood on the sides of rivers and the shores of beaches laughing while I hunt for finds, to those who have let me rummage through sheds, attics and cellars, that I do not have the space to list you all. But you know who you are and I appreciate all that you did to help me complete this research.

Those who especially deserve thanks include the following:

**Bournemouth University**
First and foremost, to a rather awesome, supportive, straight-talking and always encouraging supervisor Mark Maltby for seeing this epic journey all the way through with me! Your patience is a virtue and you are the Salt of the Earth (apologies I could not resist)! To the following staff of Bournemouth University: Kate Welham (second supervisor), Tim Darvill (for planting the idea of researching salt in the first place), Miles Russell, Iain Hewitt (total angel and amazing provider of hugs and advice), Eileen Wilkes (for a shared love of all things Poole Harbour), Ellen Hambleton and Mark Dover (support, editing and help with creating my database), Ehren Milner and Bronwen Russell (AIP), Clare Randall and Adam Lodeon (hours of wonderful brainstorming!), Fiona Knight (Graduate School support) and Ludmila Machura (learning support and personal support). To Louise Pearson who has consistently provided brilliant PhD administration support to so many researchers in the department, including myself, helping to sort out any logistical issues and always with a smile.

**Archaeologists, Institutions and General Enthusiasts**
To all the staff at Historic Environment Records in the study area: especially to Andrew Mayfield, Ben Croxford and Simon Mason (Kent HER: for being so supportive and enthusiastic), to all the lovely staff at Cornwall HER and to Clare Pinder from Dorset HER and to Richard Brunning at Somerset HER (Somerset
Levels and Moors Archaeologist) for your invaluable advice, information and enthusiasm when conducting my fieldwork in Somerset.

To Terrain Archaeology and Archaeology South-East (Peter Bellamy and Greg Priestley-Bell, for letting me raid your archives and briquetage collection!). To all those in the South Cadbury Environments Project who were so awesome when helping me to complete my fieldwork, especially Clare Randall. To Ian Jackson (Upchurch Archaeological Research Group) for sharing your site archives and so kindly letting me raid your shed for finds! To Brian Philp for inspiring me by introducing me to the wonderful archaeology of Kent in my teens and for continued support. To Keith Jarvis and Alan Bromby for all things Poole Harbour. To James Morris for helping me research and visit sites in the early days, including letting me drag you to Halstatt!

To the other salt enthusiasts: Andrew Fielding, Tom Lane and Elaine Morris.

Family and Friends
To Cat Foley, Jessica Djohari, Lizzie Nixon, Sue Jones, Adam Lodeon, Mike Lally and Chris Brockway for being just all round lovely enthusiastic people! Especially to Paul Noyce who showed me the light!

And finally, to my little family who have provided continued support, even when I buried myself in work and went quiet! To mum, nan and my niece.

I dedicate this foremost to my nana (Mary Minter aged 80…something) for always encouraging my love of archaeology. I also dedicate this to my beautifully quirky niece (Ellicia Hathaway aged 10), who has inherited my love of archaeology, but remains undecided about whether she wants to be an archaeologist or palaeontologist when she is older! Whatever you do gorgeous, will be awesome just like you, stay enthusiastic and passionate as it will continue to inspire everybody around you.
List of Contents

Volume One

Abstract...........................................................................................................................................i
Acknowledgements.......................................................................................................................iii
List of Contents..................................................................................................................................v
List of Figures......................................................................................................................................xv
List of Tables....................................................................................................................................xxx

1.0 Research Definition and Background ......................... 1
  1.1 Introduction...............................................................................................................................1
  1.2 Aim and Objectives......................................................................................................................4
  1.3 Contemporary Research Context ..............................................................................................7
  1.4 Development of the Human Relationship with Salt and the
      Exploiting of Natural Sources of Salt........................................................................................11
      1.4.1 Earliest Origins: ‘Need’ versus ‘Want’ ..............................................................................12
      1.4.1.1 A Salt Tie? Developing a Relationship with Salt .......................................................12
      1.4.1.2 A Growing Taste for Salt? ..........................................................................................14
      1.4.1.3 Exploration and Experimentation ................................................................................16
      1.4.1.4 Environmental Determinism and Biological Requirement
            Versus Cultural Choice .........................................................................................................17
  1.5 Crystallising Salt from Solution ................................................................. 20
      1.5.1 Producing Salt from Seawater .............................................................................................21
      1.5.2 Crystallising Salt from Brine ...............................................................................................22
      1.5.3 Natural Solar Evaporation: Open Pan Traditional ‘Salinas’ .............................................25
      1.5.4 Partial or Complete Artificial Evaporation .................................................................27
      1.5.5 The ‘Briquetage’ or ‘Pot Process’ Technique ....................................................................29
            1.5.5.1 Briquetage ................................................................................................................31
            1.5.5.2 Associated Archaeological Features .......................................................................36
  1.6 Archaeological Background and Wider Studies of Salt-Production
      across Europe..........................................................................................................................40
      1.6.1 Earliest Archaeological Evidence for Salt-Production in Europe ................................40
      1.6.2 The Growth of Salt-Production Sites across Europe from the
            Bronze Age. The Work of Jacques Nenquin and Pierre Gouletquer 41
            1.6.2.1 Bronze Age Salt-Production Sites ...........................................................................41
            1.6.2.2 Late Bronze Age-Early/Middle Iron Age Salt-Production Sites
                (Halstatt)..................................................................................................................42
            1.6.2.3 Late Iron Age Salt-Production Sites (La Tène)..........................................................44
1.6.2.4 Roman Salt-Production Sites ................................................................. 45
1.6.3 Overview of Prehistoric and Roman Salt-Production Sites in Europe ................................................................. 47
1.6.4 Studies of Iron Age and Roman Salt-Production in Britain .......... 49
1.6.5 A Review of Key Studies of Coastal Salt-Production Sites in Britain 50
1.6.5.1 The Famous Essex Red Hills ................................................................. 51
1.6.5.2 Research in the Lincolnshire and Fenland area ......................... 55
1.7 An Overview of the Study Area: Somerset to Kent ....................... 57
1.7.1 Somerset ................................................................................................. 59
1.7.2 Devon, Cornwall and Dorset ................................................................. 61
1.7.3 Hampshire and Sussex .......................................................................... 62
1.7.4 Isle of Wight .......................................................................................... 65
1.7.5 Kent ....................................................................................................... 65
1.8 Overview ................................................................................................. 66

2.0 Research Project Design ........................................................................ 70
2.1 Research Methodology: An Overview .................................................... 70
  2.1.1 Collecting the Data ............................................................................. 70
  2.1.2 Creating the Research Dataset ............................................................ 72
  2.1.3 Site Gazetteer and ‘Quick Guide’ .......................................................... 72
  2.1.4 Thesis Format ....................................................................................... 73
2.2 Interpretation Methodology ..................................................................... 73
  2.2.1 Research Approach: Making the Most of the Dataset .................... 76
  2.2.2 Key Site Characteristics: Defining the Data ..................................... 77
  2.2.3 Presentation of Results ....................................................................... 82
    2.2.3.1 Primary Core Data and Reconstructing Techniques of Salt-Production ............................................................................ 82
    2.2.3.2 Regional Evaluations ..................................................................... 83

3.0 Core Data Results: Distribution of Sites and Archaeological Evidence for Salt-Production across the Study Area .......... 84
3.1 Spatial and Chronological Site Distribution ......................................... 84
  3.1.1 Main Locations and Topographies ....................................................... 85
    3.1.1.1 Study Area ..................................................................................... 85
    3.1.1.2 Sites by County ............................................................................. 85
    3.1.1.3 Topography .................................................................................. 87
  3.1.2 Dating Type and Site Chronologies .................................................... 88
    3.1.2.1 Assessing Dating Accuracy: Dating Type .................................... 88
    3.1.2.2 Site Chronology: ‘Best Date’ ......................................................... 90
4.0 Characterising Sites and Salt-Producers. The Archaeology of an Ancient Craft and Identification of ‘Know-How’ ................................................................. 158
4.1 Introduction .......................................................................................... 158
4.1.1 Presentation of Chapter 4.0 .............................................................. 159
4.2 Narratives of a Salt-Production Site ...................................................... 161
4.2.1 Planning a Salt-Production Site ........................................................ 163
4.2.1.1 Logistical Factors ........................................................................ 163
4.2.1.2 Environmental Factors ................................................................. 164
4.2.1.3 Social and Cultural Factors .......................................................... 165
4.3 Raw Material Procurement and Site Preparation ................................... 165
4.3.1 Briquetage Creation .......................................................................... 166
4.3.2 Planning the Space: Groundworks and Site Creation ...................... 170
4.4 Stages of Salt-Production ..................................................................... 171
4.5 Stage 1: Water Management (Table 10.2.4) ........................................ 175
4.5.1 Examples of Stage 1 Water Management ......................................... 178
4.5.1.1 Sites with Feeders and Channels .................................................. 178
4.5.2 Working Areas with Multiple Brine Tanks ....................................... 188
4.5.3 Natural Water Management Features? .......................................... 192
4.5.4 Overview of Water Management ..................................................... 193
4.6 Stages 2 and 3: Salt Crystallisation and Salt Drying ................................ 193
4.6.1 Examples of Stages 2-3 in the Study Area .......................................................... 195
  4.6.1.1 Enclosed, Single Container Circular/Oval Hearths .............................. 196
  4.6.1.2 Enclosed Multiple Container Sub-Rectangular/Rectangular
        Hearths ........................................................................................................ 204
  4.6.1.3 Linear Enclosed Multiple Container Hearths
        (including Ditch/Gully Hearths) ................................................................. 210
  4.6.1.4 Hearths with Suspended Floors? ............................................................ 212
  4.6.1.5 Alternative Hearths ............................................................................. 216
  4.6.1.6 Ovens .................................................................................................... 219
  4.6.1.7 Enclosed Hearths/Working Areas Associated with Structures
        and Buildings ............................................................................................... 221
  4.6.1.8 Open Hearths (Direct Heat) ................................................................. 230
  4.6.1.9 Clay Platforms (Possible Open Hearths) ............................................. 231
  4.6.2 An Overview of Stages 2 and 3 in the Dataset ........................................... 234
  4.6.3 Inferring ‘Missing Links’: Relationship between Hearths
        and Briquetage ............................................................................................. 236
    4.6.3.1 Briquetage Pedestals ......................................................................... 238
    4.6.3.2 Briquetage Bars .................................................................................. 241
    4.6.3.3 Chemical Analysis of Briquetage ....................................................... 245
  4.6.4 Potential Use of Organic Artefacts in the Production of Salt
        (Stages 2 and 3) ............................................................................................. 247
  4.6.5 Processing Salt to Taste and Look Good: Absence of
        Evidence or Evidence of Absence? ............................................................. 247
  4.7 Stage 4: Debris Deposition ............................................................................ 252
    4.7.1 Briquetage Lifecycle .............................................................................. 258
  4.8 Overview of Iron Age and Romano-British Salt-Production
        Techniques within the Study Area ................................................................. 263
  4.9 Overview ....................................................................................................... 268

5.0 Regional Evaluation of the Study Area.
  Case Study I: Kent ............................................................................................. 269
  5.1 Introduction .................................................................................................... 269
    5.1.1 Key Site Groups in Kent (Table 5.1 and Figures 10.3.3-10.3.8) ......... 270
  5.2 Development of Salt-Production in Kent ....................................................... 273
    5.2.1 Overview of Site Type (Table 10.1.3 and Figures 10.3.11-10.3.16) 273
    5.2.2 Overview of Chronology (Table 10.1.8) ............................................... 274
    5.2.3 Overview of Briquetage ......................................................................... 277
    5.2.4 Overview of Site Spatial Distribution .................................................... 286
5.2.4.1 Group 1: North Kent Mainland (Table 5.1, Figures 10.3.3 and 10.3.11) ........................................................................................................... 286
5.2.4.2 Group 2 (2a-c): Medway Estuary (Table 5.1, Figures 10.3.4-10.3.6 and 10.3.12-10.3.14) ........................................................................................................... 291
5.2.4.3 Groups 3-4: Romney Marsh (Table 5.1 and Figures 10.3.7-10.3.8 and 10.3.15-16) ........................................................................................................... 303
5.2.5 ‘Villa Estates’ in North Kent? .................................................................................................................................................................................. 305
5.2.6 Distribution of Pottery-Production sites in relationship to Salt-Production Sites in North Kent .............................................................................................. 307

5.3 Site Diversity and Trends in Kent .......................................................................................................................................................................................... 309
5.3.1 Identification of ‘Working Areas’ within Kent ............................................................................................................................................................ 310
5.3.1.1 Kent Working Area A (Figure 5.18) ........................................................................................................................................................................ 310
5.3.1.2 Kent Working Area B (Figure 5.19) ........................................................................................................................................................................ 311
5.3.1.3 Kent Working Area C (Figure 5.22) ........................................................................................................................................................................ 313
5.3.1.4 Kent Working Area D (Figure 5.23) ........................................................................................................................................................................ 314
5.3.1.5 Kent Working Area E (Figure 5.25) ........................................................................................................................................................................ 316
5.3.1.6 Kent Working Area F (Figure 5.29) ........................................................................................................................................................................ 318
5.3.1.7 Kent Working Area G (Figure 5.30) ........................................................................................................................................................................ 319
5.3.1.8 Kent Working Area H (Figure 5.31) ........................................................................................................................................................................ 321
5.3.1.9 Kent Working Area I (Figures 5.32-5.34) ............................................................................................................................................................ 322
5.3.2 Key Technological Trends ......................................................................................................................................................................................... 326
5.3.2.1 Grouped Tanks in Working Areas: Kent and Essex ........................................................................................................................................ 328
5.3.2.2 Overview of Partitioned /Combined Hearths/Tanks (Figure 5.39) ......................................................................................................................................... 331
5.3.2.3 Slotted Lumps: Portable Hearths (Figure 5.40) ....................................................................................................................................................... 333

5.4 Overview ......................................................................................................................................................................................................................... 335

6.0 Regional Evaluation of the Study Area. Case Study II: Central Somerset Levels and Fieldwork Results .................. 338
6.1 Introduction ............................................................................................................................................................................................................... 338
6.1.1 Building the dataset for Somerset .............................................................................................................................................................. 340
6.1.2 The Central and North Somerset Levels ............................................................................................................................................... 341
6.2 Key Site Groups (Figure 10.4.1) ......................................................................................................................................................................................... 345
6.2.1 Overview of Site Type and Chronology ..................................................................................................................................................... 347
6.2.2 Group 1: Burnham and Highbridge Coastal Area (Table 6.2 and Figures 10.4.1, 10.1.3 and 10.1.33) ..................................................................................................................................................... 348
6.2.3 Group 2: North Somerset Levels (Table 6.2 and Figures 10.4.1 and 10.1.6) ......................................................................................................................................... 349
6.2.4 Group 3: Central Somerset Levels
6.3 Fieldwork in Group 3: Strategy and Location

6.3.1 Aim

6.3.2 Objectives

6.3.3 Fieldwork Criteria (Table 6.3)

6.3.4 Location

6.4 Fieldwork Results (Report 10.4.1: Sections 2.0-3.0)

6.4.1 Geophysical Survey (Report 10.4.1: Section 2.0)

6.4.1.1 Field 1 (Report 10.4.1: Figures 6-9)

6.4.1.2 Fields 2 and 3 (Report 10.4.1: Figures 10-13)

6.4.2 Excavation Results (Report 10.4.1: Section 3.0)

6.4.2.1 Field 1 (Report 10.4.1: Figures 14-20)

6.4.2.2 Field 3: Site 126 (Report 10.4.1: Figures 21-24)

6.4.2.3 Site 125

6.4.2.4 River Huntspill Sites

6.4.2.5 Soil Coring and Geology (Report 10.4.1: Figure 25 and Table 6)

6.4.3 Post-Excavation Results

6.4.3.1 Briquetage Assemblage

6.4.3.2 Ceramic Assemblage (Figure 6.24)

6.4.3.3 Soil/Bulk Samples (Report 10.4.1: Tables 7-8)

6.4.4 Fieldwork Overview

6.5 Technology of Salt-Production in Somerset/North Somerset

6.5.1 Briquetage in the Dataset

6.5.2 Associated Features

6.5.3 Overview of Shared Technologies between Groups 2 and 3 (Table 6.6)

6.5.4 Shared Technology: Cheshire

6.6 Case Study: Characterising salt-production in the Central Somerset Levels, (Group 3), (Sites 104, 107, 108, 110, 115, 126, 166, 198 and 295)

6.6.1 Profiling the Mounds: Size, Content and Formation

6.6.2 Working Areas and ‘Whole Site’: Collaboration and Planning

6.6.3 Technique of Salt-Production in the Central Somerset Levels

6.6.4 Re-consideration of ‘Site Type’ for Group 3

6.6.5 Re-consideration of ‘Best Date’

6.7 Development of Salt-Production in Somerset and North Somerset

6.8 Overview
7.0 Making the Invisible, Visible: Iron Age and Romano-British Coastal Salt-Production in Southern Britain .......... 448

7.1 Introduction ........................................................................................................ 448
7.2 Reflecting upon Research Approach and Outcomes ........................................ 449
  7.2.1 Reality of Deconstructing Sites ................................................................. 449
  7.2.2 Quality over Quantity? ............................................................................. 450
      7.2.2.1 The consequences and limitations of comparing sites using 'Site Totals' and 'Site Types' ......................................................... 450
  7.2.3 Moving away from the Traditional ‘Briquetage Dominated Viewpoint’: Rebalancing Studies into the Archaeology of Salt-Production .................................................................................................................. 453
7.3 An Overview of Chronological Trends and Core Phases of salt-production in the Study Area, Central Britain and Eastern Britain .......... 458
7.4 Salt Producers Making Choices: Revealing Individuality through Technological Innovation, Trends and Diversity (Figures 10.5.5-10.5.11) .................................................................................................................. 468
  7.4.1 ‘Mix and Match’: Innovation, Technological Choice and Site Diversity in the Study Area (Figures 10.5.5-10.5.11) ....................................................... 472
  7.4.2 The French Connection? Identifying shared technical features between the Continent and Britain .................................................. 481
      7.4.2.1 Pedestal Type 2 (Dorset, Fenlands and France) .............................. 482
      7.4.2.2 Deep, Thickly-lined, Rectangular Enclosed Hearths ...................... 483
      7.4.2.3 Covered Workshops (Cornwall and France) ...................................... 486
      7.4.2.4 Groups of Multiple/Divided Tanks (Kent, Essex, Fenlands and France) .................................................................................. 490
      7.4.2.5 Narrow, Long Linear Hearths (Dorset, Essex, Fenlands and France) .................................................................................. 496
      7.4.2.6 Overview of the French Connection .................................................. 507
7.5 Site Biographies, Organisation and Use of Space: Defining New ‘Modes’ of Salt-Production .................................................................................................................. 508
  7.5.1 Deconstructing and Defining Existing ‘Modes of Production’: Peacock and DeRoche (Table 7.2) .......................................................... 509
  7.5.2 Problems Applying Existing ‘Modes’ to Salt-Production ......................... 518
      7.5.2.1 Defining Domestic Versus Industrial Salt-Production (Figure 10.5.11) .................................................................................. 519
      7.5.2.2 Labour and Mode: Part Time Versus Full-Time .................................. 522
  7.5.3 Defining New Modes of Salt-Production for Southern Britain .............. 523
  7.5.4 Application of ‘Modes of Salt-Production’ to the dataset ....................... 538
  7.5.5 Exploring the New Modes of Salt-Production ......................................... 544
7.5.5.1 Mode 1: Blurring the lines between ‘Domestic’ and ‘Industrial’? 544
7.5.5.2 Mode 2: Traditional Iron Age and Romano-British Salt-Production Sites..................................................545
7.5.5.3 Mode 4: Organisation of the Site Complex: Collaboration and Site Management........................................549
7.5.5.4 Mode 5: Making Pots and Salt: Integration of People, Technology and Space? ........................................556
7.5.5.5 Mode 7: Specialist Production ‘Hubs’ ........................................560
7.5.5.6 Mode 8: External Processing Sites and/or Re-distribution hubs? Stage 5 of the Salt-Production Process? ..........573
7.5.6 Potential Sub-Definitions for Modes ........................................582
7.5.7 New Modes of Salt-Production as a Valuable Tool: Re-Balancing Studies and Understanding of Salt-Production, Distribution and Consumption ........................................589
7.6 The Cultural, Historical and Economical Significance of Salt-Production, Distribution and Consumption, in Late Iron Age and Roman southern Britain: Contextualising changing mechanisms of manufacture and supply........................................585
7.6.1 Considerations of socially embedded actions and perceptions associated with the production, distribution and consumption of salt ...............................................................587
7.6.2 Mechanisms of production, distribution and consumption in the Iron Age............................................................................................................595
7.6.2.1 Invisible consumption, low consumption, conspicuous consumption and/or import? Consideration of pre-Late Iron Age salt-production and consumption ..................................596
7.6.2.2 The Late Iron Age: Cross-channel supply and a growing taste for salt? .......................................................598
7.6.2.3 Briquetage salt cake containers as indicators of gift exchange: Decline in use as an indicator of changing mechanisms and new modes of transport? .........................603
7.6.2.4 Overview .......................................................................................................................................................609
7.6.3 Responding to Change: Exploring the Development of Production, Distribution and Supply Mechanisms between the 1st century BC and 2nd century AD .........................................610
7.6.3.1 Increase in Mode 2 sites as a ‘quick and adaptive response’ to the Roman conquest ..................................613
7.6.3.2 Mode 4 complexes as longer term and sustainable supply areas: Poole Harbour, Dorset and Romney Marsh, Kent .... 614
7.6.3.3 Restricted consumer supply? Poole Harbour and Medway Estuary as mid-1st century AD supply hubs
7.6.3.4 Increased complexity of distribution and supply mechanisms
7.6.3.5 Use of Intermediaries?
7.6.3.6 Change in mechanisms to suit growing urbanisation and specialists working in towns? Urban Trade Hubs (Towns) V Rural Market Economies
7.6.3.7 Overview
7.6.4 Responding to Change: A 2nd century breakdown in organisation or a deliberate centralisation and ‘streamlining’ of a successful industry?
7.6.4.1 Response to a breakdown resulting in a reduction in output?
7.6.4.2 Deliberate reorganisation and centralisation?
7.6.4.3 Mode 4 sites as indicators of change in the 2nd-4th centuries AD: Deliberate centralisation or an attempt to gain back a broken supply
7.6.5 The End of an Era
7.6.6 What happened next: A brief consideration of salt-production after the 4th century AD

8.0 Conclusion and Recommendations
8.1 Achievement of Research Project
8.1.1 New Approaches to the Study of Salt-Production
8.1.2 New Insights into Salt-Production in Southern Britain
8.2 Salt-Production in the Archaeological Record: An Overview and Recommendations for Future Research
8.2.1 Achieving the Research Objectives

9.0 References
## 10.0 Appendices

<table>
<thead>
<tr>
<th>Appendix for Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>1</td>
</tr>
<tr>
<td>3.0</td>
<td>15</td>
</tr>
<tr>
<td>4.0</td>
<td>220</td>
</tr>
<tr>
<td>5.0</td>
<td>246</td>
</tr>
<tr>
<td>6.0</td>
<td>264</td>
</tr>
<tr>
<td>7.0</td>
<td>320</td>
</tr>
<tr>
<td>8.0</td>
<td>352</td>
</tr>
</tbody>
</table>

**BACK COVER INSERT:** DVD Disc: Site Gazetteer (Table 10.4.1)
List of Figures (Volume One)

Figure 1.1 Controversial British Food Standards Agency salt warning ad campaign using illustrated slugs (Salt Manufacturer’s Association, 2004) ............ 9
Figure 1.2 View of solar evaporation ponds in Gozo, Malta (Harry Manley: 2003) .................................................................................................................. 26
Figure 1.3 A diagram of the method of salt-production used during the post-medieval period in Lymington, Hampshire (Lloyd, 1967: 9) ...................................................... 28
Figure 1.4 Seasonal diagram of agriculture and coastal salt-production (Redrawn from Bradley, 1975: 22) ........................................................................................................... 30
Figure 1.5 Development of briquetage ‘crystallising vessels’ in Germany, Poland and Japan (Adapted from De Brisay, 1981: 37) .............................................................. 33
Figure 1.6 Cross section of a kiln used to produce salt, still in use within Manga, Niger, in the mid-20th century, using pointed pedestals and small round vessels (Adapted from Gouletquër, 1975: 50) ............................................................... 34
Figure 1.7 Left: Single briquetage pedestal from the Bronze Age site at Tetney, Lincolnshire (Palmer-Brown, 1993: 136) Right: Artist’s impression of a Bronze Age salt -production site at Tetney (Pryor, 1997: 38) ........................................................................ 34
Figure 1.8 Excavation of a Red Hill at Peldon, Essex. Brine tank on the left, small hearth on the right (Fawn et al., 1990: Plate 4: Appendices) .............................................. 37
Figure 1.9 Reconstruction of an enclosed clay lined hearth with briquetage, Ingoldmells, Lincolnshire (Lane and Morris, 2001: 421) ................................................................. 38
Figure 1.10 Distribution map of Bronze Age salt-production sites in Europe (Adapted from Nenquin, 1961: ‘Map II’) ................................................................................ 42
Figure 1.11 Distribution map of Halstatt (Late Bronze Age-Middle Iron Age) salt-production sites in Europe (Adapted from Nenquin, 1961: ‘Map III’) ...................... 43
Figure 1.12 Recent map showing ‘European Salt Production Centres: c.2000BC-750BC’ (note that most coastal areas of Britain are not shown in this map), (Riddiford, 2010: Available from: http://www.seillevalley.com/BronzeAgeSaltMap.htm) .................................................................................................................. 44
Figure 1.13 Distribution map of La Tène (Late Iron Age) salt-production sites in Europe (Adapted from Nenquin, 1961: ‘Map IV’) .............................................................. 45
Figure 1.14 Distribution map of Gallo-Roman and Romano-British salt-production sites in Europe. (Adapted from Nenquin, 1961: ‘Map V’) .............................. 46
Figure 1.15 Map of prehistoric and Roman salt-production (briquetage) sites in Europe showing hours of sunshine (Adapted from Gouletquër, 1974: 4) ............. 47
Figure 1.16 Recent map showing ‘European Salt Production Centres: c.750BC-AD50’ (Riddiford, 2010: http://seillevalley.com/IronAgeSaltMap.htm) .................. 48
Figure 1.17 Map showing the main areas of salt-production in Britain. A: Early Romano-British period B: Late Romano British (Adapted from Rippon, 2000: 97) ................................................................................................. 50
Figure 1.18 Map of Roman Britain showing ‘native’ tribal boundaries and the main Roman towns, town capitals (civitas) and forts (Frere, 1991: xvi) ......................... 51
Figure 1.19 Distribution map of Red Hill sites in Essex (De Brisay, 1975: 5) ....... 52
Figure 1.20 Excavation of a salt-production site at Peldon, Essex, 1973. Mrs Kay de Brisay is the central figure in the pink (Fawn et al., 1990: Plate 1) ... 53
Figure 3.20 Percentage of Original Site Terminology cross-referenced with ‘Briquetage Findspot Only’ .......................................................... 109
Figure 3.21 Percentage of Original Site Terminology cross-referenced with ‘Mound Associated Briquetage’ ......................................................... 110
Figure 3.22 Percentage of Original Site Terminology cross-referenced with ‘Mound Only’ ................................................................................... 111
Figure 3.23 Percentage of Original Site Terminology cross-referenced with ‘Unknown’ ................................................................................... 112
Figure 3.24 Percentage of archaeological investigation type: Invasive V Non-Invasive ................................................................................. 113
Figure 3.25 Overview of Archaeological Investigation Types recorded within the dataset with arrow showing the relationship between Invasive and Non-Invasive (Total=366) ......................................................................................... 114
Figure 3.26 Archaeological investigation types split into detailed categories (Total=366) .................................................................................. 114
Figure 3.27 Reasons for carrying out different types of archaeological investigation on sites within the dataset (Total=366)......................... 116
Figure 3.28 Presence/Absence of archaeological remains associated with salt-production (Total=276 sites) .......................................................... 119
Figure 3.29 Confidence rating assigned to each new General and Detailed Feature Type based upon the quantity and quality of data provided for each original feature ...................................................................................... 120
Figure 3.30 Total General Feature Types recorded within the site database (note: some sites have more than one occurrence of each feature type and the total represents each feature) (Total=688) ................................................. 121
Figure 3.31 Total sites with evidence for each General Feature Type (Note: if more than one of each type was present on an individual site; only the first instance was ‘counted’) ................................................................................... 122
Figure 3.32 Percentage of briquetage assemblages where sufficient information was recorded to enable interpretation (Total=163) ................. 123
Figure 3.33 Total basic briquetage form presence across each site with confirmed briquetage (Total=163) ......................................................... 124
Figure 3.34 Simplified illustration of the main container forms found on Iron-Age and Romano-British salt-production sites in southern Britain .................. 126
Figure 3.35 Recorded briquetage container forms (Total=57 instances across 37 sites) ....................................................................................... 127
Figure 3.36 Percentage of recorded briquetage container forms (Total=57 instances across 37 sites) ........................................................................ 127
Figure 3.37 Unique example of a rectangular briquetage container found buried in Hoo, Kent (Site 315) (Type 1), (Author: 2007) ......................... 128
Figure 3.38 Left: Reconstructed sub-rectangular container (based upon Poole Harbour types), (Type 1) Right: Trough or cylindrical container (based upon Poole Harbour and Lincolnshire types), (Type 3), (Author: 2003 and 2005) ...... 129
Figure 3.39 Rectangular/Sub-rectangular container forms across the study area (Total=16 sites with the presence of Container Type 1) .................... 130
Figure 3.40 Oval/Round container forms (Type 2) by county (Total=15 sites) .... 130
Figure 3.41 Cylindrical/Trough container forms (Type 3) by county (Total=26 sites) ........................................................................................................ 131
Figure 3.42 Examples of the main pedestal types found within Iron Age and Romano-British salt-production sites in southern Britain (not to scale but in order of size) ........................................................................................................ 136
Figure 3.43 Percentage of different briquetage pedestal support types (Total=55 instances across 32 sites) ........................................................................................................ 137
Figure 3.44 Total ‘Rounded Pedestal’ Types (Total=47 instances across 32 sites) ........................................................................................................ 137
Figure 3.45 Examples of briquetage pedestals and bars from Hook, Hampshire (Site 11). Bottom left to right are examples of Types 1a and 1c (Fox 1937: Plate 2) ........................................................................................................ 138
Figure 3.46 Early Romano-British briquetage pedestals from Shapwick Road (Site 231), Poole, Dorset Left: Selection of rounded pedestals (Types 1-2) Right: Larger ‘brick or block’ type pedestal (Type 3) (Author: 2009 and 2004) .. 139
Figure 3.47 Left: Larger rounded pedestal from Lydd Quarry, Kent (Site 82) (Type 5) (Author: 2009) Right: The largest briquetage pedestal support in the study area from St George, Somerset (Site 239) (Type 6) (Author: 2006) 140
Figure 3.48 Total sites with the recorded presence of briquetage support pedestals (Total=32 sites) ........................................................................................................ 141
Figure 3.49 Total sites with recorded pedestal presence over time (Total=32 sites) ........................................................................................................ 141
Figure 3.50 Typology of briquetage bars found across the study area in the Late Iron Age and Romano-British periods (Not to scale), (Wedge included here as it is a probable variant of Types 3-4) ........................................................................................................ 143
Figure 3.51 Bar Typology continued: Type 7 Gridded Bar (only found at Site 229, not to scale) ........................................................................................................ 144
Figure 3.52 Percentage of briquetage support bar profiles (Total=40 bar types across 29 sites) ........................................................................................................ 144
Figure 3.53 Total sites with bar presence across the study area (Total=29 sites) ........................................................................................................ 144
Figure 3.54 Total sites with recorded bar presence over time (Total=29 sites with bars) ........................................................................................................ 146
Figure 3.55 Wedge (Type 6) support from Site 30, Cooling (Author: 2009) ........................................................................................................ 147
Figure 3.56 Basic Slab Typology .................................................................................................................................................................................. 147
Figure 3.57 Total briquetage support slab types (Total=38) ........................................................................................................ 148
Figure 3.58 Decorated briquetage slabs from Poole Harbour, Dorset Left: Site 231 at Hamworthy Right: 218 Boat House Clump, Upton, Dorset (Author: 2004) ........................................................................................................ 149
Figure 3.59 Sites with the presence of slabs across the study area (Total=31) .. 150
Figure 3.60 Slabs used on sites in chronological order (Total=31) ........................................................................................................ 150
Figure 3.61 Typology of Stabilisers (ad-hoc briquetage supporting material) ........................................................................................................ 151
Figure 3.62 Example of briquetage rod (Ad-Hoc supports: Type 4) found near Sites 125 and 126 in the Somerset Levels (Author: 2009) ........................................................................................................ 152
Figure 3.63 Diagram showing position of stabilisers a: Pinch-Prop from Sandy Ditch, Somerset Levels (Site 295), b: Spacer from Hobarrow Bay, Dorset (Site
Figure 3.64 Summary of all main support type (Total=103) ................................................................. 154
Figure 4.1 Simplified ‘breakdown’ of site and event cycles revealing the multiple ‘layers’ of action and thought potentially associated with salt-production. Each arrow represents people associated with this process .................................................. 162
Figure 4.2 Left: Diagram showing technique of slab-building rectangular containers by pressing the clay flat onto a wooden surface Centre: Two sherds of rectangular briquetage containers with impressions of wood on the exterior (Top: Godslington Heath, Dorset (Adapted from Farrar 1975: 16) Bottom: Ebber Rocks (Site 296), Cornwall (Author: 2009)) Right: Base of a briquetage container showing a poorly sealed ‘seam’ between two slabs which began to separate slightly during firing and subsequent use (Author: 2004) ...................... 167
Figure 4.3 Method of forming simple pedestals and rods as found on Iron Age and Roman salt-production sites in France and Britain (Adapted from Daire, 2003: 45) ....................................................................................................................... 169
Figure 4.4 A selection of pedestals found at Site 213 at Hamworthy, Poole Harbour, Dorset (Author: 2004) .................................................................................................................. 169
Figure 4.5 A possible scenario for producing squat hand squeezed pedestals in rows, by baking in the sun (Keith Jarvis pers comm 2004) ...................... 170
Figure 4.6 Left: Technique I: The most common method used to produce salt directly from seawater in the study area Right: Technique II: Variant of Technique I, where tank lining is re-cycled to obtain salt ....................... 172
Figure 4.7 Technique III: Method for producing salt by the burning of salt-impregnated organic material ............................................................ 173
Figure 4.8 Main stages of the salt-production process for all 276 sites (Table 10.2.3) ........................................................................................................... 174
Figure 4.9 Summary of Stage 1 Water Management features across all sites (Total=29 Sites) ......................................................................................... 176
Figure 4.10 Plan of the excavations at Hamworthy Peninsula near Holes Bay (Site 231) (Smith, 1931: facing p98) .................................................. 179
Figure 4.11 Brine tanks at Site 231, Hamworthy (Farrar 1975: 15 (After H.P Smith 1949: site archive)) ................................................................. 180
Figure 4.12 Plan of Trench 13: Site 213 (Terrain Archaeology Site Archive: 2004) ............................................................................................................. 182
Figure 4.13 Plan of Chidham Site B in West Sussex (Site 98), (Bradley, 1992: 32) ........................................................................................................... 183
Figure 4.14 Clay-lined brine tanks from Site 228, Furzey Island, Poole Harbour, Dorset (north-western shore) A: Single, separate brine tank (Cox and Hearne 1991: 57) B: Group of four closely associated brine tanks (Cox and Hearne 1991: 58) C: Single brine tank with the remains of a feeder channel (Author: 2004) .......................................................... 185
Figure 4.15 Deep tank from Site 82 (Archaeology South-East Site Archives: 2008) ......................................................................................................... 186
Figure 4.16 Plan of phase 12B of the Lydd Quarry excavations revealing a substantial salt-production complex with an elaborate Stage 1 Water
Management System (Archaeology South-East Site Archives: 2008 (Adapted: colour/text added by author to emphasis different feature types))

Figure 4.17 Two pairs of inter-connected brine tanks at Site 166 (only half of each pair is visible in this photograph), (Brunning 2006: 20)

Figure 4.18 The salt-production site at Cooling, North Kent (Site 30), (Miles, 2004: 29)

Figure 4.19 Funton Creek (Site 90), (Adapted from Detsicas, 1984: facing 66)

Figure 4.20 View across three joined circular settling/evaporation tanks (F103-105) with two hearths in the background (F99 and F101): Site 61. (Jackson, 1993 personal archive)

Figure 4.21 View over the cliff to the east of a briquetage mound (Site 214) Note the ledge below with natural grooves filled with seawater (Author: 2005)

Figure 4.22 Total General Feature Types associated with Stages 2 and 3 of salt-production (Total=51 sites)

Figure 4.23 An eroding joined tank and hearth at Site 228 (Alan Bromby: 2004)

Figure 4.24 Hearth with accompanying brine tank. Both are clay-lined and cut into the gravel. Four in-situ briquetage support pedestal bases were in the base of the hearth (Archaeology South-East Archives: 2008)

Figure 4.25 Part of the plan of phase 12A of the Lydd Quarry excavations showing several hearths. (Archaeology South-East Site Archives: 2008 (Adapted: colour/text added by author to emphasis different feature types. Red features are hearths and blue are tanks))

Figure 4.26 Reconstruction of the hearth in Figure 4.24 with briquetage pedestals used with a single container

Figure 4.27 Joined larger oval hearth and small tank at Site 61 (Ian Jackson Personal Archives)

Figure 4.28 One of the many oval enclosed hearths at Site 82. This hearth has the remains of four briquetage support pedestals at the base cut into the gravel and clay-lined (Archaeology South-East Archives)

Figure 4.29 A plan of the two salt-production hearths discovered at Cliffe, Kent (Site 316) (Adapted from Miles, 1975: 28)

Figure 4.30 A briquetage wedge support found within one of the hearths at Cliffe, Kent (Author: 2009)

Figure 4.31 Top: Working areas of hearths/tanks at Site 82 (Archaeology South-East Site Archive) Bottom: Small hearth containing a nearly complete pottery vessel (left) and two adjoining brine tanks filled with burnt debris (right) at Site 62 (Ian Jackson personal archive)

Figure 4.32 Small ‘hearth’ at Site 228, Furzey Island, Dorset (Author: 2004)

Figure 4.33 Left: Probable open hearth close to the main enclosed hearth (top right) at Site 213 Right: Enclosed Hearth (Direct Heat) before excavation filled with compacted briquetage (Terrain Archaeology Site Archive: 2004)

Figure 4.34 Two possible reconstructions for a rectangular enclosed hearth (direct heat) found at Hamworthy, Poole, Dorset (Site 213)

Figure 4.35 Enclosed Hearth 2, partially excavated at Site 216, Poole, Dorset (Poole Museum Site Archive: 2004)

Figure 4.36 Section of Site 198 (not to scale) (Leech, R, Bell, M et al 1983: 75)
Figure 4.37 Plan of the stone-lined enclosed hearth found on the shore at Wyke Regis (Site 217) (Adapted from Bailey, 1962:133) ..................................................209
Figure 4.38 Plan and sections of oven/furnace and associated clay lined pit (Cox and Hearne, 1991: 39) ..........................................................................................211
Figure 4.39 Section of Site 166 at East of Woolavington Bridge, River Huntspill, Somerset showing the large hearth/oven structure (Brunning, 2006: 21) ..................................................................................................................212
Figure 4.40 Left: Illustrations of Romano-British briquetage slabs and objects described as ‘plates’ from ‘Boat House Clump’, Upton Park, Dorset (Site 218), (Jarvis, 1986: 160) Right: Photograph of a decorated and inscribed slab (illustration 12 in left image) also from Site 218 (Author: 2004) ............................................................213
Figure 4.41 Example of how slabs could have been used with bars over a hearth to produce salt. Left: Horizontal bars Right: Upright bars ..................214
Figure 4.42 Examples of the way in which slabs and pedestals could have been used together. Top: Pedestals underneath supporting slabs Bottom: Slabs with pedestals above ........................................................................................................................215
Figure 4.43 Reconstruction of a briquetage perforated slab within a hearth supporting a container ..................................................................................216
Figure 4.44 ‘Gridded briquetage from Site 229 (Adapted from Cox and Hearne, 1991: 153) .................................................................................................................216
Figure 4.45 Left: Suggested reconstruction for grid-type briquetage formation used in the Seille region of France in the Later Iron Age-Early Romano periods (Smith, 1918: 41) Right: More recent reconstruction of grill furnaces from the same area (Daire, 2003: 37) ........................................................................................................217
Figure 4.46 A collapsed briquetage grid system from a Roman salt–production site in France (Daire, 2003: 70) .................................................................217
Figure 4.47 Slotted lump containing four broken briquetage slabs (Author: 2007) ..................................................................................................................218
Figure 4.48 Reconstructions of how the slotted lump material could have been used in the Medway Estuary, Kent (Adapted from Ian Jackson: Personal Archives) ........................................................................................................218
Figure 4.49 An example of oven structures with flues and chambers at Leigh Beck, Essex (Fawn et al. 1990: Plate 5) .........................................................219
Figure 4.50 Plan of the gully (52) associated with salt-production activity at Site 212. The shaded area represents the area containing briquetage fragments, the dotted linear feature is a probable Neolithic gully (Tomalin, 1980: 113) ........................................................................................................................................220
Figure 4.51 Remains of a ‘domed briquetage structure’ (88.1) and container fragments (50.3, 50.6 and 51) from the gully (Tomalin, 1989: 114) ..................................................220
Figure 4.52 Carnoon Bank (Site 14) Structure 63 and phases I and II. Site 14 (Mcavoy et al., 1980: 39) ...............................................................................................223
Figure 4.53 Trebarveth (Site 15), Cornwall showing the site eroding on the cliff edge (Source: Cornwall Historic Environment Record Archive 2009) .............224
Figure 4.54 Plan of Trebarveth, Site 15 (Peacock, 1969:53) ..................................225
Figure 4.55 Briquetage: 84-90 thick rectangular brine evaporation containers; 91-94 pedestal supports from Rope Lake Hole (Site 216), (Hawkes, 1987: 159) 226
Figure 4.56 Plans showing Romano-British activity (Phase 4) at Site 216. Briquetage and shale made up some of the ‘lower yard’ surface (135) (Plan A) and was associated with the internal area of building 117 Plan B). Both internal areas 104 and 105 had briquetage on the floors (Plan B). (Woodward 1987b: 140)

Figure 4.57 Plan of building 707 with ‘drier’ 708 at Ower, Poole Harbour (Site 225) (Woodward, 1987a: 55)

Figure 4.58 Briquetage from Site 225 (not to scale) Note the two different forms of container; the cylindrical cut edge container (201-202) and the thicker evaporation containers (198-200, 203-204) (Woodward, 1987a: 93)

Figure 4.59 Hook Park Site Plan sketch (Welsh, 1985)

Figure 4.60 Briquetage from Hook (Site 11), (Fox 1937: Plate 1)

Figure 4.61 Diagram showing the main two enclosed hearth types and the method of heat distribution

Figure 4.62 Multiple containers (Fenland Type) over an enclosed hearth, brine was transferred between containers as required to stop the containers from drying out (Author: 2006)

Figure 4.63 Briquetage pedestals from Lydd Quarry, Romney Marsh, Kent (Site 82) showing zones of banding on the exterior as a result of differential heat exposure during use (Author: 2008)

Figure 4.64 Rounded pedestal supports from Shapwick Road, Hamworthy (Type 2) (Site 213), (Author:2004)

Figure 4.65 Reconstructed pedestals used during attempts at traditional salt-production in Lincolnshire. The pedestals were used within an enclosed hearth and although distant from direct heat still had surface clouding and areas with salt (Author: 2006)

Figure 4.66 Bar fragments found within the River Huntspill after being eroded from nearby briquetage debris mounds (Author: 2008)

Figure 4.67 Reconstruction of briquetage support bars being used in the upright position

Figure 4.68 Top: Reconstruction of the use of triangular briquetage support bars in Essex showing that the bar would only work with the triangular point facing downwards Bottom: Example of the lining of a salt-production hearth with the impression of a horizontal impressed support bar (Adapted from De Brisay, 1978: 47)

Figure 4.69 A close up of the surface markings on Bar b (unstratified from the River Huntspill) (Author: 2008)

Figure 4.70 Reconstruction of briquetage support bars being used in the horizontal position

Figure 4.71 Salt covering all the hearth lining after the hearth had been used to produce salt during a day of traditional salt-production (Author: 2006)

Figure 4.72 A sketch of an individual in Africa washing salt in a large basket to remove impurities (Adapted from Gouletquer, 1975: 50)

Figure 4.73 Basketry preserved underneath a briquetage mound in the Somerset Levels at Site 166 (Brunning, 2006: 21)
Figure 4.74 Early Romano-British perforated and decorated fragment of briquetage container from 12 West Quay Road, Poole, Dorset (Site 215)  
(Author: 2009) .......................................................................................................................... 251

Figure 4.75 Percentage of the three main features created for the deposition of debris from salt-production across sites (Total=154 sites, some sites contained multiple types) .............................................................................................................................. 252

Figure 4.76 A Late Iron Age salt-production site with debris mound at Helpingham Fen, Lincolnshire (Simmons, 1975: 33) .......................................................... 254

Figure 4.77 Left: Site 155 (a scheduled debris mound) facing north (Neil Tinkley: 2008) Right: Site 108 in section, facing west towards Woolavington Bridge showing the stratigraphy of briquetage (red) and burnt charcoal layers (black)  
(Author: 2008) .................................................................................................................................. 255

Figure 4.78 View of the mound at Site 214 (Author: 2004) .......................................................... 256

Figure 4.79 Plan for Site 32 at Funton, Kent  
(Miles, 1965: 262) .............................................................................................................................. 256

Figure 4.80 Left: Briquetage layer exposed at Upton Park, Poole Harbour at Site 218 (Poole Museum Service Archive) Middle: A disturbed buried briquetage deposit near Site 227 Right: Briquetage fragments scattered around the base of a tree, disturbed by root action in the same area as Site 227 (Author: 2009) ........................................................................................................................................ 257

Figure 4.81 Lifecycle of briquetage (Hathaway, 2008: 50) ............................................................... 259

Figure 4.82 A list of some of the main methods that could have been used to dispose of briquetage and general salt-production waste with most 'casual' at the bottom ........................................................................................................................................ 260

Figure 4.83 Section of one of a pair of joined tanks at Site 62, Medway Estuary, Kent ........................................................................................................................................ 270

Figure 4.84 Probable water management tank for salt-production with the lining removed for roasting at Site 229: East of Corfe River, Dorset (Cox and Hearne, 1991: 40) ........................................................................................................................................ 271

Figure 5.1 Graph showing the Best Dates for all salt-production sites in Kent... 275

Figure 5.2 Left: Example of a c.1st century A.D. flat-based briquetage container found on the foreshore at Higham, Kent (Type 1 or 2)) Right: Remains of a Type 1 briquetage container from Site 30, Cooling, Kent (Author: 2008) ...................................................................................................................... 277

Figure 5.3 Basic Typology and Chronology of containers used for salt-production in Kent (coloured forms present only) ........................................................................................................................................ 278

Figure 5.4 Basic Typology and Chronology of pedestals in Kent (coloured forms present only) ........................................................................................................................................ 278

Figure 5.5 Selection of Type 1 and 5 Rounded Pedestals from Site 82 (Author: 2008) ........................................................................................................................................ 281

Figure 5.6 Selection of briquetage supports from Site 82. Left: Eroded Type 1a Rounded Pedestal; Centre: Rods (Stabiliser Type 4); Right: Ad-hoc Stabilisers (Author: 2008) ........................................................................................................................................ 282

Figure 5.8 Left: Rarer ‘Arrow’-shaped wedge (Type 6) from Site 30, Cooling Kent Centre: Triangular/Boomerang Type Bars (Types 3/4) from Site 30, Cooling Right: Triangular Bars (Type 4) from Site 42, Upchurch Marshes, Medway Estuary, Kent (Author: 2008-2009) ........................................................................................................................................ 285

Figure 5.9 Rare multi-phased area of salt-production at Cooling (Site 30):
Working Areas highlighted in blue (Adapted from Miles 2004: 319).................287
Figure 5.10 Top: Earlier excavations of a well-preserved Romano-British pottery
kiln at Site 30 (photograph within site archives in Maidstone Museum) Bottom:
Large quantities of pottery from Site 30 in storage (inset: BBW) (Author: 2009)...........288
Figure 5.11 Slotted Lump from Site 19 (Author: 2009)........................................293
Figure 5.12 Left: Large fragment of a flat-sided briquetage container with a
wiped exterior from Site 312 Right: Probable brine transfer vessel from Site
312 (Author: 2009)...........................................................................................................295
Figure 5.13 Attractive white slip decorated red ware plate from Site 62
(Author: 2009)....................................................................................................................300
Figure 5.14 Small selection of the many cattle bones with evidence for
butchery from Site 62 (Author: 2008)...............................................................................301
Figure 5.15 Plan of excavations at Site 82, Lydd Quarry (Phases 12A and 12B),
(Adapted from: Archaeology South-East Site Archives: 2008: colour added by
author to emphasis different feature types)..........................................................................304
Figure 5.16 Map of key Romano-British roads, villas and towns in Kent (Millet
2007: 149)..........................................................................................................................306
Figure 5.17 Two maps showing the close proximity of pottery production sites
(top) (Adapted from Swan 1984: 27), and salt-production sites (including
briquetage findspots) in North Kent and the Medway Estuary (bottom),
(Ordnance Survey Map Data ©Crown Copyright Database Right 2012. An
Ordnance Survey/Edina Supplies Service)........................................................................308
Figure 5.18 Kent Working Area A (based upon examples in Site 82) .........................311
Figure 5.19 Kent Working Area B at Site 316 (Shaded area represents hearth
'clearout ' areas), (This is based upon the site plan in Figure 4.29) ..................311
Figure 5.20 Section of the main hearth (the left hearth in Figure 5.19 above)
with the partitioned area (Adapted from Miles, 1975: 28)..................................................312
Figure 5.21 Kent Working Area B: Reconstruction of possible original formation313
Figure 5.22 Kent Working Area C. Based upon Site 61 (based upon Figures
4.20 and 4.27)....................................................................................................................314
Figure 5.23 Kent Working Area D (based upon Site 82: Figure 4.24 and Figure
5.24 below) .........................................................................................................................315
Figure 5.24 Plan of a hearth in Working Area D containing the fragments of a
pottery vessel possibly used to transfer brine as well as a set of four in-situ
round pedestals (Archaeology South-East Site Archive)............................................315
Figure 5.25 Kent Working Area E: Site 82 (based upon example in Figure
4.31: top).............................................................................................................................316
Figure 5.26 Reconstruction showing the original, then later re-arrangement
and addition of features in Working Area E (Site 82) .....................................................317
Figure 5.27 Kent Working Area E: Site 62 (based upon Figure 4.31: bottom) ....317
Figure 5.28 Kent Working Area E at Site 62: Dashed lines represent later
conversion of the single feature into two............................................................................318
Figure 5.29 Kent Working Area F: Based upon Site 90 (Figure 4.19) ........319
Figure 5.30 Kent Working Area G (based upon Site 30 in Figure 4.18)........320
Figure 5.31 Kent Working Area H (based upon site plan of Site 30 in
Figure 4.18)..........................................................................................................................321
Figure 5.32 Kent Working Area I: Based upon feature plan in Figure 5.33 ....... 323
Figure 5.33 Large grouped Early Romano-British hearth area revealed during excavations for the Sittingbourne Northern Relief Road (Dawkes, 2011: Figure 11) ................................................................. 324
Figure 5.34 Alternate uses for the four 'hearth' areas in Kent Working Area I .... 325
Figure 5.35 Map of salt-production sites in North Kent (Group 1), showing the closest Red Hill salt-production sites in the Thames Estuary, Essex (orange star) (Ordnance Survey Map Data: © Crown Copyright/database right 2011. An Ordnance Survey/EDINA supplied service) ................................................................. 327
Figure 5.36 A reconstruction of a classic Romano-British 'Red Hill' salt-production site in Essex (Adapted from De Brisay 1978: 40) ................................................................. 328
Figure 5.37 Roasting clay tank lining in a group of brine tanks (Technique II) .... 329
Figure 5.38 Rotation of tanks within Technique III ................................................................. 330
Figure 5.39 All working areas in Kent with joined hearth/tanks (Top left to right: Sites 82, 316 and 61 Bottom left to right: Site 82 x2 and Site 62) ...................... 332
Figure 5.40 An alternative reconstruction of the method for using slotted lumps as portable hearths leaving a 'liner burnt surface' ................................................................. 333
Figure 5.41 Slotted Lump distribution in the Medway Estuary, Kent (1st century AD) ................................................................................................................................. 334
Figure 6.1 Overview of main areas containing prehistoric archaeological remains and of the geology in the Somerset Levels and Severn Estuary (Brean Down represents a Bronze Age salt-production site), (Bell and Walker, 1992) ................................................................................................................................. 342
Figure 6.2 View of the River Huntspill facing east (taken near Woolavington Bridge), (Author: 2008) ................................................................................................................................. 343
Figure 6.3 Chronology of salt-production in Central and North Somerset based upon HER records and the original dataset ................................................................. 348
Figure 6.4 The ancient tidal 'River Siger' that originally fed Romano-British salt-production sites in the Somerset Levels (sites shown in orange) (Brunning, 2006: 19) ................................................................................................................................. 352
Figure 6.5 Map showing the location of River Huntspill ............................................................. 354
Figure 6.6 Map showing the main location of sites exposed by the River Huntspill ................................................................. 357
Figure 6.7 Left: Photographs and sketch plan of Site 166 (Sketch: Brunning personal archive), (Brunning 2006: photographs: 20-21) ................................................................................................................................. 358
Figure 6.8 Map showing the location of Fields 1-3 in relation to each other and known sites ................................................................................................................................. 363
Figure 6.9 Scheduled mound (SAM 429: Site 154) next to ‘Field 1’ facing north-east (Neil Tinkley: 2008) ................................................................................................................................. 365
Figure 6.10 View across the centre of the mound of Site 126 in Field 3 showing an open area being troweled to the left of the photograph centre (Author: 2008) ................................................................................................................................. 366
Figure 6.11 View of Field 3 facing south-west, showing the tree growing through the mound of Site 103 on the top left (Author: 2008) ................................................................................................................................. 368
Figure 6.12 View of Test Pit 3 at Site 295 fully excavated (west facing), note the rich dark peat which provided an excellent source of fuel and the thick
layer of briquetage (Author: 2008) ................................................................. 369
Figure 6.13 Test Pit 6 fully sectioned showing spade marks and peat cutting at its base (Author: 2008) ................................................................. 370
Figure 6.14 Geologocal map showing superficial geology and the bias of sites identified outside the areas covered by post-4th century A.D. alluvium. Arrows show the potential original extent of site distribution ......................................................... 373
Figure 6.15 Left: Clay briquetage 'slabs' with knife cuts and organic matter impressions, found in Test Pit 2 Right: 'Hobnail' slab from Site 295 (Test Pit 2), (Author: 2009) ................................................................. 376
Figure 6.16 Illustration showing a scenario for forming clay slabs with hobnail impressions as found in Test Pit 2 ................................................................. 377
Figure 6.17 a: Briquetage stabiliser (Type 1: Pinch-Prop) from Test Pit 2 with damaged side b: Reconstruction of stabiliser and the probable conjectured thickness of the containers it was adhered to (Author: 2009) ................................................................. 378
Figure 6.18 Four fragments of a briquetage support bar from Test Pit 2 at Site 295 (Author: 2009) ................................................................. 380
Figure 6.19 1: Bars from Site 125 (Author: 2008); 2 Bar from Site 166 (not to scale), (Percival 2005); 3: Large robust bars lying within the River Huntspill, eroded from nearby debris mounds (Author: 2008) 4: Bar from Stanford Wharf Essex Red Hill (Biddulph et al. 2012: Plates: Figure 8.3) (not to scale)... 381
Figure 6.20 Examples of fire-bars found within the fieldwork area in and around Site 126 (Author: 2009) ................................................................. 382
Figure 6.21 Fragment of vitrified fire-bar excavated from Site 126 (Author: 2009) ................................................................. 383
Figure 6.22 Left to right: Vitrified clay lumps from Site 126; a vitrified lump with a curved base (inferring formation on a curved surface) and drip formation on the lower half (Author: 2009) ................................................................. 383
Figure 6.23 Fuel ash slag from Rivenhall, Essex (Bayley et al., 2001: 21) ................................................................. 384
Figure 6.24 Selection of Romano-British pottery sherds from Field 1, Test Pit 2, including a jug handle (Author: 2009) ................................................................. 385
Figure 6.25 Field 1 with newly discovered mound ................................................................. 391
Figure 6.26 Round pedestal (Type 5) from Site 166 (not to scale), (Percival 2005: Figure 3) ................................................................. 395
Figure 6.27 Basic typology and chronology of pedestals in Somerset (coloured forms present only) ................................................................. 396
Figure 6.28 Left: Briquetage from a 2nd-3rd century AD salt-production site in East Huntspill (Site 198), (Not to scale), (Leech et al. 1983: 76) Right: Large multi-faceted pedestal from the 1st century AD site at St George's, North Somerset (Author:2006) ................................................................. 397
Figure 6.29 Chronology and basic typology of bars in Somerset (coloured forms present only) ................................................................. 399
Figure 6.30 'Hobnail' slab from Huntspill Site 166 (not to scale), (Percival 2005: Figure 12) ................................................................. 400
Figure 6.31 Small fragment of possible briquetage container from Site 166 (not to scale), (Percival 2005: Figure 1) ................................................................. 402
Figure 6.32 Simple reconstruction showing how the larger pedestals at Site
239 could have supported much larger lead pans (in comparison to clay containers) .................................................................................................................. 403
Figure 6.33 Basic typology and chronology of containers in Somerset (coloured forms present only) ........................................................................................................ 404
Figure 6.34 Small-scale reconstruction of a raised hearth in Somerset (Brunning, 2006: 20) ................................................................................................................... 407
Figure 6.35 Lead brine-evaporation container from Shavington, Cheshire discovered in 1998 (Nevell and Fielding, 2005: 44) ...................................................... 409
Figure 6.36 Top: Selection of main briquetage support forms used in c.1st century A.D salt-production at Middlewich, Cheshire (Bestwick, 1974: 68) Bottom: Briquetage supports also from Middlewich (large squared pedestal to the left) (Nevell and Fielding, 2005: 29) ................................................................. 411
Figure 6.37 Map showing the location of Sites 107, 108, 110, 115, 166 and 198........................................................................................................................................ 413
Figure 6.38 Section drawing of the mound at Site 108, exposed by the River Huntspill Left: (Grove and Brunning 1998: 64) Right: (Author: 2008) ......................... 419
Figure 6.39 Section of Site 104 (as exposed by the River Huntspill), (Grove, 1996) ........................................................................................................................................ 420
Figure 6.40 Somerset Working Area A based upon Site 166........................................ 423
Figure 6.41 Hearth from Site 166 within the debris mound, resting on natural peat............................................................................................................................... 424
Figure 6.42 Reconstruction of Site 166 showing a different working area layout compared to the reconstruction of a Red Hill in Essex in Figure 6.35 (Brunning 2006: 21) ........................................................................................................................................ 425
Figure 6.43 Scenarios for mound formation in the Central Somerset Levels (Group 3) ........................................................................................................................................ 426
Figure 6.44 Scenario 1a for Site and Waste Management for salt-production in the Central Somerset Levels. Grey shaded area represents the ‘Whole Site’ .... 428
Figure 6.45 Scenario 1b for Site and Waste Management for salt-production in the Central Somerset Levels. Dark grey shaded area represents the ‘Single site specific space’. Lighter grey shaded areas represent ‘Shared space used by several working areas’ ........................................................................................................ 429
Figure 6.46 Scenario 2a for Site and Waste Management for salt-production in the Central Somerset Levels. Grey shaded area represents the ‘Whole Site’ 430
Figure 6.47 Scenario 2b for Site and Waste Management for salt-production in the Central Somerset Levels. Dark grey shaded area represents the ‘Single site specific space’. Lighter grey shaded areas represent ‘Shared space used by several working areas’ ......................................................................................... 431
Figure 6.48 Middle Iron Age Red Hill 9504, Stanford Wharf, Essex (Biddulph et al., 2012: 68) .................................................................................................................. 432
Figure 6.49 Early Romano-British Red Hill at Osea Road, Essex (simplified to show tip lines) (Adapted from Fawn et al., 1990: 32) ............................................ 432
Figure 6.50 A reconstruction of a typical Late Roman salt-production site at Stanford Wharf, Essex (on an earthwork platform as opposed to a Red Hill), (Adapted from Biddulph et al. 2012: 161) .................................................................................................................. 436
Figure 6.51 Reinterpreted of Site Types for Somerset and North Somerset
based upon probable larger quantities of ‘Mound Associated Briquetage’........437
Figure 6.52 Reinterpreted of Site Types for Somerset and North Somerset
based upon probable larger quantities of ‘Actual Site’ in Group 3 .................438
Figure 6.53 Sites in Central and North Somerset with reinterpreted dating .......439
Figure 7.1 Group of Late Iron Age salt producing ‘furnaces’ at Marsal ‘Pransieu’, Seille region, France (Olivier and Kovacik, 2006: 563)..................478
Figure 7.2 Selection of ‘hand-bricks’ from Lincolnshire and France (Adapted from De Brisay, 1981: 33) A selection of ‘hand-brick’ pedestals (Type 2) found at Site 213 at Hamworthy, Poole Harbour, Dorset (Author: 2004) ..................482
Figure 7.3 Rectangular deep cut hearth with associated clay pit (and probable open hearth) at Site 213, Hamworthy, Dorset (Terrain Archaeology Site Archive: 2004) Right: Site 215, Poole, Dorset (Poole Museum Site Archive: 2004)..................................................................................................................484
Figure 7.4 Example of a c.1st century B.C salt-production ‘workshop’ in France (L’atelier de Landrellec), (Daire, 2003: 83).................................488
Figure 7.5 Left: Plan of the salt producing ‘workshop’ at Enez Vihan, France
Right: Central stone-lined rectangular hearth within the workshop
(Daire, 2003: 84-85)..........................................................................................489
Figure 7.6 Comparison of settling tanks in Essex, Kent, Norfolk and France
(Biddulph et al., 2012: 162)..............................................................................490
Figure 7.7 Kent Working Areas with multiple grouped water management
tanks (Kent Working Areas C, F and G)..........................................................492
Figure 7.8 Left: Early Romano-British combined tanks at Site 61 (Kent Working
Area C), (Ian Jackson personal archives) Middle: Late Romano-British
combined tanks from Stanford Wharf, Essex (Biddulph et al. 2012: 134) Right:
Late Romano-British combined hearth from Middleton, Norfolk (Lane and
Morris 2001: 175))..........................................................................................492
Figure 7.9 Left: c.1st century AD salt-production workshop, post-excavation
at Ebihens, France (Daire 2003: 38) Right: Reconstruction of the same
workshop (Daire 2003: 145)..............................................................................498
Figure 7.10 A: Late Iron Age/Early Romano-British hearth at Site 229, Dorset
(Cox and Hearne 1991: 38) B: Late Romano-British hearth from Site 30,
Kent (Miles 2004: 29)......................................................................................500
Figure 7.11 (ctd from 7.14) C-E: Late Romano-British hearths from
contemporary salt-production working areas on the same site, Stanford
Wharf, Essex (Biddulph et al. 2012: 115, 126 and 142) F: Late Romano-
British narrow hearth from Middleton, Norfolk..............................................502
Figure 7.12 Narrow hearth with a complete arch leading into a stokehole at
Middleton, Norfolk (Lane and Morris, 2001: 174)...........................................503
Figure 7.13 Left: Triangular wedges from Stanford Wharf, Essex (Poole, 2012:
Plates: Figure 8.5) Right: Reconstruction of wedges embedded within a deep
narrow salt-production hearth at Peldon, Essex (De Brisay, 1978: 46).............505
Figure 7.14 Reconstruction of the narrow hearth at Site 229 (Corfe River,
Poole Harbour) in use for salt-production (Hearne and Cox, 1991: 17)..........506
Figure 7.15 Round briquetage pedestal bases found in-situ within hearth
lining on either side of the Phase 1 salt-production hearth at Middleton,
Norfolk (Lane and Morris, 2001: 172)

Figure 7.16 Potential relationships between the new modes of salt-production...

Figure 7.17 Light wooden structures used in salt-production sites associated with brine springs, in Mexico. Left: Abandoned during most of the year Right: Site cleaned/repairs before the new season of salt-production (Contreras, 2011: 52)

Figure 7.18 Percentage of Salt-Production Modes represented within the Study Area.

Figure 7.19 Modes of salt-production in the study area plotted chronologically.

Figure 7.20 Modes of salt-production in the study area plotted chronologically (Simplified Chronology).

Figure 7.21 Modes of salt-production across Cornwall, Somerset, Dorset and Kent showing the dominance of Mode 2 in Kent and Dorset (with addition of Springhead, Kent and Crandon Bridge, Somerset and with Mode 4 shown as single sites (Somerset Mode 4=94 combined sites, Kent Mode 5=2 sites combined).

Figure 7.22 Modes of salt-production across Cornwall, Somerset, Dorset and Kent showing the variety of modes in Dorset and Kent (with addition of Springhead, Kent and Crandon Bridge, Somerset; Mode 4 shown as single sites (Somerset Mode 4=94 combined sites, Kent Mode 5=2 combined sites).

Figure 7.23 Modern salt-production in Moldavia, Romania. Brine is transported away from a spring and is heated using a metal cauldron over a simple surface hearth to crystallise salt (Alexianu et al., 2011: 14).

Figure 7.24 Dorset Working Areas A-C, from Site 228 at Furzey Island, Dorset.

Figure 7.25 Distribution map showing finds of brick and tiles stamped with the insignia of the Classis Britannica (with position of Complex 1 added), (Adapted from Peacock, 1982: 145)

Figure 7.26 Tile-built ‘saltern hearth’ from Stanford Wharf, Essex (Biddulph et al., 2012: 128).

Figure 7.27 Site plan and finds distribution at Site 225, Ower, Dorset (Woodward, 1987: 47).

Figure 7.28 Traditional cheese made using brine from local salt springs in Moldavia, Romania (Alexianu et al., 2011: 13).

Figure 7.29 Hypothetical distribution of salt in Late Iron Age Britain (Lane and Morris, 2001: 400).

Figure 7.30 Distribution of Black Burnished Ware II from Kent and Essex (Millet, 2007: 167).

Figure 7.31 Reconstruction of the Somerset Levels during the Roman period showing the location of the trans-shipment port at Crandon Bridge and its proximity to the branches of the River Siger in the Brue Valley (Central Somerset Levels) feeding Complex 2 (Mode 4), (shown by dashed orange line) (Adapted from Rippon, 2008: 91).

Figure 7.32 Plan of ‘Property 4’ at Springhead, Kent (with emphasis boxes added), (Adapted from Andrews et al., 2011: 107).

Figure 7.33 Tank 16831 at ‘Property 4’, Springhead, Kent (Andrews et al, 2011: 107).
Figure 7.34 Possible Sub-Definitions for new Modes of Salt-Production ........582
Figure 7.35 Simple timeline of significant chronological trends/events for salt-
production in southern Britain ..........................................................587
Figure 7.36 Uses of salt, derived from ethnographic and historical literature (left:
traditional themes, right: practical uses) (Hathaway 2008: 51) ..................589
Figure 7.37 Symbolic acts associated with salt-production and
Consumption .......................................................................................591
Figure 7.38 Timeline showing main responses to change (as evidenced in salt-
production) during the 1st century BC-4th century AD (large yellow square shows
period covered by Roman Empire in Britain and the vertical dashed green line
shows the end of coastal salt-production in the study area) .....................612
Figure 7.39 Simplified mechanisms of 1st century BC-4th century AD Romano-
British salt-distribution and supply .......................................................621

List of Tables (Volume One)

Table 1.1 Key Themes in Chapter 1.0 ....................................................3
Table 1.2 Phasing and chronology referred to for the Iron Age and Romano-
British period of Britain ......................................................................5
Table 1.3 Three suggested key discoveries resulting from early salt
experimentation (Chapman et al., 2001: 10) ..........................................17
Table 1.4 Methods of exploiting and producing salt ................................21
Table 1.5 The three main components seawater (Gilman et al., 1998: 3) ....22
Table 1.6 Average percentage of solids in seawater (Briggs, 2008) ........23
Table 1.7 The natural order of salt evaporation (Rapp, 2002: 220) ...........23
Table 1.8 Events and associated feature types from a complete
salt-production site (Gilman et al., 1998: 12 and 16) ................ ..........36
Table 1.9 Status of prehistoric and Roman water management features
(Gilman et al., 1998: 12 and 16) ............................................................36
Table 1.10 Status of prehistoric and Roman artificial heating features
(Gilman et al., 1998: 12 and 16) ............................................................38
Table 1.11 Status of prehistoric and Roman debris mounds
(Gilman et al., 1998: 12 and 16) ............................................................39
Table 1.12 Status of prehistoric and Roman working areas and structures
features (Gilman et al., 1998: 12 and 16) ..............................................39
Table 2.1 Database Outcomes ............................................................72
Table 2.2 Interpretation Methodology sections ....................................74
Table 2.3 Main issues affecting the research outcome .........................75
Table 2.4 Key Characteristics: General and Detailed Feature Types .........78
Table 2.5 Key Characteristics: General Briquetage Forms ....................79
Table 3.1 Key Themes in Chapter 3.0 ..................................................84
Table 3.2 Total Site Type Categories recorded within the site database for
each site .............................................................................................98
Table 3.3 Main briquetage container forms found on Iron Age and Romano-
British salt-production sites in southern Britain ................................126
Table 7.14 Potential contenders for determining whether changes in 2nd century AD salt-production were due to a breakdown in mechanisms (negative) or deliberate re-organisation (positive)…………………………………………………………...629