Thesis presented to the University of Oxford for the degree of Doctor of Philosophy.

REGIONAL STUDIES IN THE SEDIMENTOLOGY, MINERALOGY & GEOCHEMISTRY OF THE PENARTH GROUP ("RHAETIC") OF BRITAIN.

VOL 2: FIGURES & PLATES.

D.G. Jones.

Linacre College & Department of Geology & Mineralogy, March, 1981.

LIST OF FIGURES.

LIST OF PLATES.

NOTE: The black and white chequered scale used on many of the ensuing plates is marked in 1 cm. divisions.

CHAPTER 1.

PLATE 1.7 Brecciated fabric produced by fluid-escape, Grey Marls, Blue Anchor, Somerset. (Photomicrograph, plane polarised light).

PLATE 1.8 Dark grey chaotic mudstone passing upwards into laminated siltstone/mudstone displaced by a "microfault", Grey Marls, Blue Anchor, Somerset.

PLATE 1.9 Desiccation cracks infilled with grey-green mudstone, Grey Marls, Lavernock Point, South Glamorgan.

PLATE 1.10 The Grey Marls at Blue Anchor Point, Somerset. The white bands are horizons of nodular gypsum whilst extensive conjugate gypsum veins cut across bedding.

PLATE 1.11 Nodular bedded gypsum and small gypsum veins. Grey Marls, Blue Anchor, Somerset.

PLATE 1.12 Nodular gypsum containing small pinkish quartz crystals, Grey Marls, Blue Anchor, Somerset.

PLATE 1.13 Nodular cavities ? after gypsum. Grey Marls, St. Audries' Bay, Somerset.

PLATE 1.14 Two light, irregular and nodular dolomitic beds in dark dolomitic mudstone, probably evaporitic replacements, Grey Marls, Blue Anchor, Somerset.

PLATE 1.15 Quartz laths after anhydrite, dolomitic band illustrated in plate 1.14 Grey Marls, Blue Anchor, Somerset. (Photomicrograph; plane polarised light).

PLATE 1.16 Small, elongate anhydrite relict (centre of photograph) in coarse, sparry calcite, Grey Marls, Lavernock Point, South Glamorgan (Photomicrograph, plane polarised light).

PLATE 1.17 Gypsum laths in micritic matrix; Grey Marls, Lavernock Point, South Glamorgan (Photomicrograph, plane polarised light).

PLATE 1.18 Finely laminated dolomicrite/dolomitic microspar micro fabric, ? algal mat, Grey Marls, Blue Anchor, Somerset. (Photomicrograph, plane polarised light).

CHAPTER 2.

PLATE 2.1 Bioturbated Calcareous siltstone passing upwards into laminated siltstone/mudstone, Sully Member, Blue Anchor Somerset.

PLATE 2.2 Extensive *Diplocraterion* burrows, Sully Member, Blue Anchor, Somerset.

PLATE 2.3 *Rhizocorallium* burrows and *Protocardia* sp. casts, Sully Member, Blue Anchor, Somerset.

PLATE 2.4 *Arenicolites* burrows, Sully Member, Blue Anchor, Somerset.

PLATE 2.5 *Siphonites* burrows, Sully Member, Blue Anchor, Somerset.

CHAPTER 3.

PLATE 3.1 The Westbury Member at Blue Anchor, Somerset, a typical sequence of dark argillites with thin calcareous and arenaceous interbeds.

PLATE 3.2 Dark sediment from the basal Westbury Member infilling Diplocraterion burrows in the Tea Green Marls, Charton Bay Devon

PLATE 3.3 Wave ripples, Lower Unit of the Westbury Member, Westbury Garden Cliff, Gloucestershire. Two perpendicular sets can be seen which in places form an interference pattern.

PLATE 3.4 Tool marks, trails and a gutter cast on the base of a sandstone, Lower Unit, Westbury Member, Westbury Garden Cliff, Gloucestershire.

PLATE 3.5 Syntaxial quartz overgrowths in a sandstone, Lower Westbury Member, Blue Anchor, Somerset. (Photomicrograph, X-polars).

PLATE 3.6 Pyrite replacing other grains (mostly quartz) in a sandstone, Lower Unit, Westbury Member, Blue Anchor Somerset. (Photomicrograph, plane polarised light).

PLATE 3.7 Dark shales containing a limestone nodule (diagenetic) and a continuous limestone bed (primary depositional) Westbury Member, Blue Anchor, Somerset.

PLATE 3.8 Recrystallised bivalve shells containing dark areas of pseudo-pleochroic calcite revealing original shell structure, silty biomicrite, Westbury Member, Blue Anchor, Somerset. (Photomicrograph, plane, polarised light).

PLATE 3.9 Bone-beds 1: ripple cross-laminated sandstone with primarily fish teeth and scales. Westbury Member, Blue Anchor, Somerset.

PLATE 3.10 Bone-beds 2: bioclastic limestone with fish teeth scales and coprolites, St. Audries Bay, Somerset.

PLATE 3.11 Bone-beds 3: conglomeratic, micaceous sandstone with fish teeth, scales, coprolites and larger reptilian bone fragments, Westbury Member, Patchway, Avon.

PLATE 3.12 Bone-beds 4: the famous conglomeratic bone-bed from Aust Cliff, Avon containing clasts of Carboniferous and Triassic rocks, large bone fragments and coprolites in a sandy matrix containing fish teeth and scales.

PLATE 3.13 Two perpendicular, interfering sets of ripple marks, Upper Unit, Westbury Member, Harrogate House, nr. Northallerton, North Yorkshire.

PLATE 3.14 Oriented bivalves on the upper surface of a biosparritic limestone, Westbury Member, Blue Anchor, Somerset.

PLATE 3.15 Biosparrite composed primarily of bivalve shell fragments, Westbury Member, Lilstock, Somerset. (Photomicrograph, plane polarised light).

PLATE 3.16 Biomicsparrite, Westbury Member, Blue Anchor, Somerset.

PLATE 3.17 Biomicsparrite with bivalve and gastropod shell fragments, Westbury Member, Blue Anchor, Somerset. (Photomicrograph, plane polarised light).

PLATE 3.18 The Bridgend Member at Stormy Down, Mid-Glamorgan. The light rock in the lower part of the cutting is the Lower Sandstone.

PLATE 3.19 Typical photomicrograph of the Lower Sandstone, Bridgend Member, Stormy Down. Interlocking grains and some quartz overgrowths (x-polars).

PLATE 3.20 Tabular cross-bedding, Lower Sandstone Bridgend Member Stormy Down, Mid-Glamorgan.

PLATE 3.21 Cast of interference ripples, Lower Sandstone, Bridgend Member, Stormy Down, Mid-Glamorgan.

PLATE 3.22 Large wood fragments, Lower Sandstone, Bridgend Member, Stormy Down, Mid-Glamorgan.

PLATE 3.23 Diplocraterion burrows at the top of the Lower Sandstone, Bridgend Member, Stormy Down, Mid-Glamorgan.

PLATE 3.24 The boundary of the Lower Sandstone and Inter-sand Mudstones, Bridgend Member, Stormy Down, Mid-Glamorgan. Note: extensive Skolithos burrows at the top of the Lower Sandstone (left end of scale in cm.)

PLATE 3.25 The Inter-sand Mudstones, Bridgend Member, Stormy Down, Mid-Glamorgan. A fine interlamination of the mudstones with siltstones is visible near the hammer.

PLATE 3.26 Flaggy appearance of the Upper Sandstone, Bridgend Member, Stormy Down, Mid-Glamorgan,

PLATE 3.27 Photomicrograph of typical Upper Sandstone, Bridgend Member, Stormy Down, Mid-Glamorgan: c.f. to plate 3.19 (plane polarised light).

PLATE 3.28 Argillaceous sandstone with Teichichnus burrows, Gribun Member, Allt na Teangaidh, Mull.

PLATE 3.29 Contorted silty sandstone, overlain by pebbly sandstone. Gribun Member, Monadh Dubh, Rhum.

PLATE 3.30 Sandy limestone with abundant carbonised wood fragments, Gribun Member, Monadh Dubh, Rhum.

PLATE 3.31 Ripple cross-laminated fine sandstone with mudstone drapes, Gribun Member, Monadh Dubh, Rhum.

PLATE 3.32 Conglomerates with thin intercalated mudstones of the Hapford Member (horizontally bedded) lying unconformably on steeply dipping Carboniferous limestone (hammer on contact) Hapsford Bridge, Somerset.

PLATE 3.33 Conglomerate containing Carboniferous limestone clasts, Hapsford Member, Hapsford Bridge, Somerset.

PLATE 3.34 Heavily bored clast of Carboniferous limestone, Hapsford Member, Hapsford Bridge, Somerset.

PLATE 3.35 Conglomerate composed of well-rounded Carboniferous limestone clasts cemented by sparry, "dog tooth", calcite, Hapsford Member, Butcombe, Somerset.

PLATE 3.36 Photomicrograph of tightly cemented sandstone with syntaxial overgrowths on quartz and Feldspar grains. Westbury Member, Treguff, South Glamorgan. (X-polars).

PLATE 3.37 Photomicrograph of sandstone cemented by sparry Ferroan calcite (cf. plate 3.36). Westbury Member Treguff, South Glamorgan. (plane polarised light).

CHAPTER 4.

PLATE 4.1 Polished surface of typical Cotham Member lithology Blue Anchor Somerset: calcareous mudstone with thin lenticular siltstones. The bioturbation in this specimen is unusual.

PLATE 4.2 Oscillation-rippled calcareous siltstone with abundant bioturbation, Cotham Member, Lavernock Point, South Glamorgan.

PLATE 4.3 Flat-topped ripple marks and desiccation cracks, Cotham Member, Lavernock Point, South Glamorgan. (The small pits are probably weathering features).

PLATE 4.4 Deep desiccation crack, Cotham Member, Lavernock Point, South Glamorgan.

PLATE 4.5 Deep desiccation crack, penetrating down into dark shales of the Westbury Member, Cotham Member. St. Mary's Well Bay, South Glamorgan.

PLATE 4.6 Horizontal surface displaying large desiccation polygons, Cotham Member, Lavernock Point, South Glamorgan

PLATE 4.7 Rippled sandstone showing well developed small desiccation polygons, Cotham Member, St. Mary's Well Bay, South Glamorgan.

PLATE 4.8 Oolitic limestone; the ooids nucleated on recrystallised bivalve shell fragments, Cotham Member, Culverhole, Devon. (photomicrograph, X- polars).

PLATE 4.9 Polished surface of Cotham Marble, Cotham Member, Patchway, Avon.

PLATE 4.10 Microfabric of Cotham Marble; the "hedge" and "tree" zones of Hamilton (1961) can be discerned. (Photomicrograph, plane polarised light).

PLATE 4.11 "Crazy" Cotham Marble, Culverhole, Devon.

PLATE 4.12 Pustular upper surface of the "Estheria Bed", Wainlode Cliff, Gloucestershire Internally these features display arborescent growths comparable to those of the Cotham Marble.

PLATE 4.13 Contorted lamination, Cotham Member, St. Audrie's Bay, Somerset.

PLATE 4.14 Detail of plate 4.13

PLATE 4.15 Contorted lamination, Cotham Member, Lilstock, Somerset.

PLATE 4.16 Contorted lamination preserved in an early diagenetic nodular limestone, Cotham Member, Blue Hill, Nottinghamshir

PLATE 4.17 Contorted lamination preserved in an early diagenetic nodular limestone, Cotham Member, Bunny road cutting, Nottinghamshire.

PLATE 4.18 Carboniferous oosparrite clast in - "Rhaetic" conglomerate, Hapsford Bridge, Somerset

PLATE 4.19 Carboniferous crinoidal-bivalve-foraminiferal biosparrite clast in conglomerate, Hapsford Member, Hapsford Bridge, Somerset. (Photomicrograph, plane polarised light).

PLATE 4.20 Matrix of conglomerate composed principally of micrite -coated and micritic grains cemented by sparry calate, Hapsford Member, Hapsford Bridge, Somerset. (Photomicrograph, plane polarised light).

PLATE 4.21 Conglomerate matrix containing quartz, ooids, micrite-coated grains and peloids in sparry calcite cement. Hapsford Member, Hapsford Bridge, Somerset. (Photomicrograph, plane polarised light).

PLATE 4.22 Clast at left edge of photomicrograph with faint rim cement and major sparry calcite cementation. Darker areas in the spar reflect an iron zonation displayed by potassium ferricyanide staining. (plane polarised light).

PLATE 5.1 The Langport Member, Pinhay Bay, Devon. Note the prominent wavy-bedded matrix supported calcirudite near the top of the photograph.

PLATE 5.2 A thin gastropod/bivalve calcarenite bed in the predominantly micritic limestones of the Langport Member, Pinhay Bay, Devon.

PLATE 5.3 Typical microspar fabric of Langport Member Limestone, Pinhay Bay, Devon. (Photomicrograph, plane polarised light).

PLATE 5.4 Bivalve shell fragment mould infilled with microspar; a thin rim cement, not discernible here, is also present. Langport Member, Pinhay Bay, Devon. (Photomicrograph, plane polarised light).

PLATE 5.5 Pyrite rims voids which are infilled with sparry calcite, Langport Member, Lavernock Point, South Glamorgan. (Photomicrograph, plane polarised light).

PLATE 5.6 Voids filled with sparry calcite with pyrite as a later replacive infill. Langport Member, St. Mary's Well Bay, South Glamorgan. (Photomicrograph, plane polarised light).

PLATE 5.7 Echinoid Fragments with syntaxial sparry calcite overgrowths set in sparry ferroan calcite, Langport Member, Lavernock Point, South Glamorgan. (Photomicrograph plane polarised light).

PLATE 5.8 Syntaxial overgrowths on a bivalve and an echinoid fragment, Langport Member, Lavernock Point, South Glamorgan (photomicrograph, plane polarised light).

PLATE 5.9 An echinoid spine Fragment(at extinction) with surrounding overgrowth and later ferroan spar cement all in optical continuity, Langport Member, Lavernock Point, South Glamorgan. (Photomicrograph, x-polars).

PLATE 5.10 Oomicrite overlying micrite, Langport Member, St. Mary's Well Bay, South Glamorgan. Note darkened micrite nuclei to ooids. (Photomicrograph, plane polarised light).

PLATE 5.11 Inferred solution seams and flasers, Langport Member, Pinhay Bay, Devon.

PLATE 5.12 Slump bed bounded by undisturbed strata, Langport Member, Pinhay Bay, Devon.

PLATE 5.13 Mudstone-filled desiccation cracks, Langport Member, Lilstock, Somerset.

PLATE 5.14 Burrow-mottled limestone, Langport Member, Culverhole, Devon.

PLATE 5.15 Diplocraterion burrows with bleached haloes, Langport Member, Charton Bay, Devon.

PLATE 5.16 Thallasinoides burrows, Langport Member, Shepton Mallet Somerset.

PLATE 5.17 Spongeliomorpha and other burrows and borings, Langport Member, Pinhay Bay, Devon.

PLATE 5.18 Unidentified ? crustacean burrow in highly burrowed and bored limestone, Langport Member, Culverhole, Devon. The right hand wall of the burrow is penetrated by a boring.

PLATE 5.19 Spectacular Diplocraterion burrowing from the topmost Langport Member ("Sun Bed") Pinhay Bay, Devon.

PLATE 5.20 Trypanites clavatus borings infilled with dark Gault clay, Langport Member, Culverhole, Devon.

PLATE 5.21 The blocky calcareous siltstones and mudstones of the Watchet Member overlain by fissile Liassic shales and limestones, Lavernock Point, South Glamorgan.

PLATE 5.22 Concentration of Liostrea hisingeri and Modiolus hillanus in calcareous siltstones, Watchet, Member, Lavernock Point, South Glamorgan.

CHAPTER 6.

PLATE 6.1 The alternating limestone-argillite, Blue Lias, sequence at St. Audrie's Bay, Somerset.

PLATE 6.2 The Blue Lias at Lavernock Point, South Glamorgan.

PLATE 6.3 A laminated, bituminous shale from the Pre-planorbis Beds, St. Audrie's Bay, Somerset. (Photomicrograph, plane polarised light).

PLATE 6.4 Detail of plate 6.3 showing alternating organic-rich and quartz silt-rich laminations. (Photomicrograph, plane polarised light).

PLATE 6.5 Photomicrograph (plane polarised light) of a typical Blue Lias micritic limestone, Lavernock Point, South Glamorgan.

PLATE 6.6 A typical Blue Lias biomicrite containing bivalve, ostracod, foraminiferal and echinoderm fragments, Lavernock Point, South Glamorgan. (Photomicrograph, plane polarised light).

FIGURES

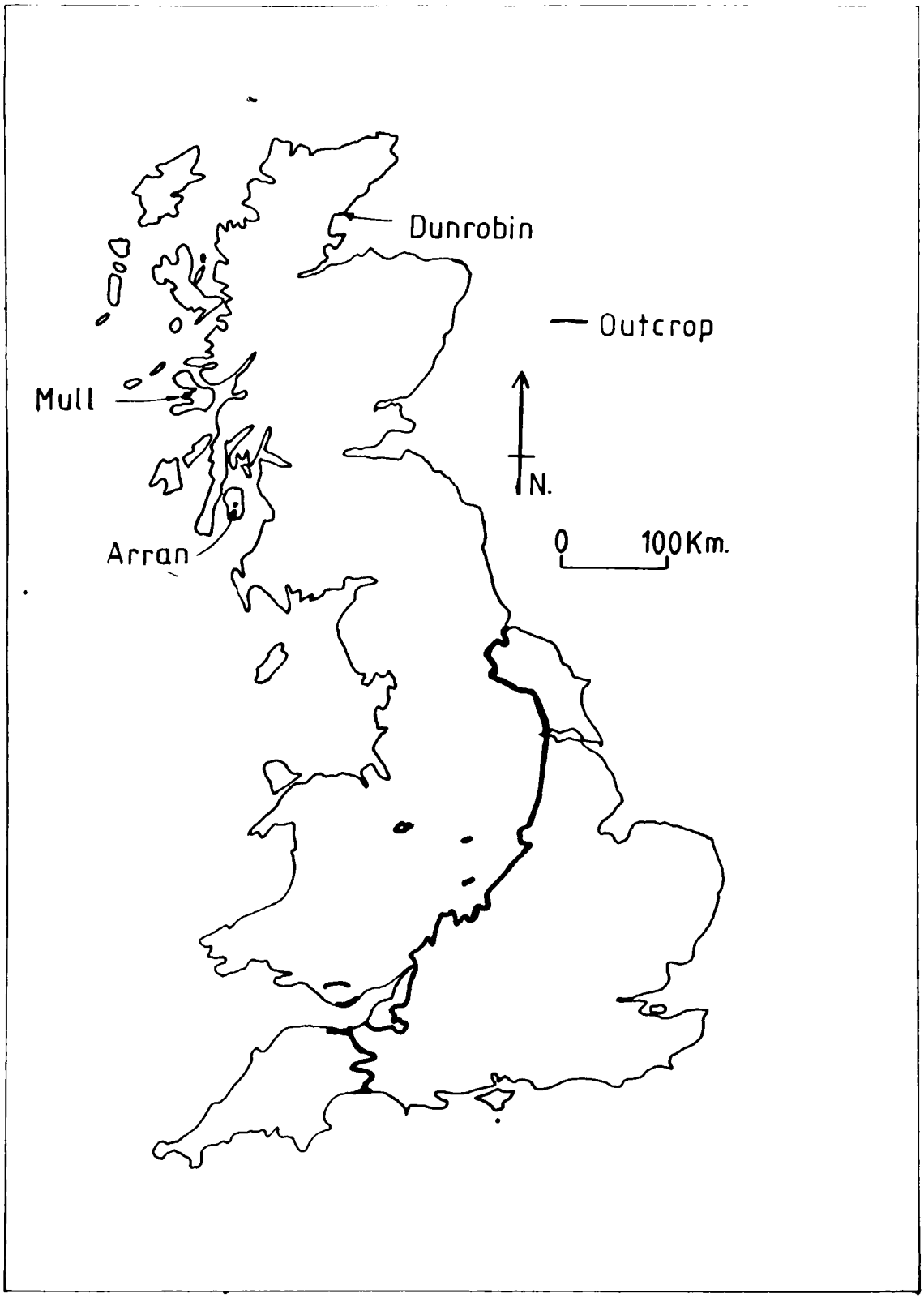


FIG. 0.1: OUTCROP OF THE PENARTH GROUP, GREAT BRITAIN (Modified after Orbell, 1973)

<table>
<tr><th>SYSTEM</th><th>STAGE</th><th>GROUP</th><th>FORMATION</th><th>M E M B E R</th></tr>
<tr><td>Jurassic</td><td>Hettangian</td><td colspan="3">Pre-planorbis Beds</td></tr>
<tr><td rowspan="4">Triassic</td><td rowspan="3">Rhaetian

(Rhaetic)</td><td rowspan="2">Penarth
Group</td><td>Lilstock Formation
(Upper Rhaetic)</td><td>Watchet Member (W. Beds)
Langport Member (L.Beds, White Lias)
Cotham Member (C. Beds)</td></tr>
<tr><td>Westbury Formation
(Lower Rhaetic)</td><td>Westbury Member (W. Beds)
Hapsford Member
~Gribun Member [N.W. Scotland]
~Bridgend Member [Mid Glamorgan]
Sully Member (S.Beds)</td></tr>
<tr><td>–?– ?– ?–?– Norian</td><td>Mercia Mudstone Group
(Keuper Marls)</td><td>Blue Anchor Formation
Red Marls</td><td>Grey Marls
Tea Green Marls</td></tr>
</table>

FIG. 0.2 : THE STRATIGRAPHY OF THE PENARTH GROUP (Old terminology in parentheses)

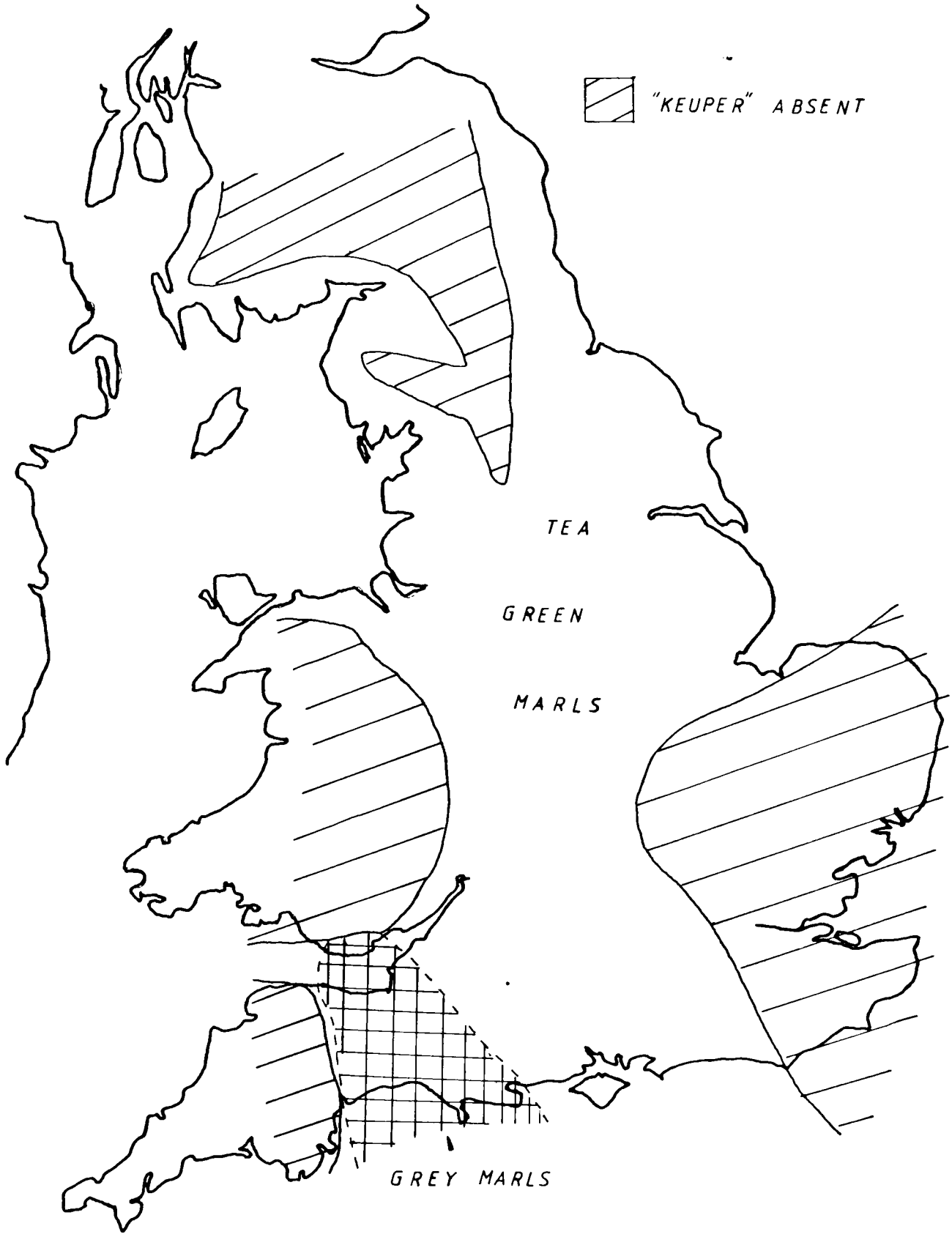
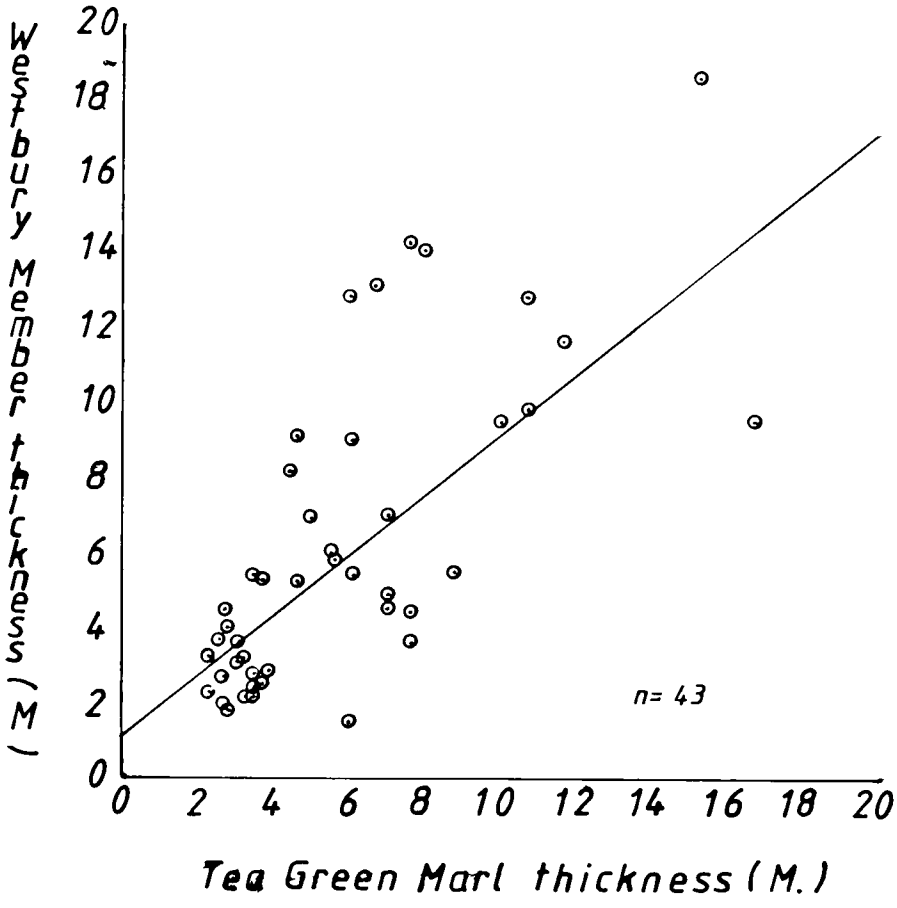
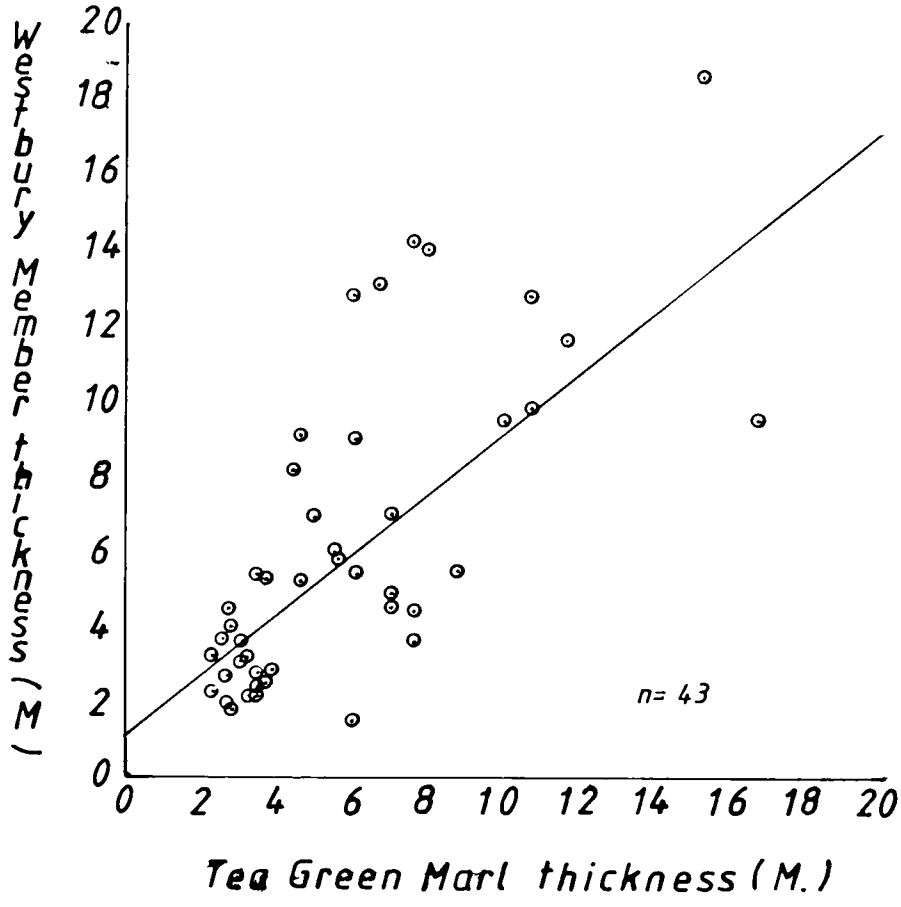


FIG. 1.1: DISTRIBUTION, GREY & TEA GREEN MARLS.



LINEAR REGRESSION DATA
y-intercept = 1·17
slope of line = 0·87
correlation coefficient = 0·70

FIG 1·2: GRAPH ILLUSTRATING THE CORRELATION BETWEEN WESTBURY MEMBER & TEA GREEN MARL THICKNESSES .



LINEAR REGRESSION DATA
y-intercept = 1·17
slope of line = 0·87
correlation coefficient = 0·70

FIG 1·2: GRAPH ILLUSTRATING THE CORRELATION BETWEEN WESTBURY MEMBER & TEA GREEN MARL THICKNESSES .

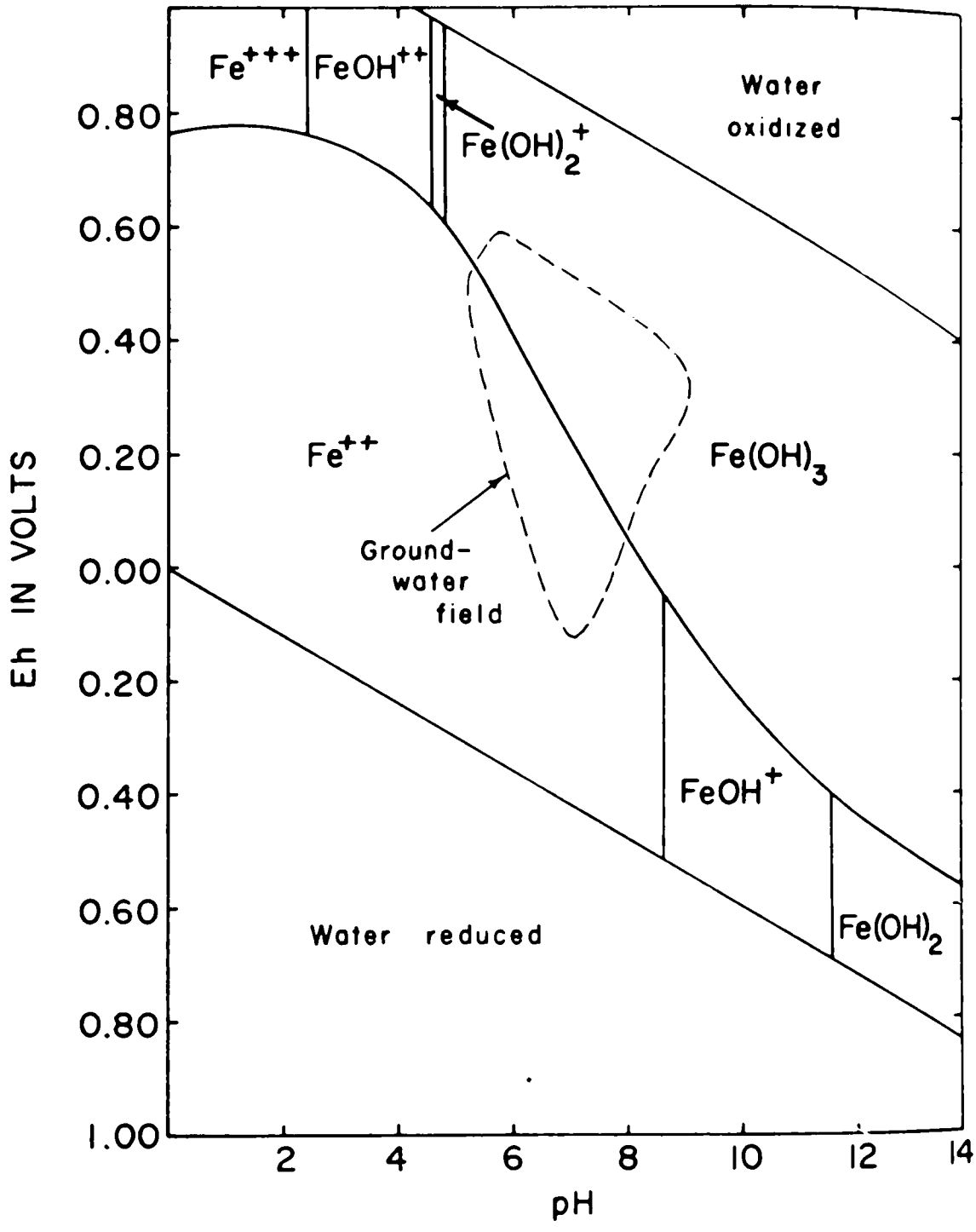


FIG. 1.3: IRON GEOCHEMISTRY IN RELATION TO THE Eh/pH OF PORE FLUIDS (After Walker, 1967)

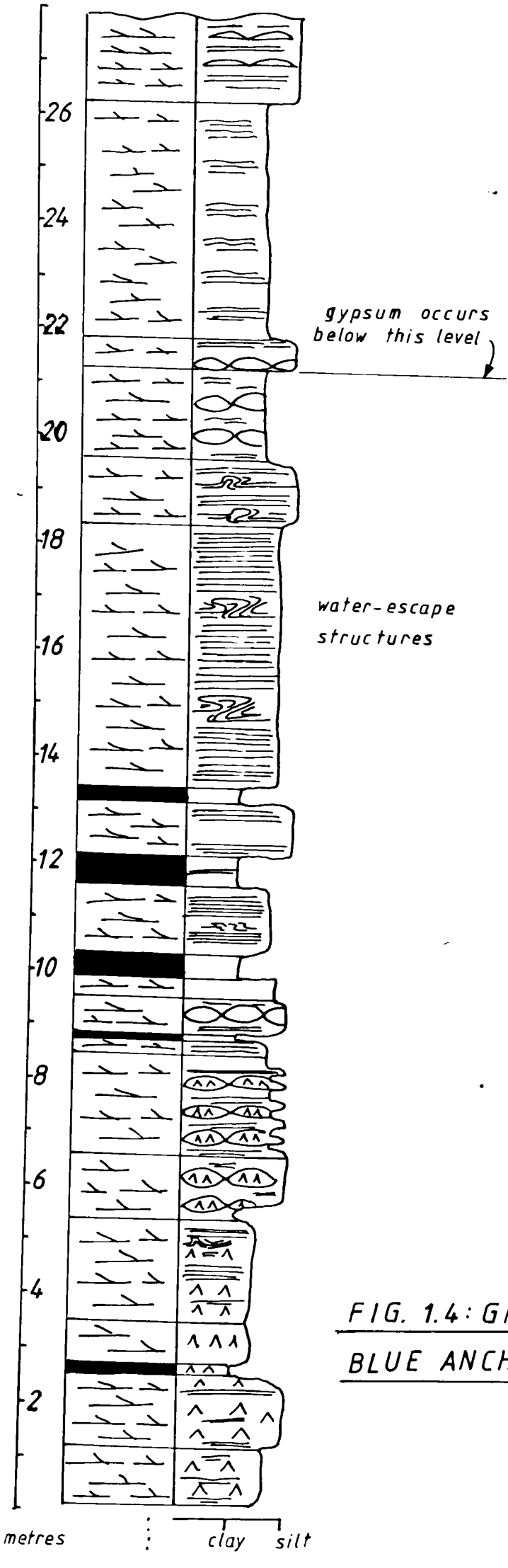


FIG. 1.4: GRAPHIC LOG, GREY MARLS BLUE ANCHOR, SOMERSET.

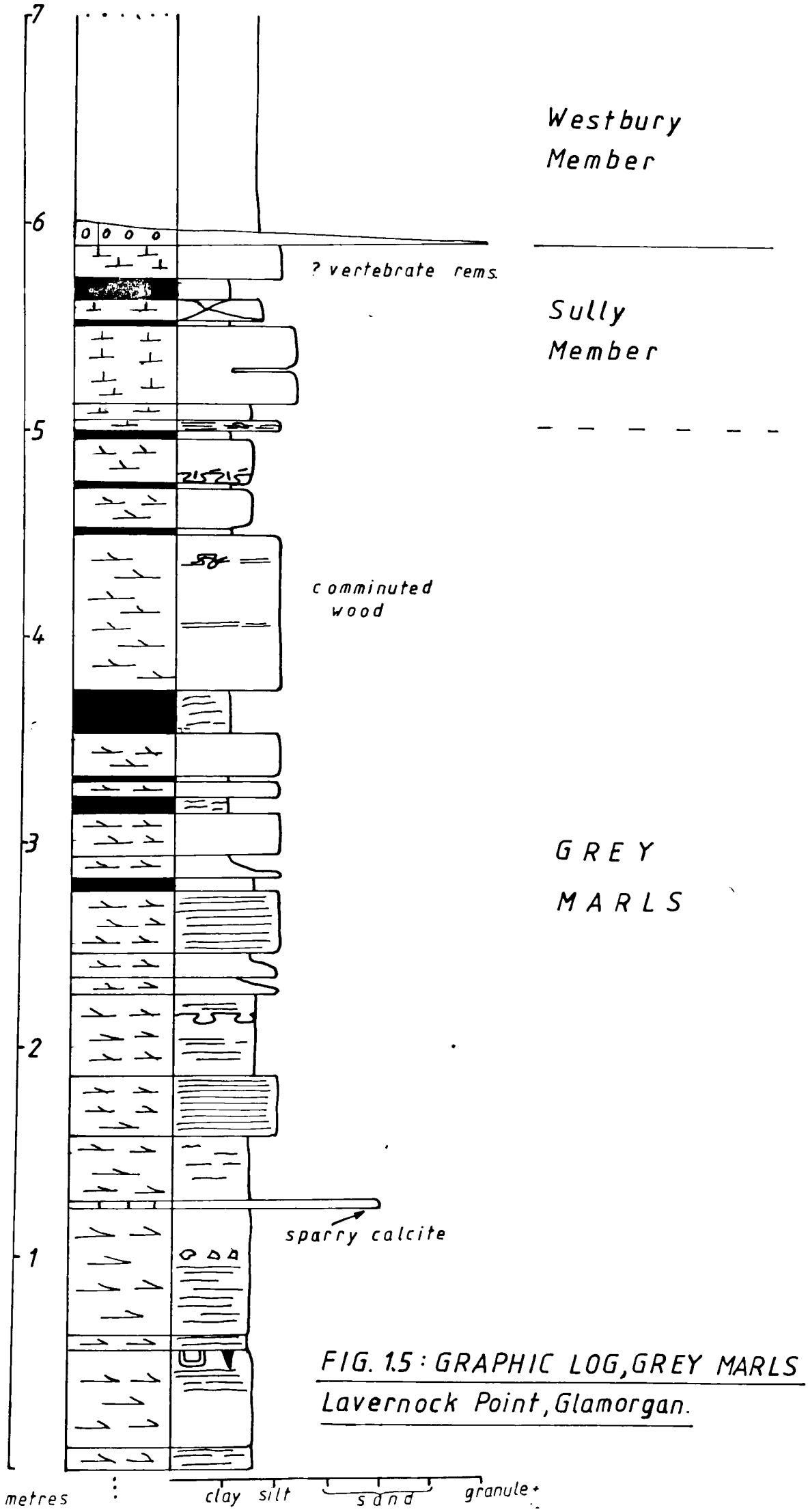


FIG. 1.5 : GRAPHIC LOG, GREY MARLS
Lavernock Point, Glamorgan.

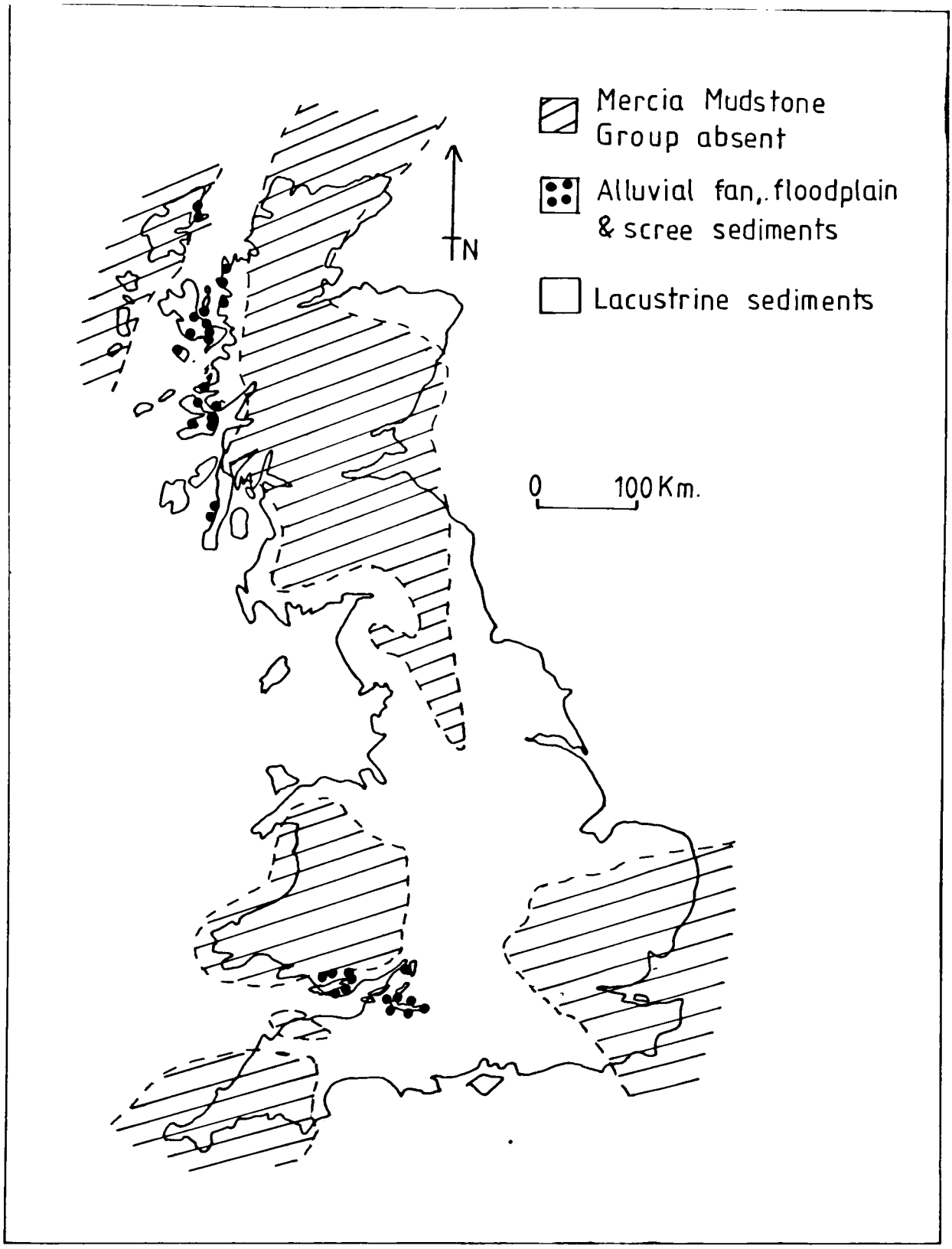


FIG. 1.6: PALAEOENVIRONMENTS, MERCIA MUDSTONE GROUP & PROBABLE LATERAL EQUIVALENTS

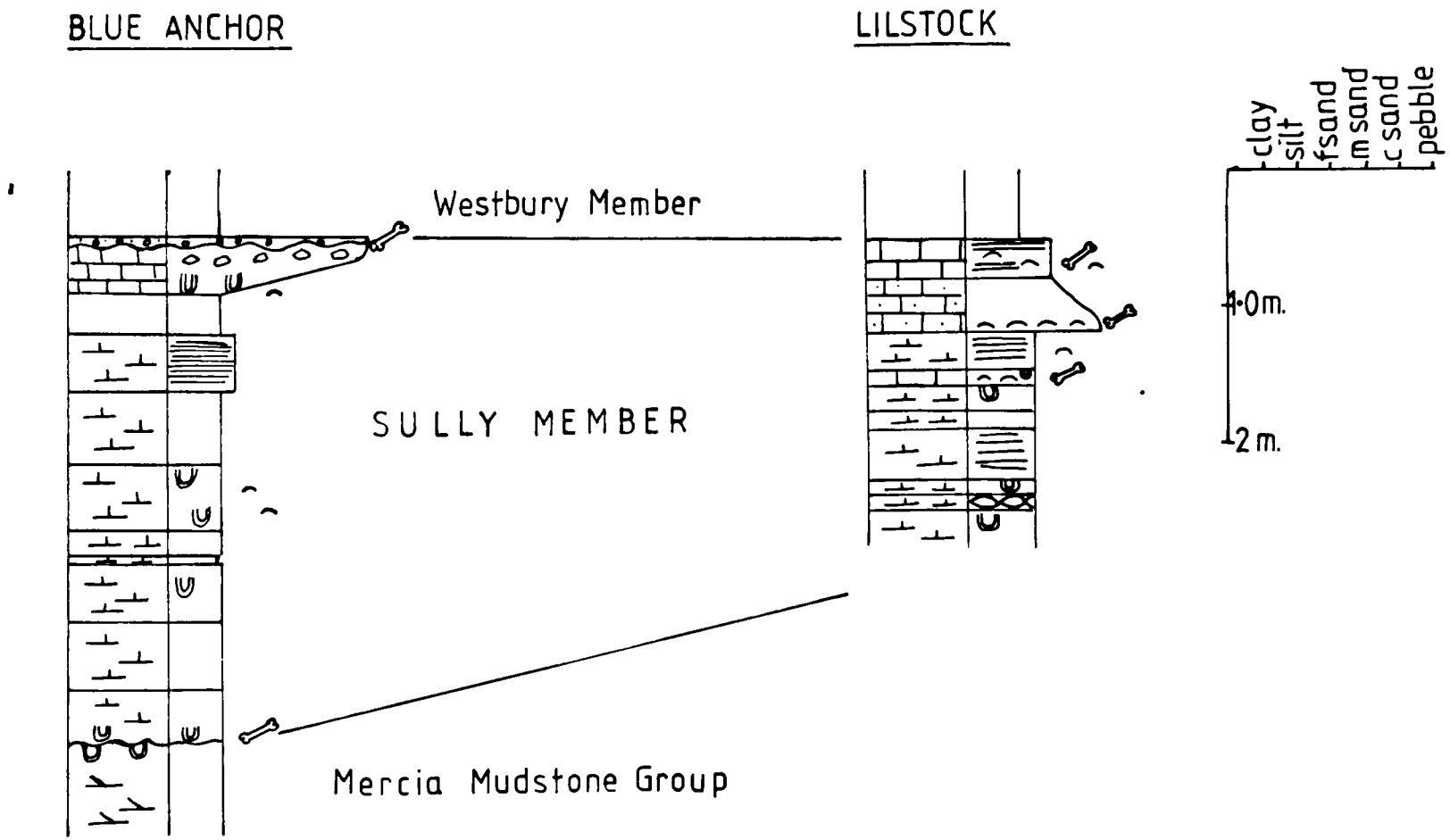


FIG. 2.1: GRAPHIC LOGS, SULLY MEMBER (See also fig. 1.5)

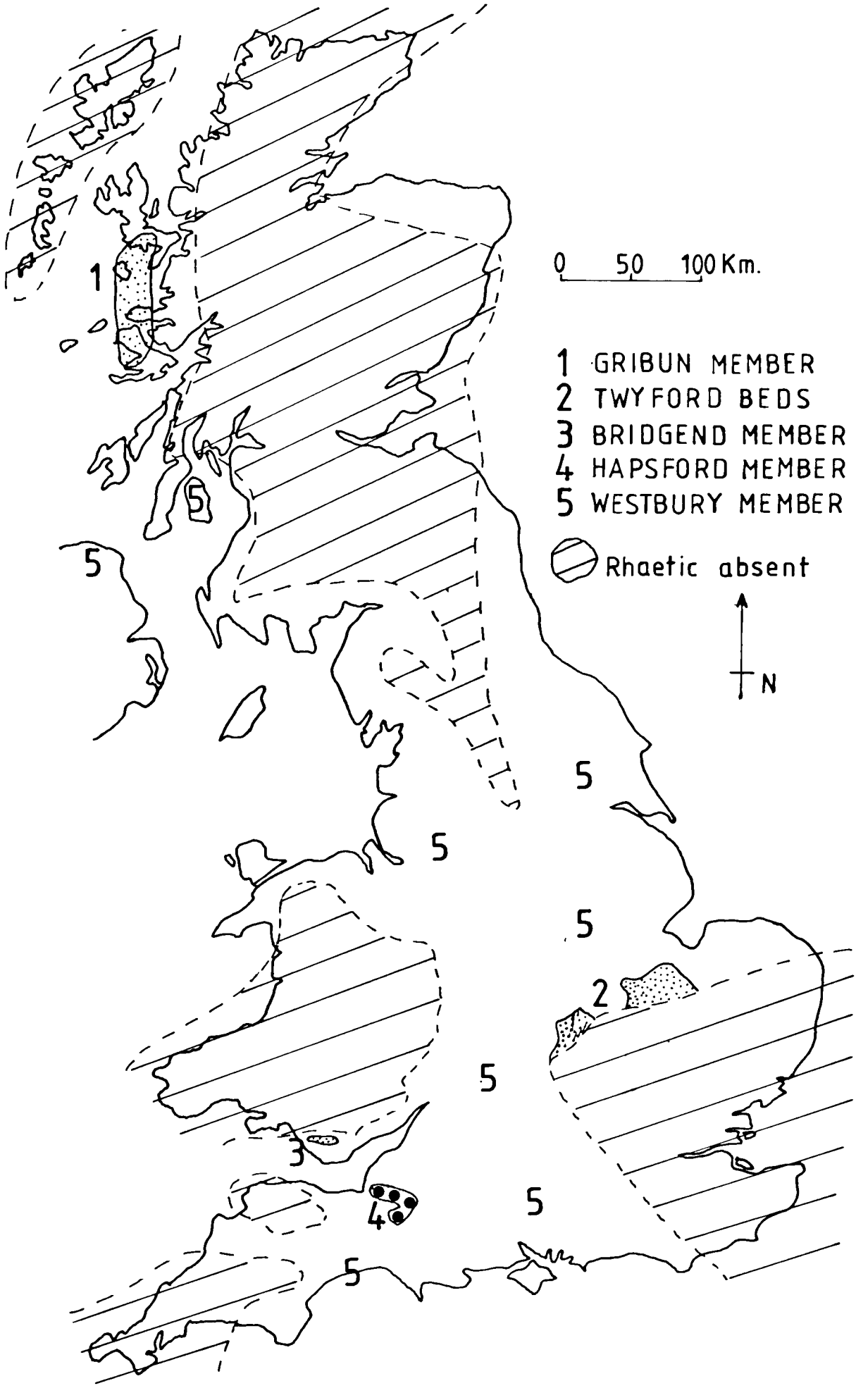


FIG. 3.1: DISTRIBUTION OF THE WESTBURY MEMBER & IT'S LATERAL EQUIVALENTS.

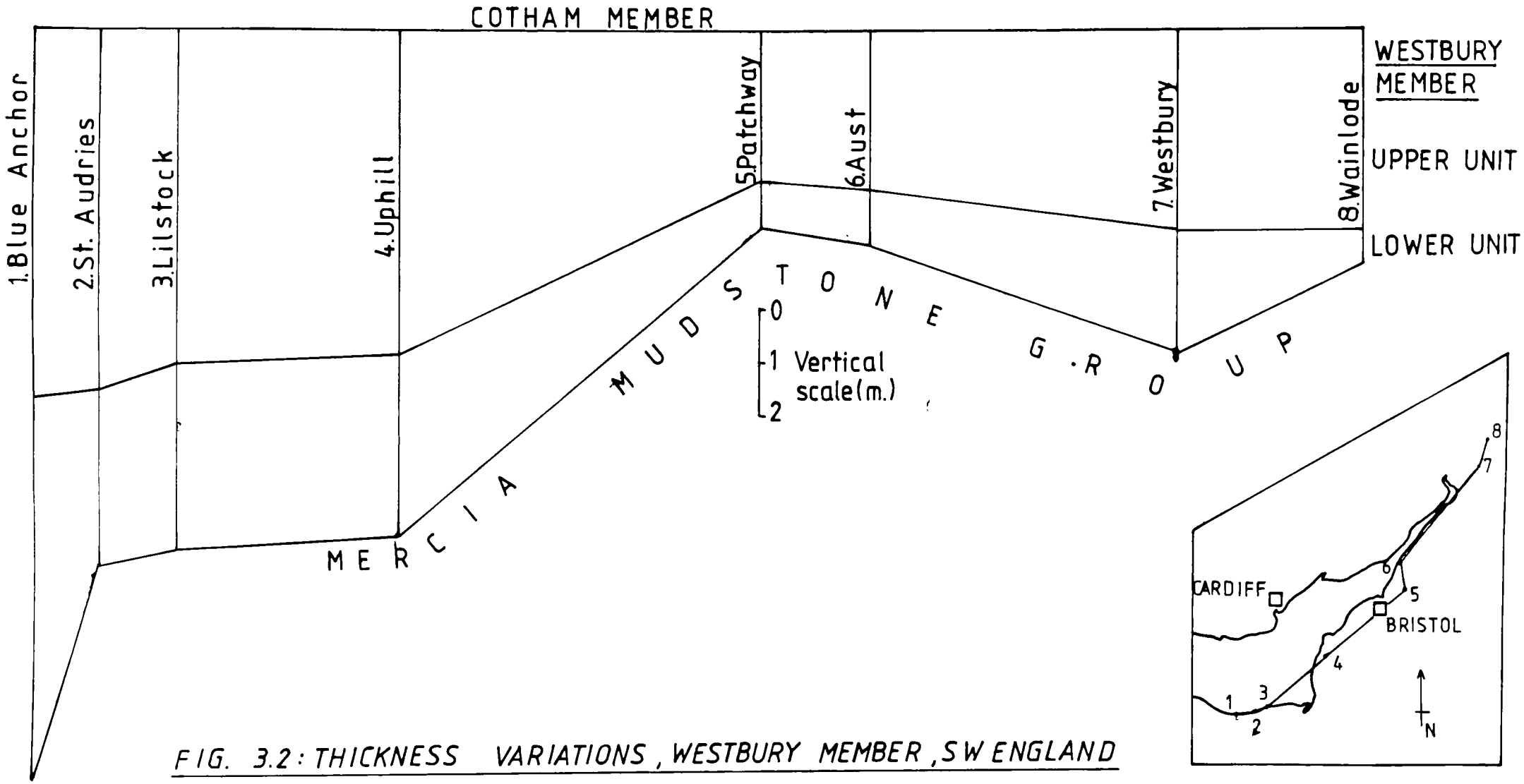


FIG. 3.2: THICKNESS VARIATIONS, WESTBURY MEMBER, SW ENGLAND

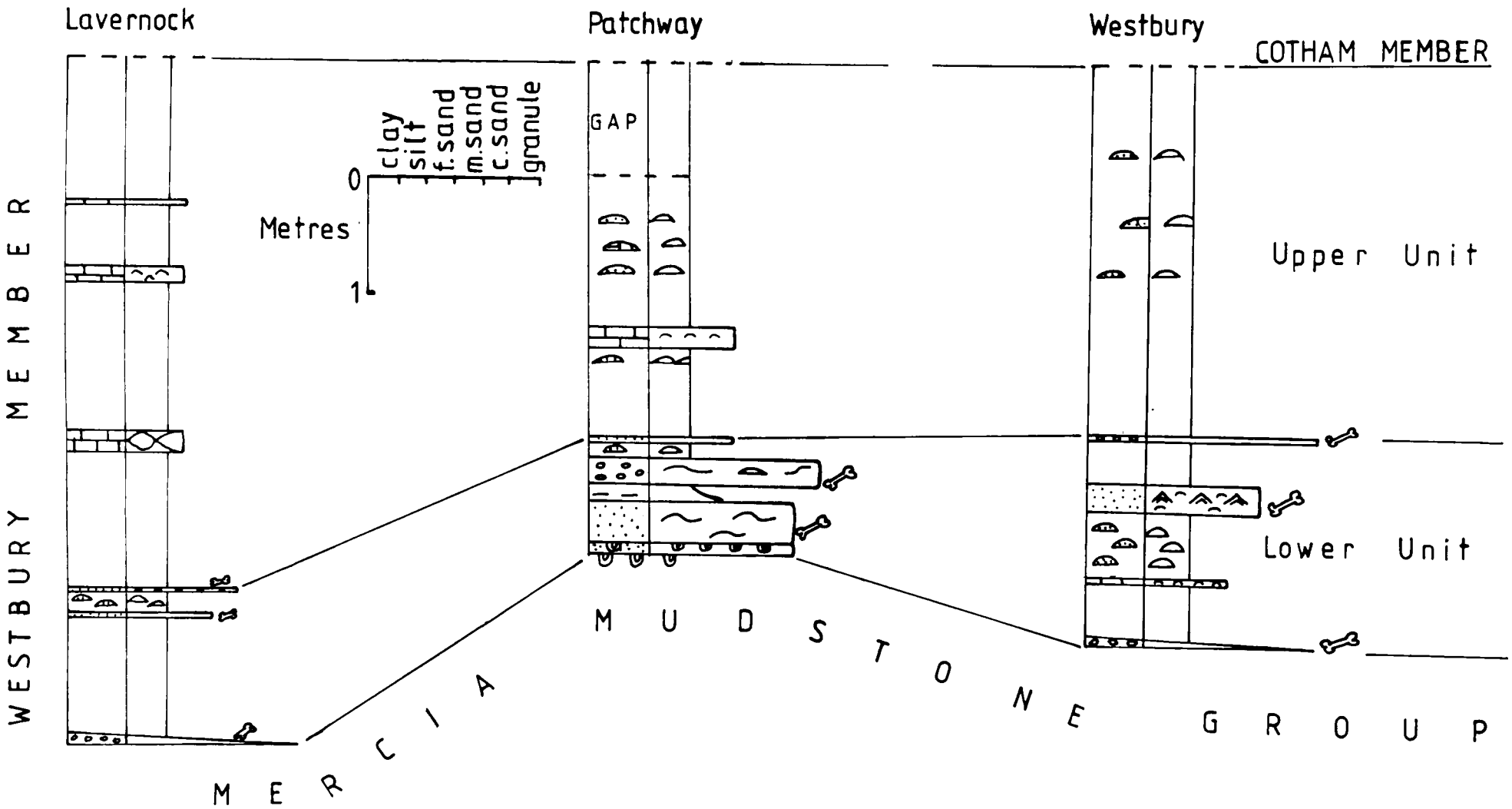


FIG. 3.3 : REPRESENTATIVE VERTICAL SECTIONS, WESTBURY MEMBER

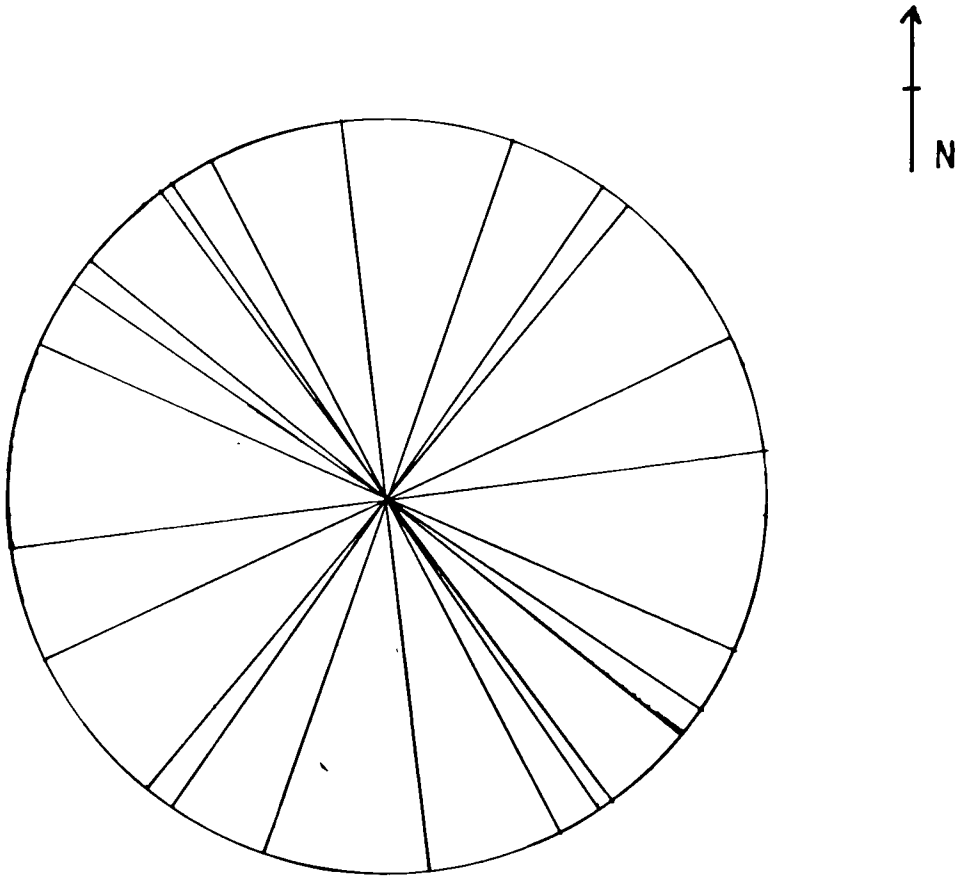
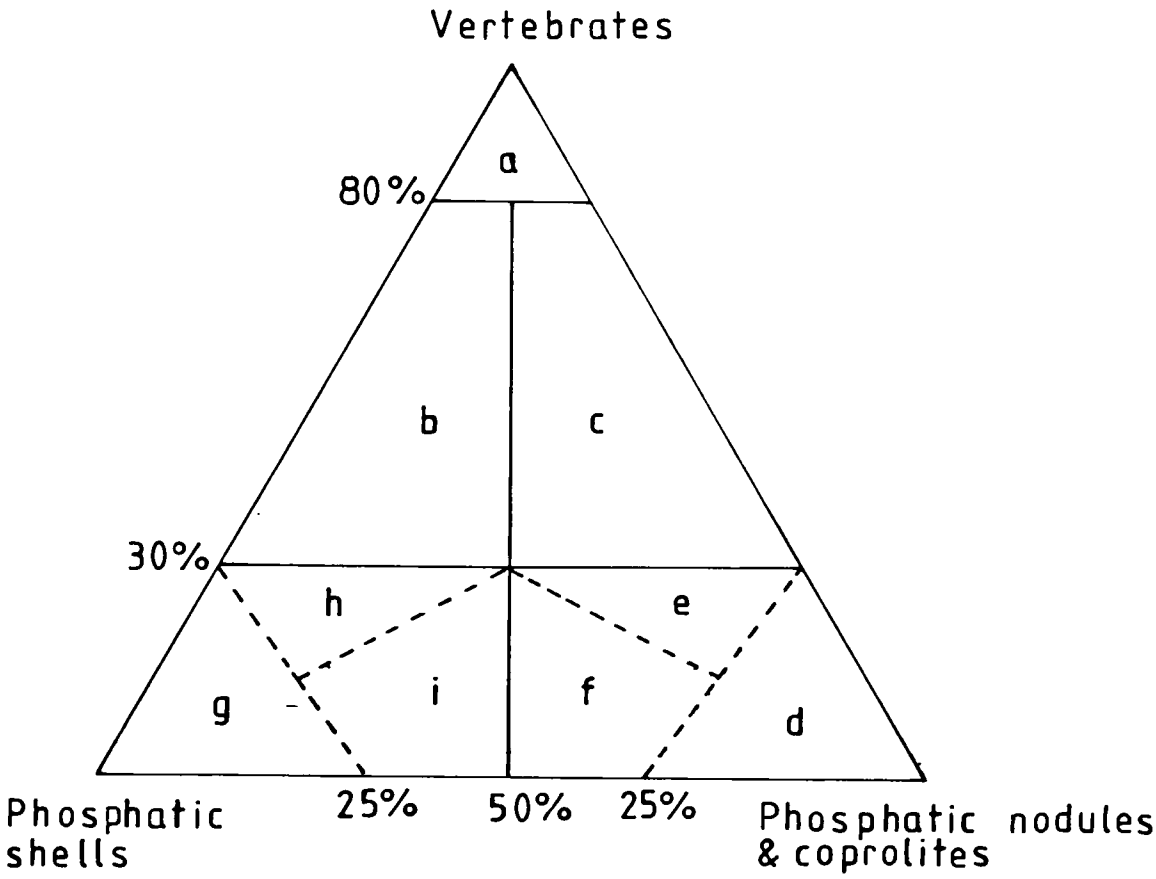


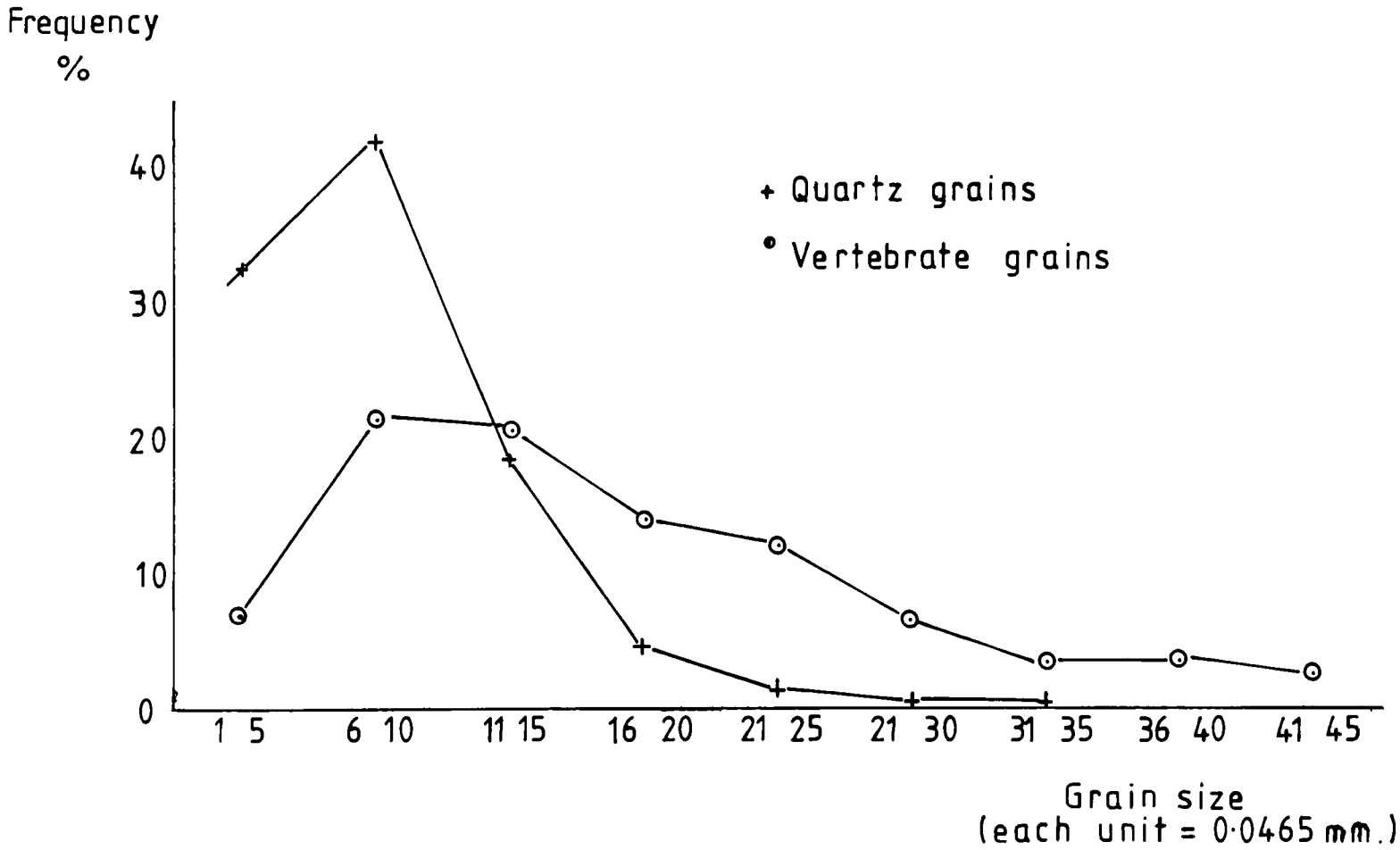
FIG. 3.4 : OSCILLATION-RIPPLE CREST ORIENTATIONS, WESTBURY MEMBER, SOMERSET & SOUTH WALES.

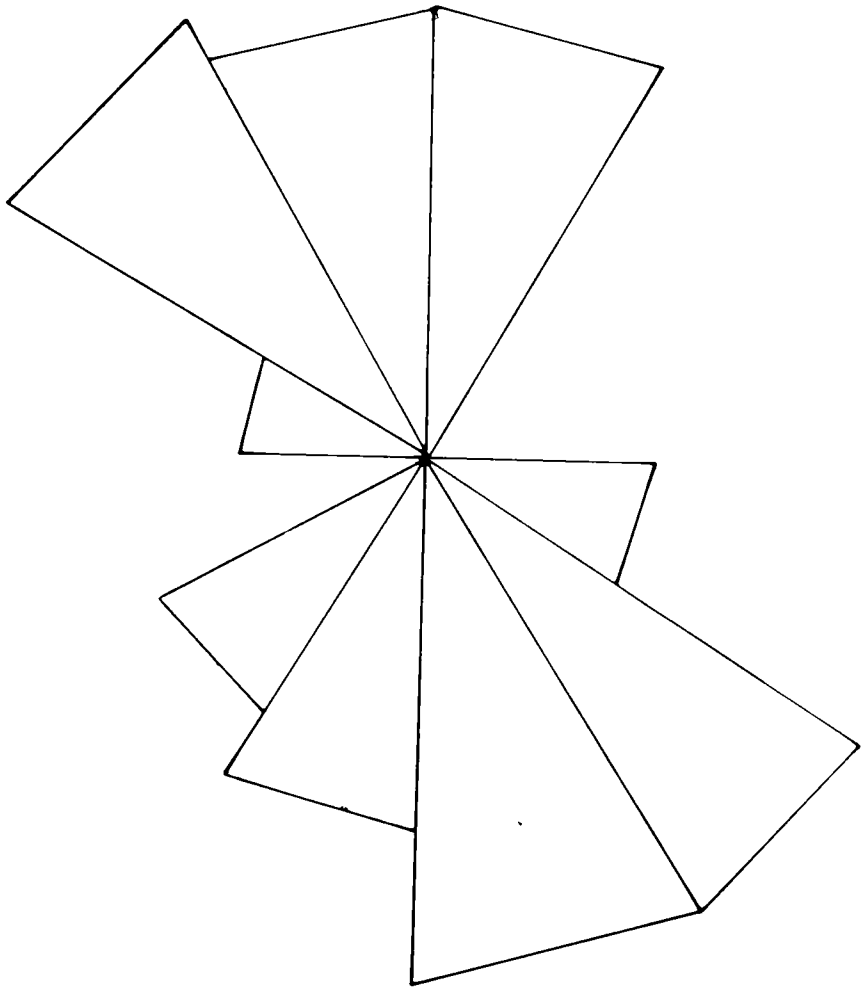


a Lithobone-beds
b Phosphatic shell bone-bed (Biobone-bed)
c " nodule " " (Pel- " ")
d ..... Phosphorite
e Vertebrate-rich "
f Phosphatic shell-rich "
g ..... Phosphatic shell bed
h Vertebrate-rich " " "
i Phosphatic nodule-rich " " "

FIG. 3.5 : CLASSIFICATION OF PHOSPHATIC DEBRIS DEPOSITS (After Antia, 1979)

FIG. 3.6: TYPICAL QUARTZ v VERTEBRATE GRAIN SIZE DISTRIBUTION IN A RHAETIC BONE-BED (Patchway Avon.)





n. = 100
Class interval 30°

FIG. 3.7 : LONG-AXIS ORIENTATION PLOT, *Pleurophorus elongatus*, UPPER UNIT, WESTBURY MEMBER, BLUE ANCHOR, SOMERSET.

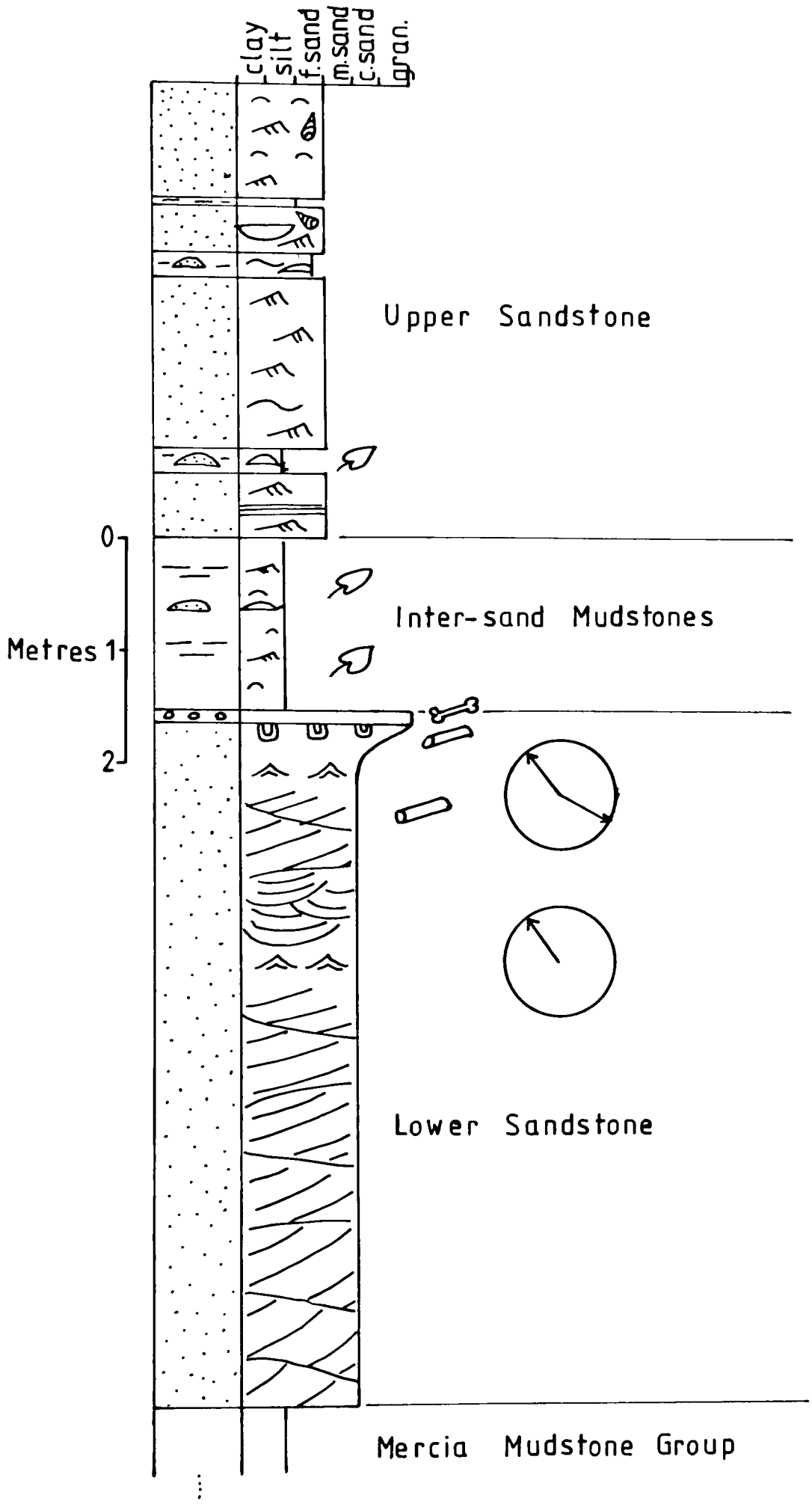
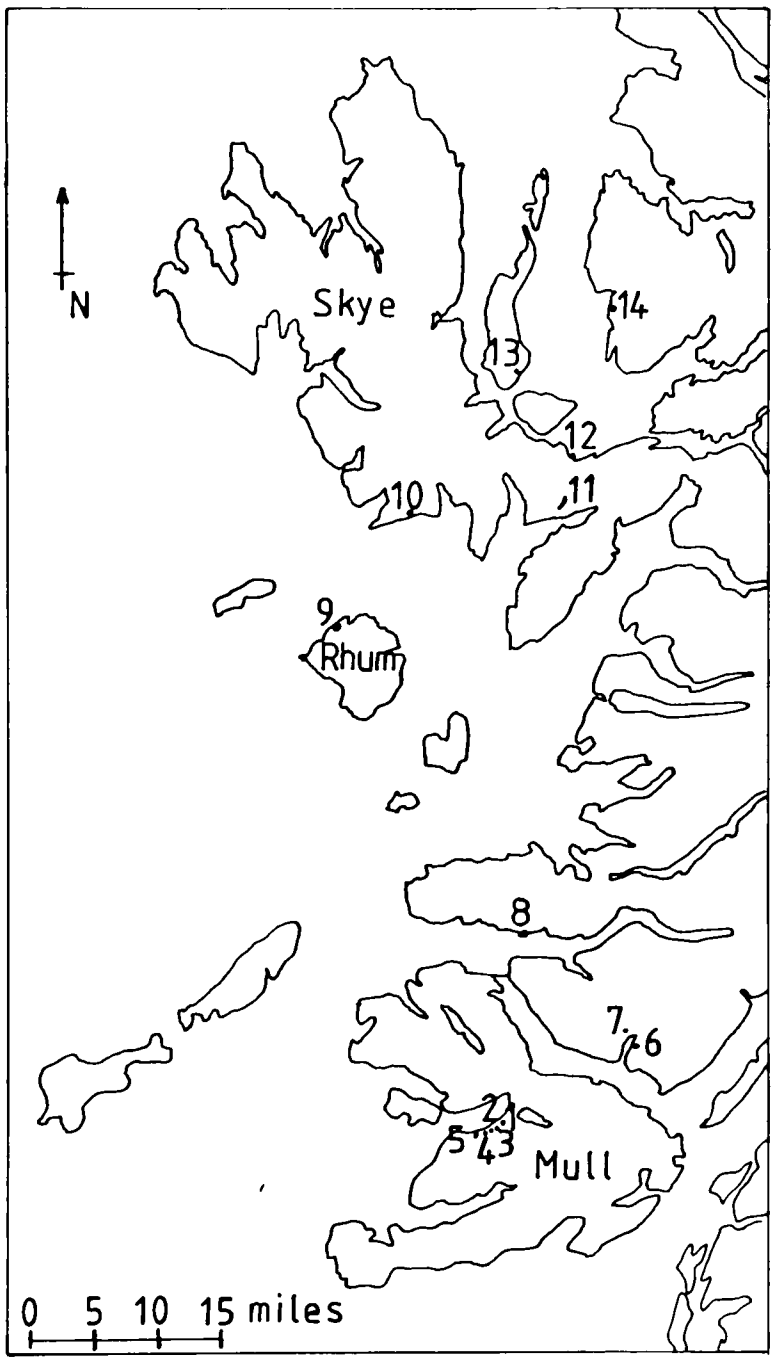


FIG. 3.8: GRAPHIC LOG, BRIDGEND MEMBER, STORMY DOWN

FIG. 3.9 : WESTERN SCOTTISH LOCALITIES



1 Allt na Teangaidh
2 Above Mckinnon's cave
3 Locality 023
4 Sloc nam Ban
5 Coireachan Gorma
6 Morvern: Loch Aline
7 " Larachbeg
8 Ardnamurchan: Rudha a' Mhile
9 Rhum
10 An Leac
11 Heaste
12 Ob Lusa
13 Raasay : Eyre
14 Applecross

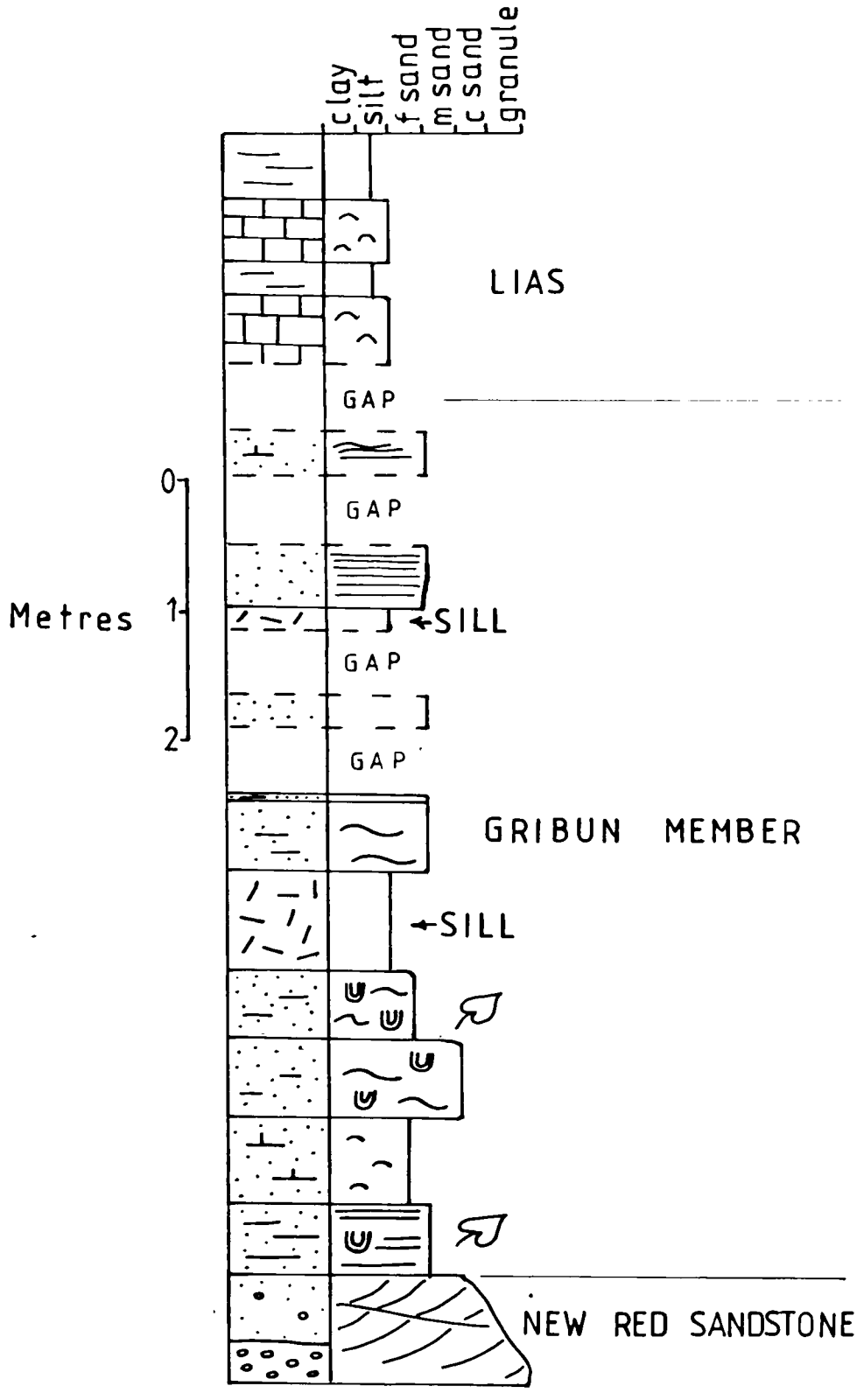


FIG. 3.10 : GRAPHIC LOG, GRIBUN MEMBER, ALLT NA TEANGAIDH, MULL.

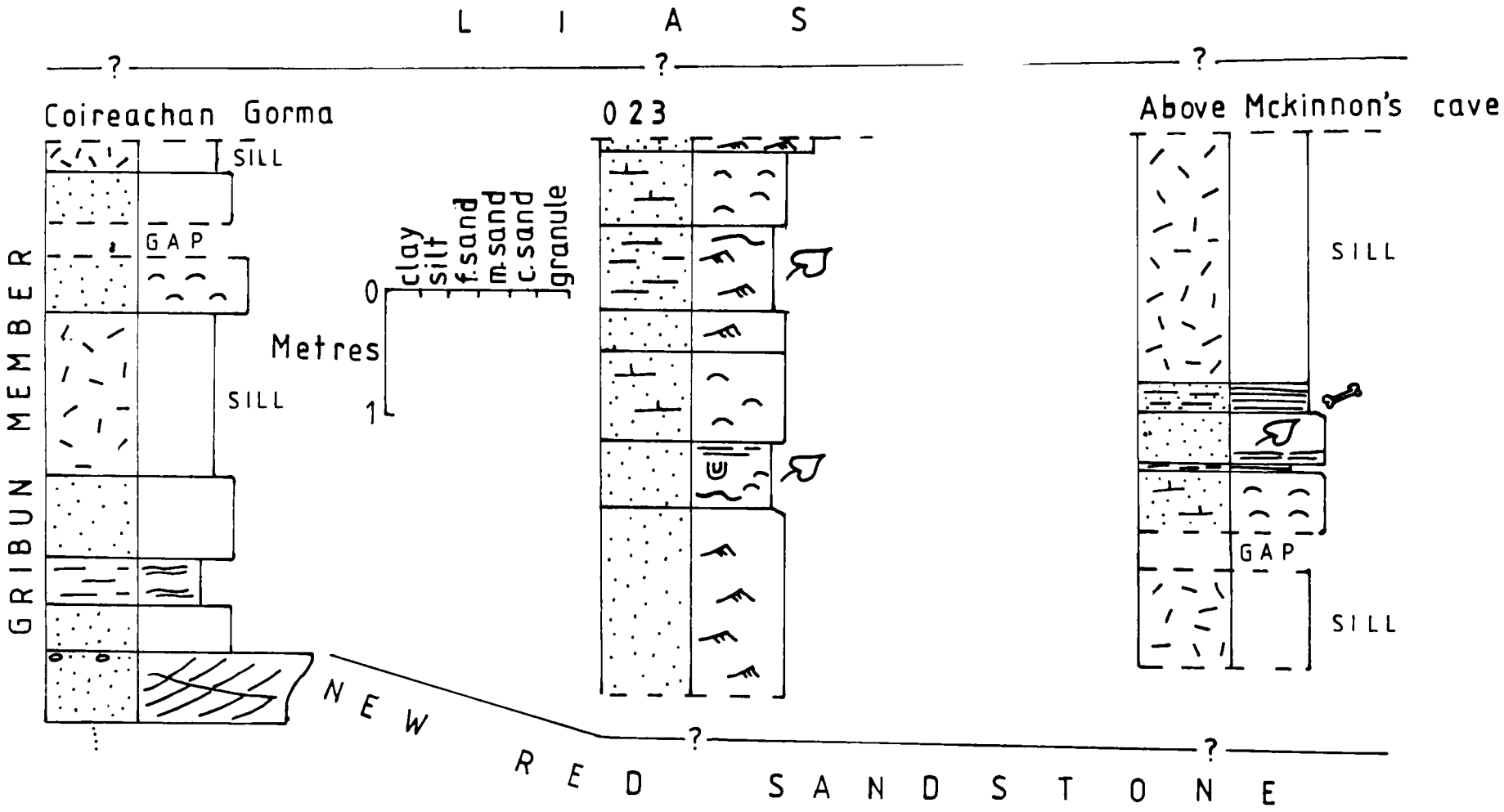


FIG. 3.11: VERTICAL SECTIONS OF MINOR EXPOSURES, GRIBUN MEMBER, MULL

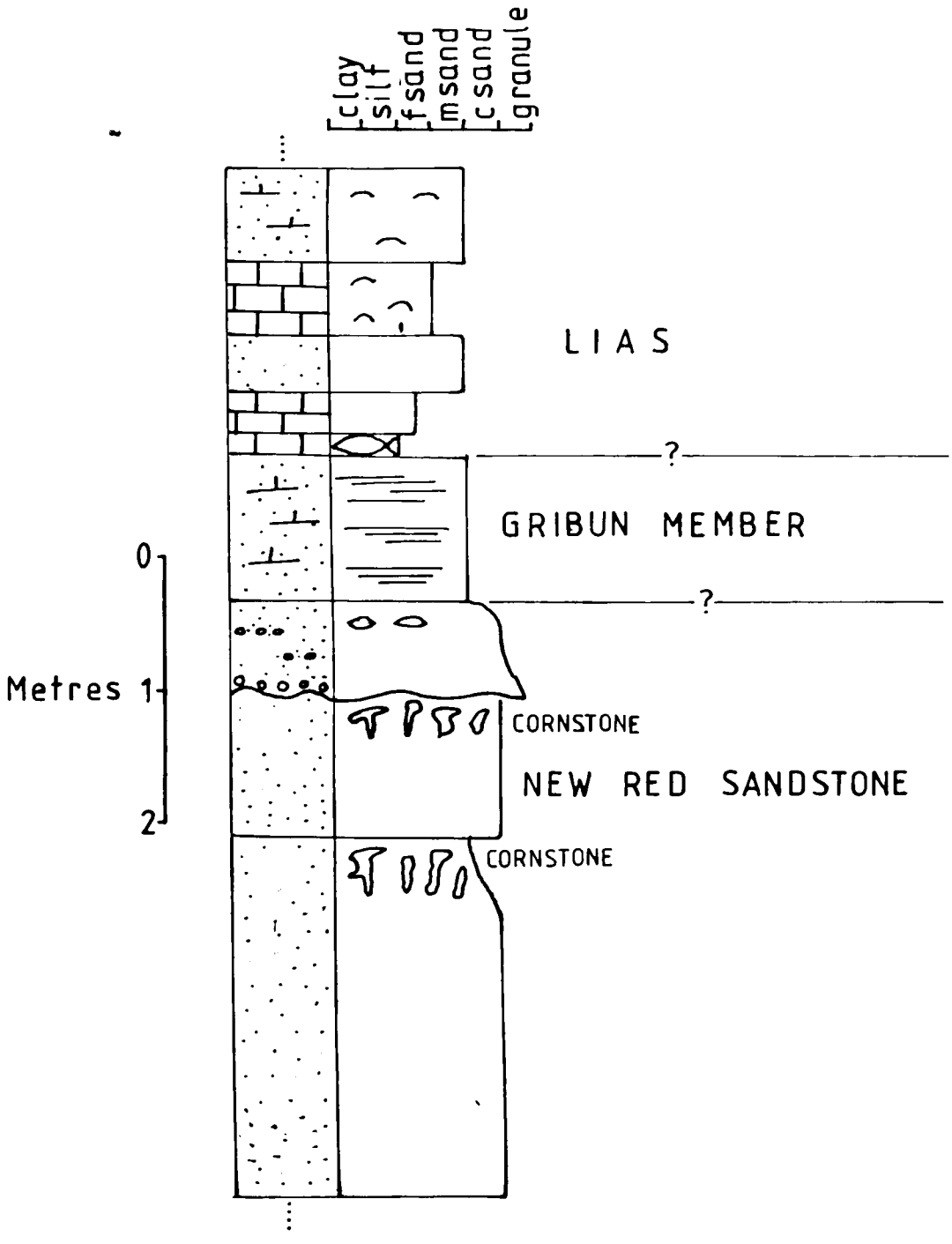


FIG. 3.12: VERTICAL SECTION, RUDHA A' MHILE, ARDNAMURCHAN.

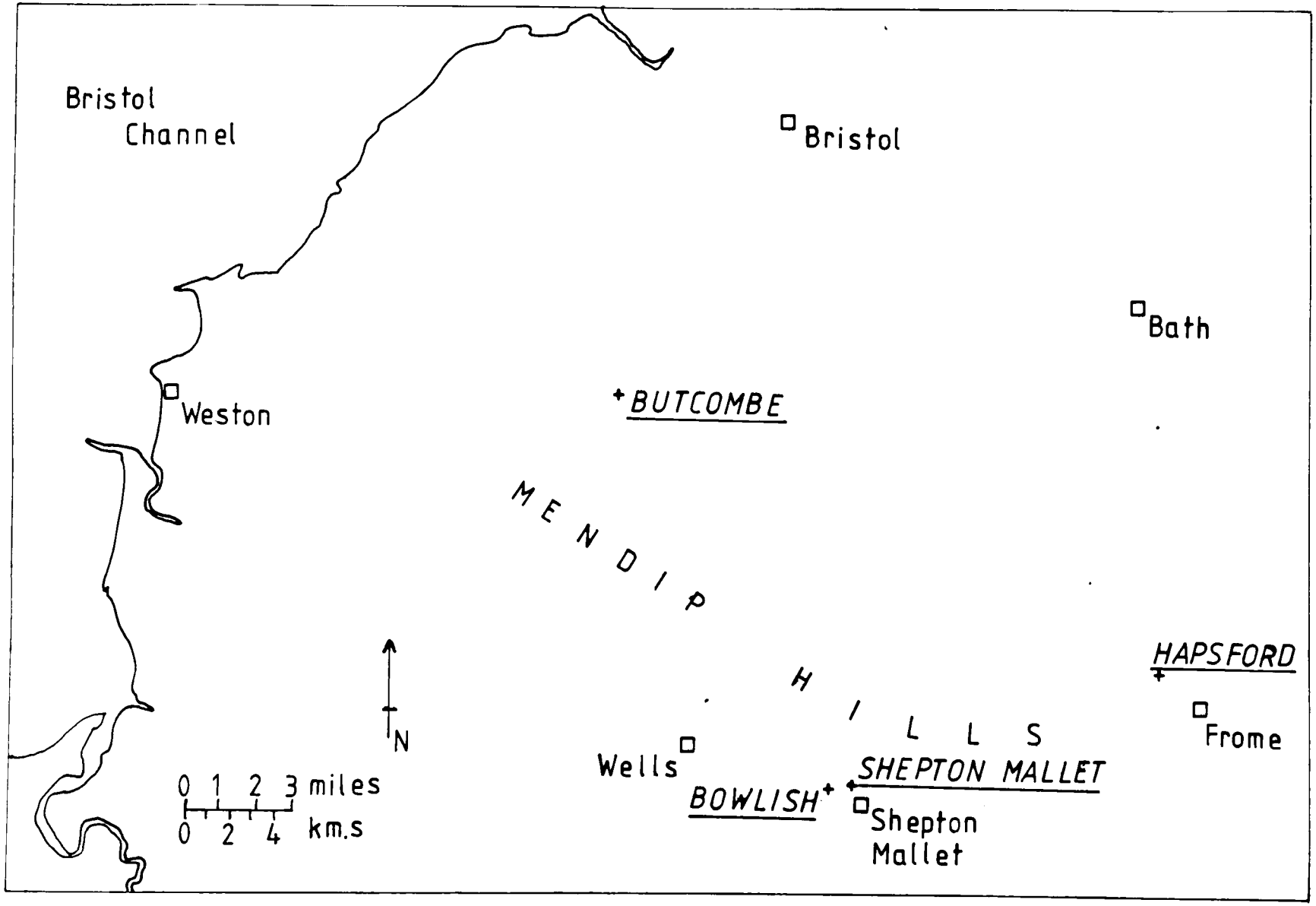


FIG. 3.13: LOCALITIES IN THE MENDIPS, S.W. ENGLAND.

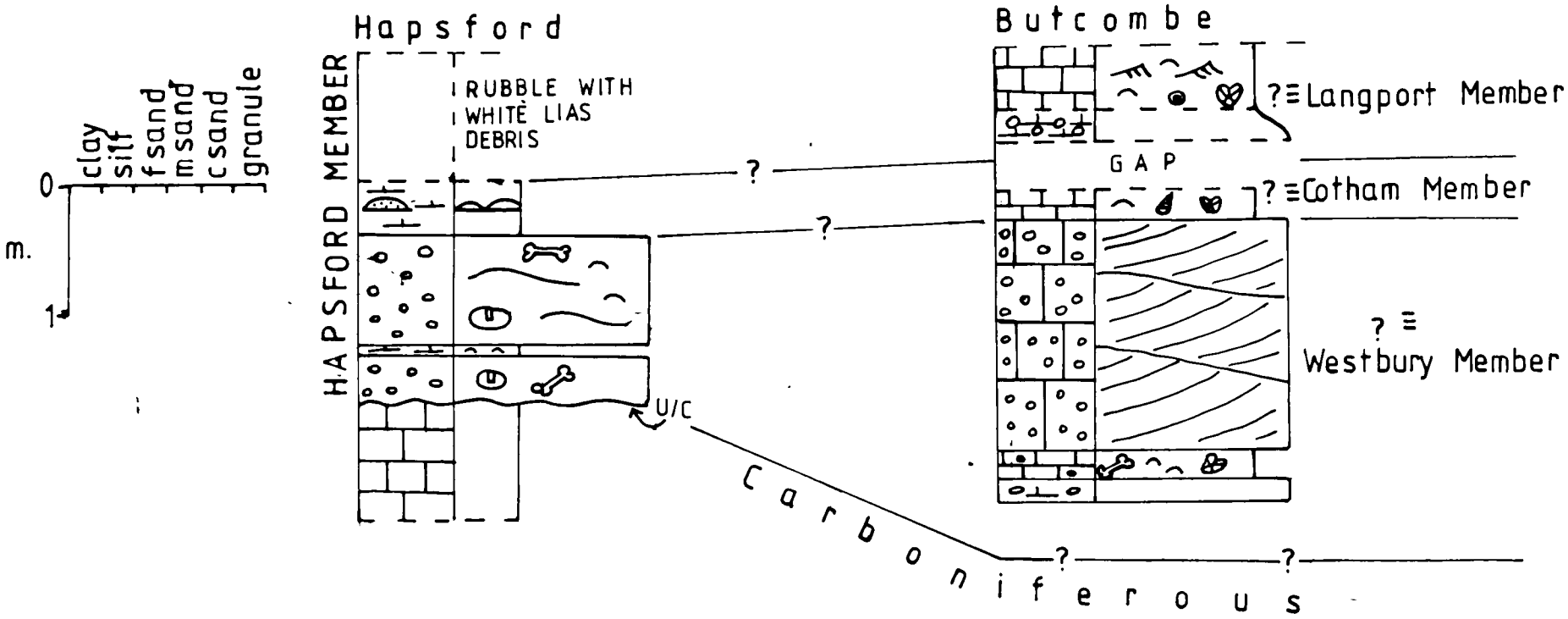


FIG. 3.14 : VERTICAL SECTIONS , HAPSFORD MEMBER

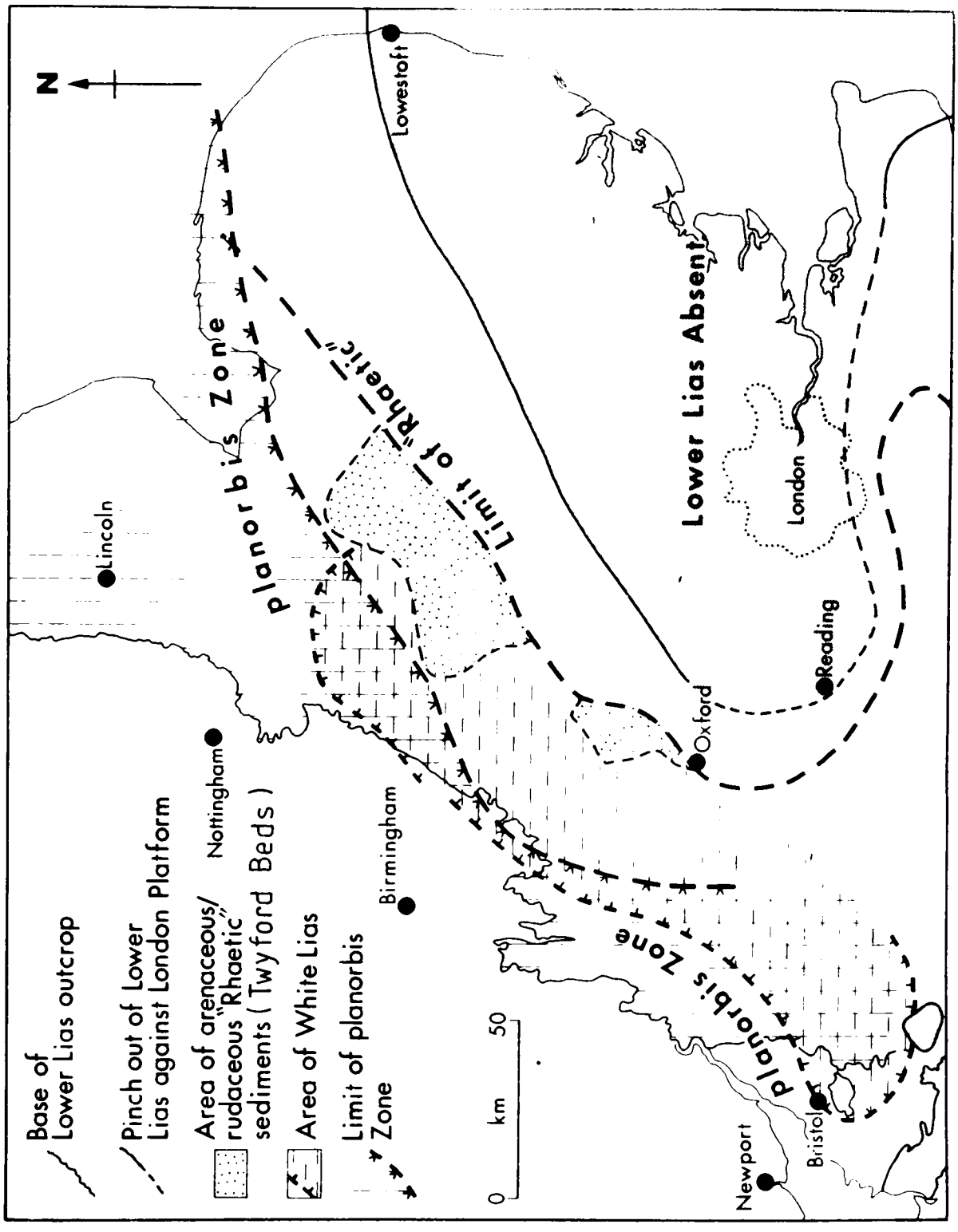


FIG. 3.15: DISTRIBUTION OF THE TWYFORD BEDS

(After Donovan, Horton & Ivimey-Cook, 1979)

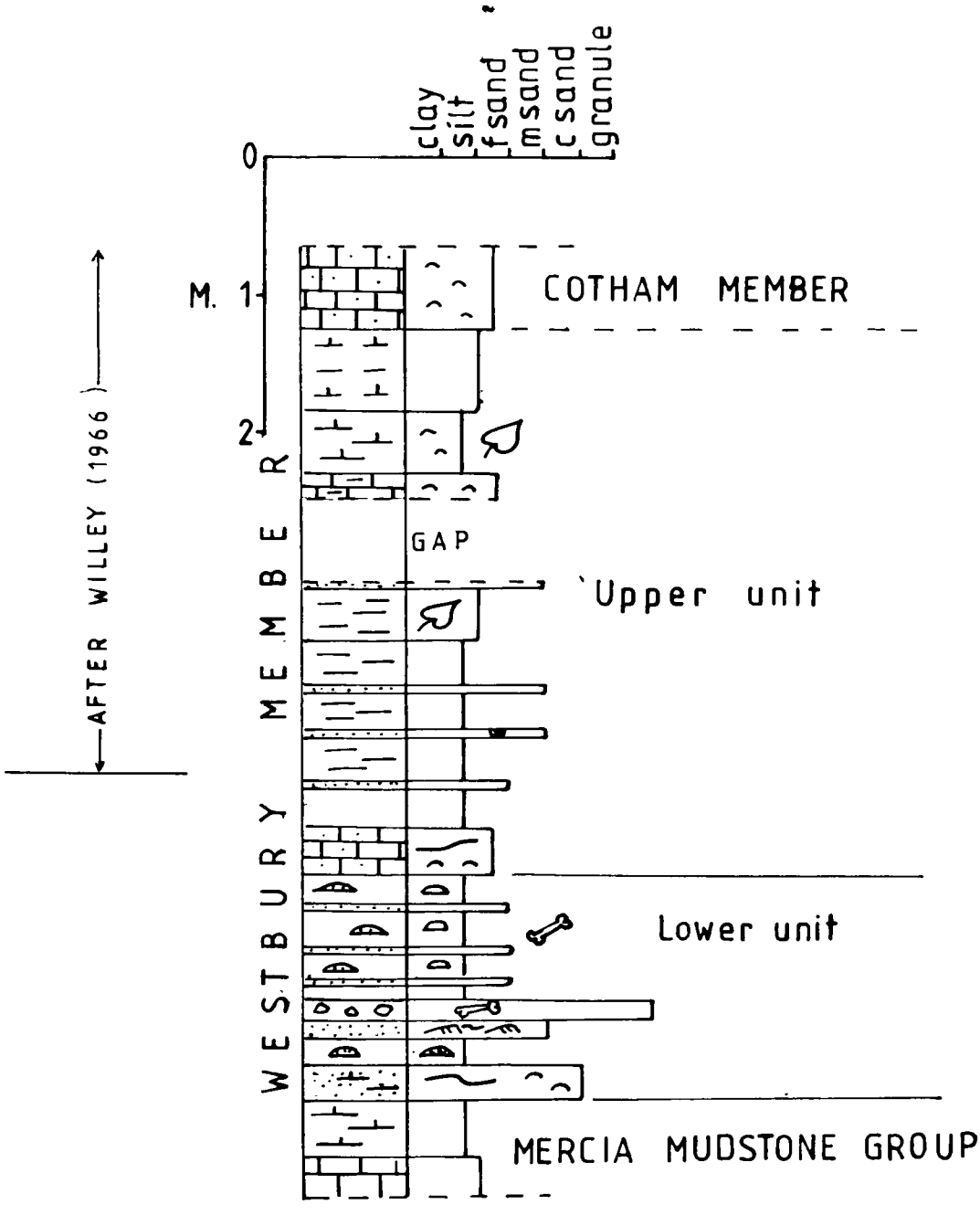


FIG. 3.16: VERTICAL SECTION, TREGUFF, GLAMORGAN

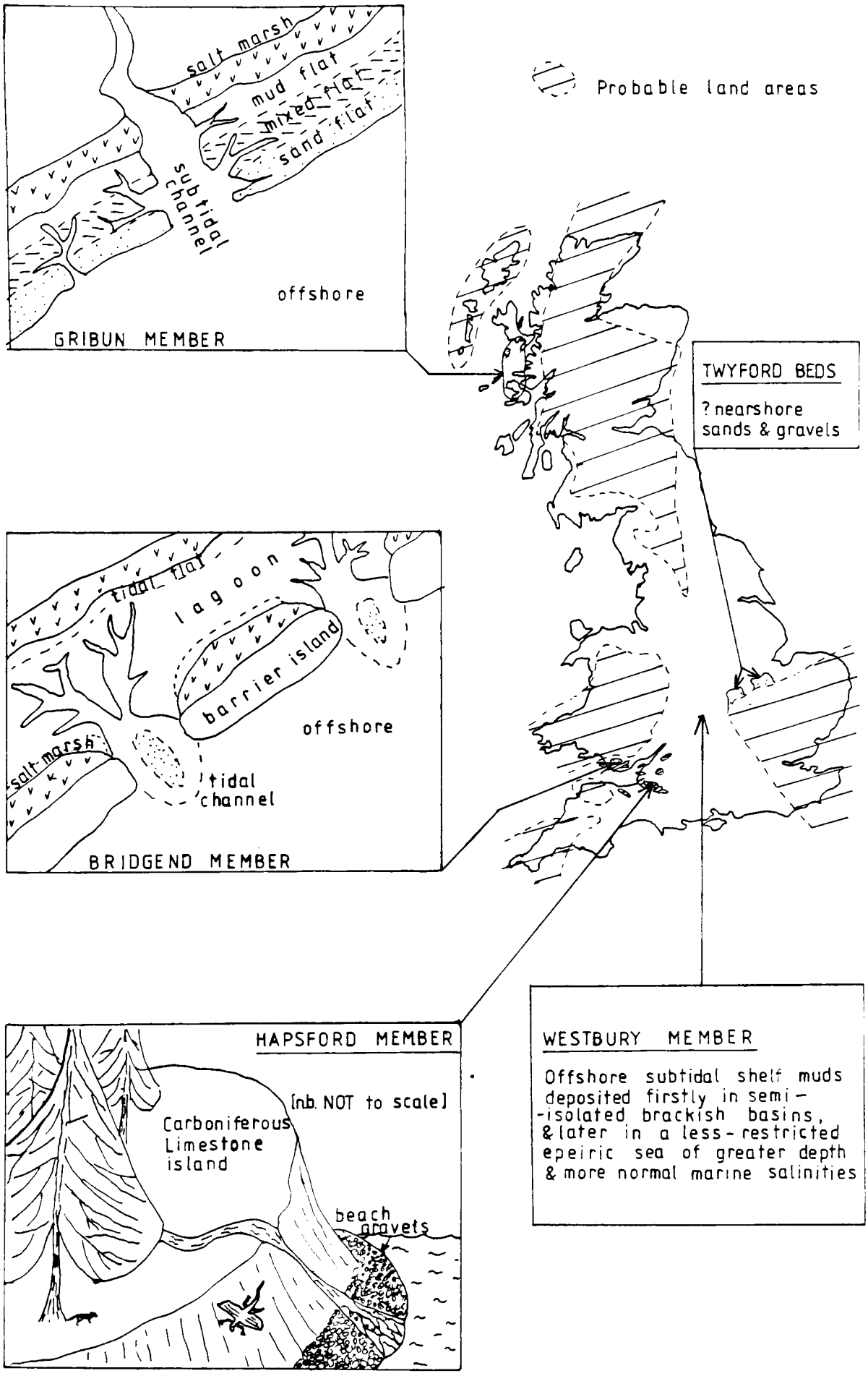


FIG. 3.17: GENERALISED PALAEOENVIRONMENTS, WESTBURY MEMBER & LATERALLY-EQUIVALENT LITHOFACIES

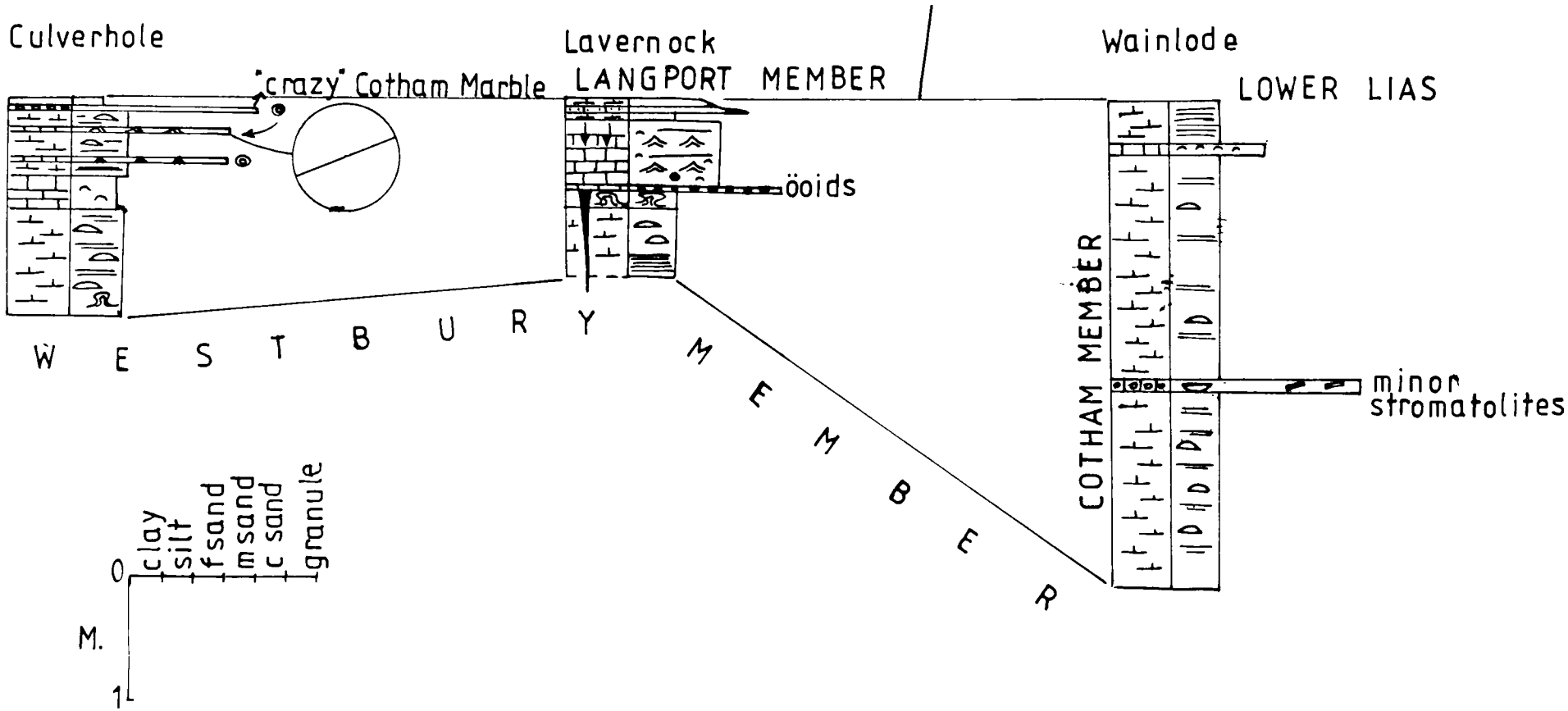


FIG. 4.1 : REPRESENTATIVE VERTICAL SECTIONS , COTHAM MEMBER

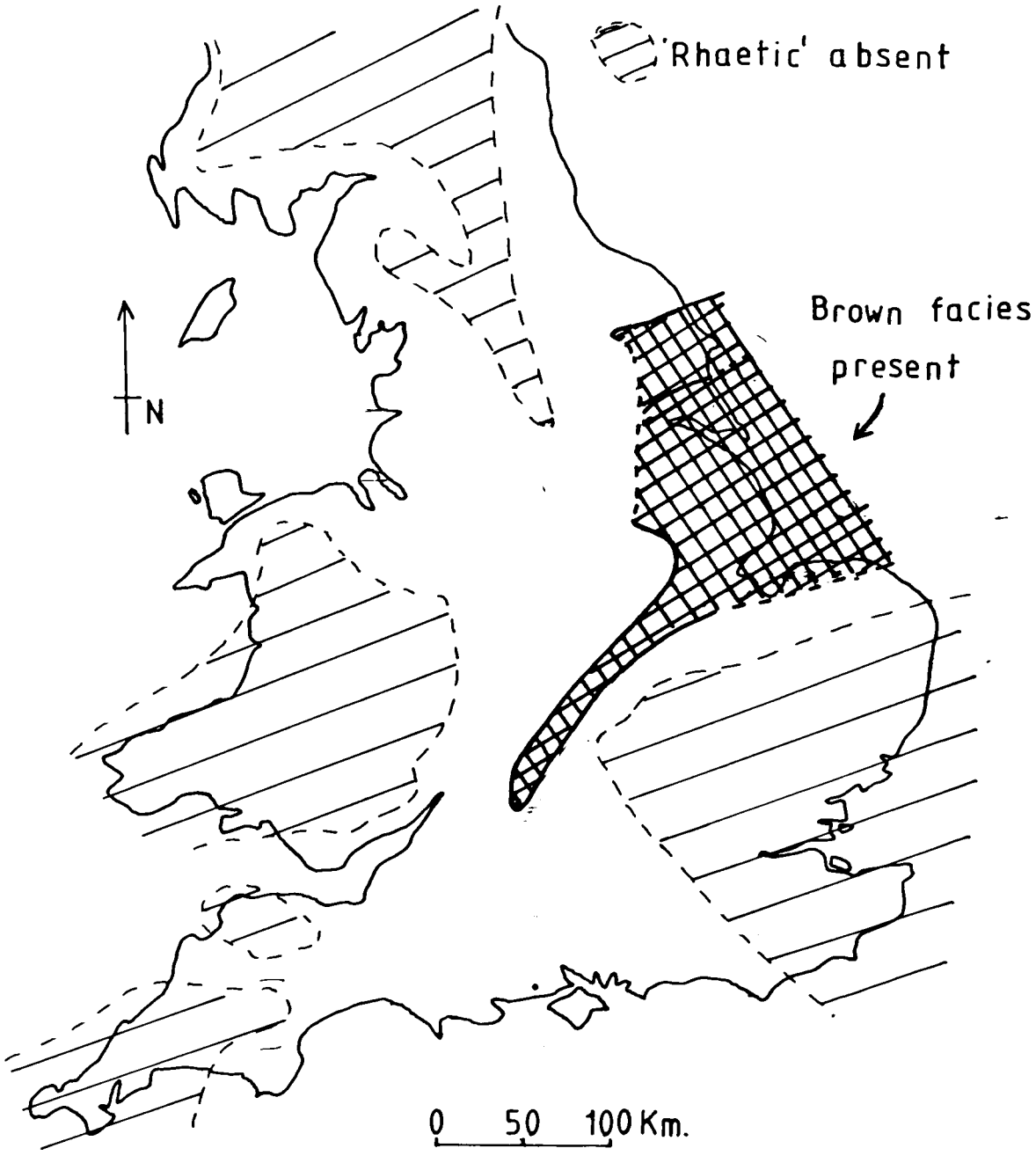
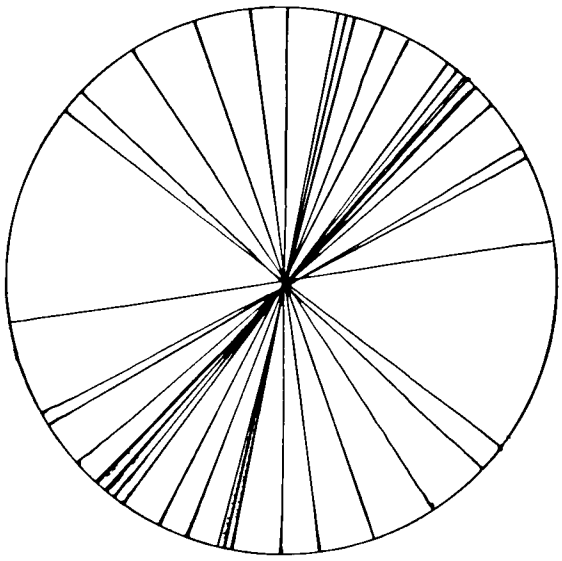
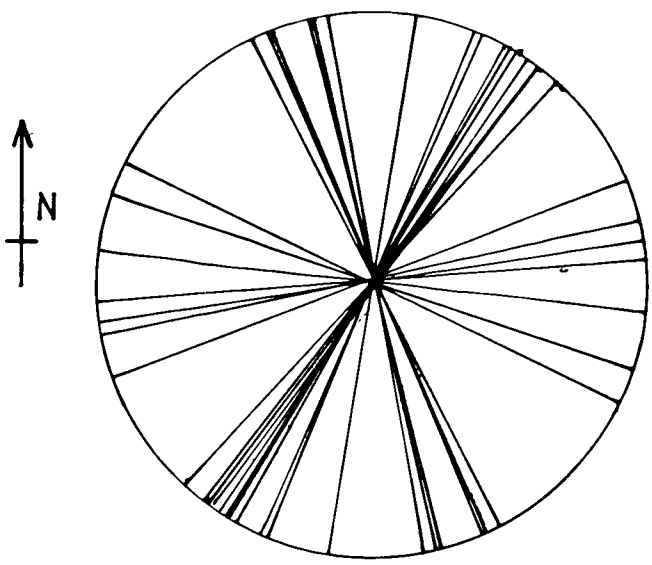


FIG. 4.2: DISTRIBUTION OF BROWN FACIES COTHAM MEMBER

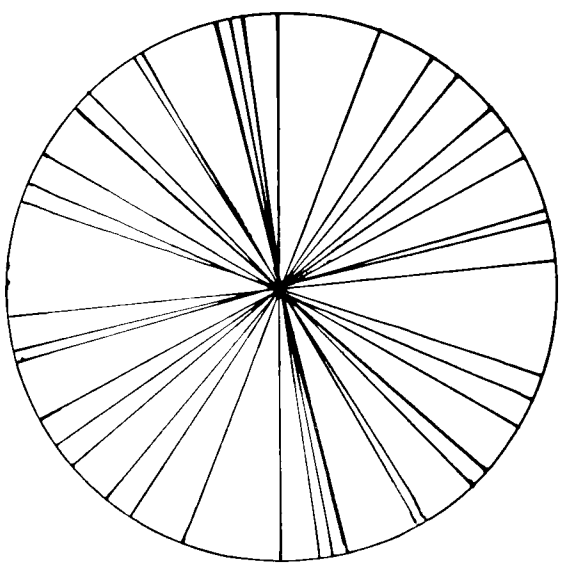
FIG. 4.3: OSCILLATION-RIPPLE CREST ORIENTATIONS, COTHAM MEMBER, SOMERSET & SOUTH WALES



St. Audries, Somerset



Lavernock, Glamorgan



St. Mary's well bay, Glamorgan

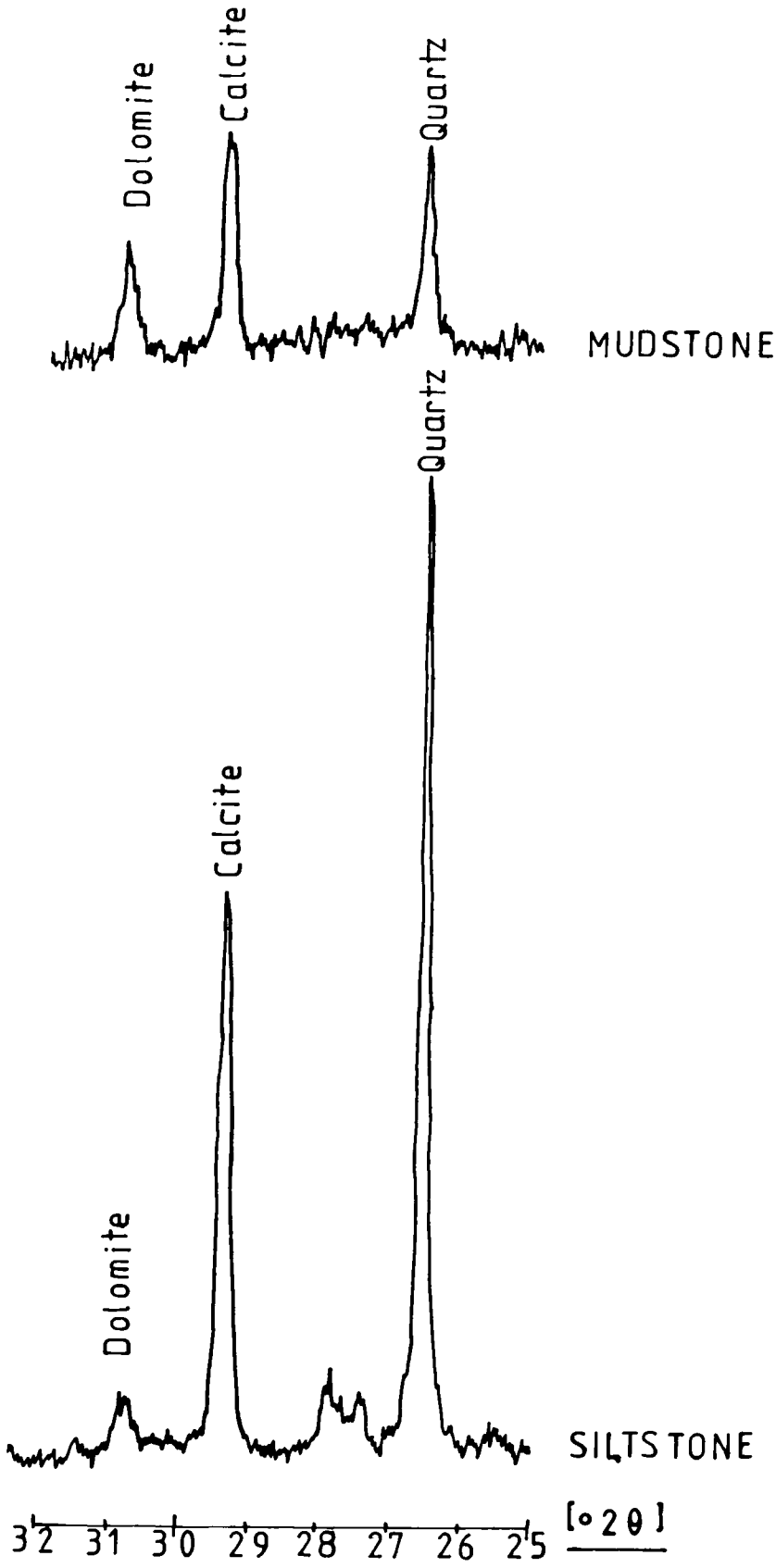


FIG: 4.4: TYPICAL COMPARATIVE X-RAY DIFFRACTOGRAMS OF COTHAM MEMBER MUDSTONE WITH SILTSTONE

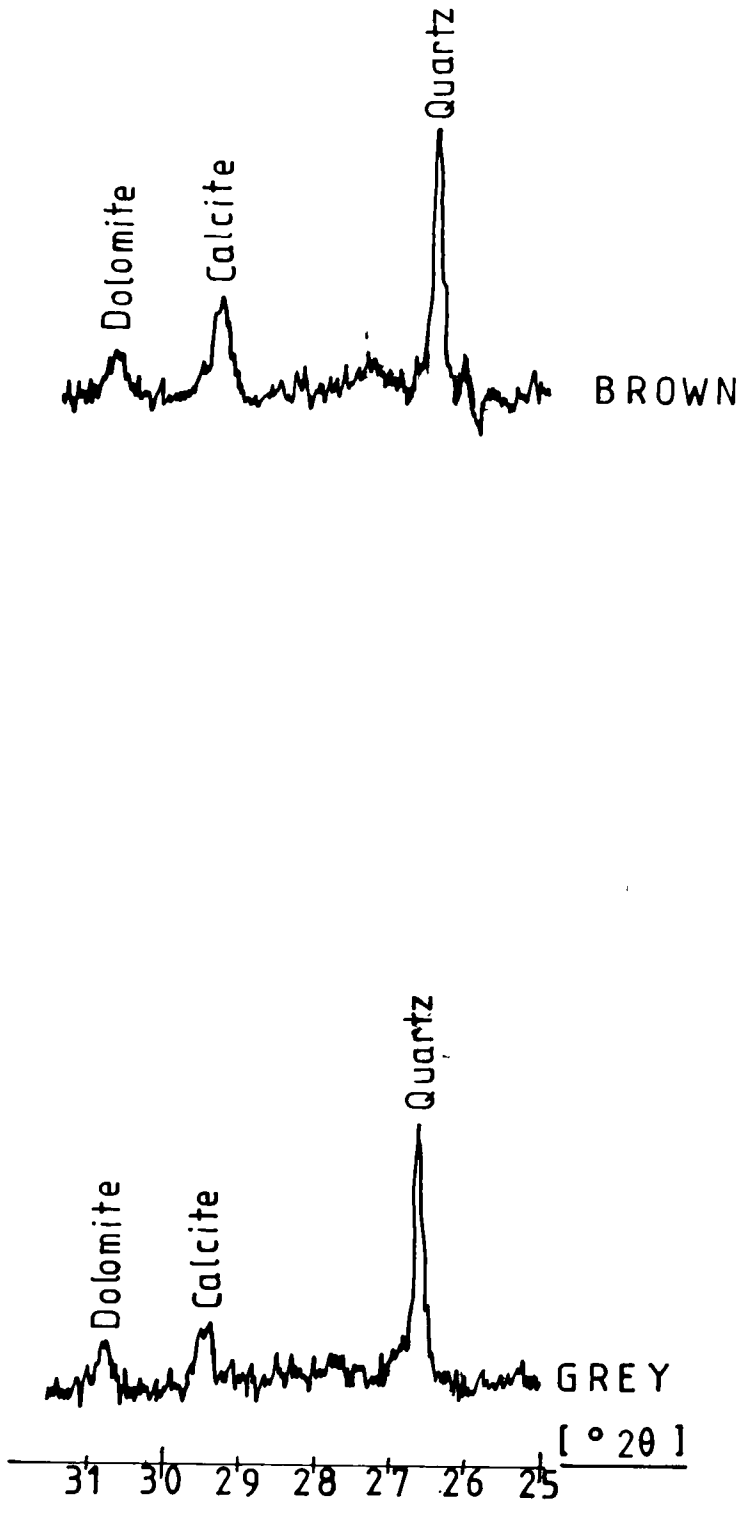


FIG. 4.5 : TYPICAL COMPARATIVE X RAY DIFFRACTOGRAMS, GREY & BROWN MUDSTONES, COTHAM MEMBER.

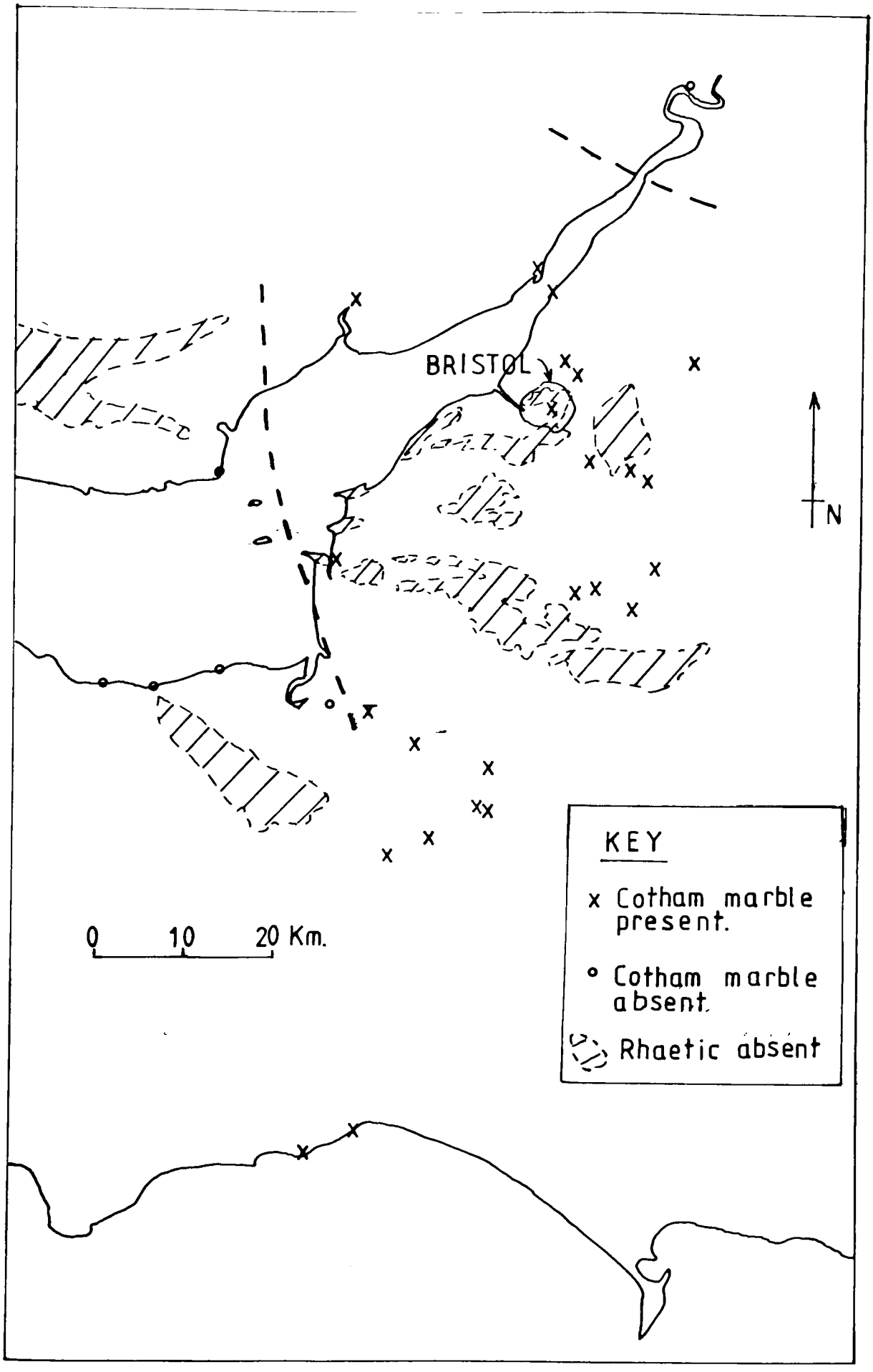


FIG. 4.6 : DISTRIBUTION OF THE COTHAM MARBLE

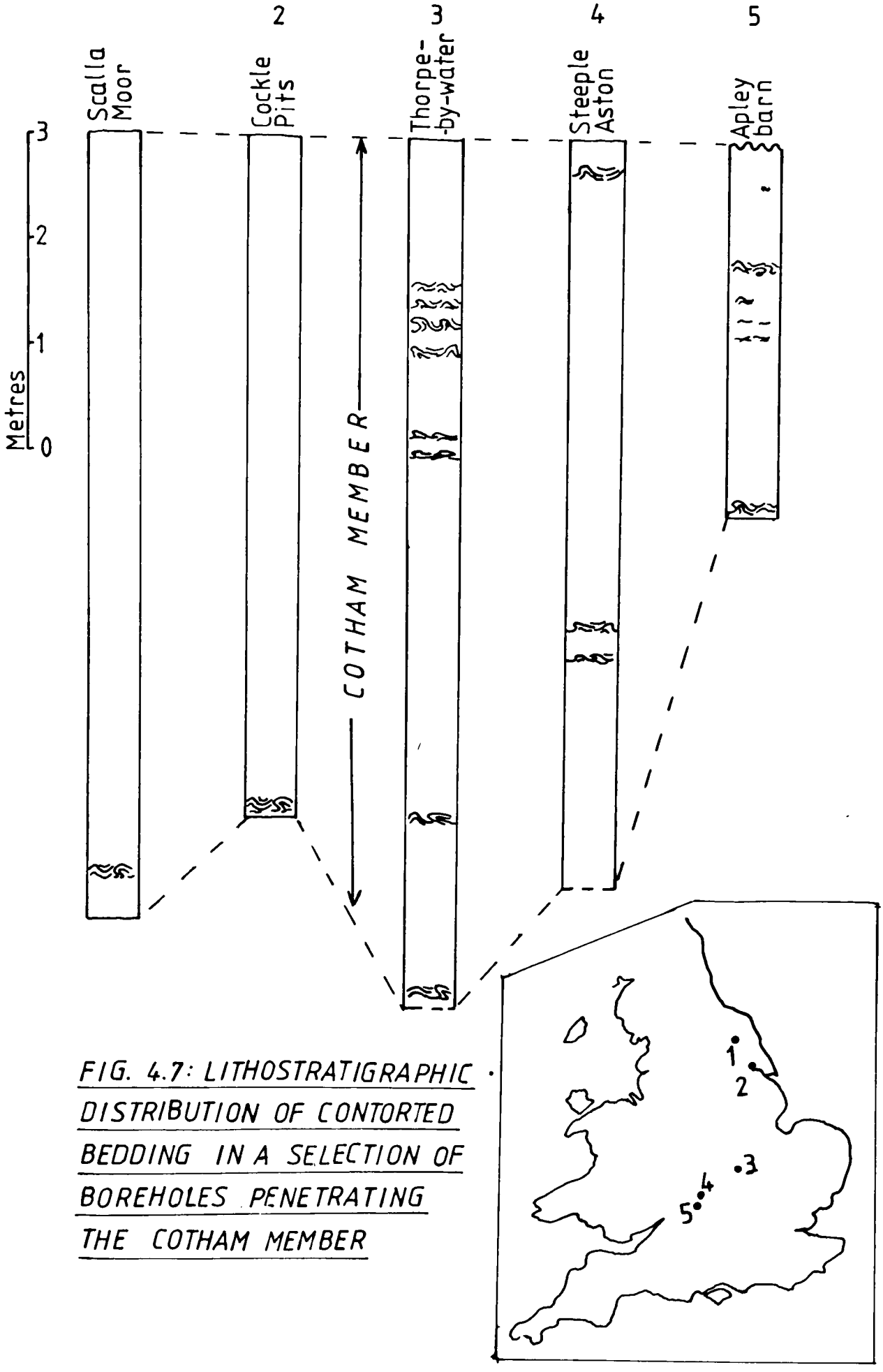


FIG. 4.7: LITHOSTRATIGRAPHIC DISTRIBUTION OF CONTORTED BEDDING IN A SELECTION OF BOREHOLES PENETRATING THE COTHAM MEMBER

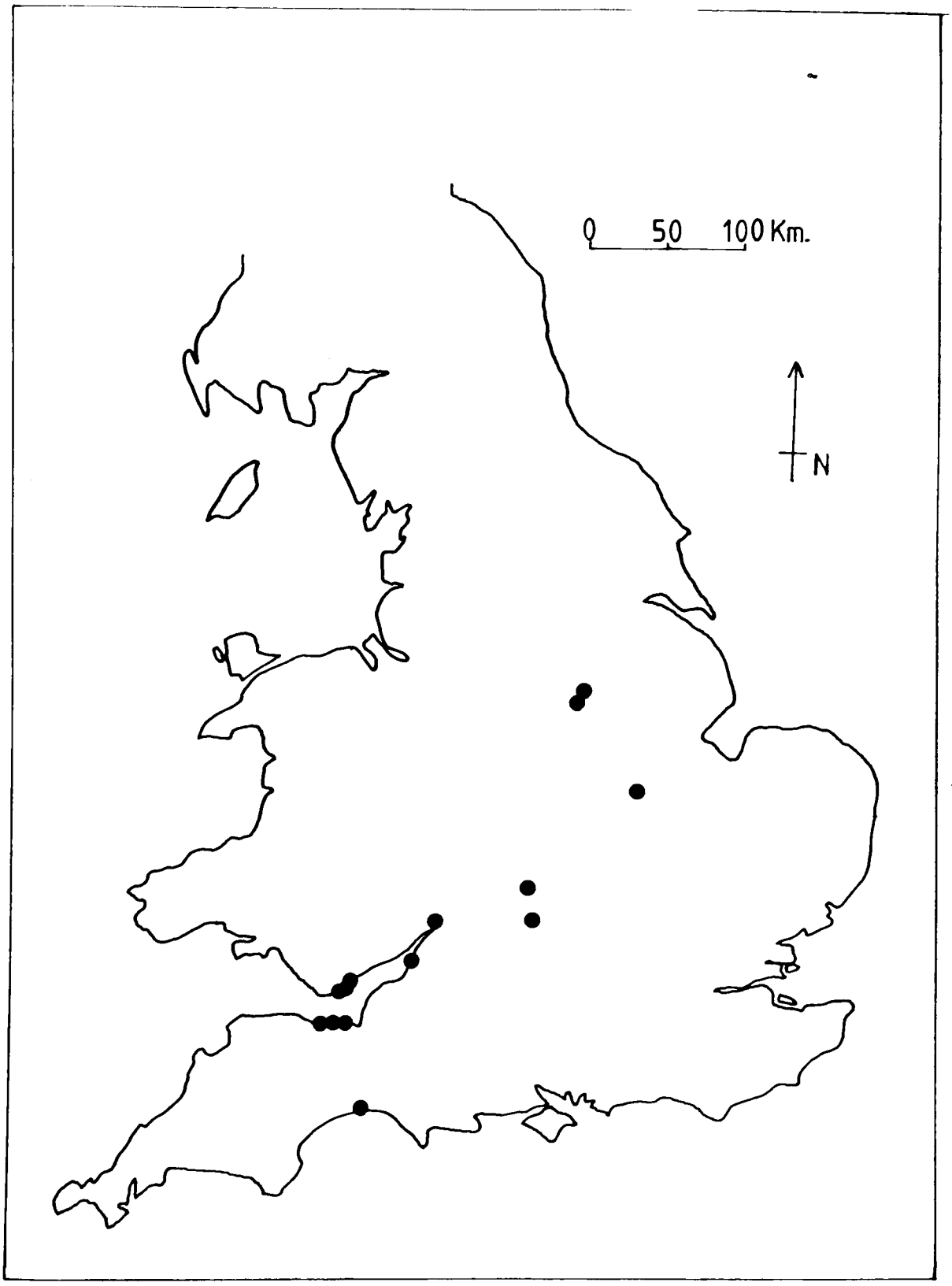


FIG. 4.8 : LOCATIONS WHERE CONTORTED BEDDING OCCURS IN THE UPPER COTHAM MEMBER

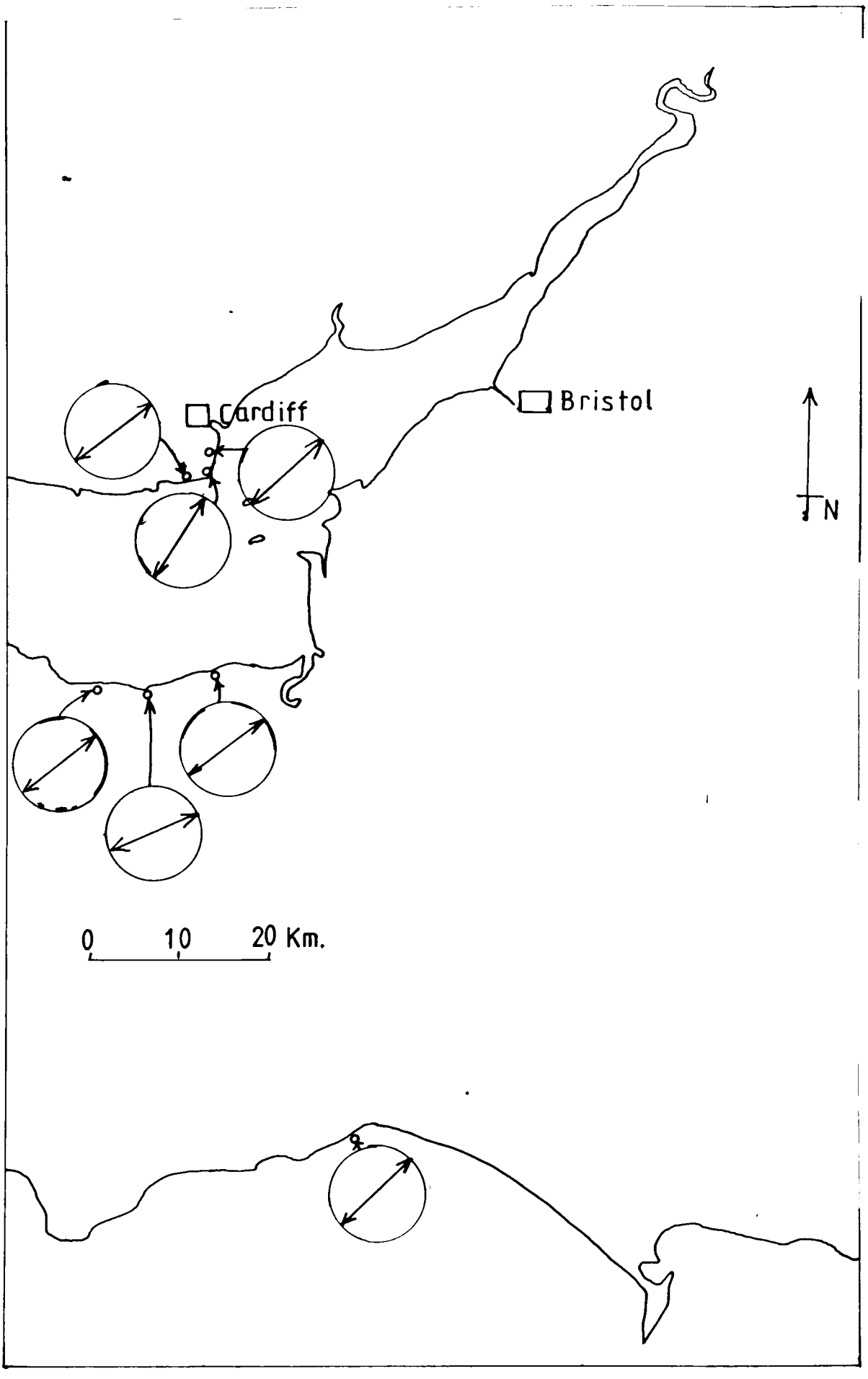


FIG. 4.9 : CONTORTED BEDDING : FOLD-AXIS AZIMUTHS, COTHAM MEMBER

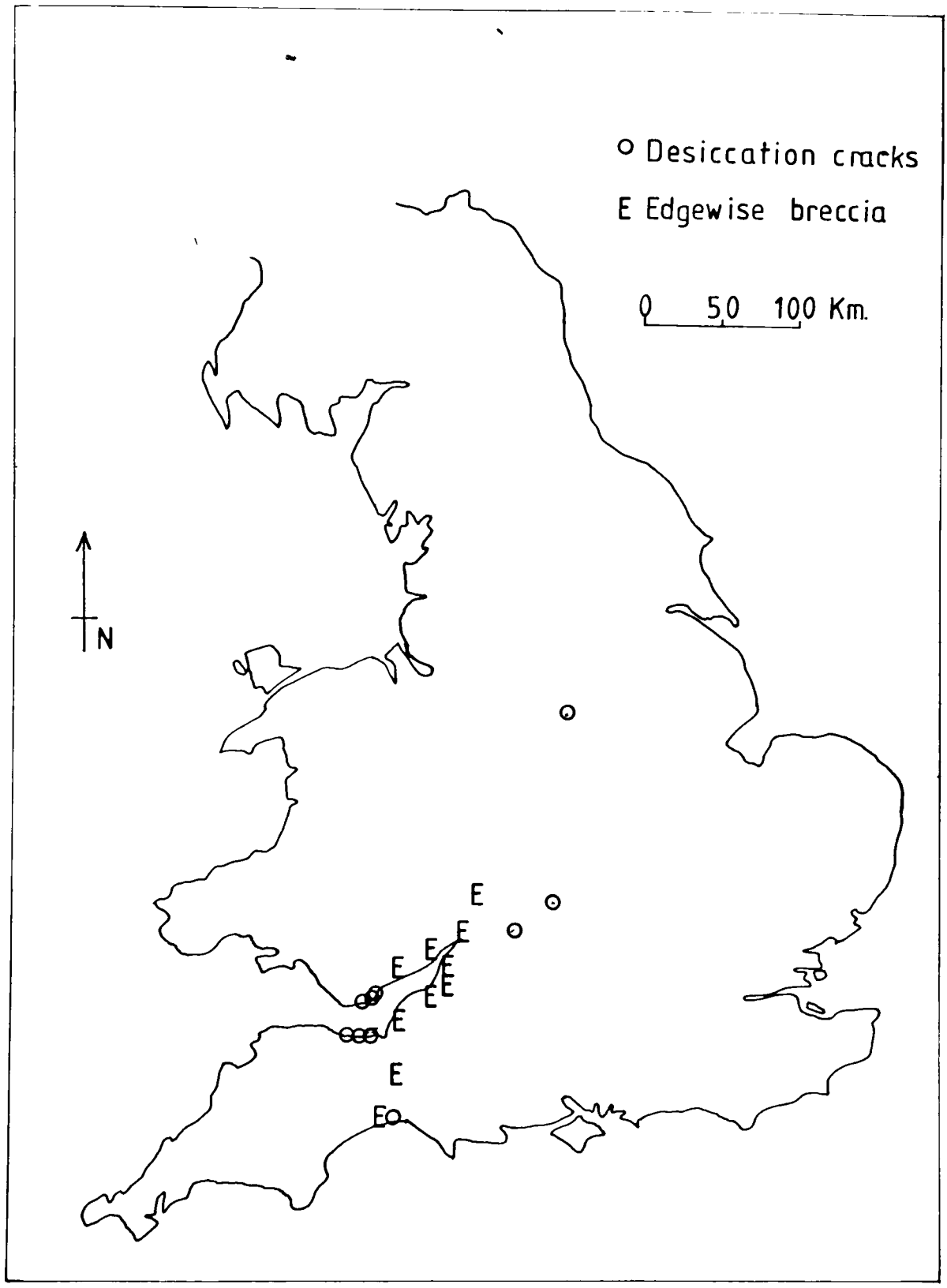
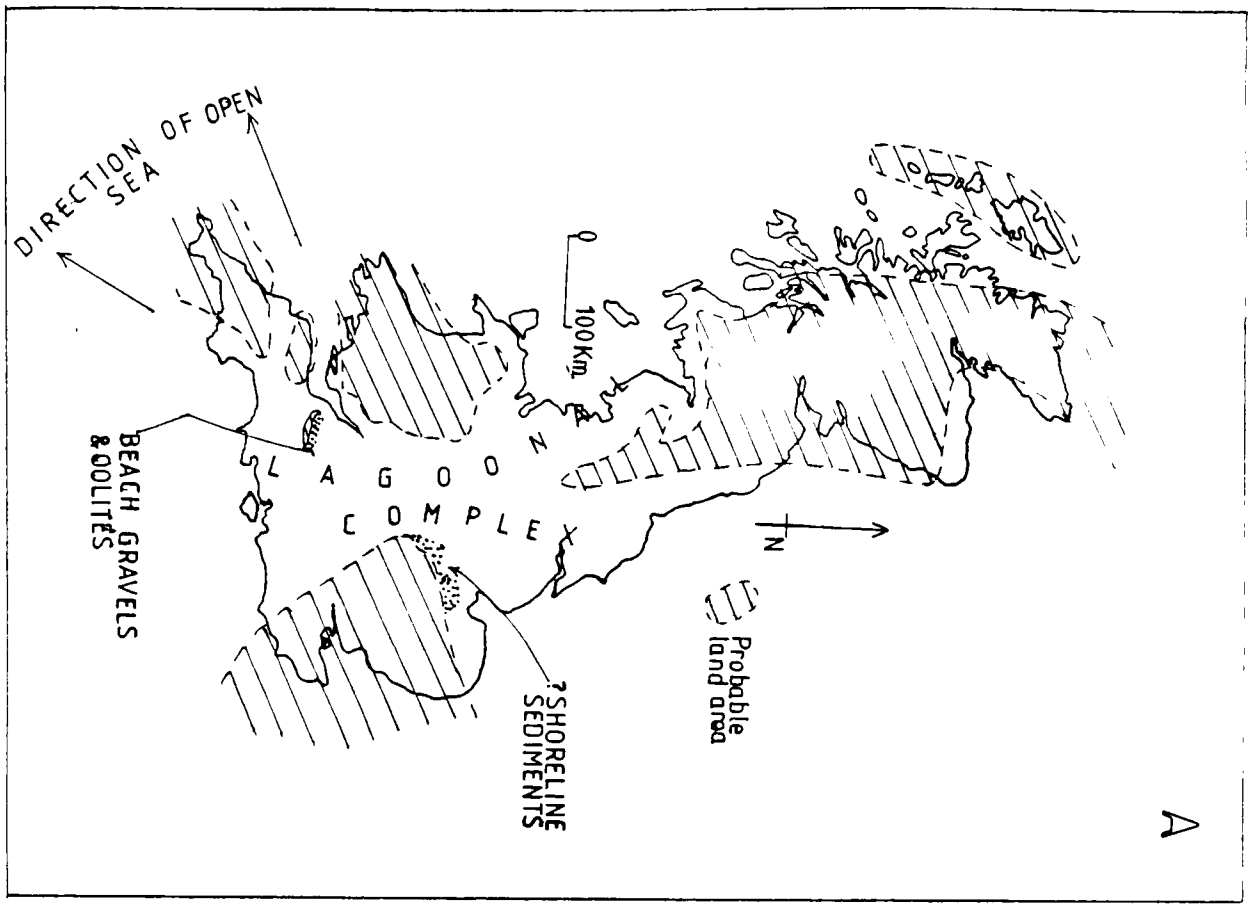


FIG. 4.10: OCCURRENCES OF INDICATORS OF EMERGENCE, COTHAM MEMBER



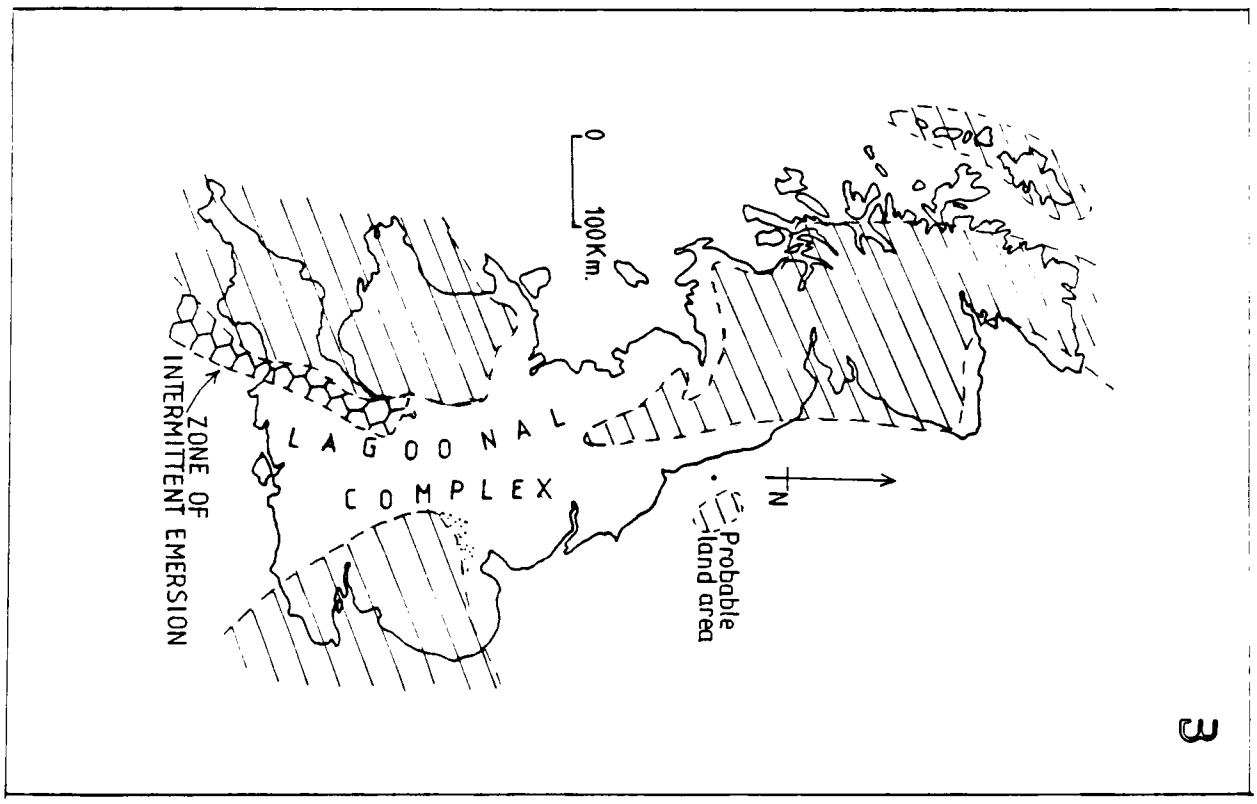


FIG. 4.11: PALAEOENVIRONMENTS , COTHAM MEMBER
[A: LOWER , B: UPPER]

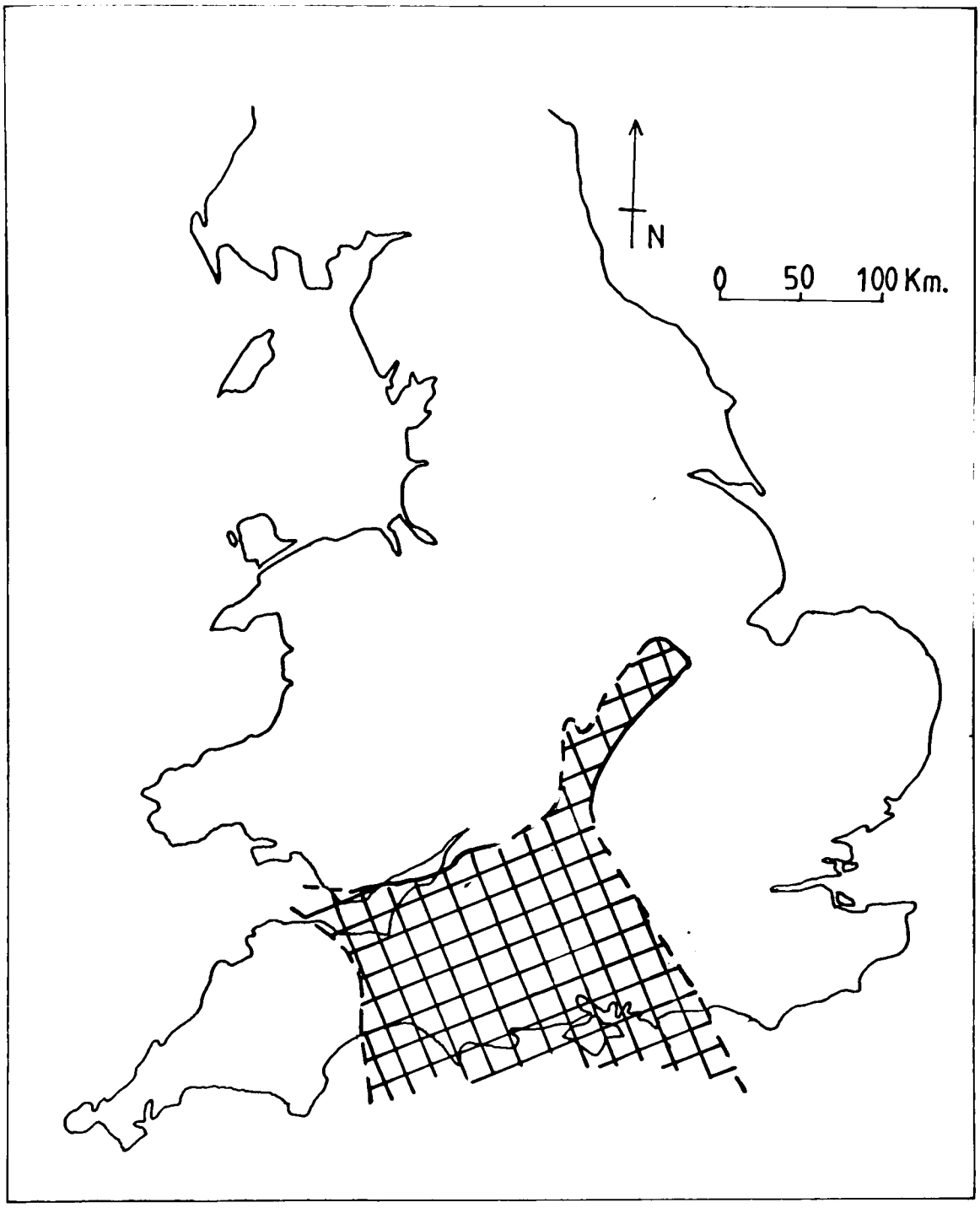


FIG. 5.1: DISTRIBUTION OF THE LANGPORT MEMBER

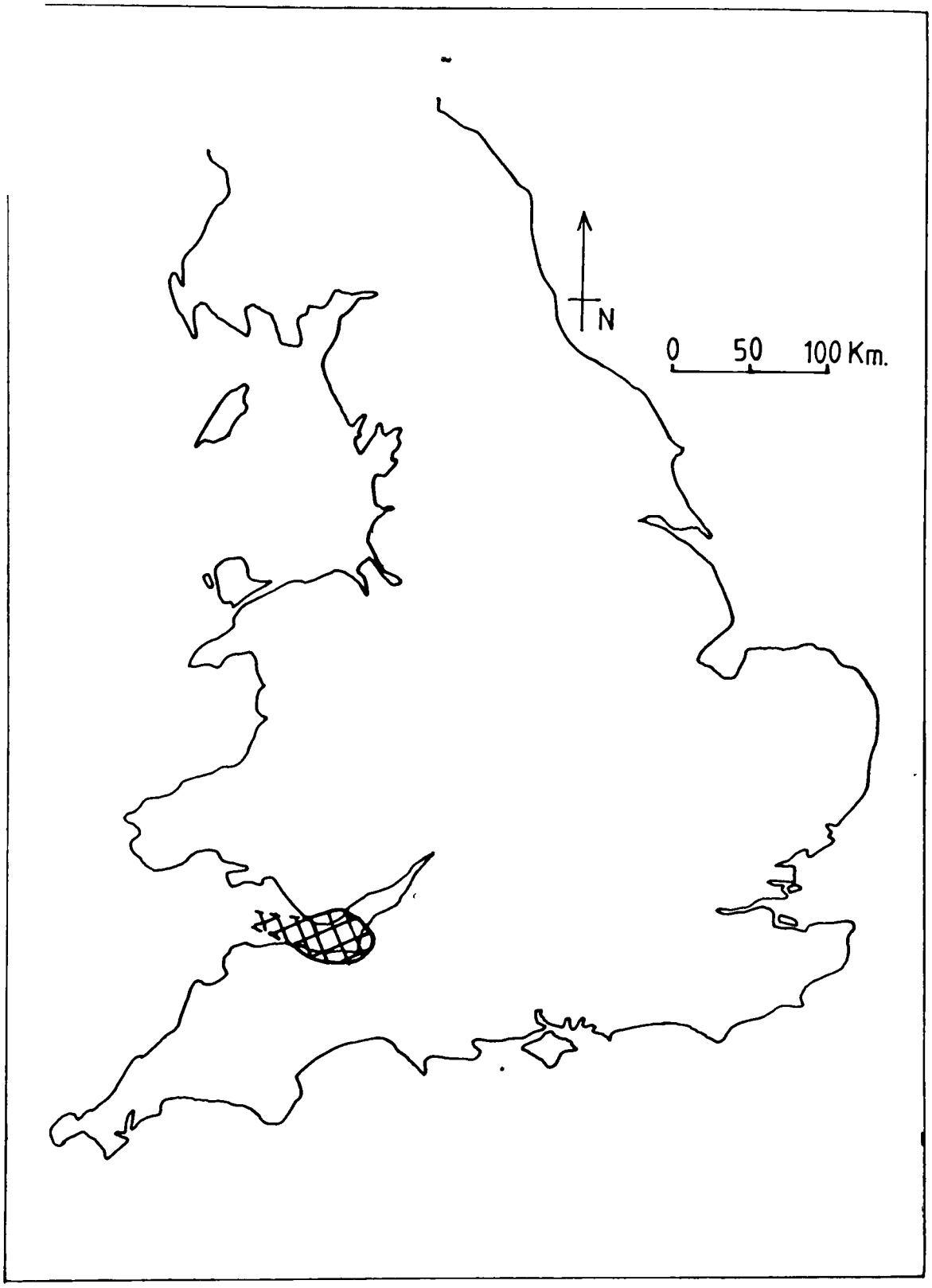


FIG. 5.2: DISTRIBUTION OF THE WATCHET MEMBER

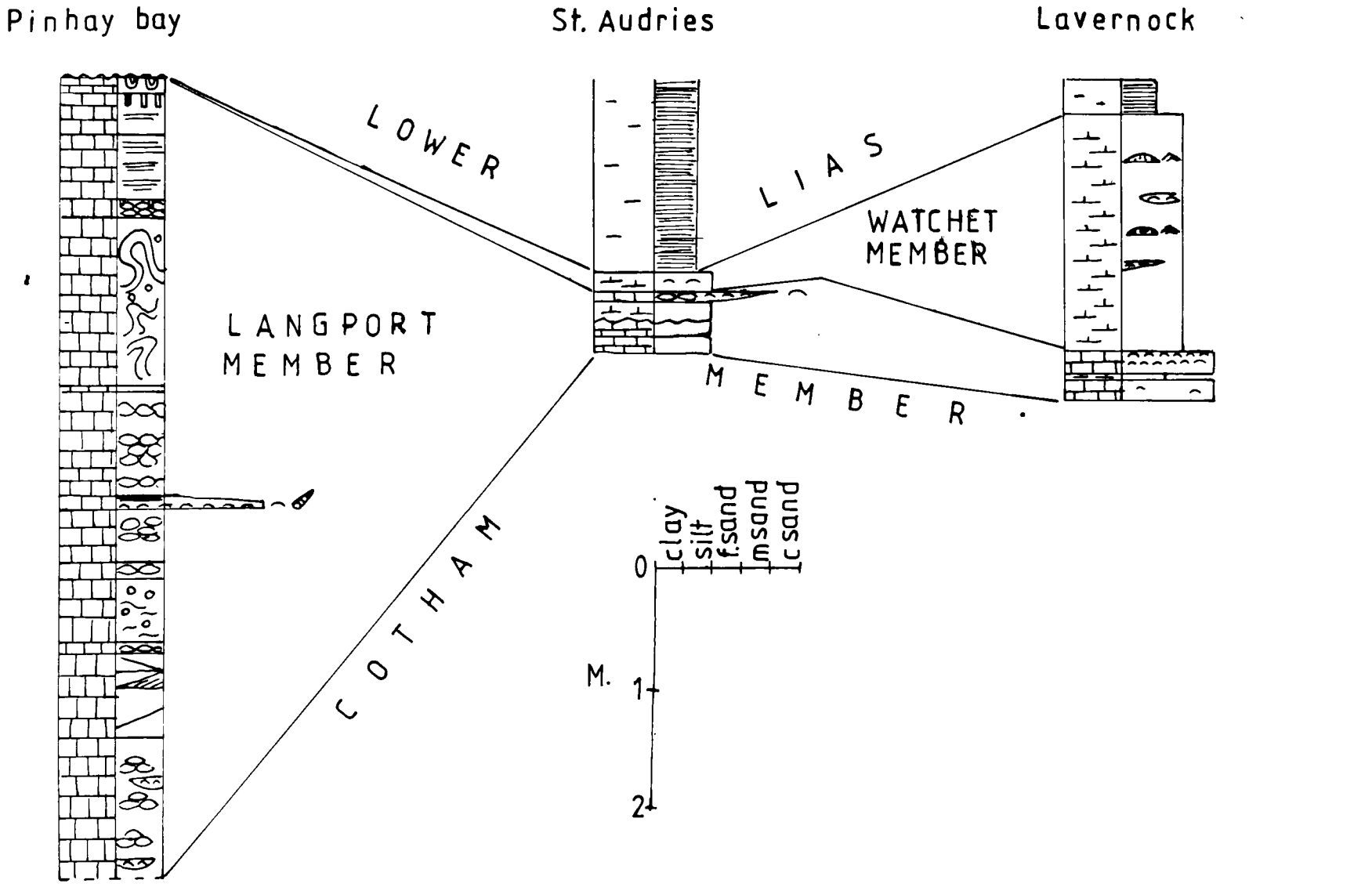


FIG. 5.3: TYPICAL VERTICAL SECTIONS, LANGPORT & WATCHET MEMBERS

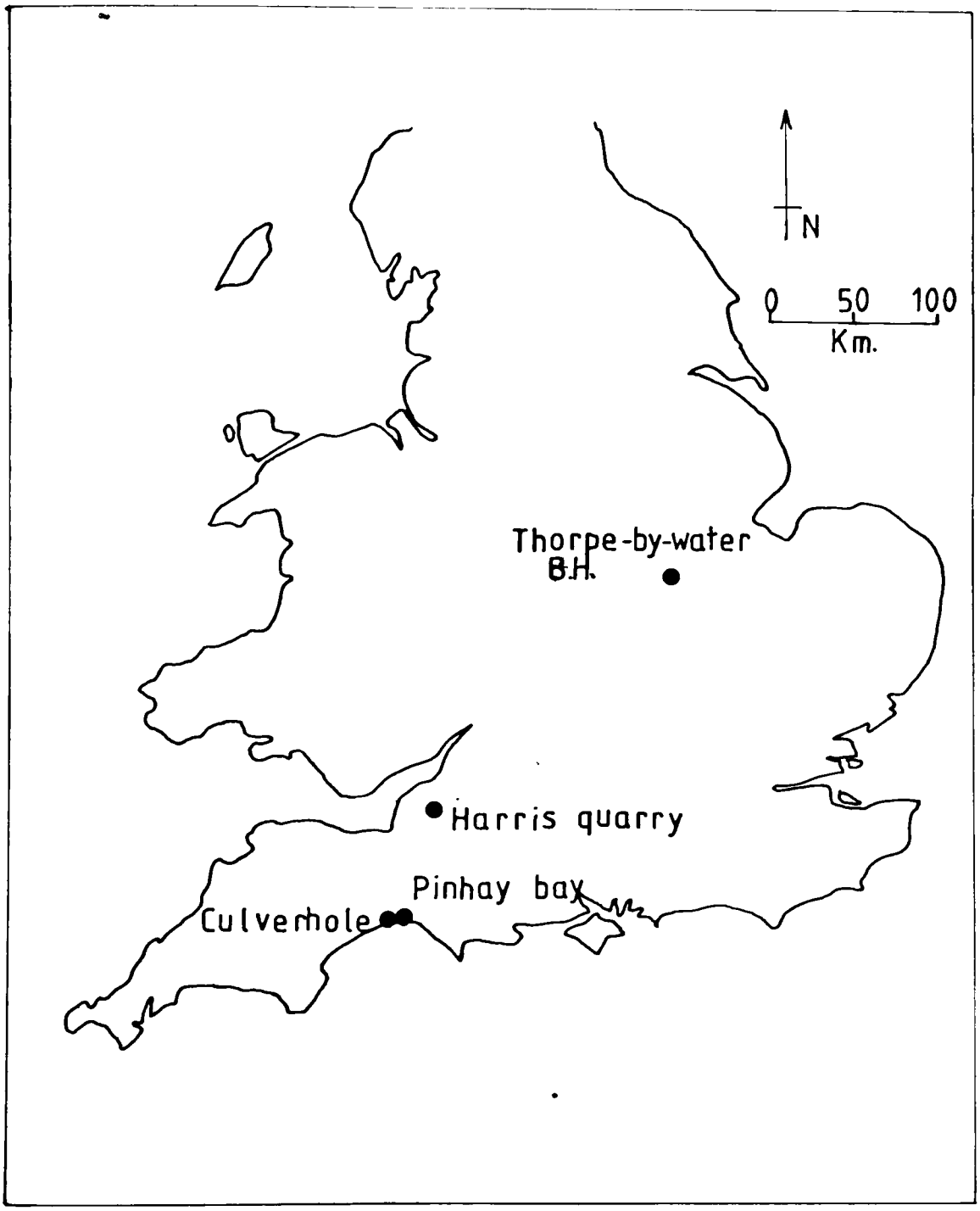


FIG. 5.4 : HARDGROUND LOCALITIES, LANGPORT MEMBER

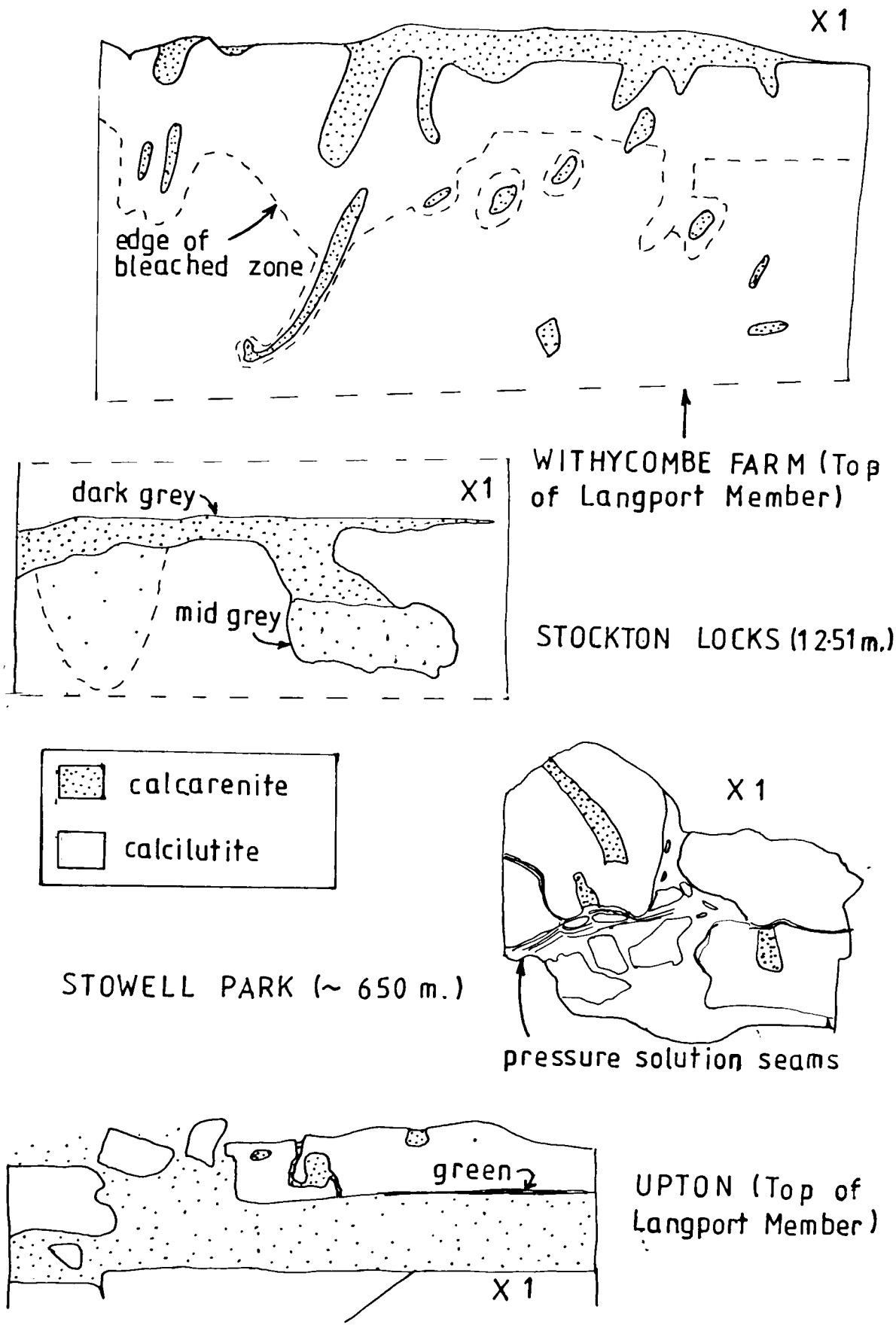


FIG. 5.5: CONTRASTING BURROW STYLES IN THE LANGPORT MEMBER IN A NUMBER OF IGS BOREHOLES

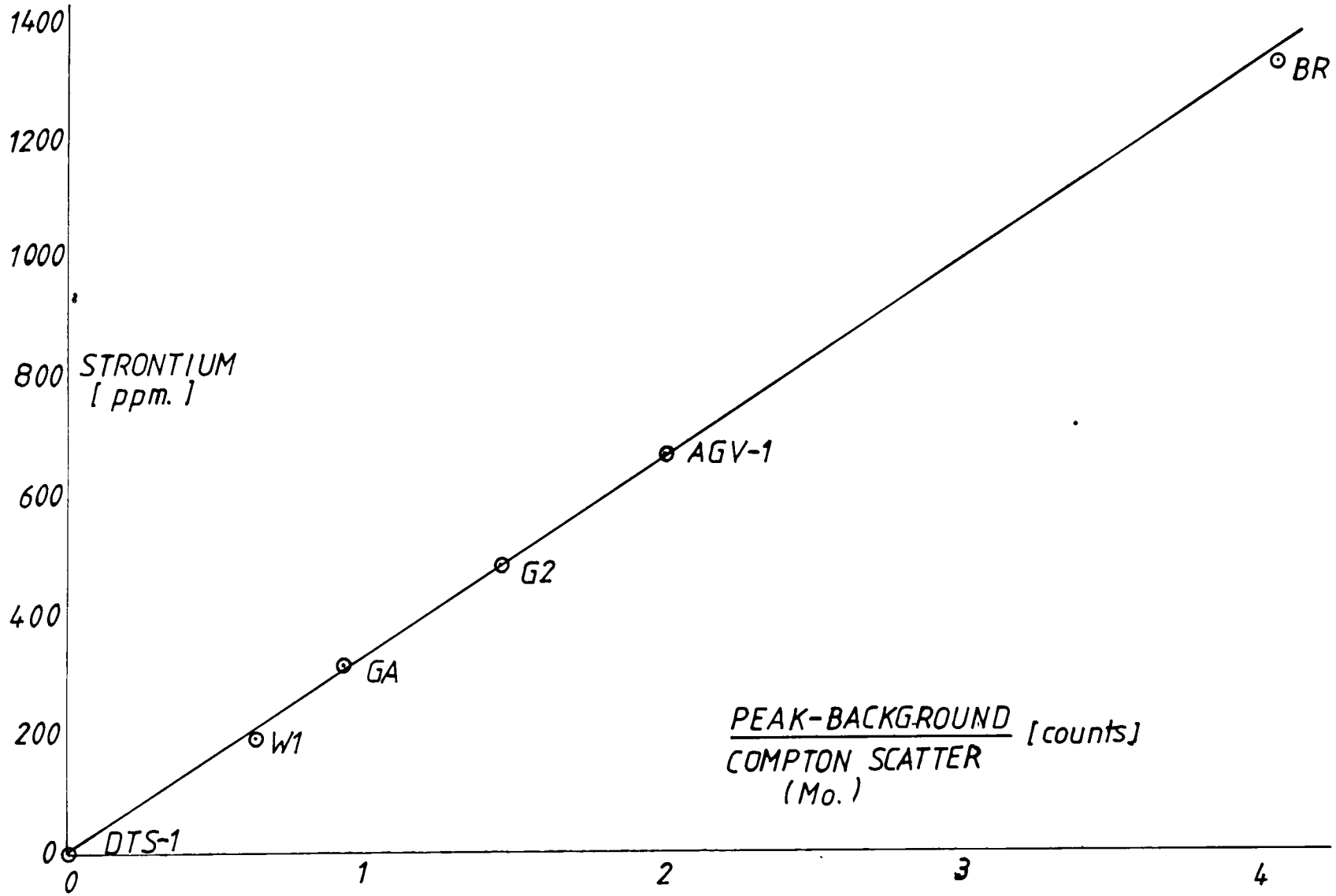


FIG. 5.6: CALIBRATION GRAPH FOR STRONTIUM, USING X-RAY FLUORESCENCE

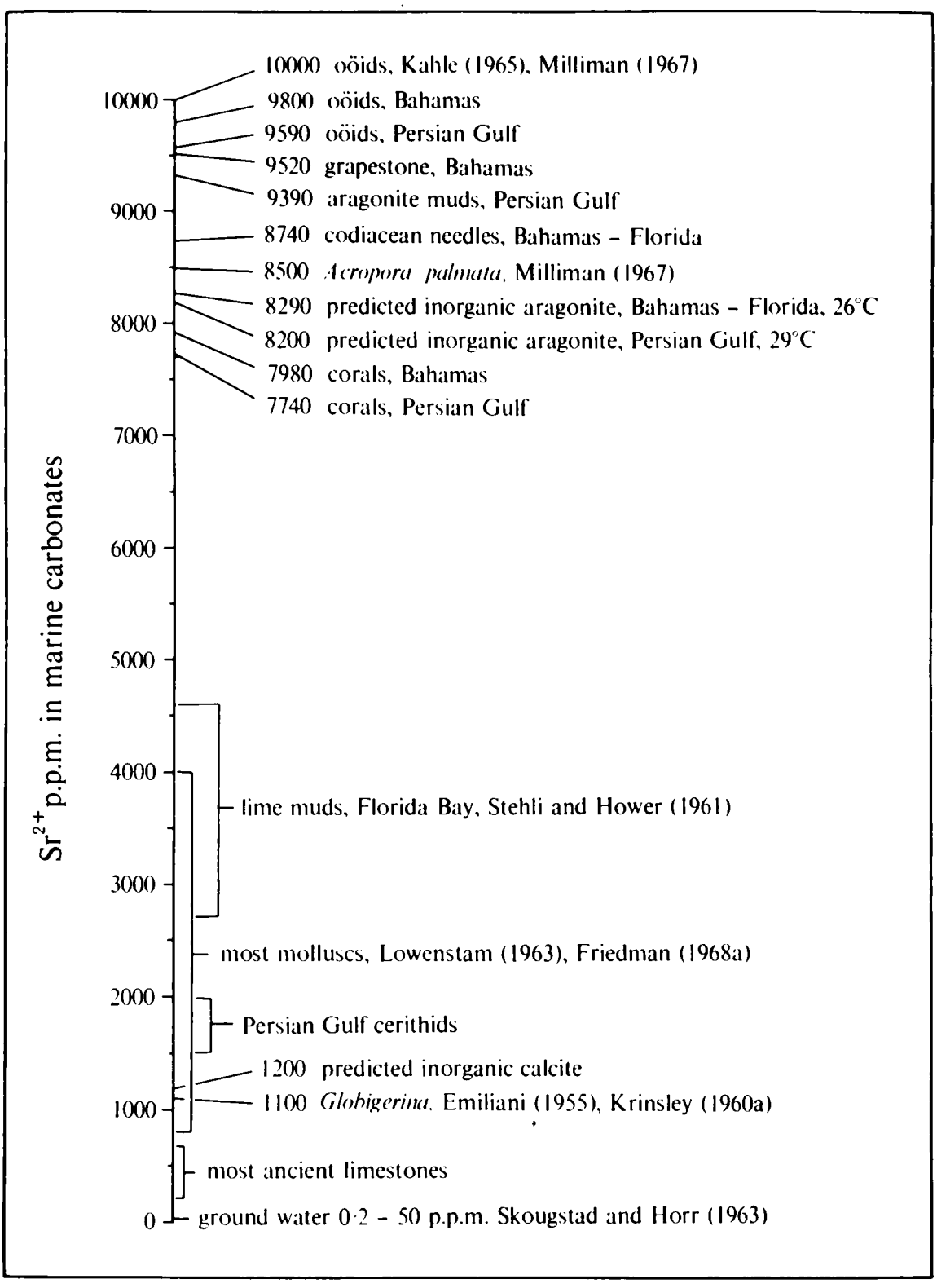
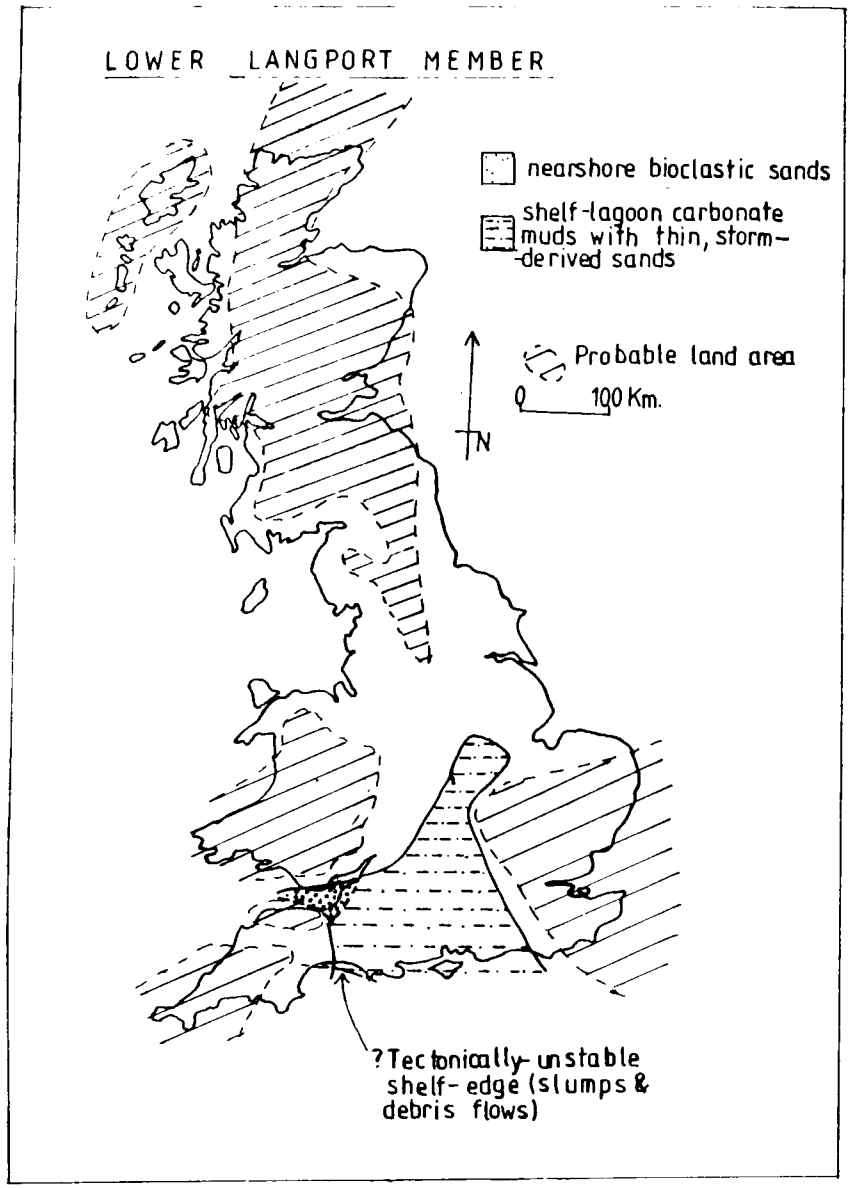


FIG. 5.7: CONCENTRATIONS OF Sr^{2+} IN NATURAL PRECIPITATES & GROUND WATER (After Bathurst, 1975)



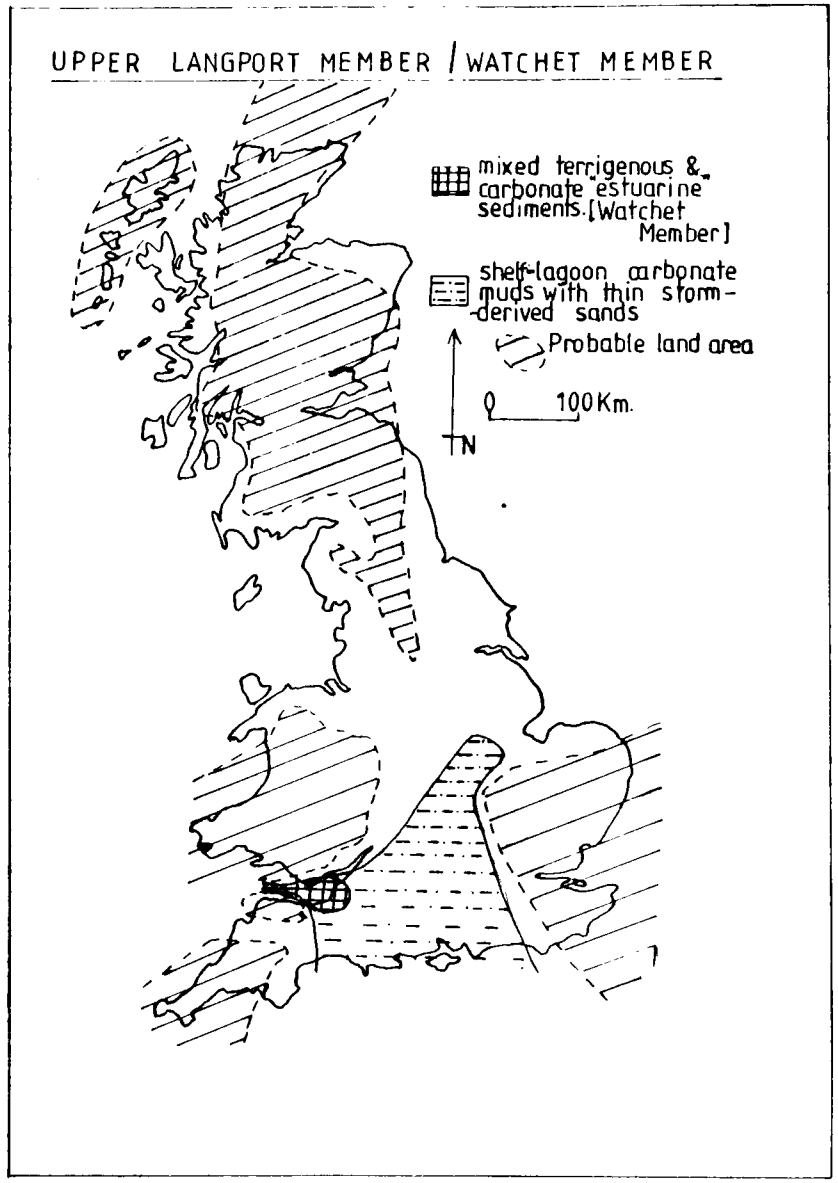


FIG. 5.8: PALAEOENVIRONMENTS, LANGPORT & WATCHET MEMBERS

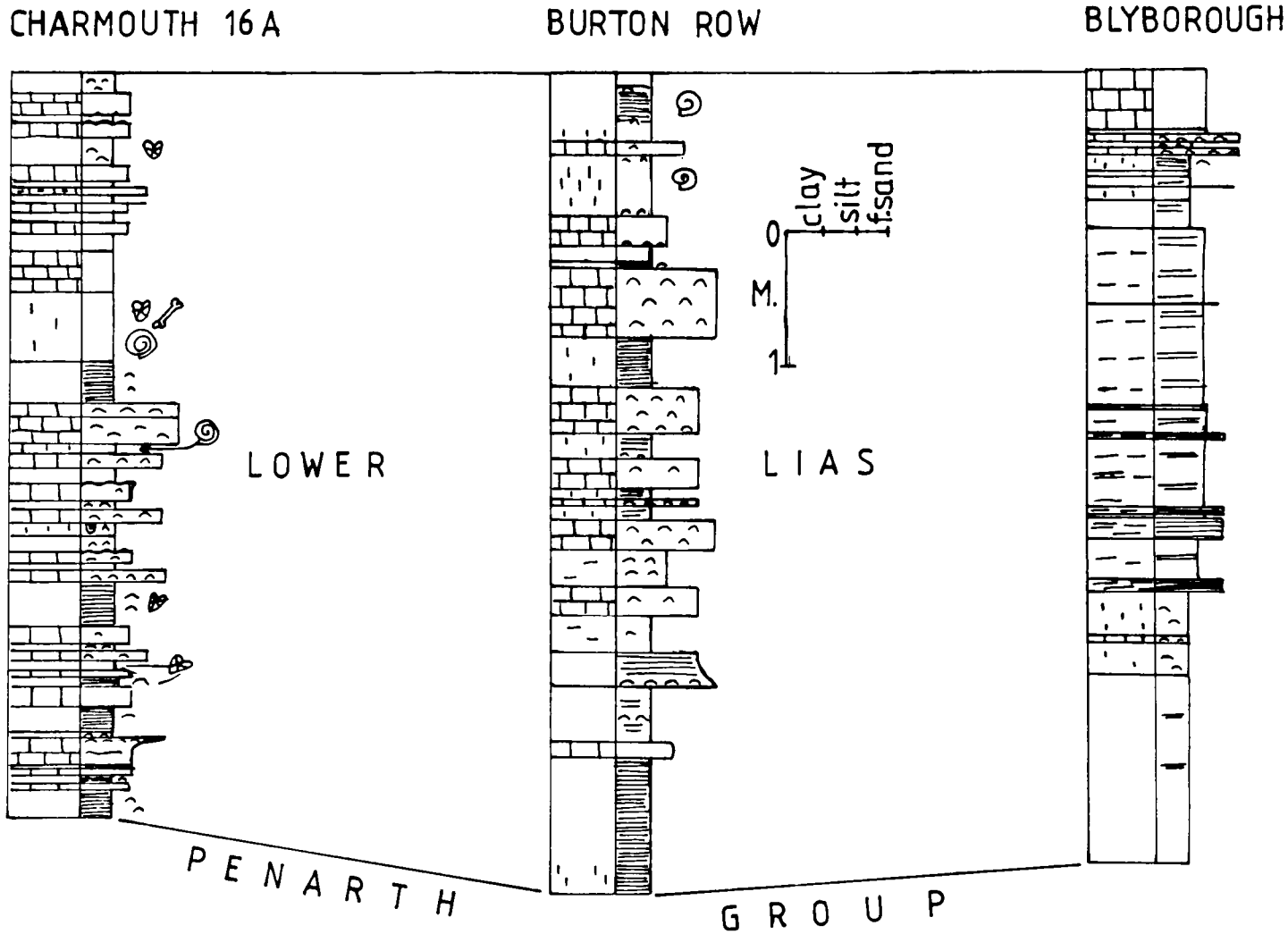


FIG. 6.1: GRAPHIC LOGS OF THE LOWER LIAS IN SOME I.G.S. BOREHOLES

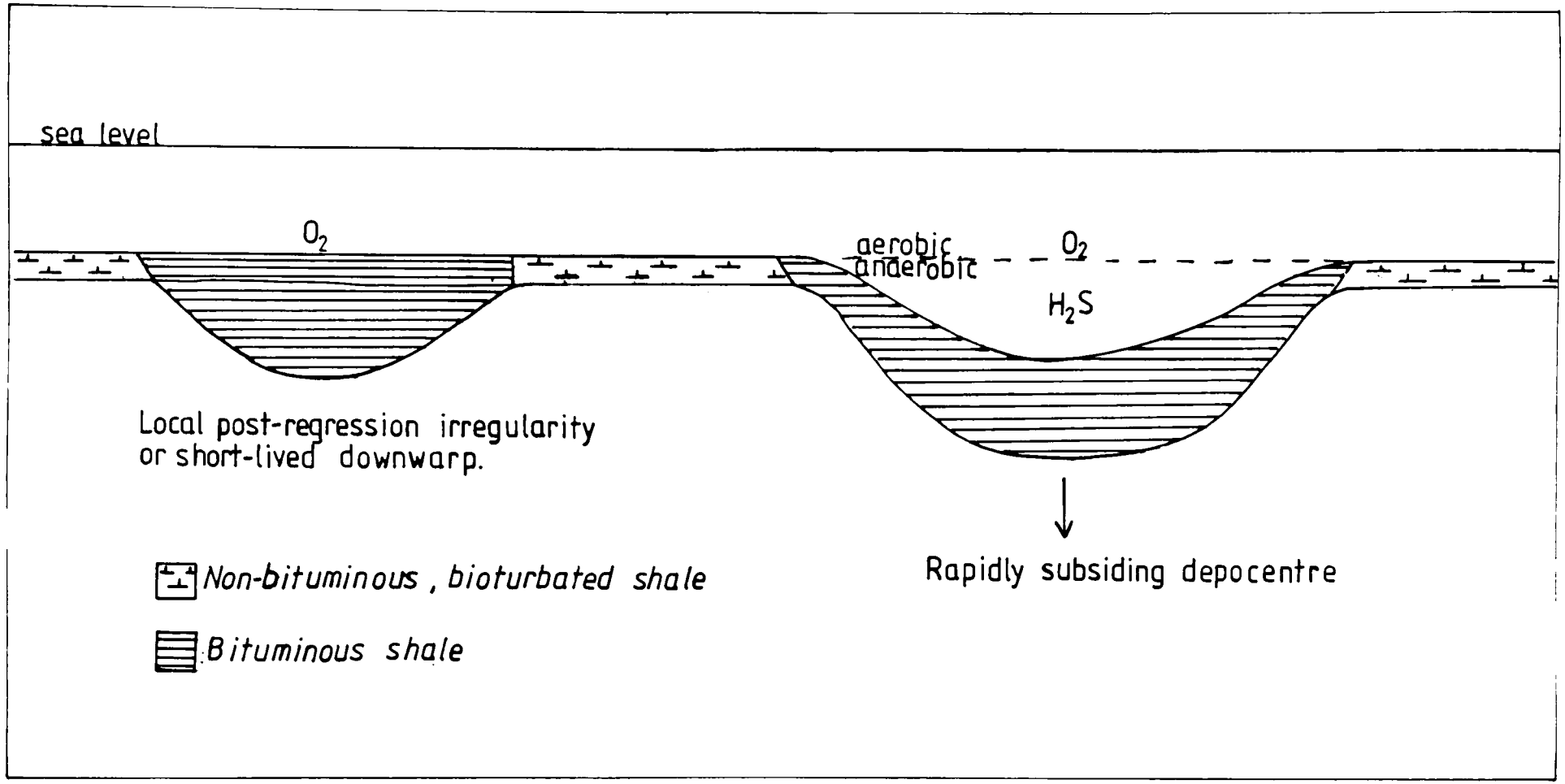


FIG. 6.2: MODEL FOR JURASSIC BITUMINOUS SHALE DEPOSITION (After Hallam & Bradshaw, 1979)

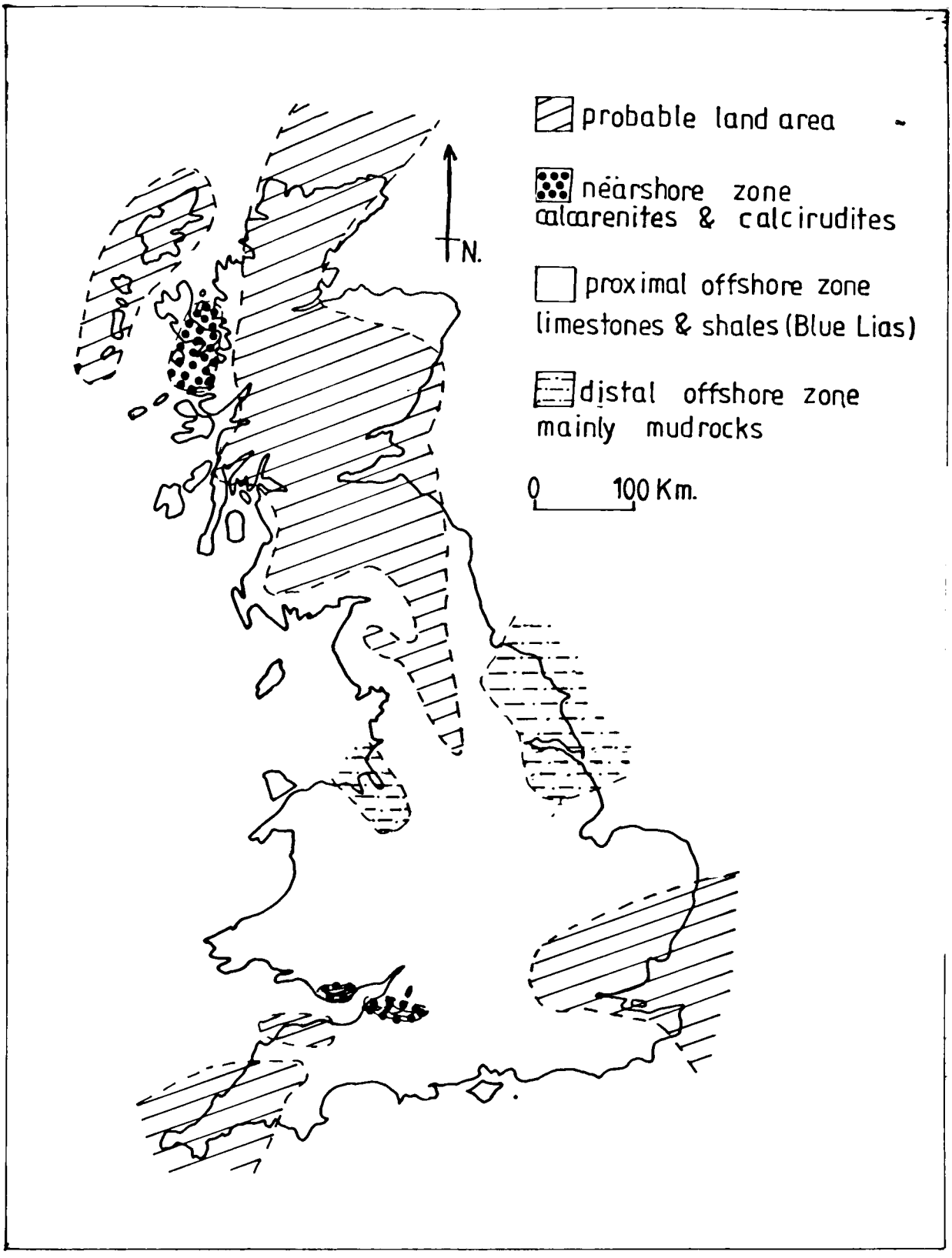


FIG. 6.3: PALAEOENVIRONMENTS, LOWER LIAS

KEY TO SAMPLE LOCATIONS: FIGS 7.1, 7.3, 7.5, 7.6, 7.7

1. British Steel, ore terminal foundations, Redcar.
2. Harrogate house
3. Dibdale
4. Crosby Court. } Near Northallerton.
5. I.G.S. Scalla Moor B.H.
6. I.G.S. Cockle Pits B.H.
7. I.G.S. Blyborough B.H.
8. I.G.S. Wilkesley B.H.
9. I.G.S. Platt Lane B.H.
10. Beacon Hill, Newark.
11. Barnstone railway cutting.
12. Bunny hill road cut
13. I.G.S. Thorpe-by-water B.H.
14. I.G.S. Withycombe Farm B.H.
15. I.G.S. Steeple Aston B.H.
16. I.G.S. Apley barn B.H.
17. I.G.S. Upton B.H.
18. I.G.S. Stowell park B.H.
19. Wainlode Cliff
20. Westbury garden cliff
21. Aust Cliff
22. Carrefour hypermarket, Patchway.
23. St. Mary's Well bay, Cardiff.
24. I.G.S. Burton Row B.H.
25. Lilstock.
26. St. Audries.
27. Blue Anchor
28. I.G.S. Selworthy no. 2, B.H.
29. Railway cutting, Shepton Mallet.
30. Culverhole
31. D of E Winterborne kingston B.H.

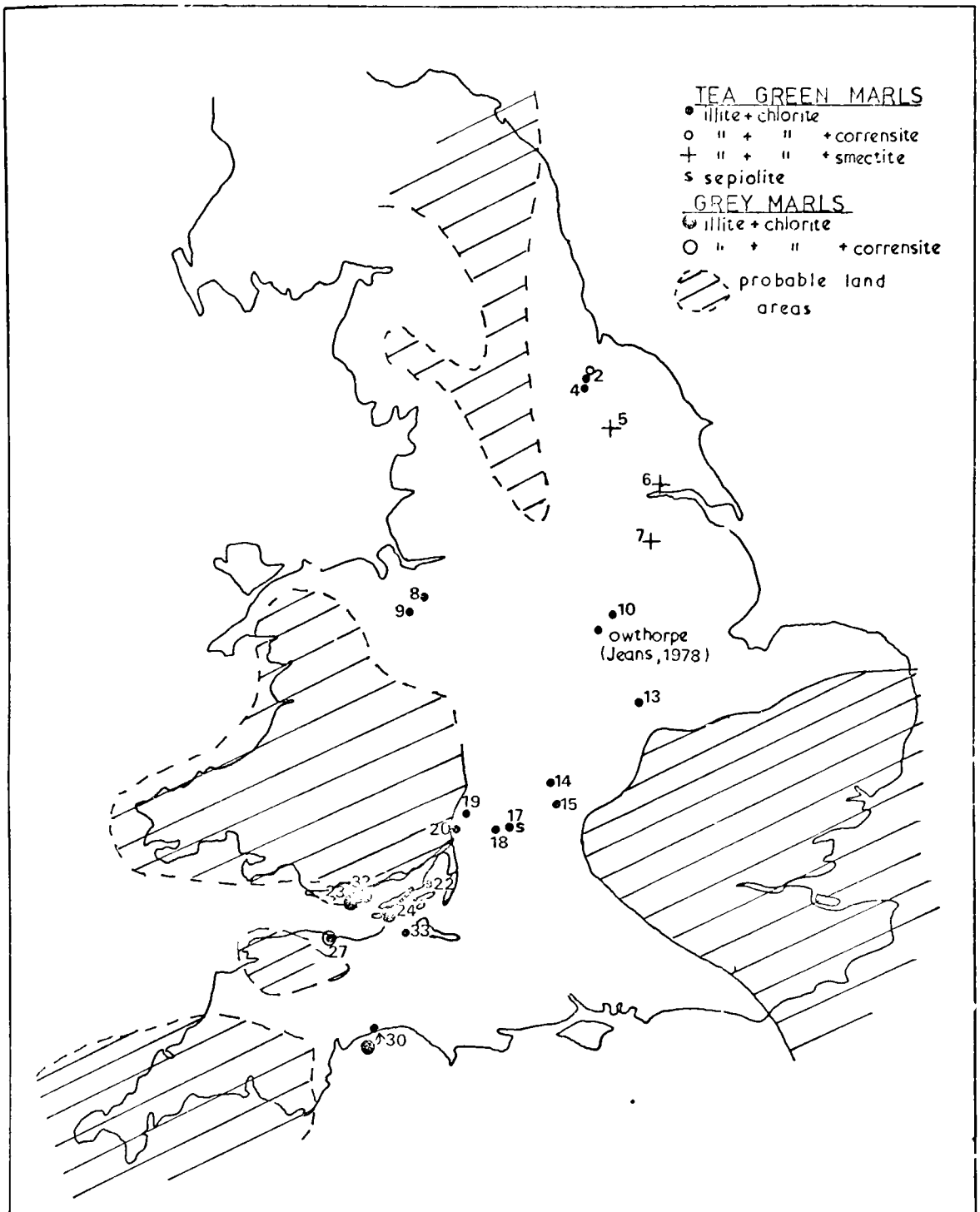


FIG. 7.1: CLAY MINERAL DISTRIBUTION, TEA GREEN & GREY MARLS

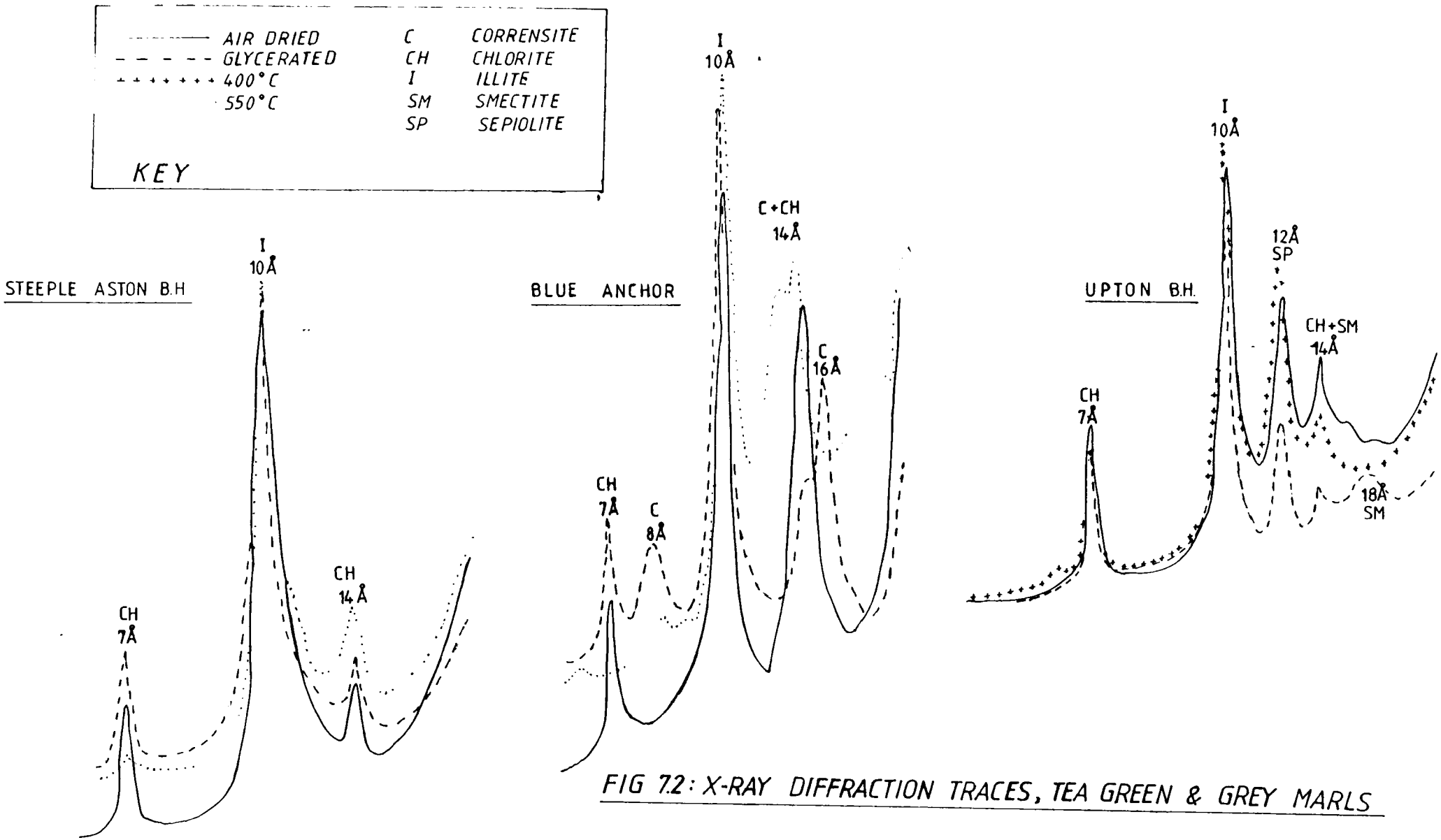


FIG 7.2: X-RAY DIFFRACTION TRACES, TEA GREEN & GREY MARLS

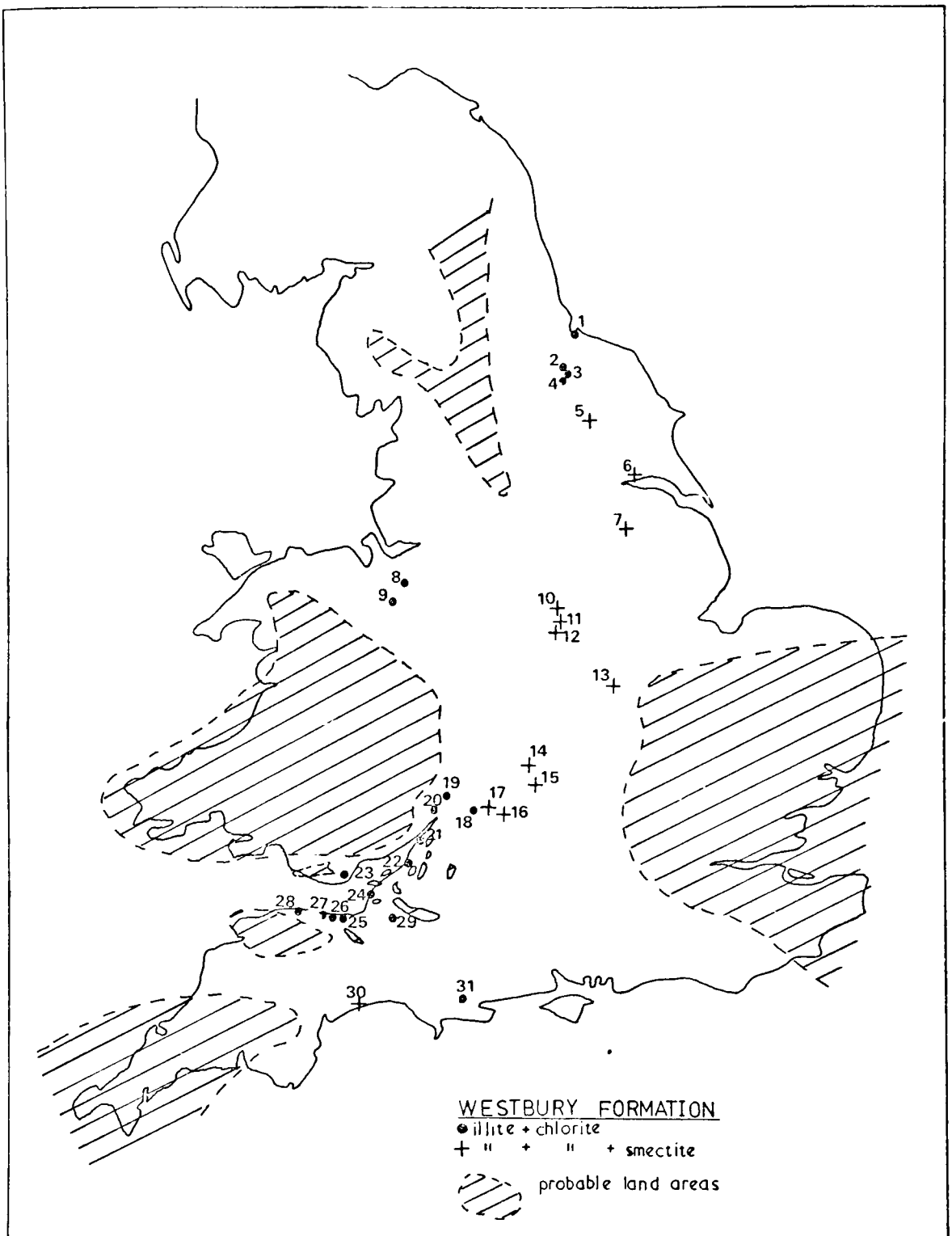


FIG. 7.3: CLAY MINERAL DISTRIBUTION, WESTBURY FORMATION

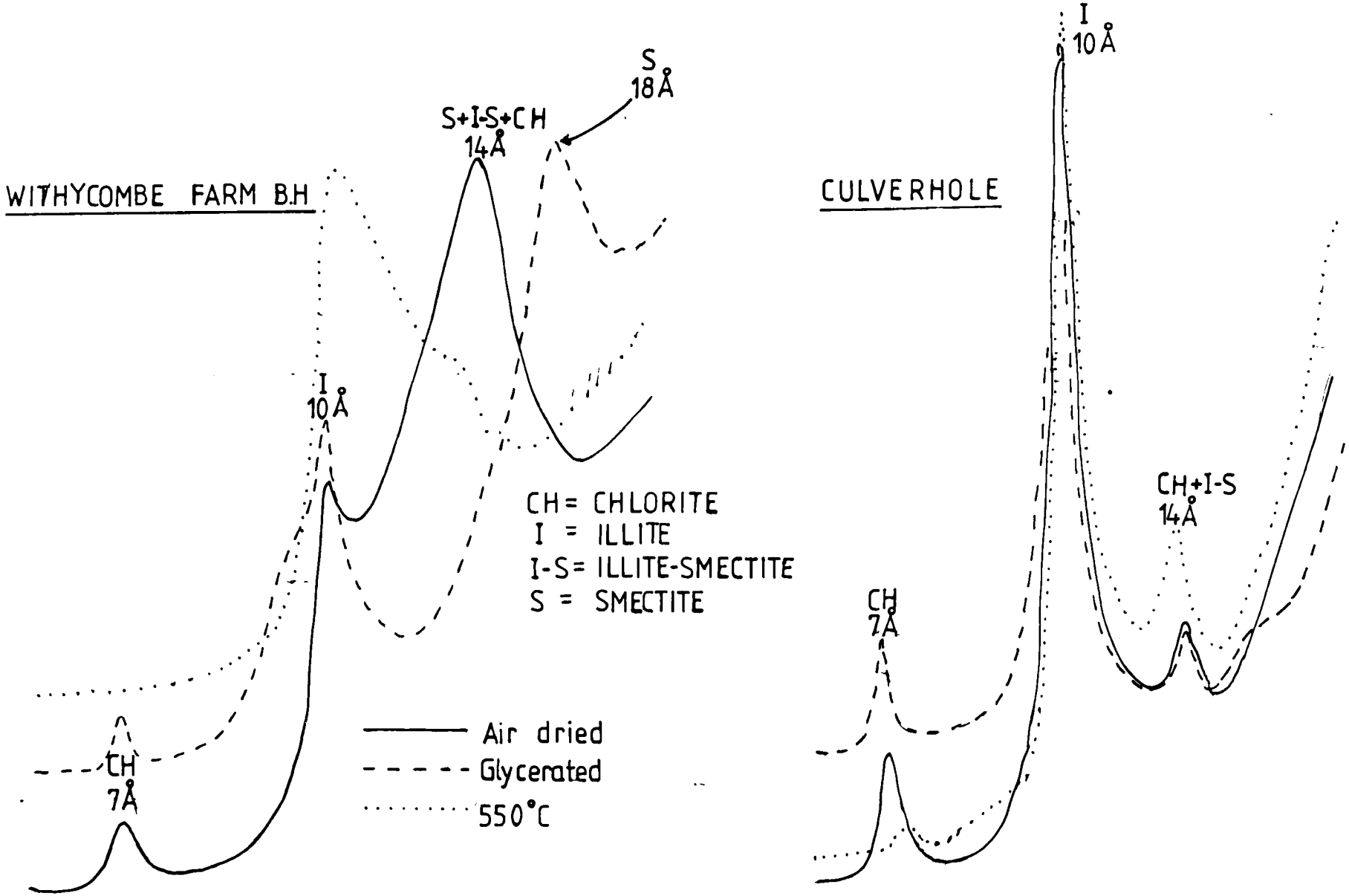


FIG 7.4: X-RAY DIFFRACTION TRACES, WESTBURY MEMBER

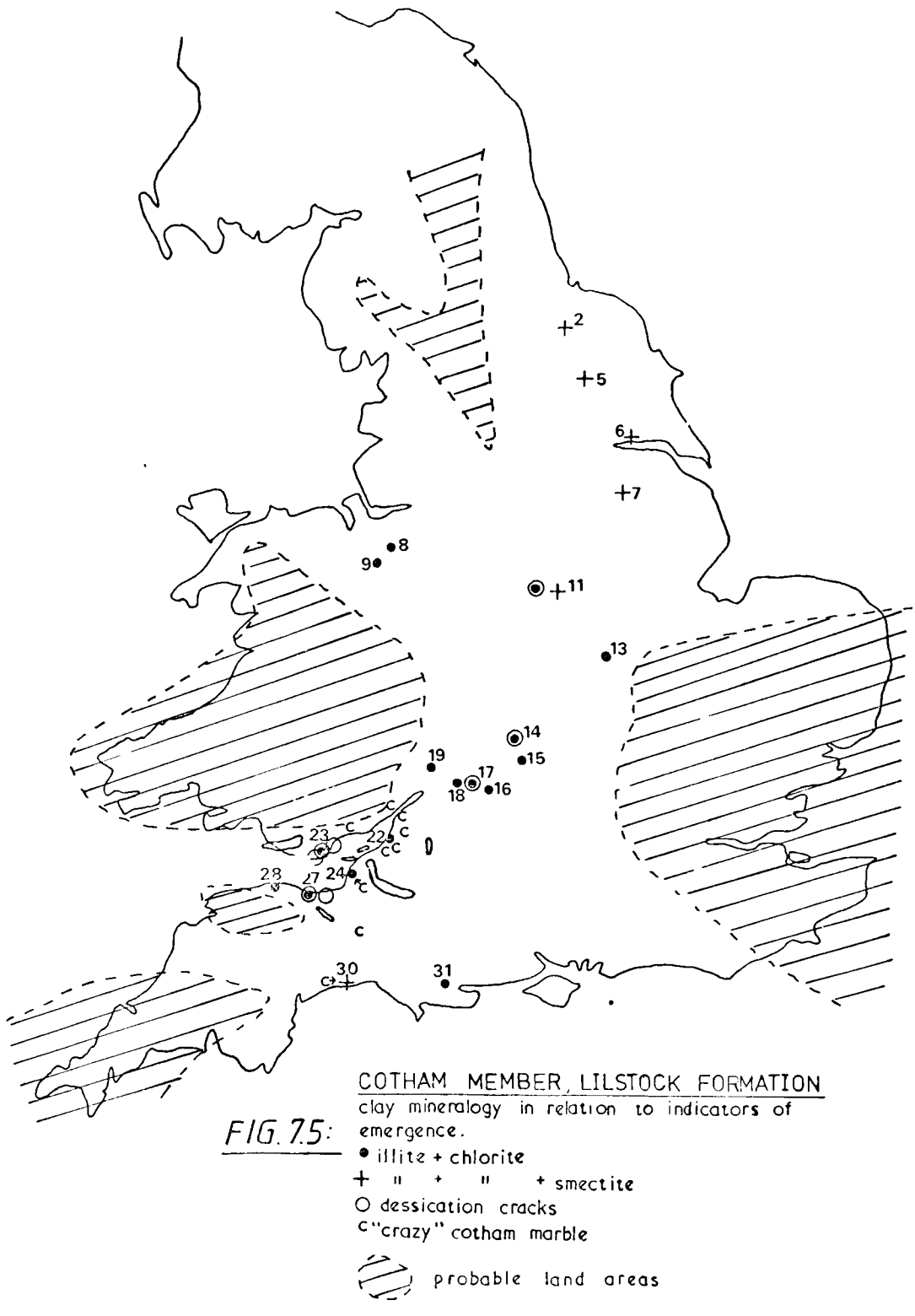


FIG. 7.5:

COTHAM MEMBER, LILSTOCK FORMATION

clay mineralogy in relation to indicators of emergence.

- ● illite + chlorite
- \+ " + " + smectite
- O dessication cracks
- C "crazy" cotham marble
- probable land areas

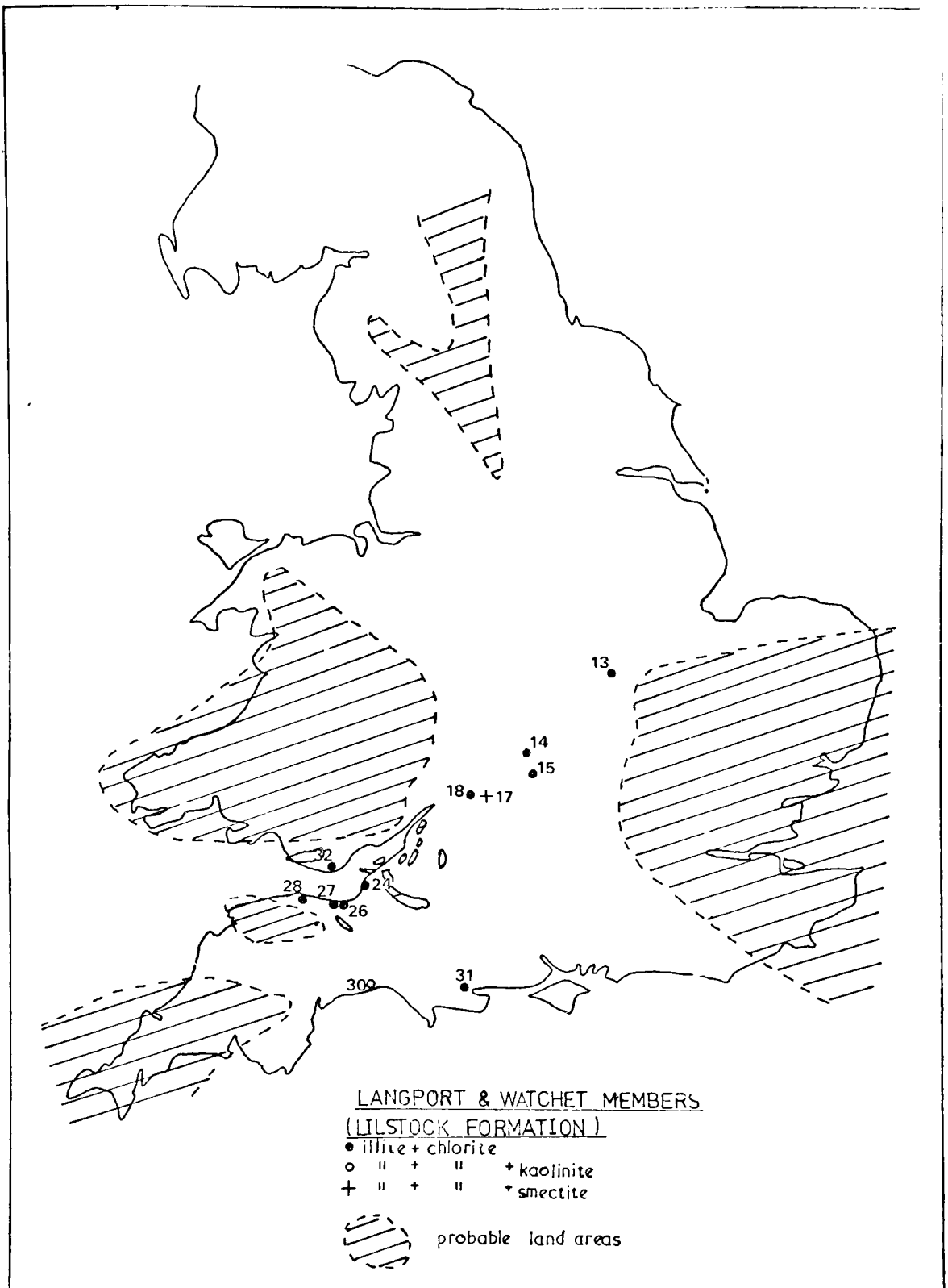


FIG. 7.6: CLAY MINERAL DISTRIBUTION, LILSTOCK FORMATION

FIG. 7.7: CLAY MINERAL DISTRIBUTION, LOWER LIAS

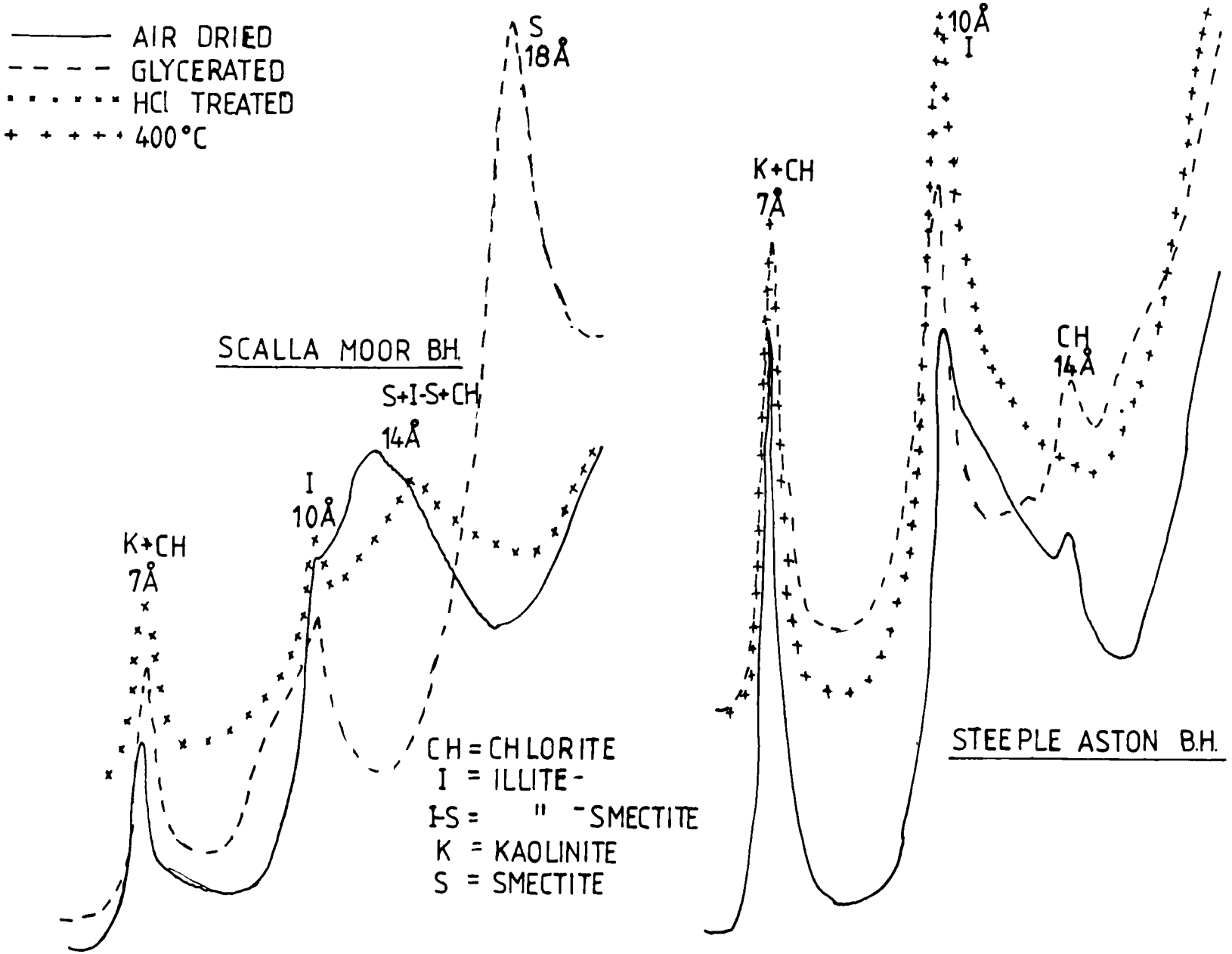


FIG. 7.8 : X-RAY DIFFRACTION TRACES, LOWER LIAS

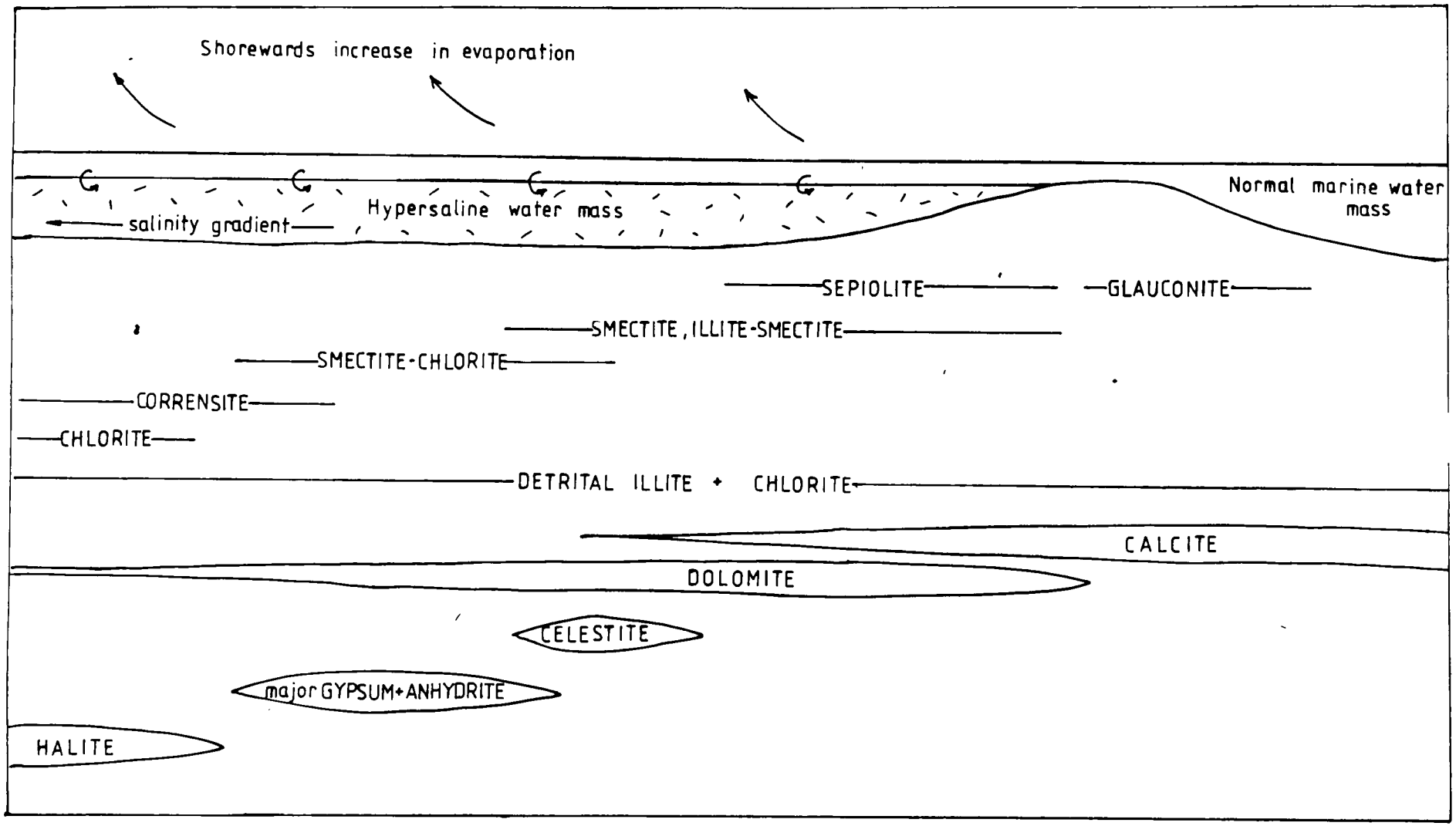


FIG. 7.9: MODEL FOR THE ORIGIN & DISTRIBUTION OF CLAYS, MERCIA MUDSTONE GROUP (After Jeans, 1978)

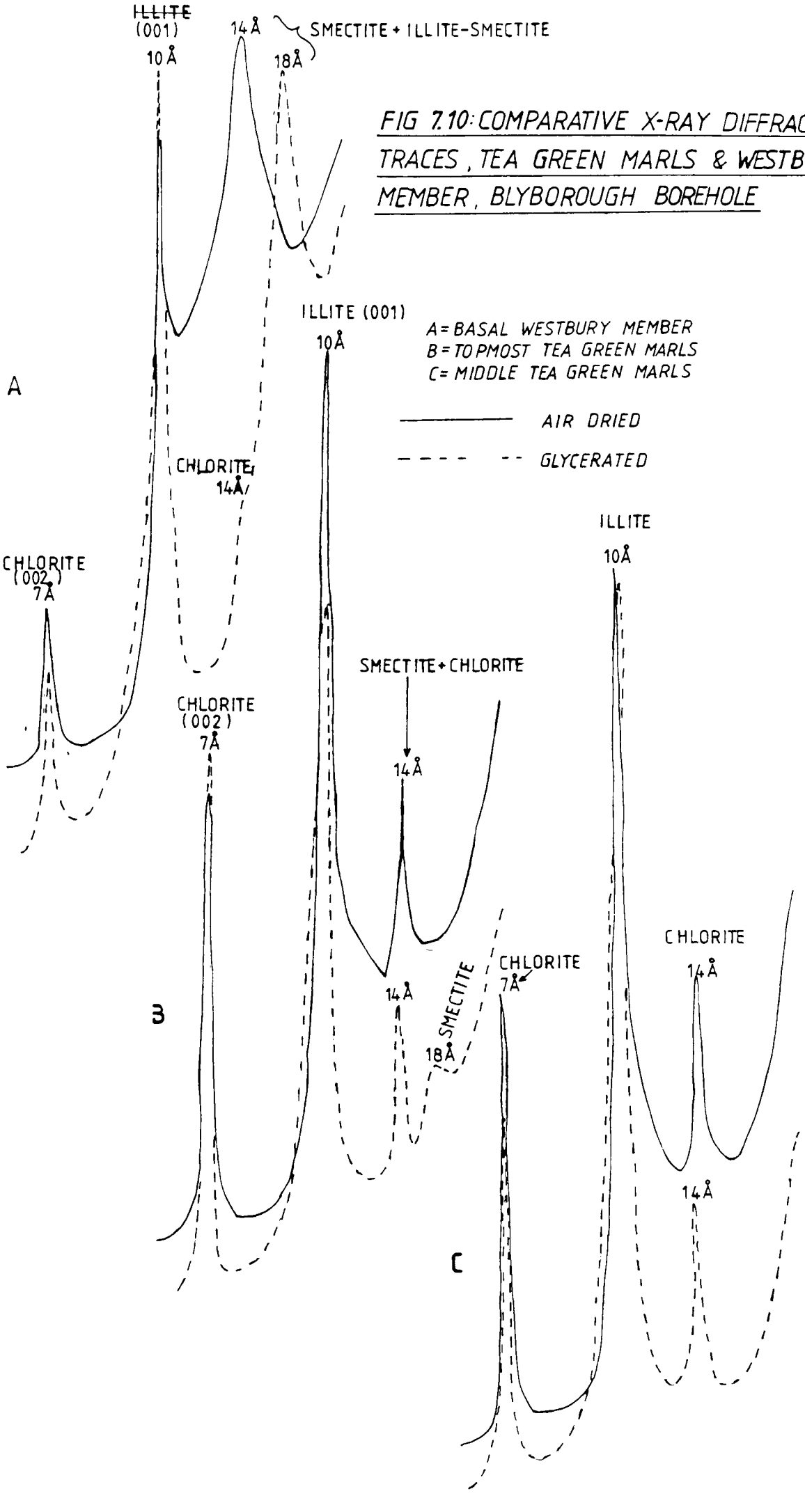


FIG 7.10: COMPARATIVE X-RAY DIFFRACTION TRACES, TEA GREEN MARLS & WESTBURY MEMBER, BLYBOROUGH BOREHOLE

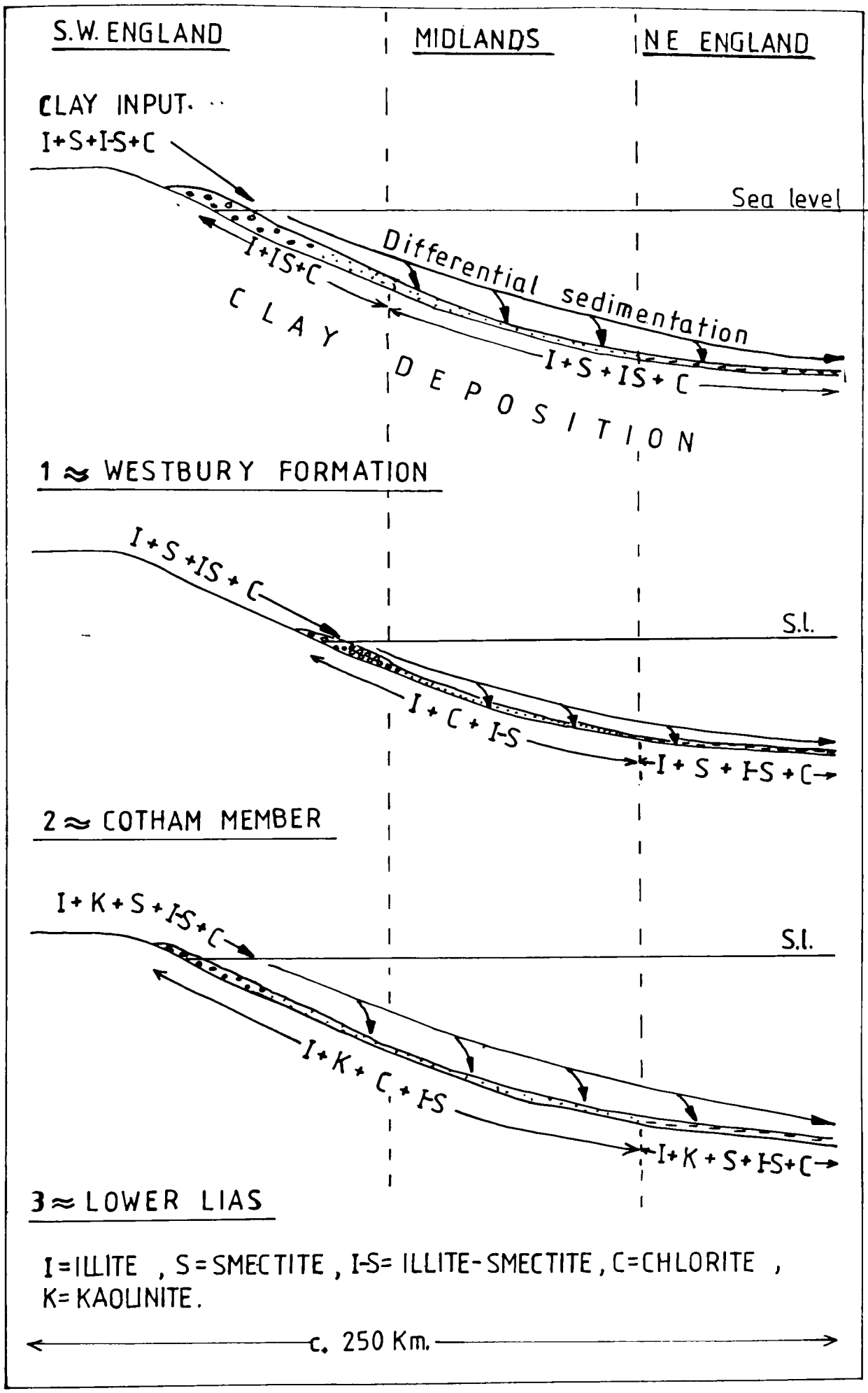


FIG. 7.11: MODEL TO EXPLAIN CLAY MINERAL DISTRIBUTIONS

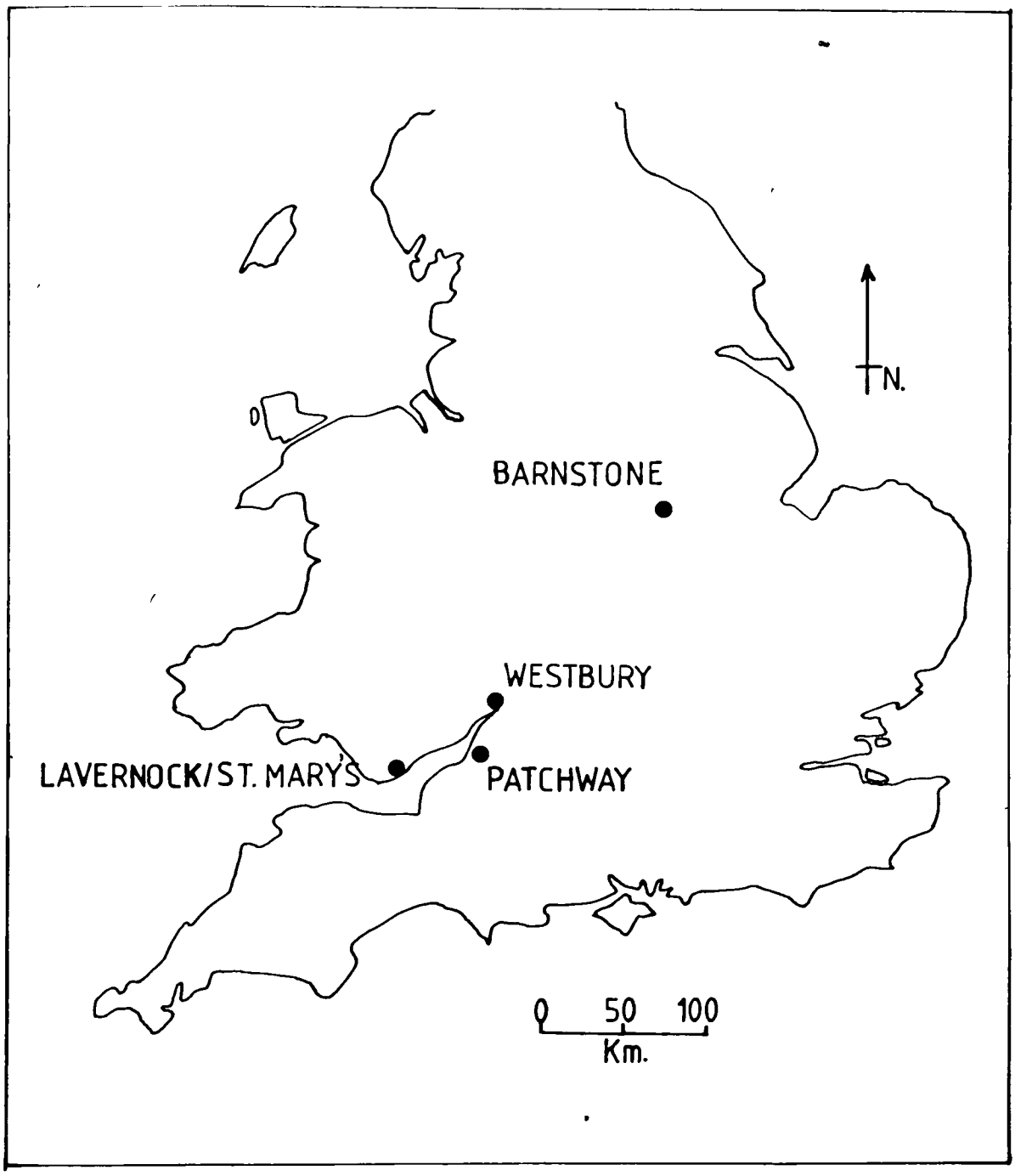


FIG. 8.1: ORGANIC CARBON IN THE WESTBURY MEMBER: LOCATIONS OF DETAILED ANALYSES

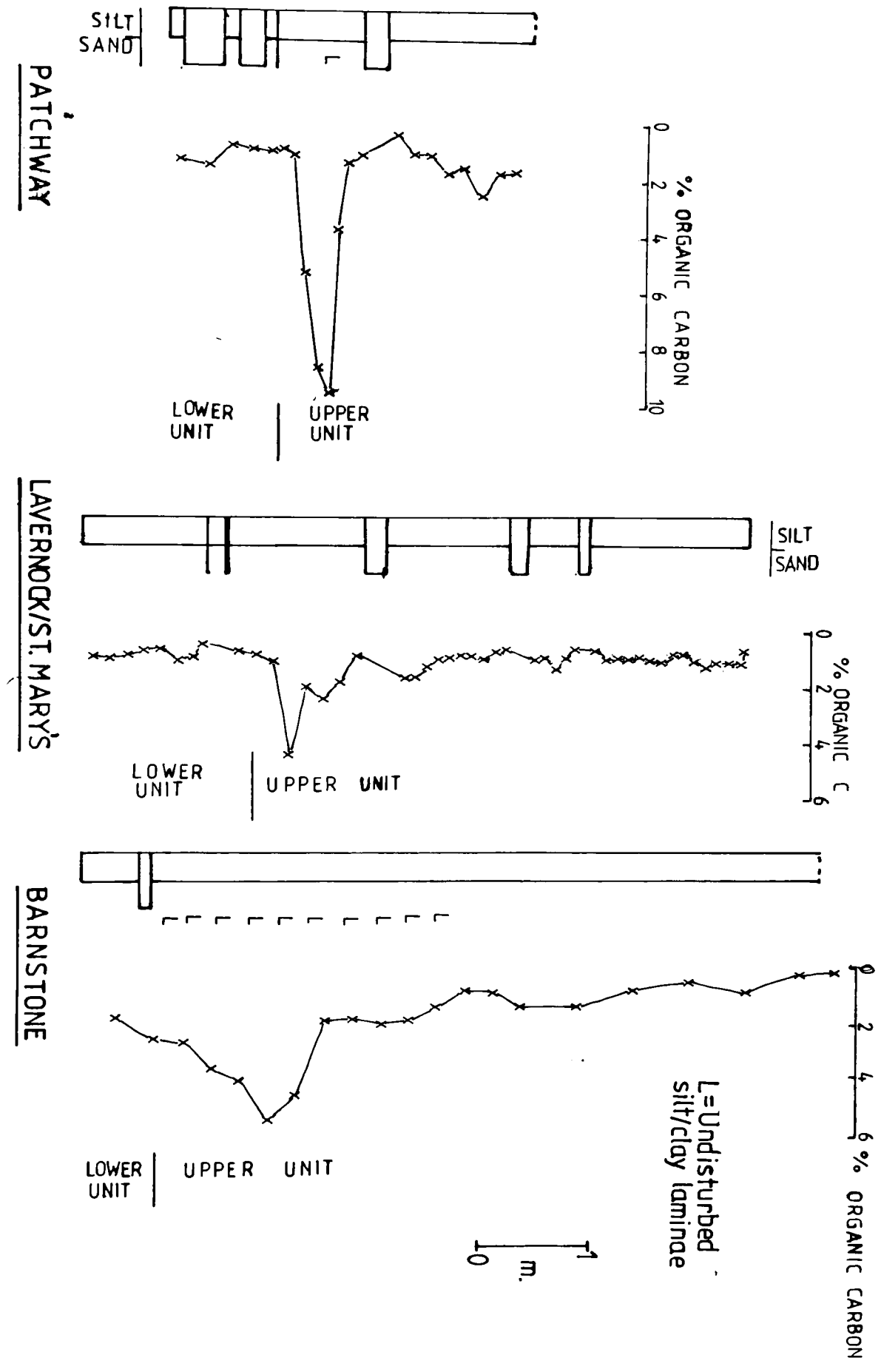


FIG. 8.2: ORGANIC CARBON PROFILES, WESTBURY MEMBER

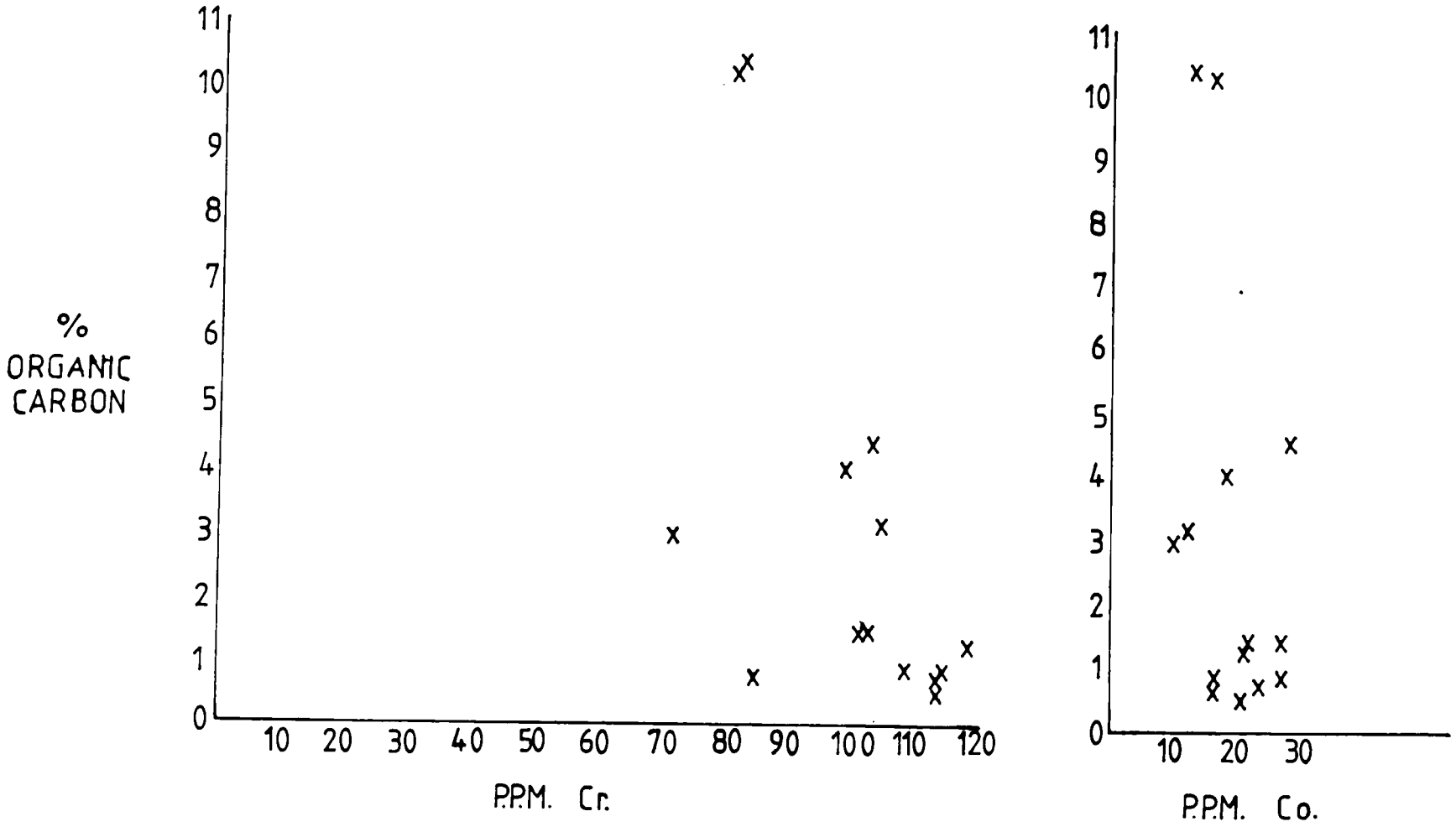


FIG.8.3: ORGANIC CARBON CONTENT VS CHROMIUM & COBALT, WESTBURY MEMBER

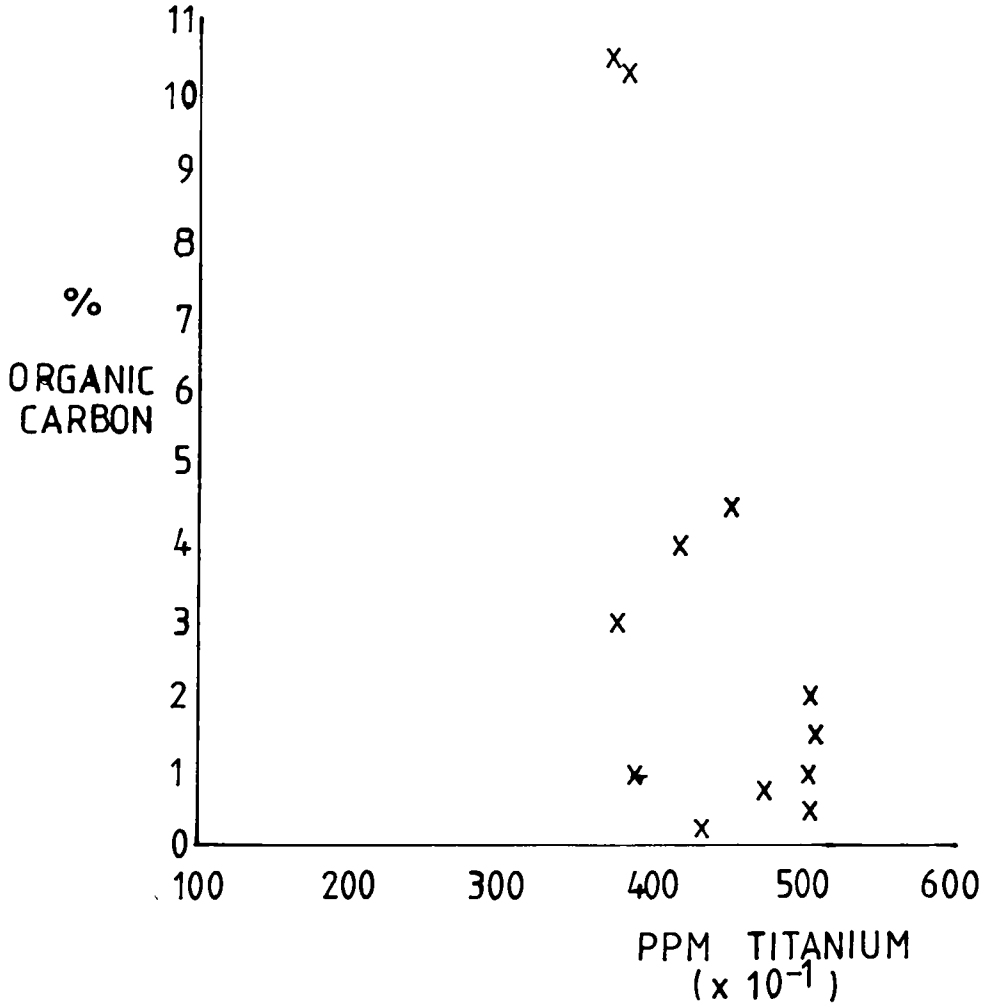
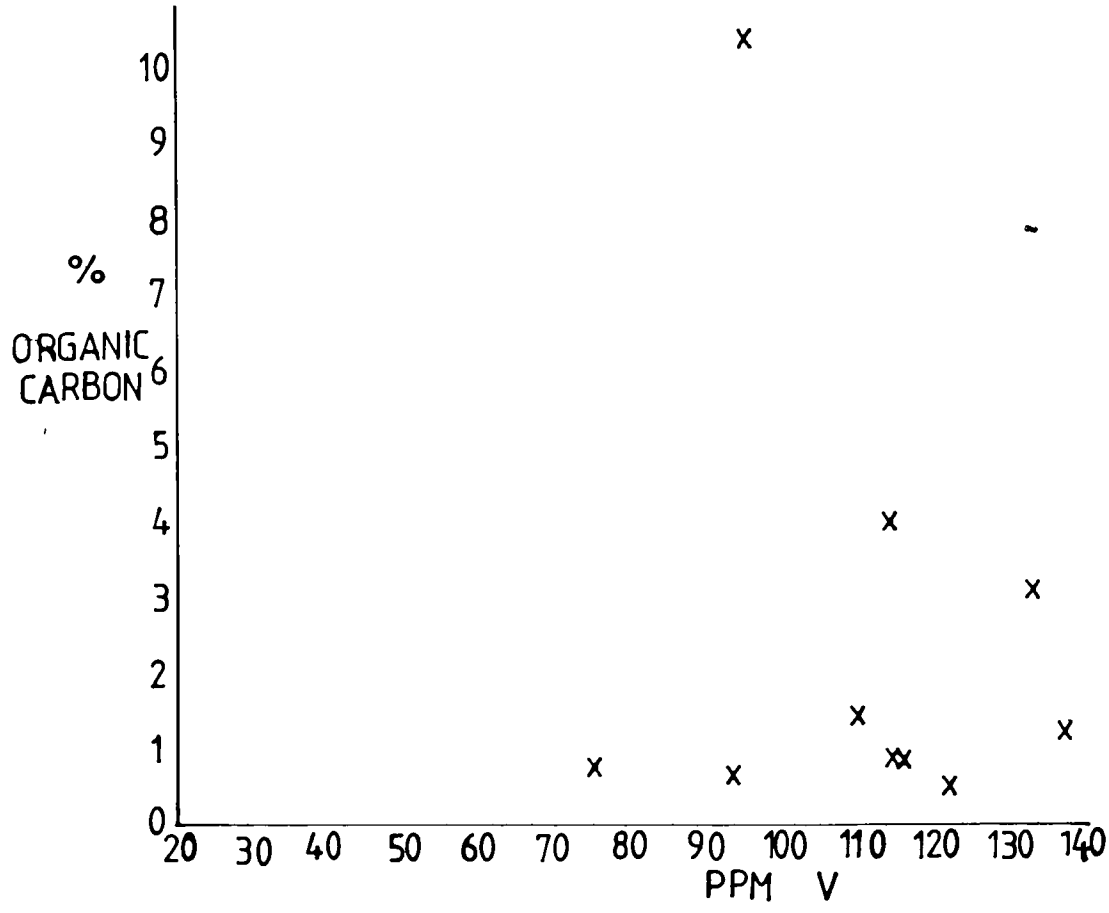


FIG 8.4: ORGANIC CARBON VS TITANIUM, WESTBURY MEMBER



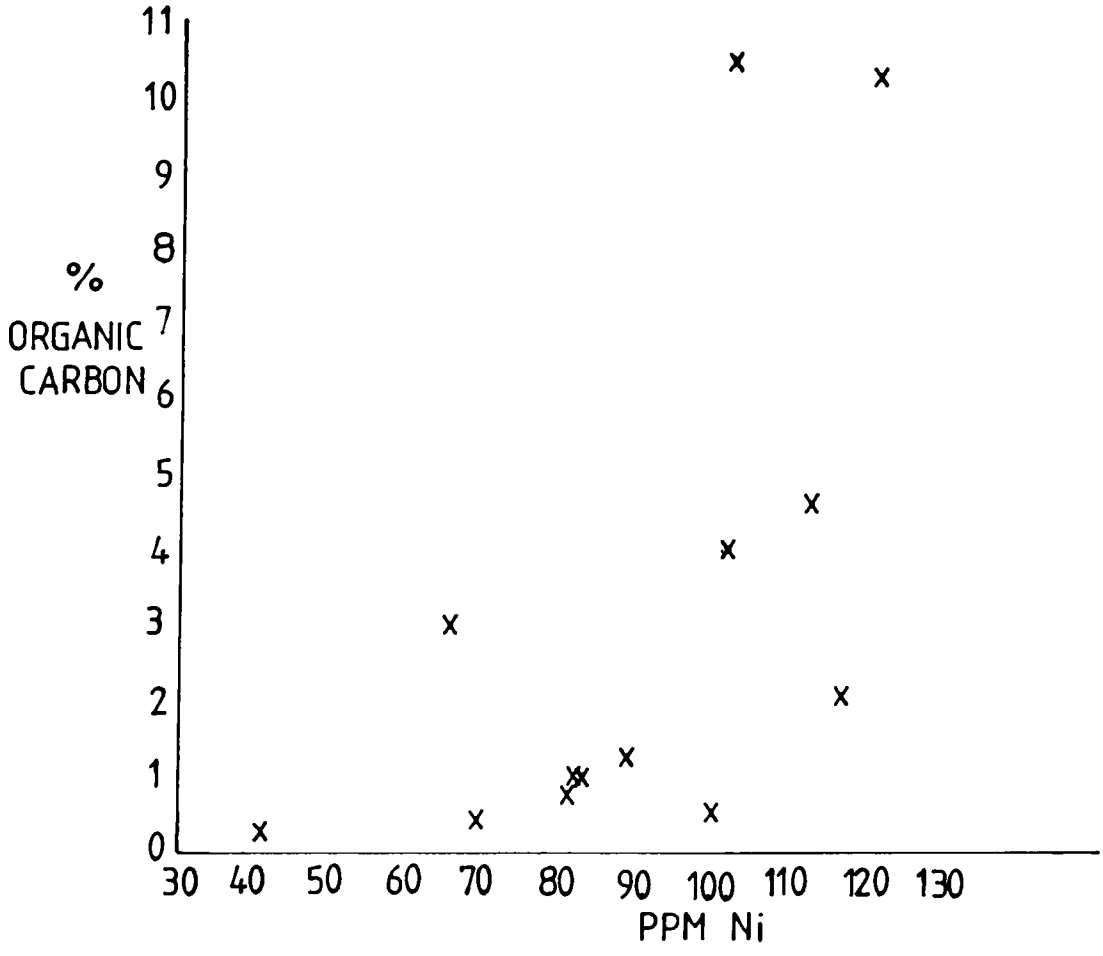


FIG. 8.5: ORGANIC CARBON VS VANADIUM/NICKEL, WESTBURY MEMBER

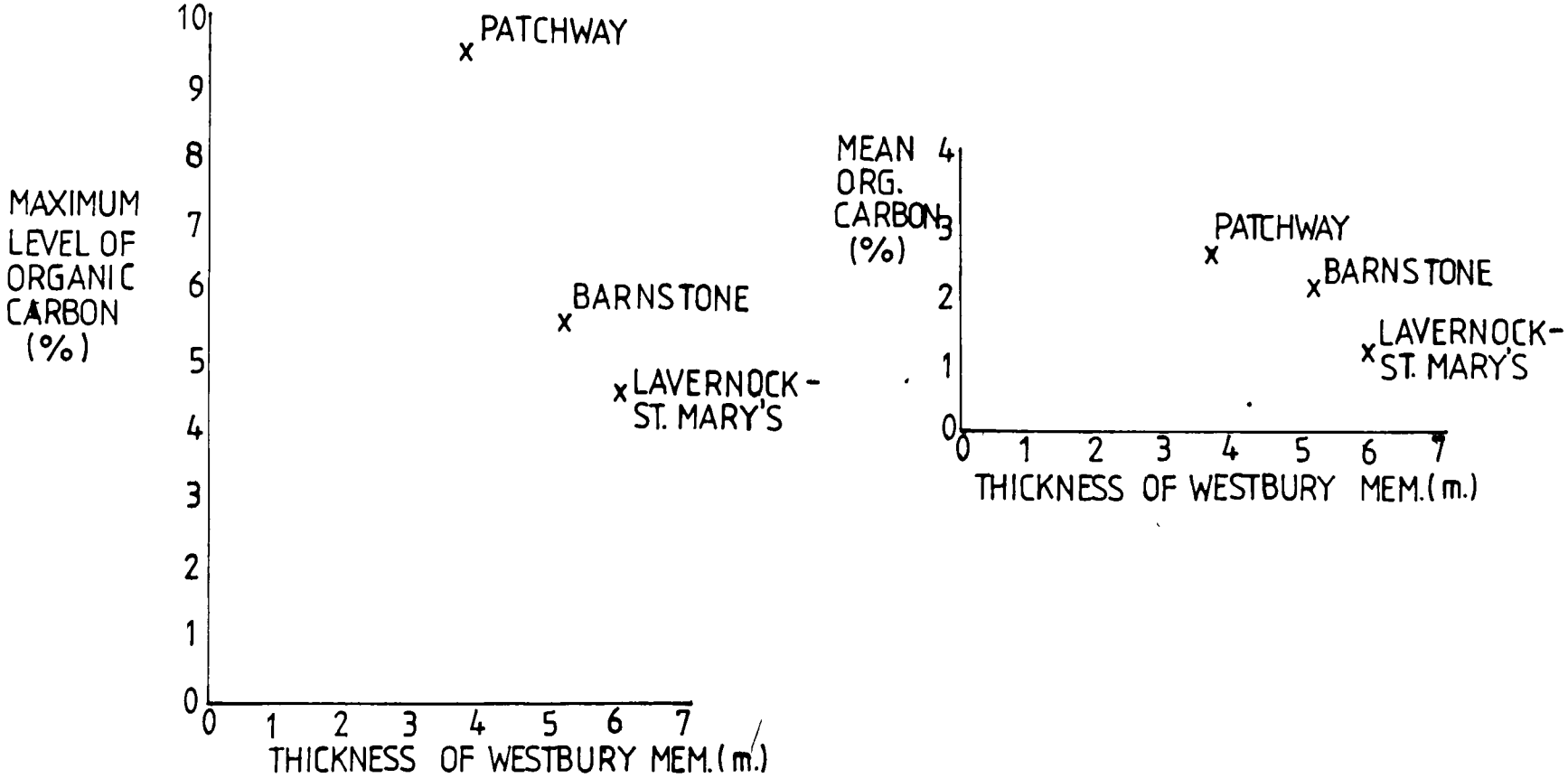
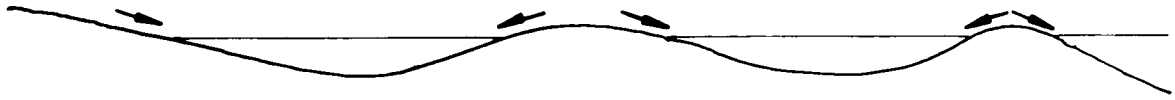
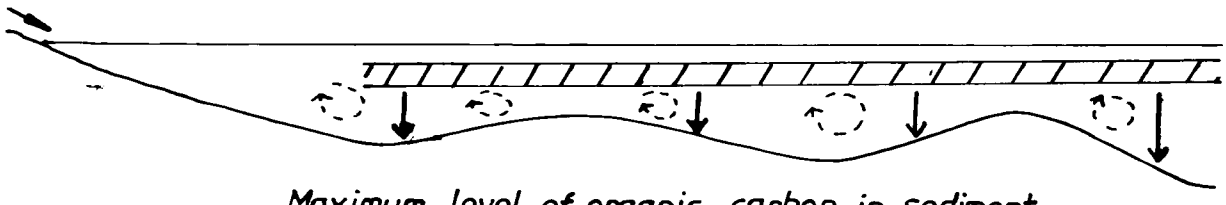


FIG. 8.6: THICKNESS OF THE WESTBURY MEMBER VS. ORGANIC CARBON CONTENT

1. SEMI-ISOLATED BASINS: Mainly terrestrial organic input.



2. SHALLOW, LINKED BASINS: High phytoplanktonic organic input linked to good water mixing & nutrient recycling from bottom sediments



Maximum level of organic carbon in sediment

3. DEEPER, LINKED BASINS: Reduced phytoplanktonic activity due to diminished nutrient recycling.

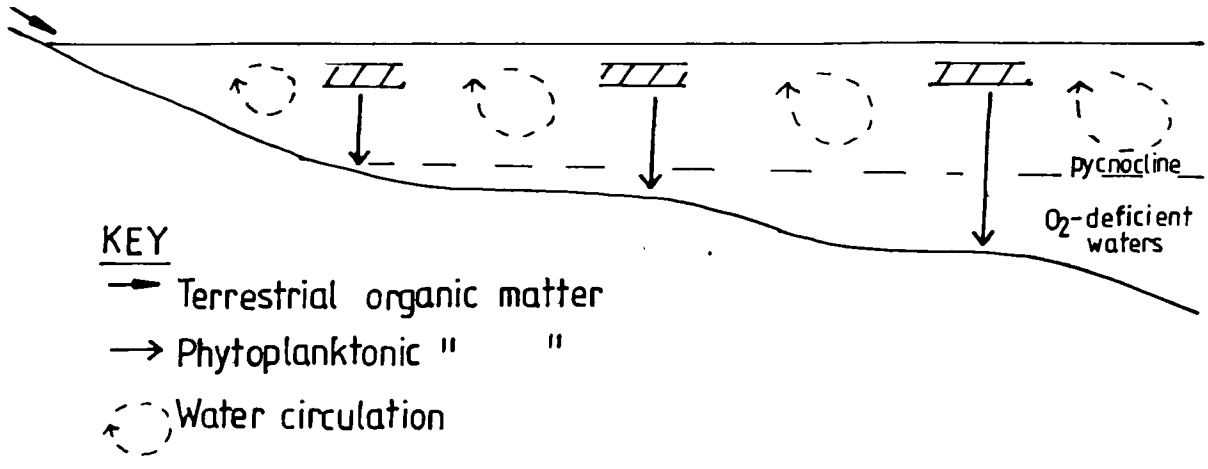


FIG. 8.7: PROPOSED MODEL FOR ORGANIC CARBON DISTRIBUTION IN THE WESTBURY MEMBER

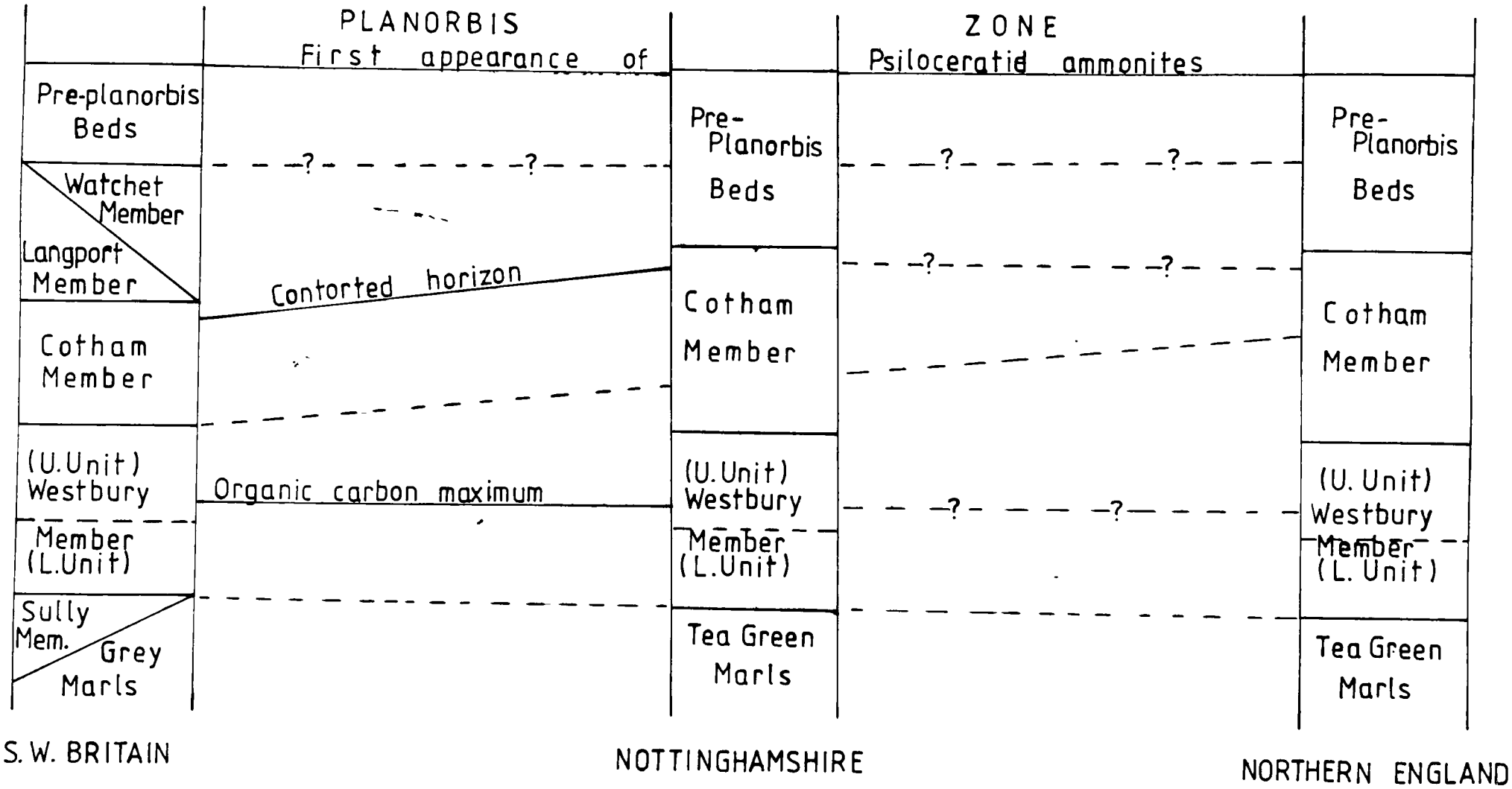


FIG. 9.1 : DIAGRAMMATIC REPRESENTATION OF REGIONAL CORRELATION , PENARTH GROUP

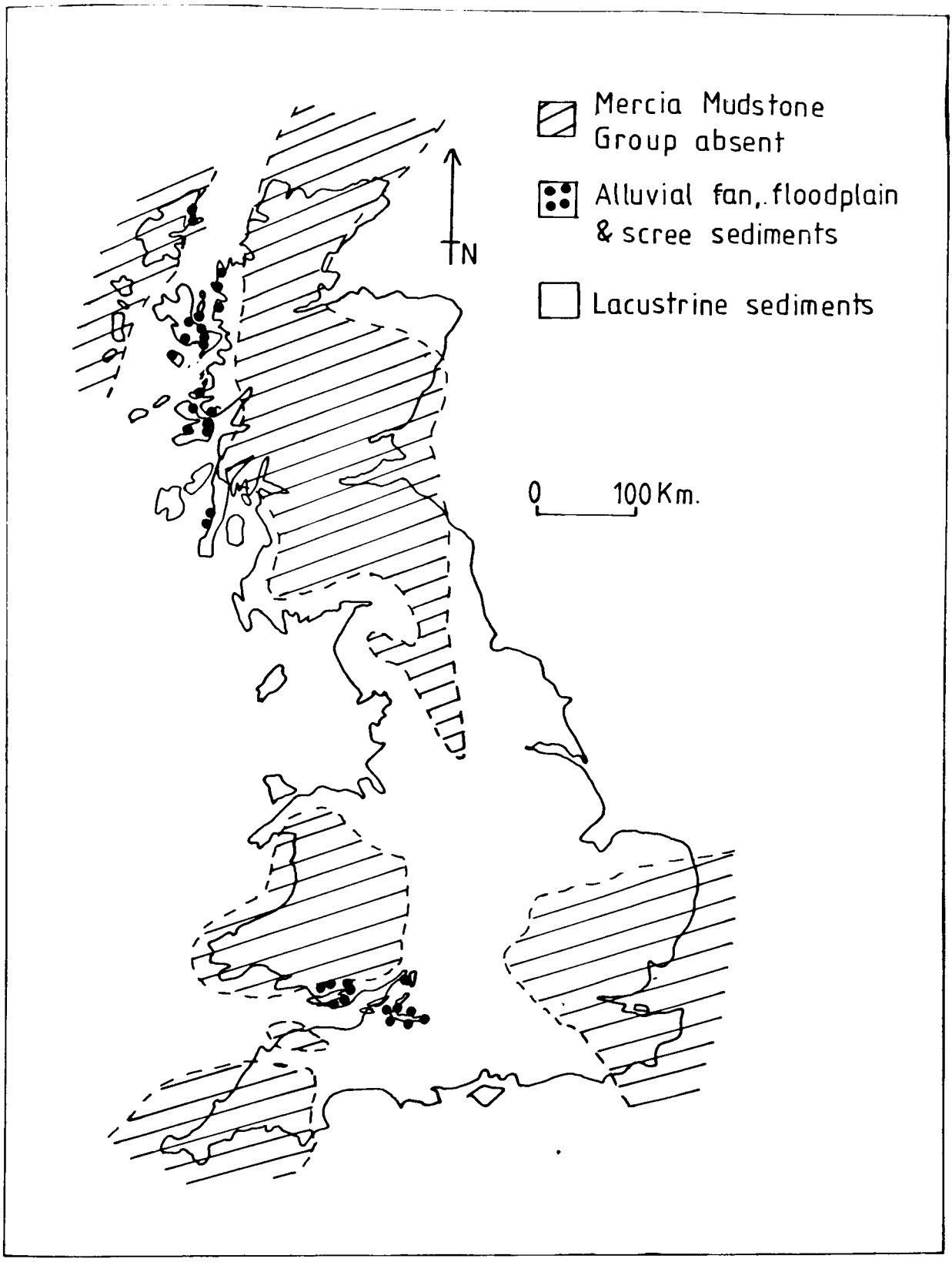


FIG. 9.2: PALAEOGEOGRAPHY, MERCIA MUDSTONE GROUP & PROBABLE LATERAL EQUIVALENTS

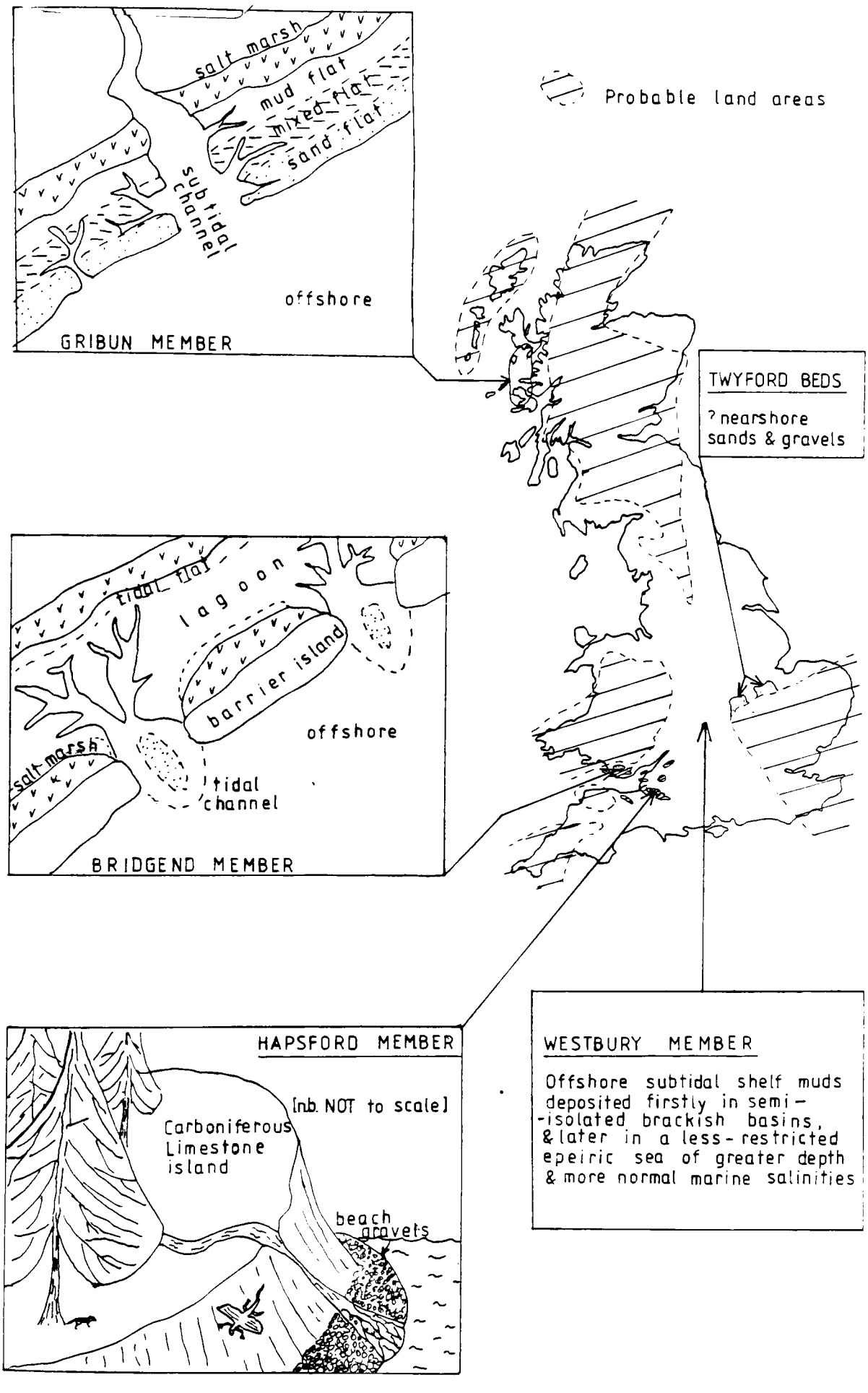


FIG. 9.3: GENERALISED PALAEOGEOGRAPHY, WESTBURY MEMBER

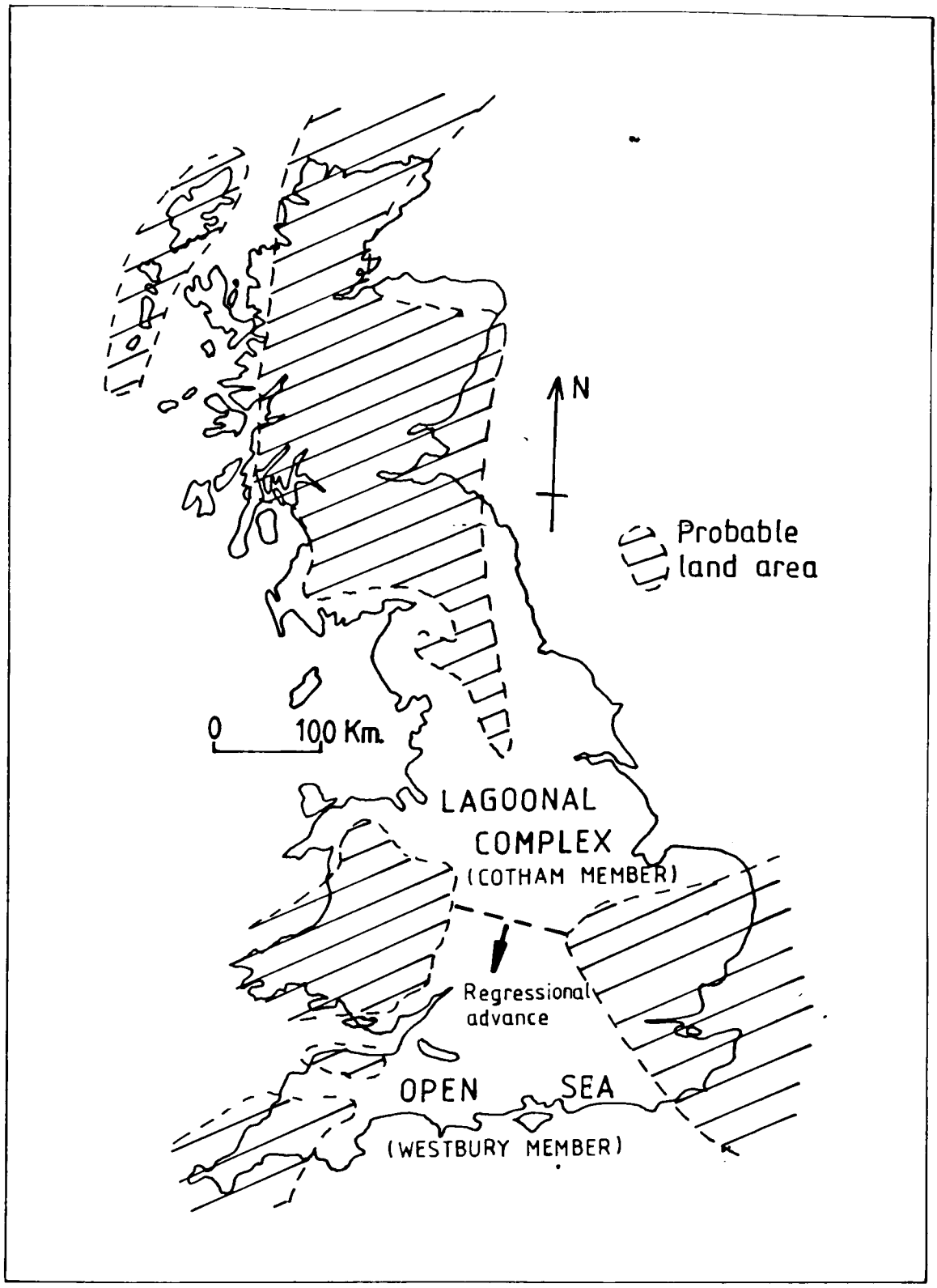


FIG. 9.4: STYLISED PALAEOGEOGRAPHY AROUND THE WESTBURY MEMBER/COTHAM MEMBER BOUNDARY

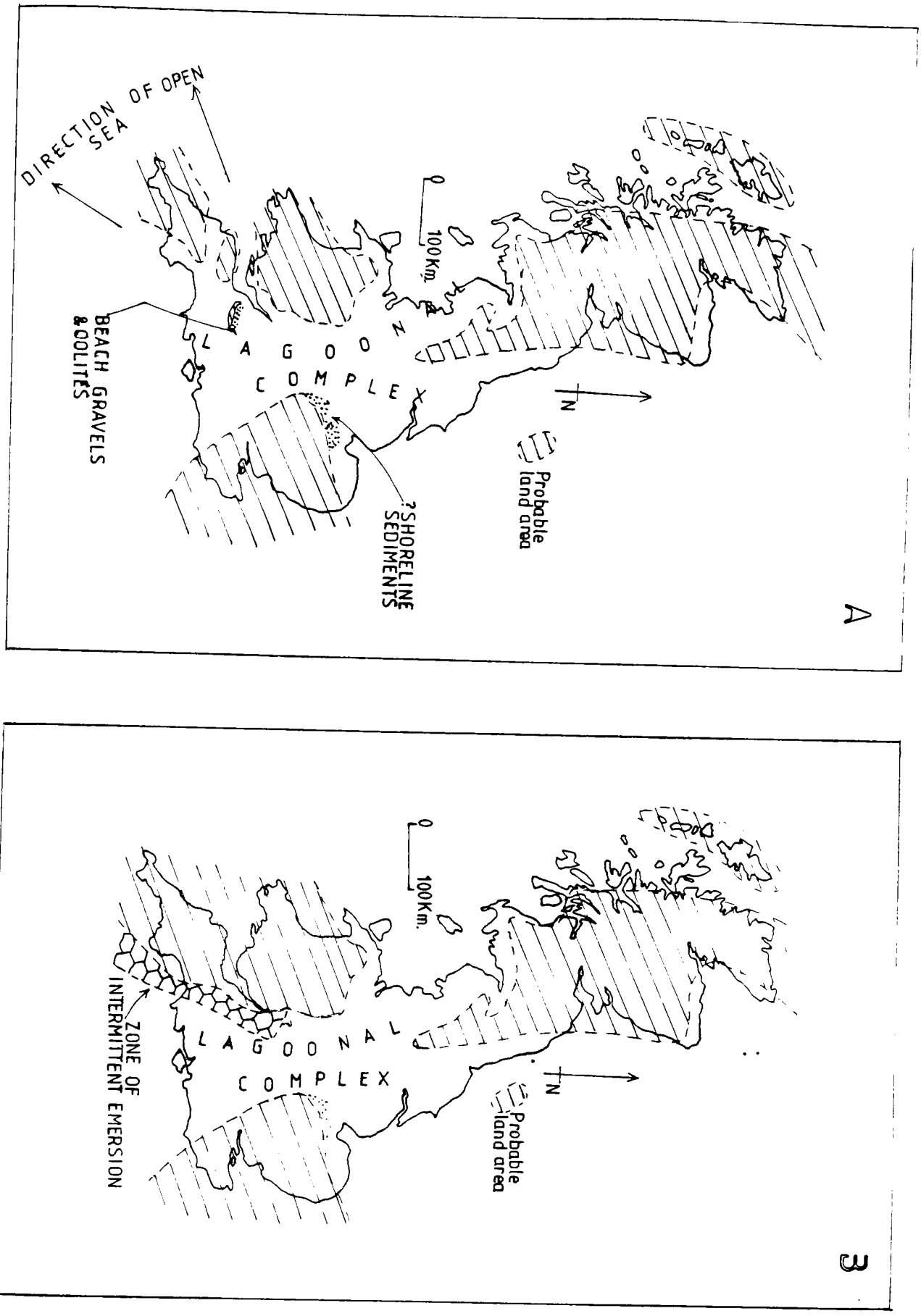
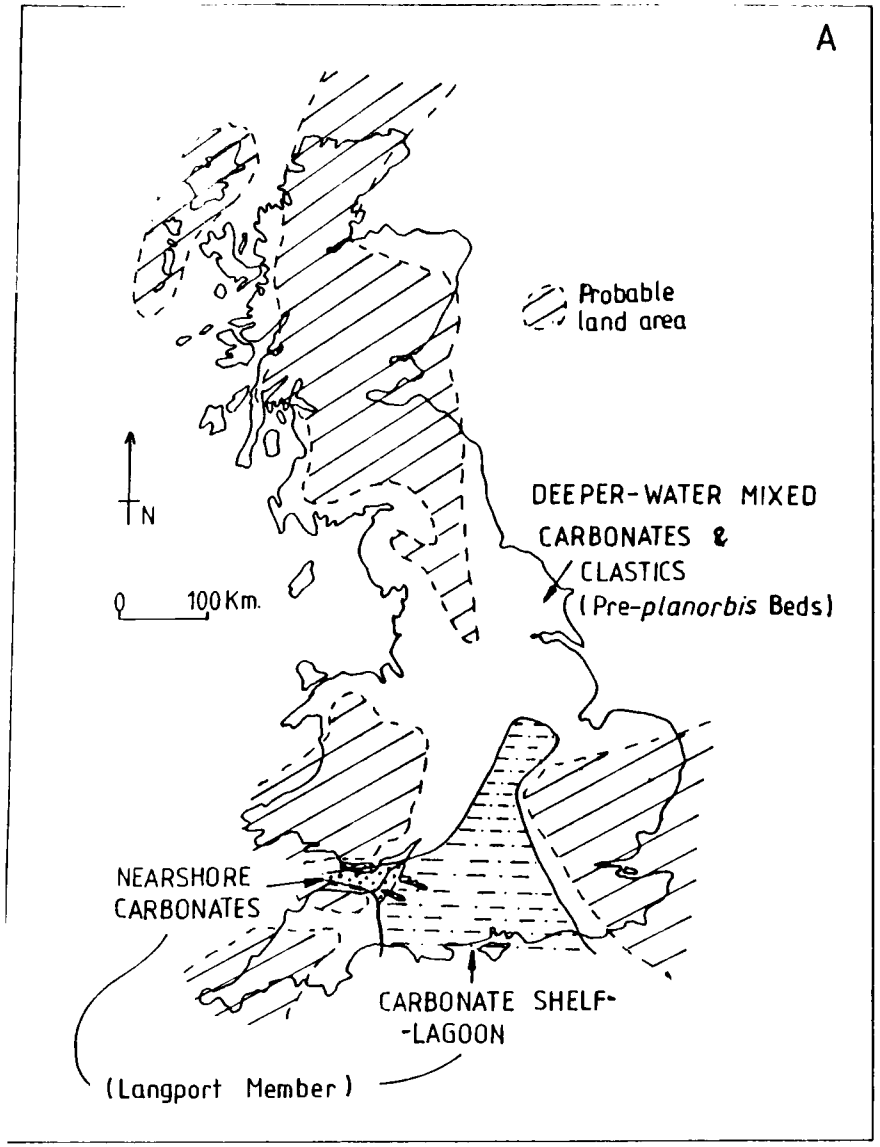


FIG. 9.5: PALAEOGEOGRAPHY OF THE COTHAM MEMBER
A. ON THE COMPLETE ESTABLISHMENT OF LAGOONAL CONDITIONS
B. NEAR THE CLOSE OF COTHAM MEMBER DEPOSITION



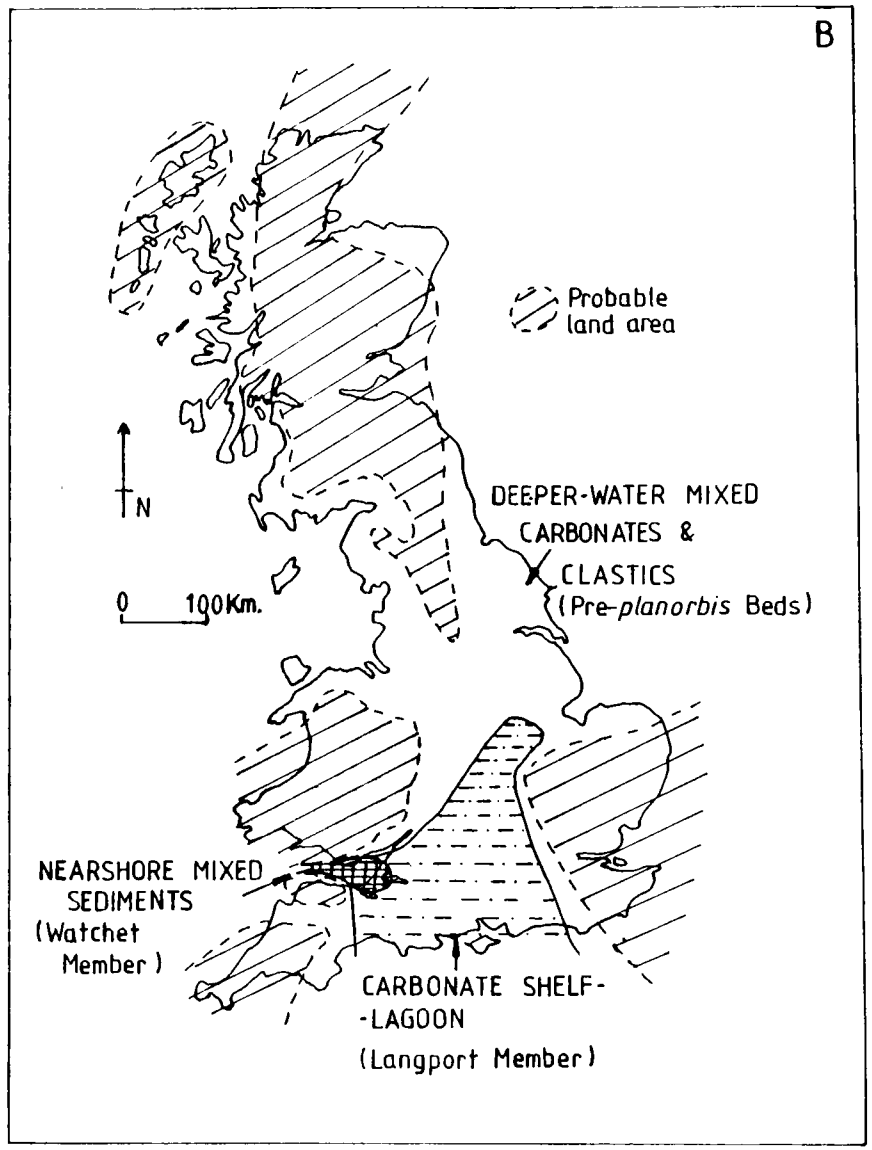


FIG. 9.6: PALAEOGEOGRAPHY: LANGPORT MEMBER/WATCHET MEMBER/PRE-PLANORBIS BEDS A. EARLY B. LATE

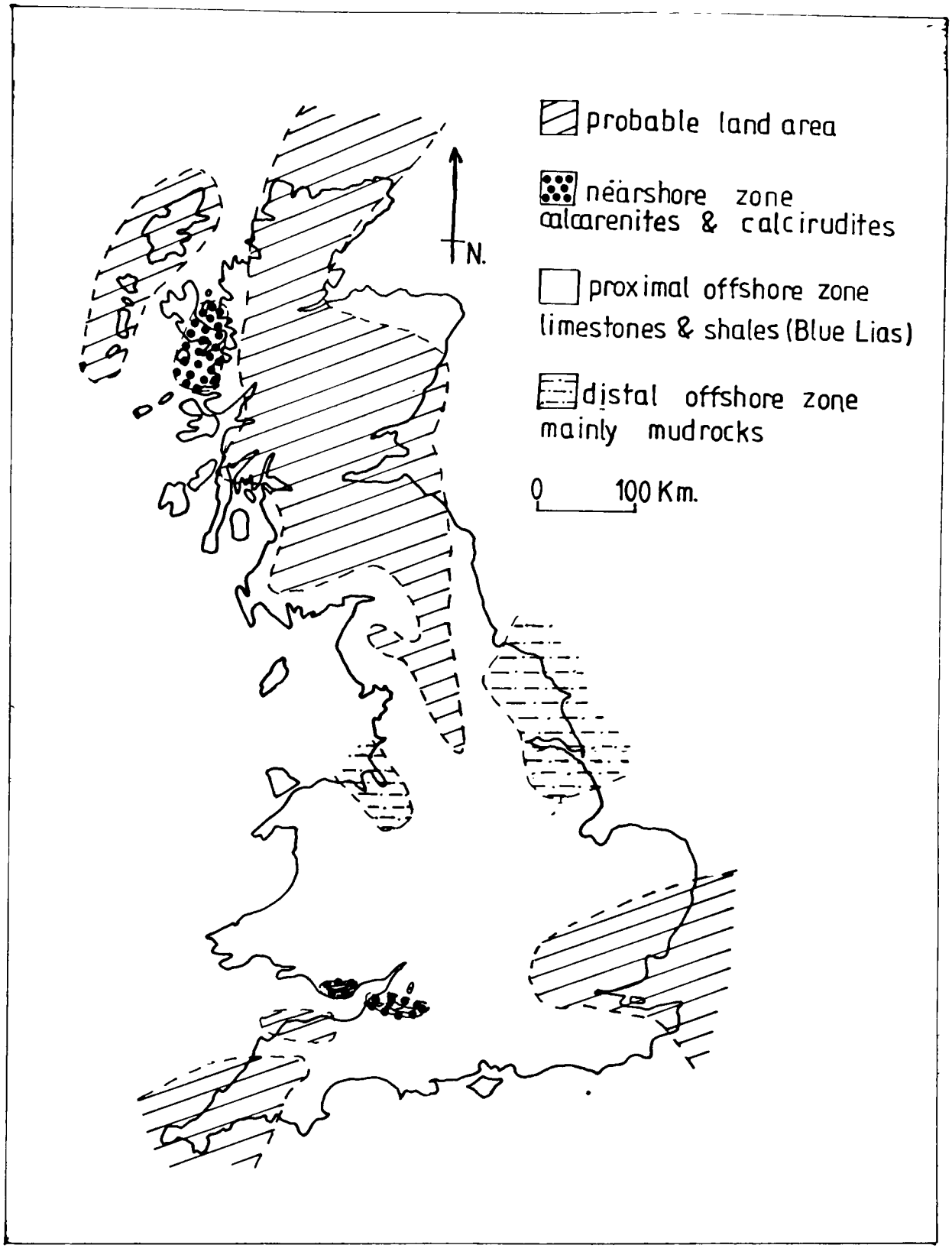


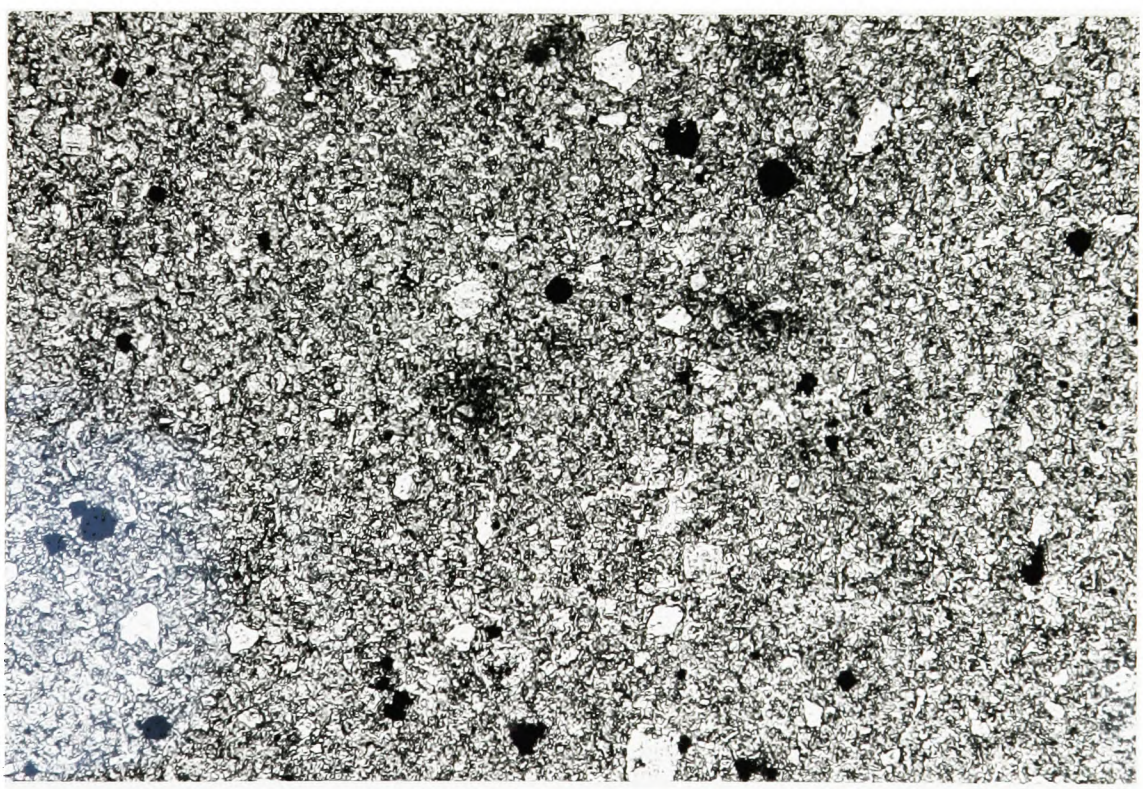
FIG. 9.7: PALAEOGEOGRAPHY: LOWERMOST JURASSIC

PLATES

PLATE 1.1 THE UPPER TRIASSIC SEQUENCE AT AUST CLIFF, AVON.

PLATE 1.2 CALCITE, REPLACING DOLOMITE RHOMBS IN A NODULE FROM THE TEA GREEN MARLS. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).


Lias
Cotham Member
Westbury Member
Tea Green Marls
Red Marls



100μ

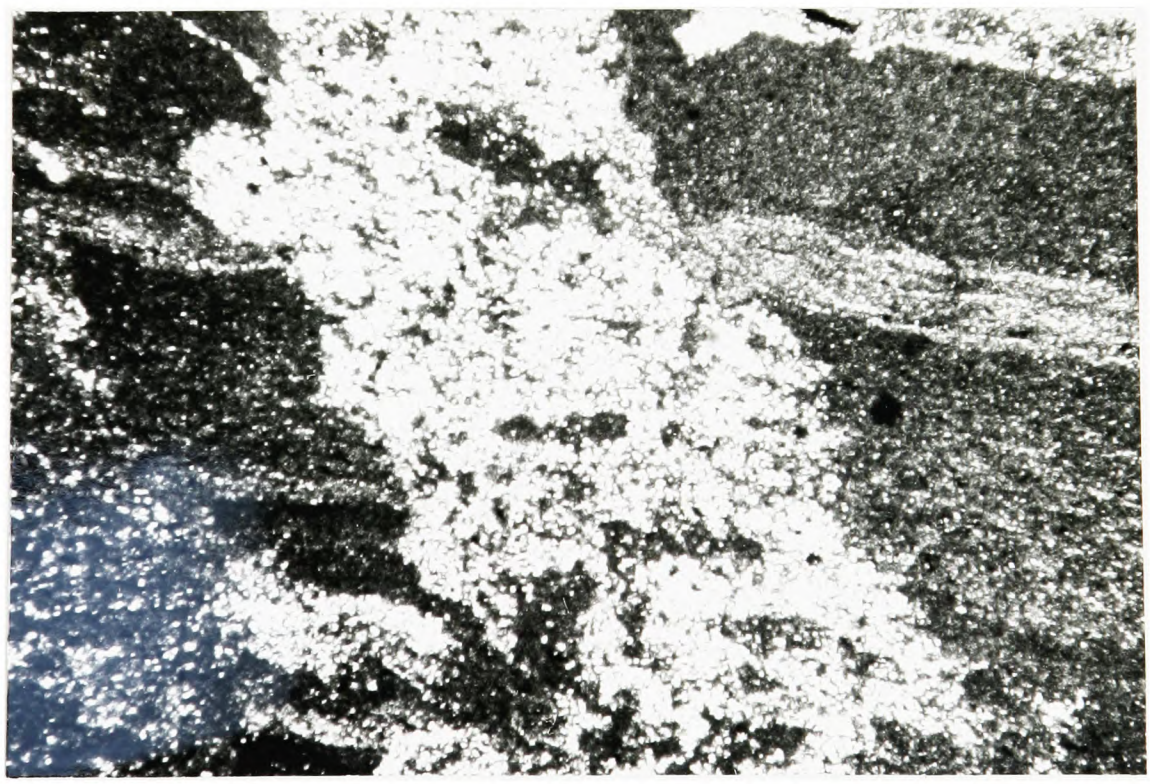
PLATE 1.3 LAMINATED DOLOMICRITE/DOLOMITE SILTSTONE: THE LAMINATION DISTURBED BY A SMALL FLUID ESCAPE STRUCTURE, GREY MARLS, BLUE ANCHOR, SOMERSET.

PLATE 1 4 LAMINATED DOLOMICRITE/DOLOMITIC SILTSTONE, GREY MARLS LAVERNOCK POINT, SOUTH GLAMORGAN (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).

1 mm.

PLATE 1.5 ARENICOLITES BURROWS AND INFILLED DESICCATION CRACKS, GREY MARLS, LAVERNOCK POINT, SOUTH GLAMORGAN.

PLATE 1.6 SILT-IN-FILLED FLUID-ESCAPE FEATURE CUTTING ACROSS LAMINATION, GREY MARLS, BLUE ANCHOR, SOMERSET. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).



1 mm.

PLATE 1.7 BRECCIATED FABRIC PRODUCED BY FLUID ESCAPE, GREY MARLS, BLUE ANCHOR, SOMERSET. (Scale in cm).

PLATE 1.8 DARK GREY CHAOTIC MUDSTONE PASSING UPWARDS TO LAMINATED SILTSTONE/MUDSTONE DISPLACED BY A MICROFAULT, GREY MARLS, BLUE ANCHOR, SOMERSET.

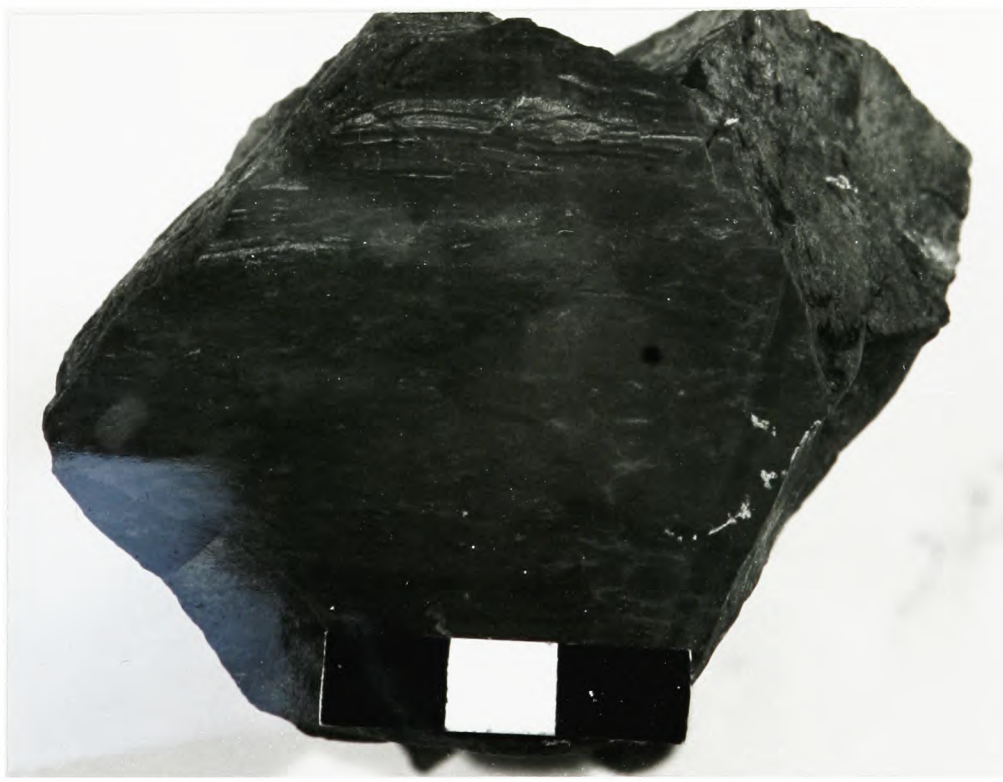


PLATE 1.9 DESICCATION CRACKS INFILLED WITH GREY-GREEN MUDSTONE, GREY MARLS, LAVERNOCK POINT, SOUTH GLAMORGAN.

PLATE 1.10 THE GREY MARLS AT BLUE ANCHOR POINT SOMERSET. THE WHITE BANDS ARE HORIZONS OF NODULAR GYPSUM WHILST ESTENSIVE CONJUGATE GYPSUM VEINS CUT ACROSS BEDDING.

PLATE 1.11 NODULAR BEDDED GYPSUM AND SMALL GYPSUM VEINS. GREY MARLS, BLUE ANCHOR, SOMERSET.

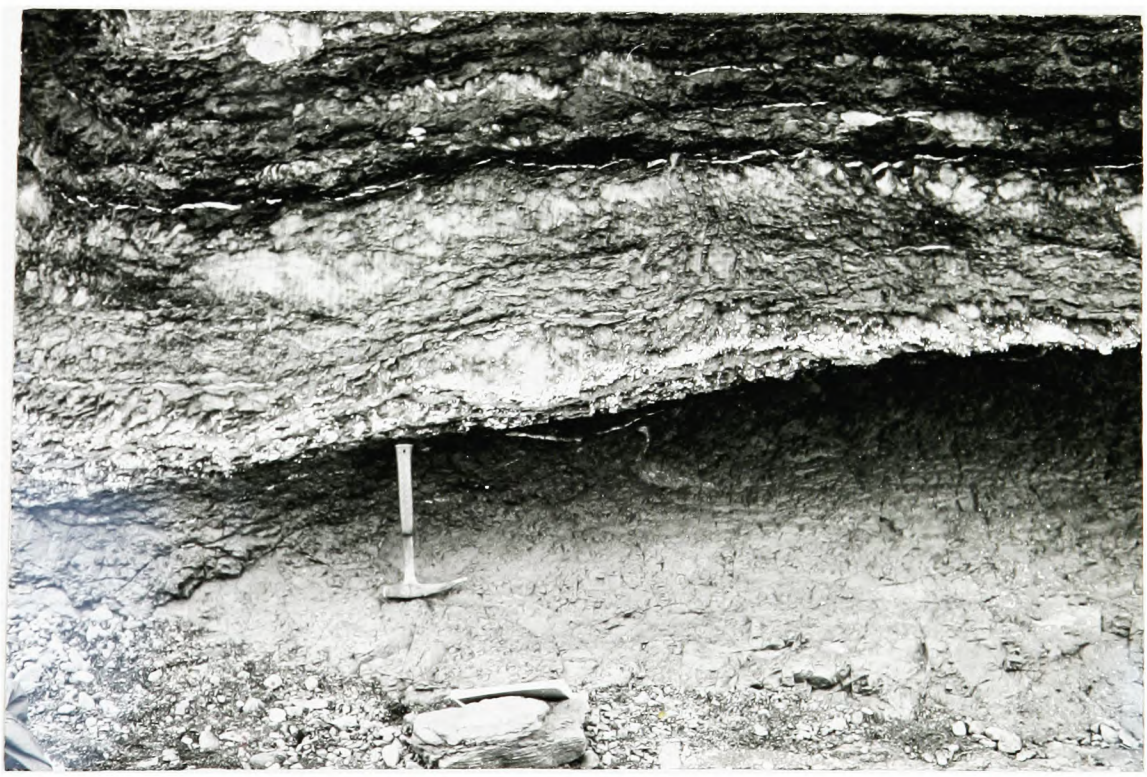


PLATE 1.12 NODULAR GYPSUM CONTAINING SMALL PINKISH QUARTZ CRYSTALS, GREY MARLS, BLUE ANCHOR, SOMERSET.

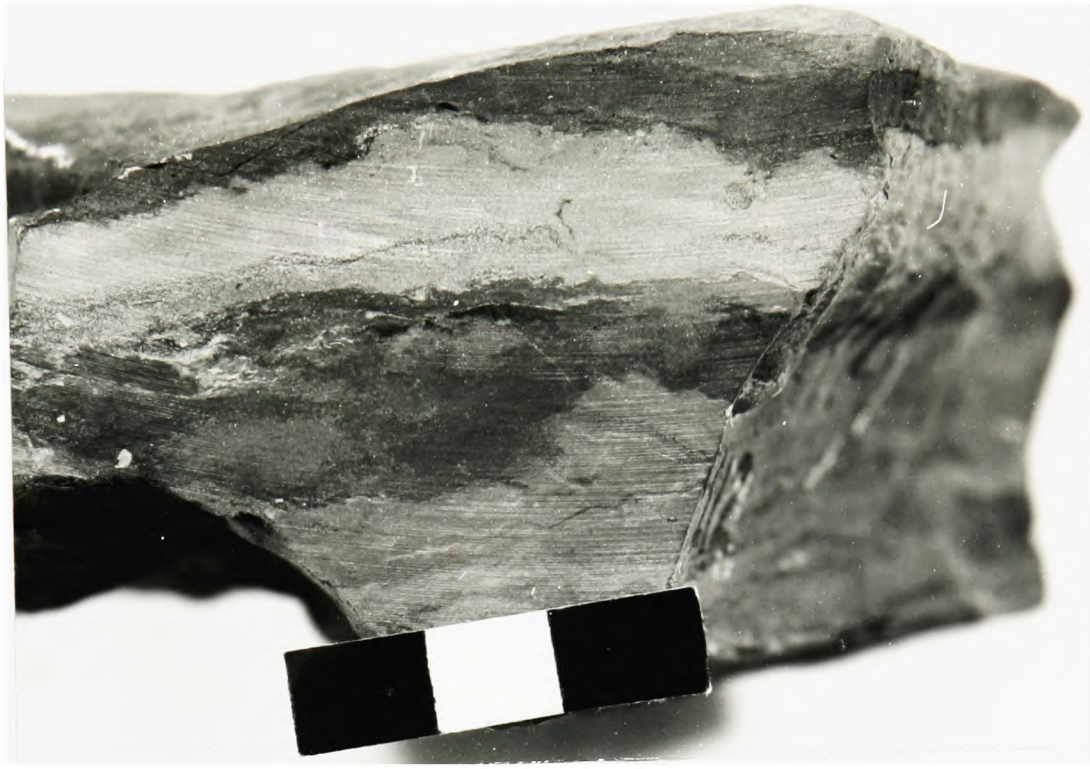
PLATE 1.13 NODULAR CAVITIES ? AFTER GYPSUM GREY MARLS, ST. AUDRIES BAY, SOMERSET.

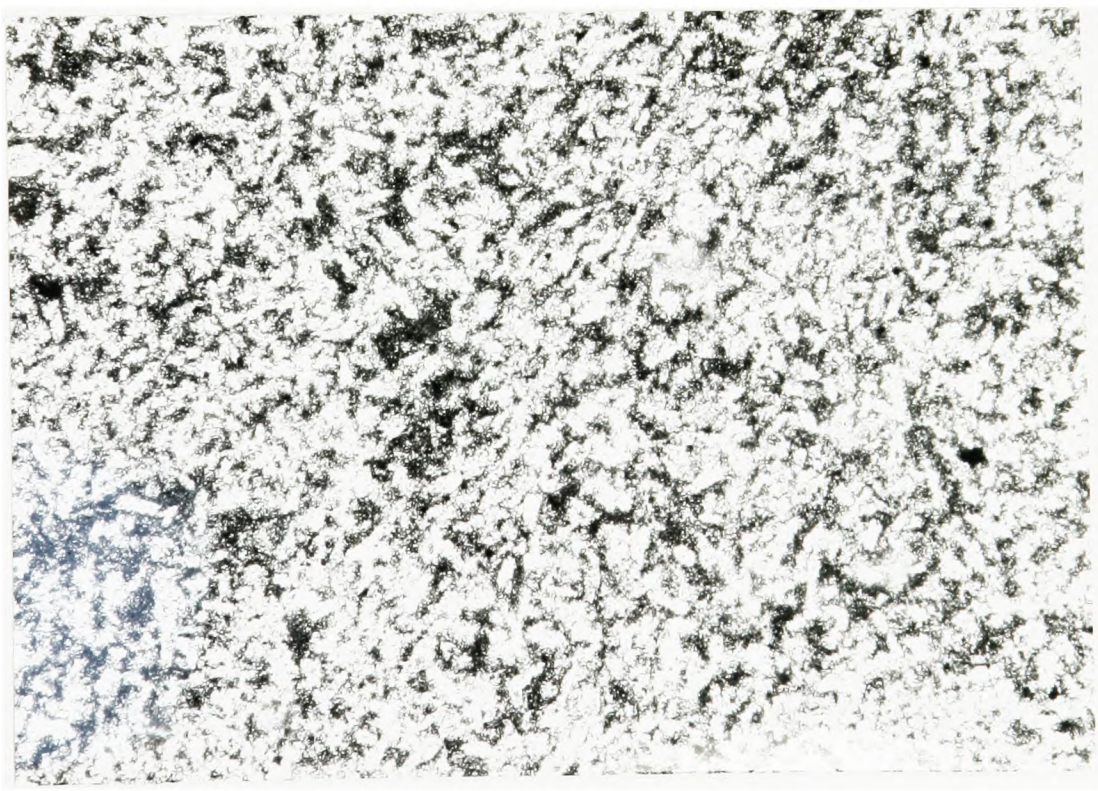

YASHICA

PLATE 1.14 TWO LIGHT, IRREGULAR AND NODULAR DOLOMITIC BEDS IN DARK DOLOMITIC MUDSTONE, PROBABLY EVAPORITIC REPLACEMENTS, GREY MARLS, BLUE ANCHOR, SOMERSET.

PLATE 1.15 QUARTZ LATHS AFTER ANHYDRITE, DOLOMITIC RAND ILLUSTRATED IN PLATE 1.14 GREY MARLS, BLUE ANCHOR SOMERSET.

(PHOTOMICROGRAPH, PLANE POLARISED).

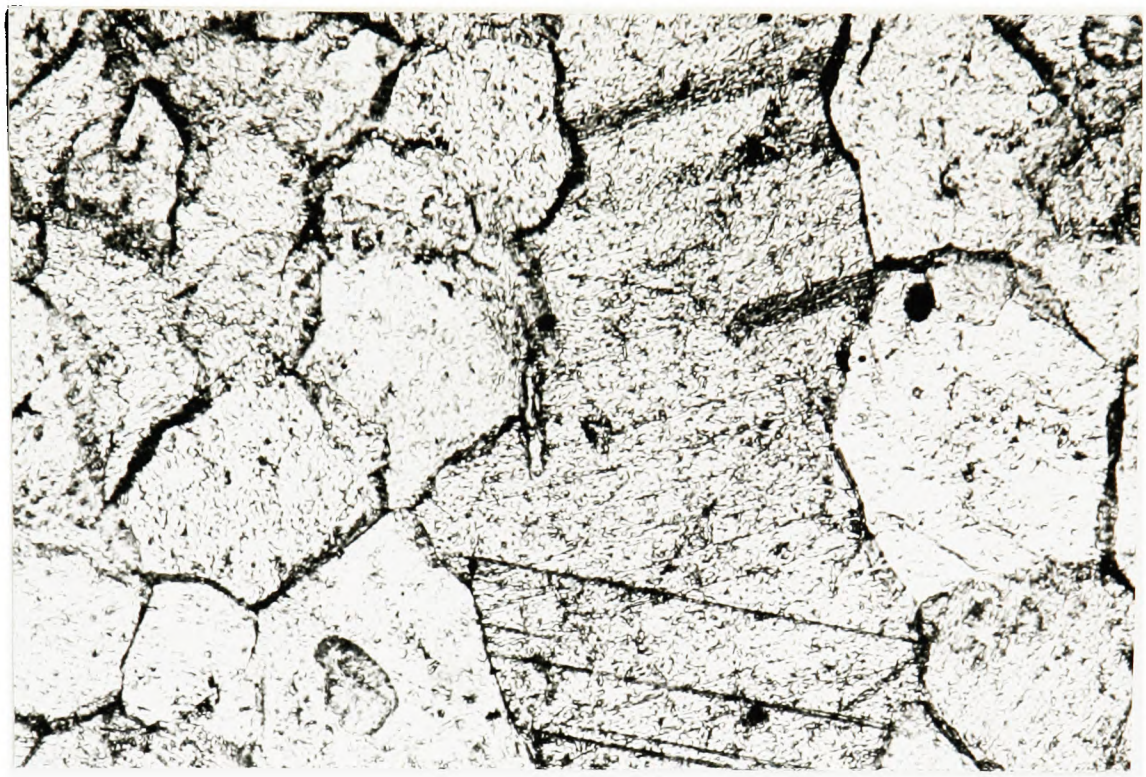




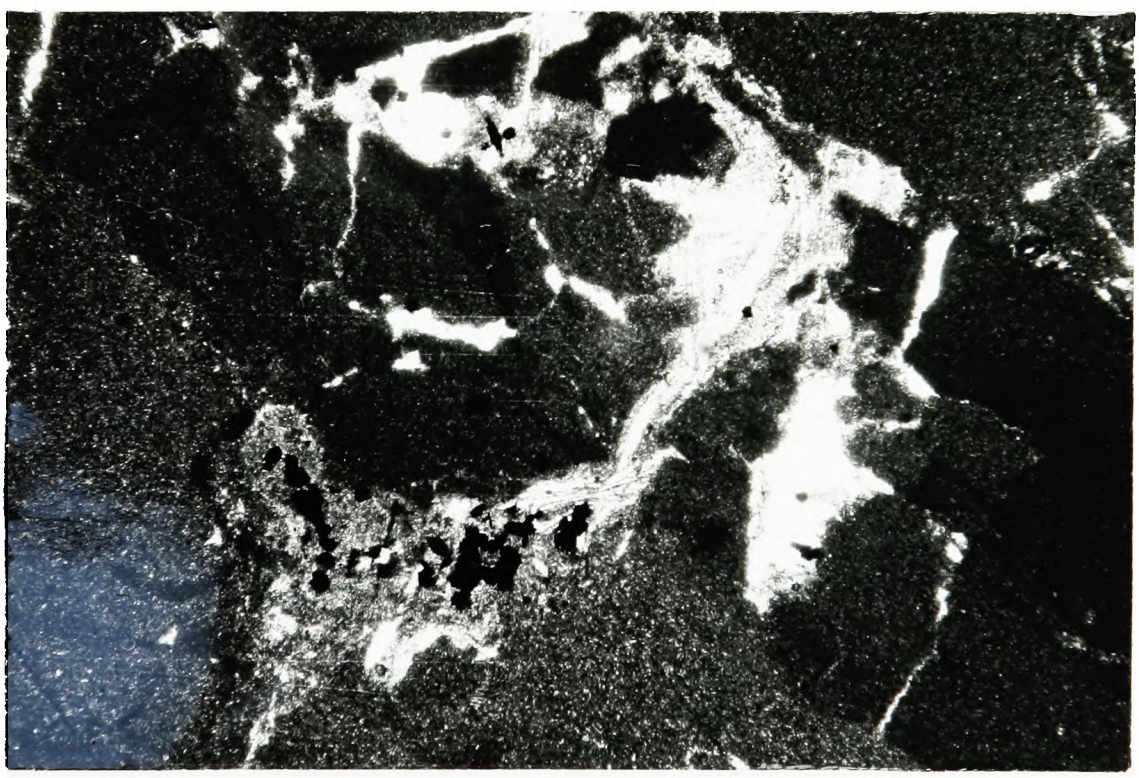
100μ

PLATE 1.16 SMALL ELONGATE ANHYDRITE RELICT (CENTRE OF PHOTOGRAPH) IN COARSE, SPARRY CALCITE, GREY MARLS, LAVERNOCK POINT, SOUTH GLAMORGAN (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).

PLATE 1.17 GYPSUM LATHS IN MICRITIC MATRIX, GREY MARLS, LAVERNOCK POINT, SOUTH GLAMORGAN (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).



100μ



1 mm.

PLATE 1.1C FINELY LAMINATED DOLOMICRITE/DOLOMITIC MICROSPAR MICROFABRIC, ? ALGAL MAT, GREY MARLS, BLUE ANCHOR, SOMERSET (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).

PLATE 2.1 BIOTURBATED CALCAREOUS SILTSTONE PASSING UPWARDS INTO LAMINATED SILTSTONE/MUDSTONE, SULLY MEMBER. BLUE ANCHOR, SOMERSET.

1 mm.

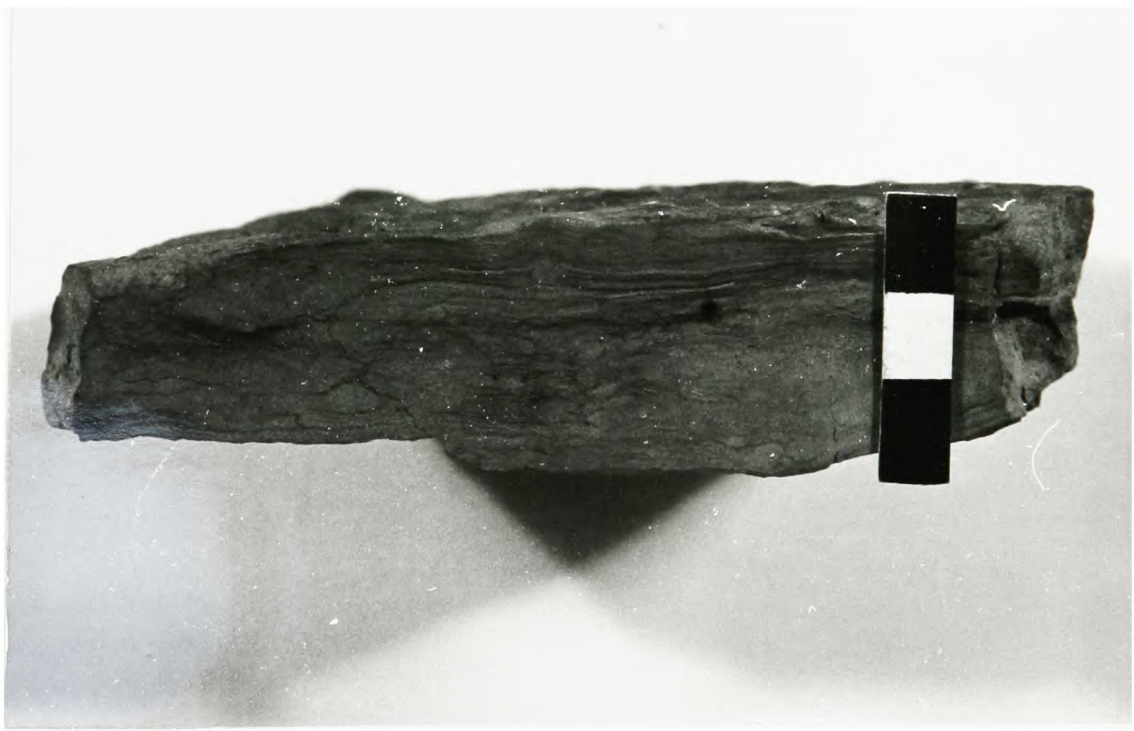


PLATE 2.2 EXTENSIVE *DIPLOCRATERION* BURROWS SULLY MEMBER, BLUE ANCHOR, SOMERSET.

PLATE 2.3 *RHIZOCORALLIUM* BURROWS AND *PROTOCARDIA* SP. CASTS, SULLY MEMBER, BLUE ANCHOR, SOMERSET.


YASHICA

PLATE 2.4 ARENICOLITES BURROWS, SULLY MEMBER, BLUE ANCHOR, SOMERSET.

PLATE 2.5 SIPHONITES BURROWS, SULLY MEMBER, BLUE ANCHOR, SOMERSET.


2

PLATE 3.1 THE WESTBURY MEMBER AT BLUE ANCHOR, SOMERSET. A TYPICAL SEQUENCE OF DARK ARGILLITES WITH THIN CALCAREOUS AND ARENACEOUS INTERBEDS.

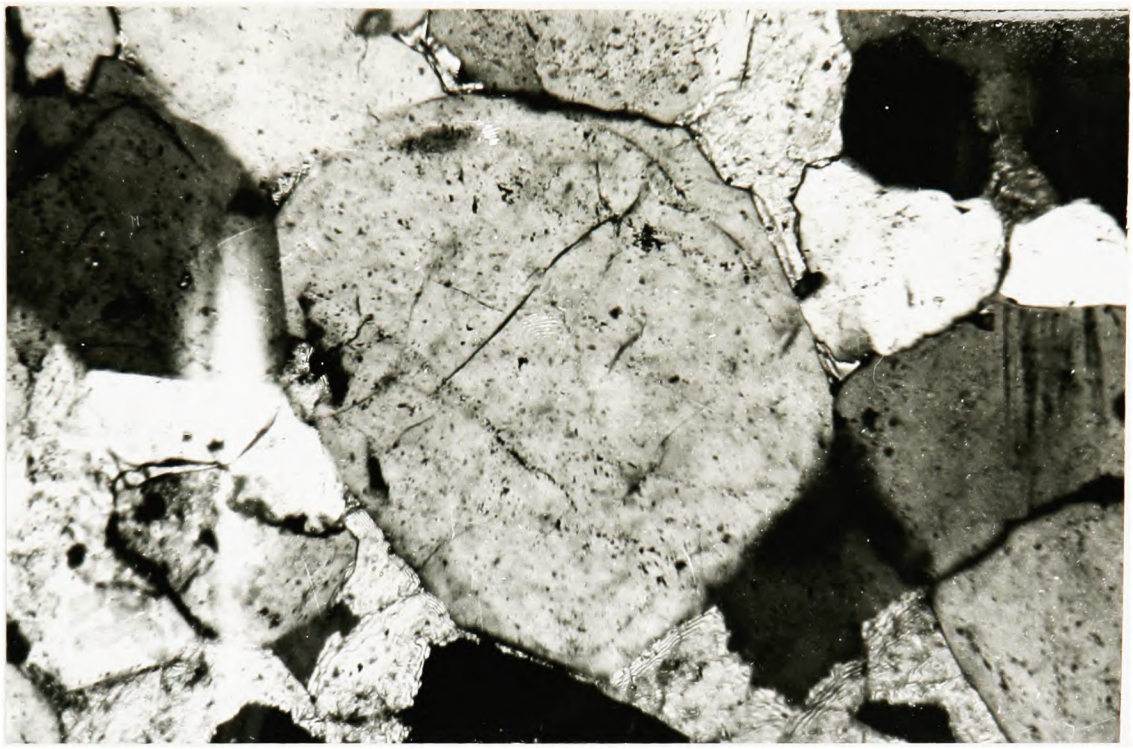
PLATE 3.2 DARK SEDIMENT FROM THE BASAL WESTBURY MEMBER INFILLING *DIPLOCRATERION* BURROWS IN THE TEA GREEN MARLS, CHARTON BAY, DEVON.

PLATE 3.3 WAVE RIPPLES, LOWER UNIT OF THE WESTBURY MEMBER, WESTBURY GARDEN CLIFF, GLOUCESTERSHIRE. TWO PERPENDICULAR SETS CAN BE SEEN, WHICH IN PLACES FORM AN INTERFERENCE PATTERN.

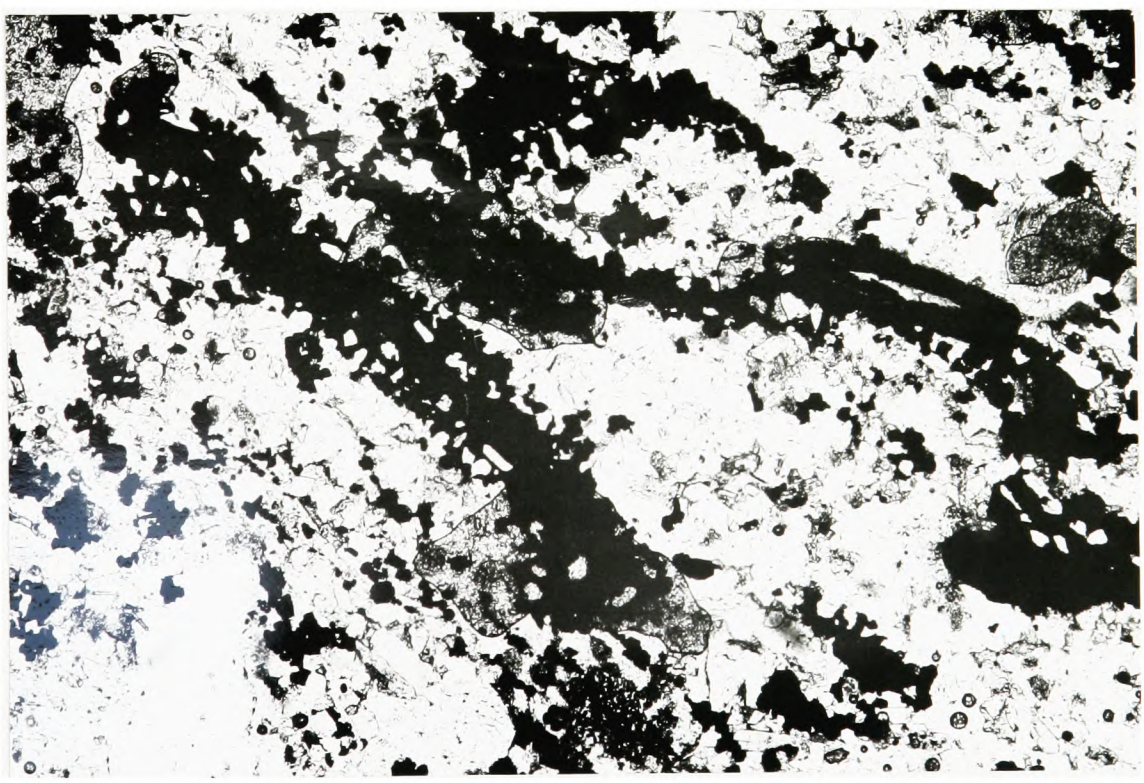
PLATE 3.4 TOOL MARKS, TRAILS AND A GUTTER CAST ON THE BASE OF A SANDSTONE, LOWER UNIT, WESTBURY MEMBER, WESTBURY GARDEN CLIFF, GLOUCESTERSHIRE.

PLATE 3.5 SYNTAXIAL QUARTZ OVERGROWTHS IN A SANDSTONE, LOWER WESTBURY MEMBER, BLUE ANCHOR, SOMERSET. (PHOTOMICROGRAPH X-POLARS).

PLATE 3.6 PYRITE REPLACING OTHER GRAINS (MOSTLY QUARTZ) IN A SANDSTONE, LOWER UNIT, WESTBURY MEMBER, BLUE ANCHOR, SOMERSET. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).



100μ



500μ

PLATE 3.7 DARK SHALES CONTAINING A LIMESTONE NODULE (DIAGENETIC) AND A CONTINUOUS LIMESTONE BED (PRIMARY DEPOSITINAL) WESTBURY MEMBER, BLUE ANCHOR, SOMERSET.

PLATE 3.8 RECRYSTALLISED BIVALVE SHELLS CONTAINING DARK AREAS OF PSEUDO-PLEOCHROIC CALCITE REVEALING ORIGINAL SHELL STRUCTURE, SILTY BIOMICRITE, WESTBURY MEMBER, BLUE ANCHOR SOMERSET. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).

1 mm.

PLATE 3.9 BONE-BEDS 1: RIPPLE CROSS-LAMINATED SANDSTONE WITH PRIMARILY FISH TEETH AND SCALES, WESTBURY MEMBER, BLUE ANCHOR, SOMERSET.

PLATE 3.10 BONE-BEDS 2: BIOCLASTIC LIMESTONE WITH FISH TEETH, SCALES AND COPROLITES, ST. AUDRIES BAY, SOMERSET.

PLATE 3.11 BONE-BEDS 3: CONGLOMERATIC MICACEOUS SANDSTONE WITH FISH TEETH, SCALES, COPROLITES AND LARGER REPTILIAN BONE FRAGMENTS, WESTBURY MEMBER, PATCHWAY, AVON.

PLATE 3.12 BONE-BEDS 4: THE FAMOUS CONGLOMERATIC BONE-BED FROM AUST CLIFF, AVON, CONTAINING CLASTS OF CARBONIFEROUS AND TRIASSIC ROCKS, LARGE BONE FRAGMENTS AND COPROLITES IN A SANDY MATRIX CONTAINING FISH TEETH AND SCALES.

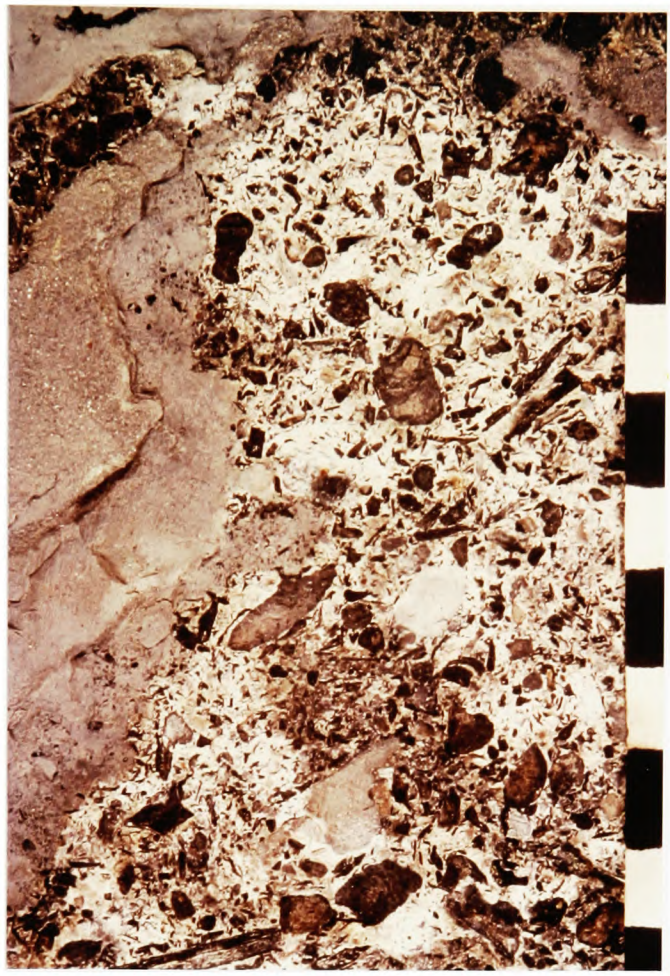


PLATE 3.13 TWO PERPENDICULAR, INTERFERING SETS OF RIPPLE MARKS, UPPER UNIT, WESTBURY MEMBER, HARROGATE HOUSE, NR. NORTHALLERTON, NORTH YORKSHIRE.

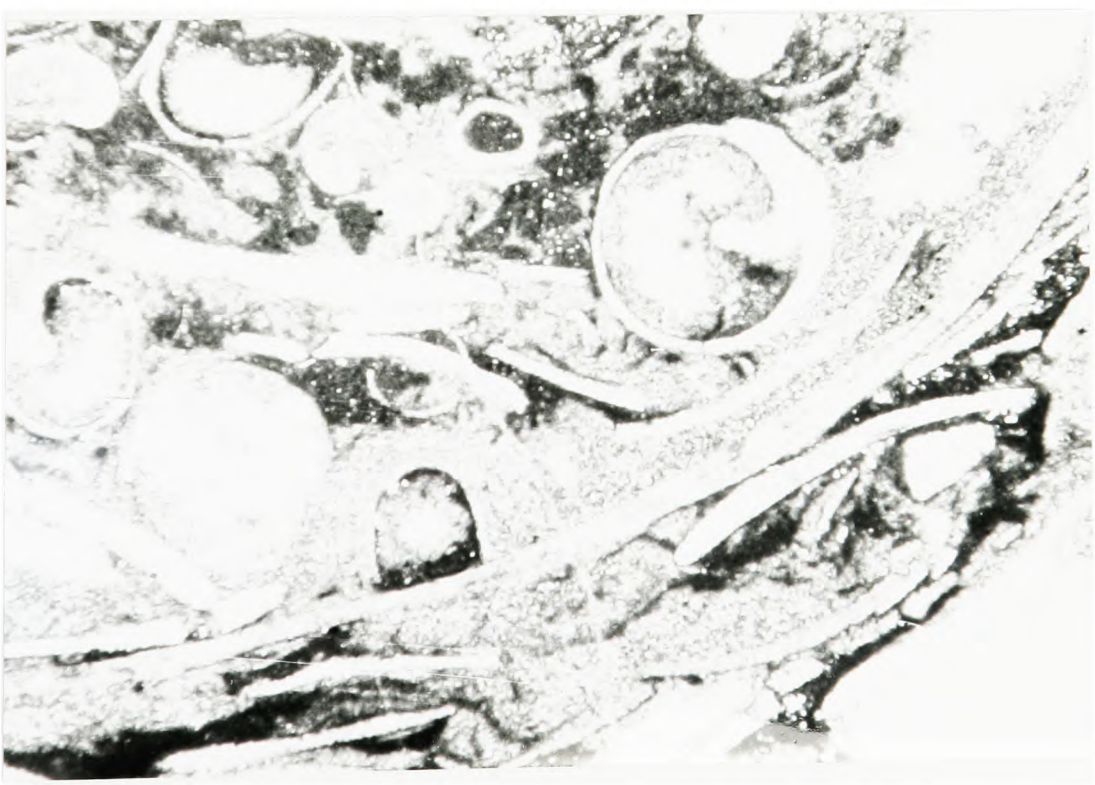
PLATE 3.14 ORIENTED BIVALVES ON THE UPPER SURFACE OF A BIOSPARRITIC LIMESTONE, WESTBURY MEMBER, BLUE ANCHOR, SOMERSET.

PLATE 3.15 BIOSPARRITE COMPOSED PRIMARILY OF BIVALVE SHELL FRAGMENTS, WESTBURY MEMBER, LILSTOCK SOMERSET. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).

1 mm.

PLATE 3.16 BIOMICSPARRITE, WESTBURY MEMBER, BLUE ANCHOR, SOMERSET.

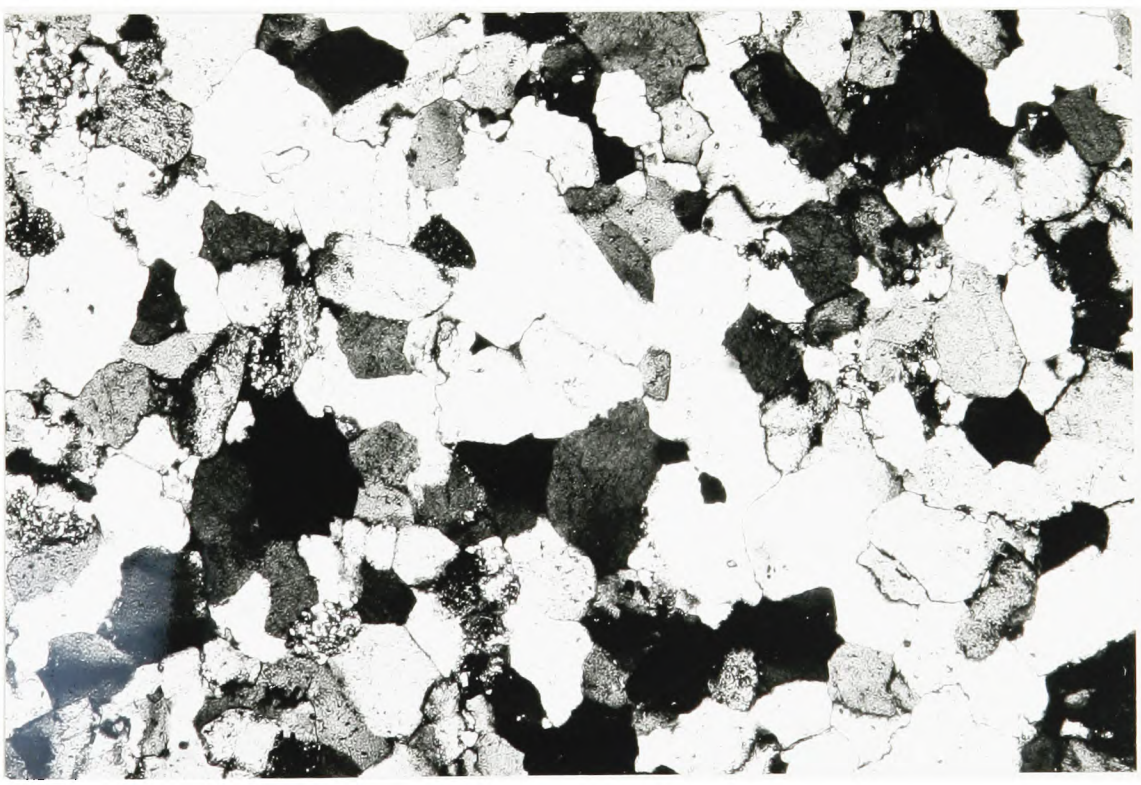
PLATE 3.17 . BIOMICSPARRITE WITH BIVALVE AND GASTROPOD SHELL FRAGMENTS, WESTBURY MEMBER, BLUE ANCHOR, SOMERSET. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).



1 mm.

PLATE 3.18 THE BRIDGEND MEMBER AT STORMY DOWN, MID GLAMORGAN. THE LIGHT ROCK IN THE LOWER PART OF THE CUTTING IS THE LOWER SANDSTONE.

PLATE 3.19 TYPICAL PHOTOMICROGRAPH OF THE LOWER SANDSTONE, BRIDGEND MEMBER, STORMY DOWN. INTERLOCKING GRAINS AND SOME QUARTZ OVERGROWTHS (X-POLARS).



500μ

PLATE 3.20 TABULAR CROSS-BEDDING, LOWER SANDSTONE, BRIDGEND MEMBER, STORMY DOWN, MID. GLAMORGAN.

PLATE 3.21 CAST OF INTERFERENCE RIPPLES, LOWER SANDSTONE, BRIDGEND MEMBER, STORMY DOWN, MID GLAMORGAN.

PLATE 3.22 LARGE WOOD FRAGMENTS, LOWER SANDSTONE, BRIDGEND MEMBER, STORMY DOWN, MID GLAMORGAN

PLATE 3.23 DIPLOCRATERION BURROWS AT THE TOP OF THE LOWER SANDSTONE, BRIDGEND MEMBER, STORMY DOWN, MID GLAMORGAN.

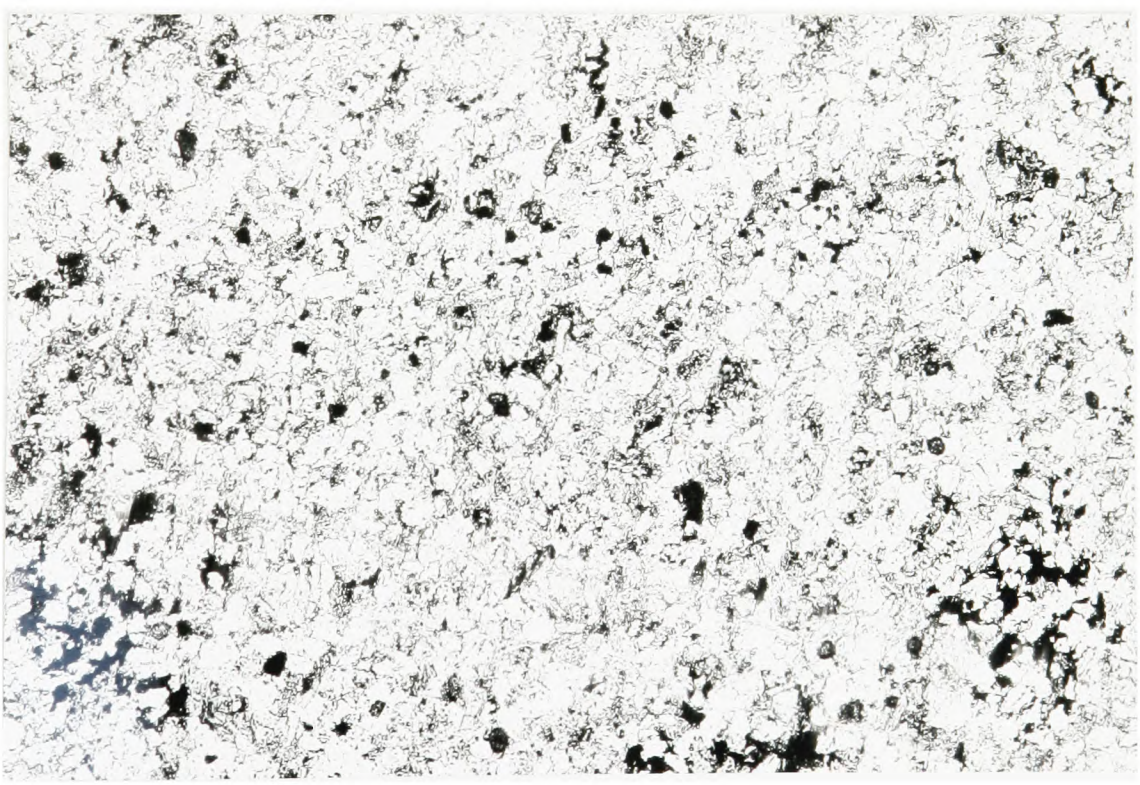

YASHICA

PLATE 3.24 THE BOUNDARY OF THE LOWER SANDSTONE AND INTER-SAND MUDSTONES, BRIDGEND MEMBER, STORMY DOWN, MID GLAMORGAN. NOTE: EXTENSIVE SKOLITHOS BURROWS AT THE TOP OF THE LOWER SANDSTONE (LEFT END OF SCALE IN CM.)

PLATE 3.25 THE INTER-SAND MUDSTONES, BRIDGEND MEMBER, STORMY DOWN, MID GLAMORGAN. A FINE INTERLAMINATION OF THE MUDSTONES WITH SILTSTONES IS VISIBLE NEAR THE HAMMER.

PLATE 3.26 FLAGGY APPEARANCE OF THE UPPER SANDSTONES BRIDGEND MEMBER, STORMY DOWN, MID. GLAMORGAN.

PLATE 3.27 PHOTOMICROGRAPH OF TYPICAL UPPER SANDSTONE, BRIDGEND MEMBER, STORMY DOWN, MID GLAMORGAN: C.F. TO PLATE 3.19 (PLANE POLARISED LIGHT).



500 μ

PLATE: 3.28 ARGILLACEOUS SANDSTONE WITH *TEICHICHNUS* BURROWS, GRIBUN MEMBER, AILT NA TEANGAIDH, MULL.

PLATE 3.29 CONTORTED SILTY SANDSTONE, OVERLAIN BY PEBBLY SANDSTONES, GRIBUN MEMBER, MONADH DUBH, RHUM

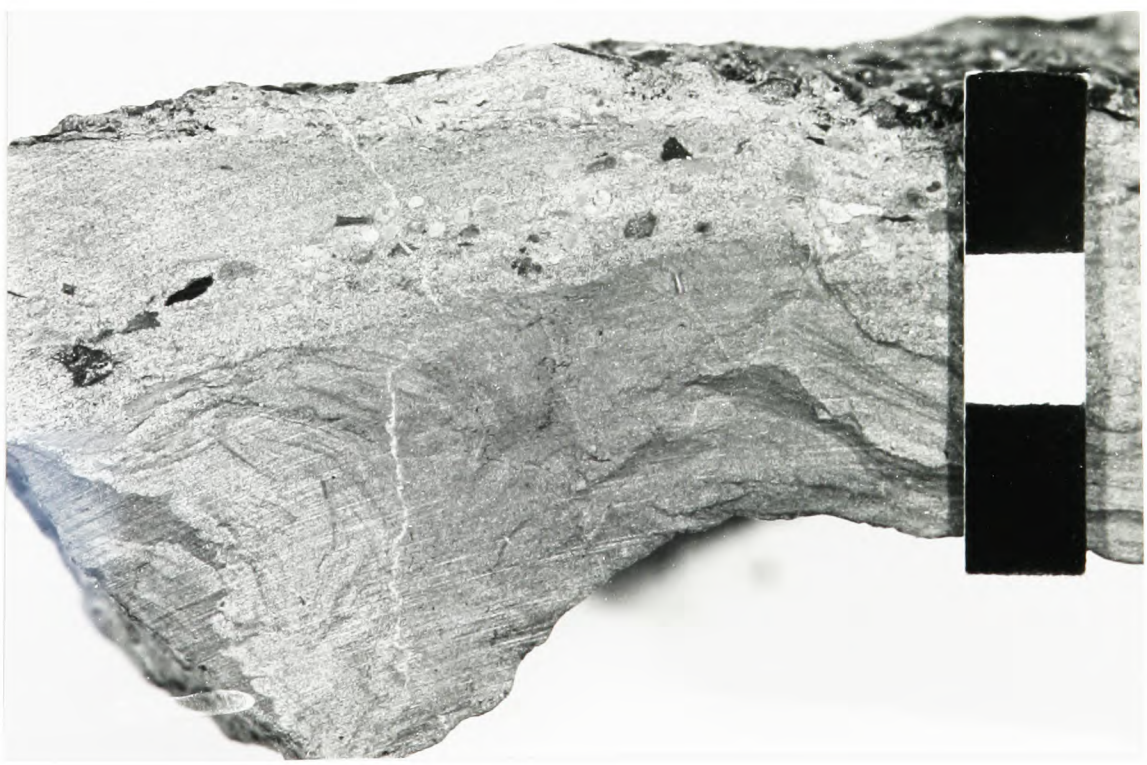


PLATE 3.30 SANDY LIMESTONE WITH ABUNDANT CARBONISED WOOD FRAGMENTS, GRIBUN MEMBER, MONADH DUBH, RHUM.

PLATE 3.31 RIPPLE CROSS-LAMINATED FINE SANDSTONE WITH MUDSTONE DRAPES, GRIBUN MEMBER, MONADH DUBH, RHUM.


027B

PLATE 3.32 CONGLOMERATES WITH THIN INTERCALATED MUDSTONES OF THE HAPSFORD MEMBER, (HORIZONTALY BEDDED) LYING UNCOMFORTABLY ON STEEPLY DIPPING CARBONIFEROUS LIMESTONE (HAMMER ON CONTACT) HAPSFORD BRIDGE, SOMERSET.

PLATE 3.33 CONGLOMERATE CONTAINING CARBONIFEROUS LIMESTONE CLASTS, HAPSFORD MEMBER, HAPSFORD BRIDGE, SOMERSET.

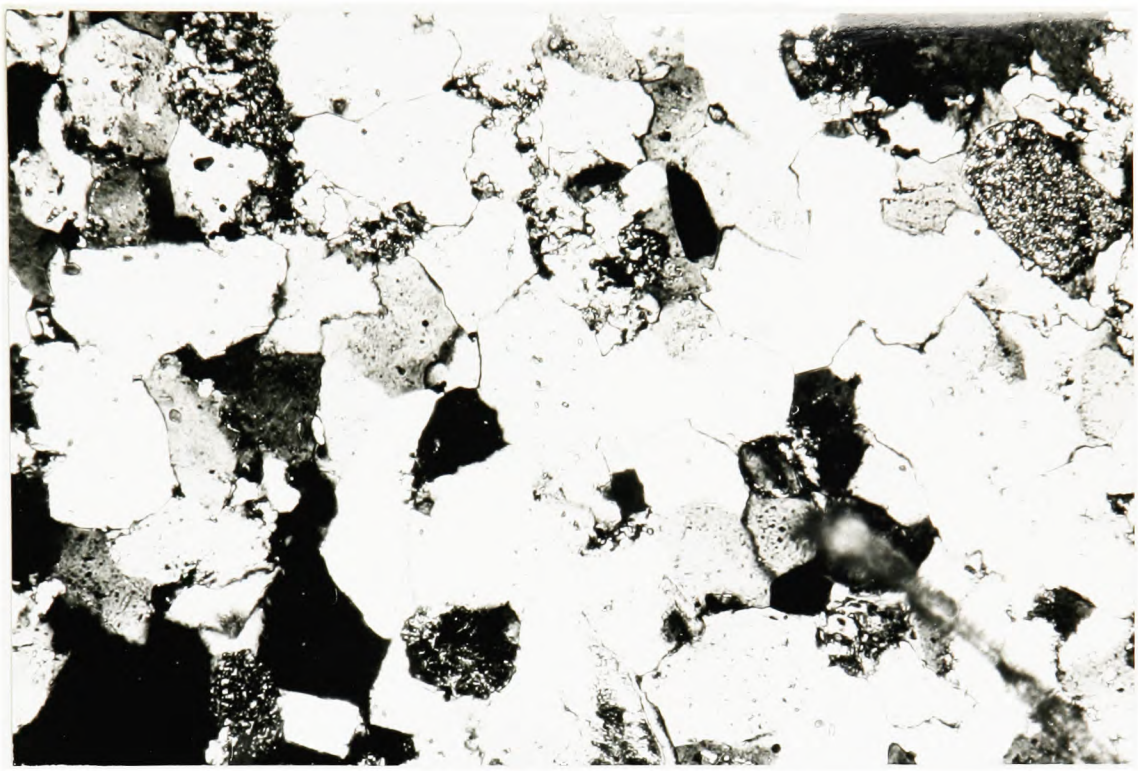
PLATE 3.34 HEAVILY BORED CLAST OF CARBONIFEROUS LIMESTONE, HAPSFORD MEMBER, HAPSFORD BRIDGE, SOMERSET.

PLATE 3.35 CONGLOMERATE COMPOSED OF WELL-ROUNDED CARBONIFEROUS LIMESTONE CLASTS CEMENTED BY SPARRY "DOG-TOOTH", CALCITE, HAPSFORD MEMBER, BUTCOMBE, SOMERSET.

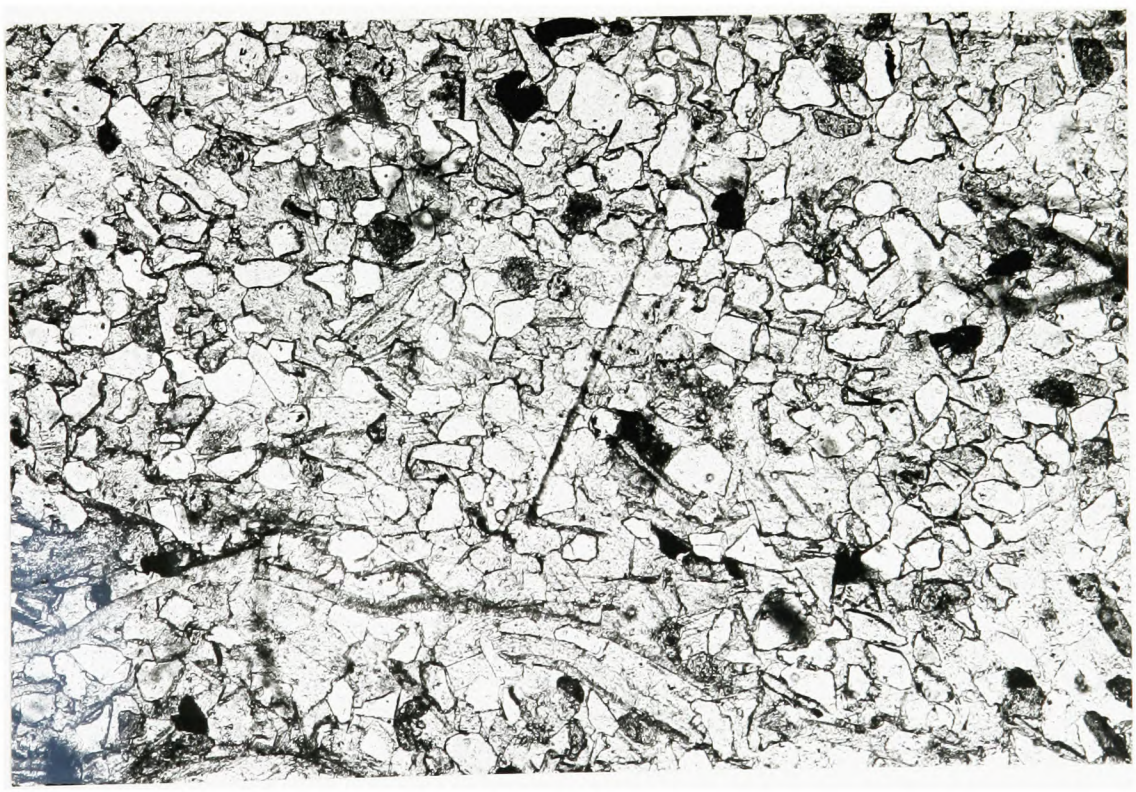

BUT

PLATE 3.36 PHOTOMICROGRAPH OF TIGHTLY CEMENTED SANDSTONE WITH SYNTAXIAL OVERGROWTHS ON QUARTZ AND FELDSPAR GRAINS, WESTBURY MEMBER, TREGUFF SOUTH GLAMORGAN (X-POLARS).

PLATE 3.37 PHOTOMICROGRAPH OF SANDSTONE CEMENTED BY SPARRY FERROAN CALCITE (CF. PLATE 3.36) WESTBURY MEMBER, TREGUFF, SOUTH GLAMORGAN (PLANE POLARISED LIGHT).



100μ



500μ

PLATE 4.1 POLISHED SURFACE OF TYPICAL COTHAM MEMBER LITHOLOGY, BLUE ANCHOR, SOMERSET: CALCAREOUS MUDSTONES WITH THIN LENTICULAR SILTSTONES. THE BIOTURBATION IN THIS SPECIMEN IS UNUSUAL.

PLATE 4.2 OSCILLATION-RIPPLED CALCAREOUS SILTSTONE WITH ABUNDANT BIOTURBATION, COTHAM MEMBER, LAVERNOCK POINT, SOUTH GLAMORGAN.


YASHICA

PLATE 4.3 FLAT-TOPPED RIPPLE MARKS AND DESICCATION CRACKS, COTHAM MEMBER, LAVERNOCK POINT, SOUTH GLAMORCAN (THE SMALL PITS ARE PROBABLY WEATHERING FEATURES).

PLATE 4.4 DEEP DESICCATION CRACK, COTHAM MEMBER, LAVERNOCK POINT, SOUTH GLAMORGAN.

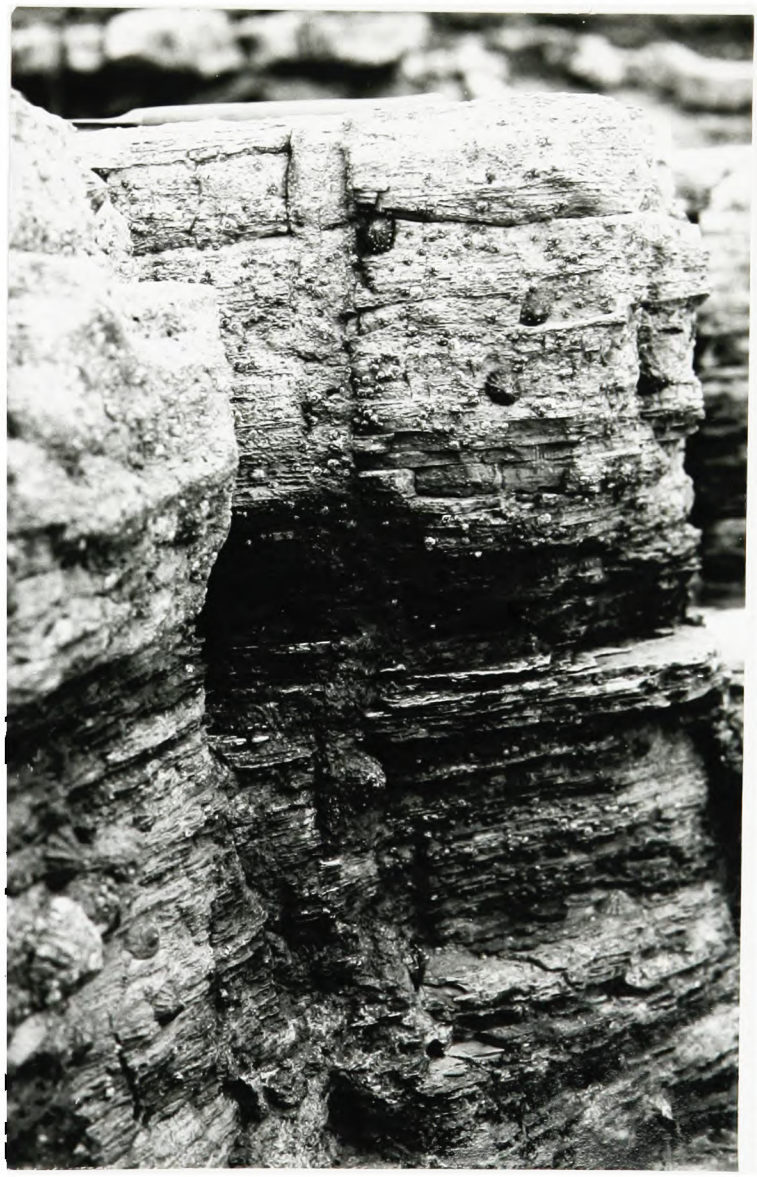


PLATE 4.5 DEEP DESICCATION CRACK, PENETRATING DOWN INTO DARK SHALES OF THE WESTBURY MEMBER, COTHAM MEMBER, ST. MARY'S WELL BAY, SOUTH GLAMORGAN.

PLATE 4.6 HORIZONTAL SURFACE DISPLAYING LARGE DESICCATION POLYGONS, COTHAM MEMBER, LAVERNOCK POINT, SOUTH GLAMORGAN

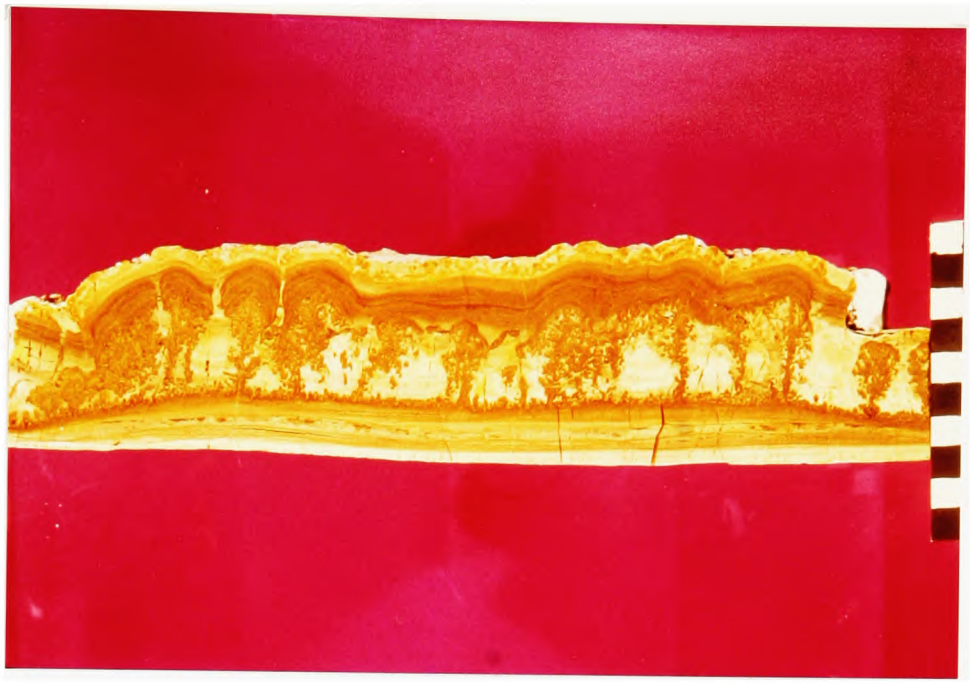
PLATE 4.7 RIPPLED SANDSTONE SHOWING WELL DEVELOPED SMALL DESICCATION POLYGONS, COTHAM MEMBER, ST. MARY'S WELL BAY, SOUTH GLAMORGAN.

PLATE 4.8 OOLITIC LIMESTONE: THE OOIDS NUCLEATED ON RECRYSTALLISED BIVALVE SHELL FRAGMENTS, COTHAM MEMBER, CULVERHOLE, DEVON. (PHOTOMICROGRAPH, X-POLARS).

100μ

PLATE 4.9 POLISHED SURFACE OF COTHAM MARBLE, COTHAM MEMBER, PATCHWAY, AVON.

PLATE 4.10 MICROFABRIC OF COTHAM MARBLE, THE "HEDGE" AND "TREE" ZONES OF HAMILTON (1961) CAN BE DISCERNED. (PHOTOMICROGRAPH, POLARISED LIGHT)



1 mm.

PLATE 4.11 "CRAZY" COTHAM MARBLE, CULVERHOLE, DEVON.

PLATE 4.12 PUSTULAR UPPER SURFACE OF THE "ESTHERIA BED", WAINLODE CLIFF, GLOUCESTERSHIRE. INTERNALLY THESE FEATURES DISPLAY AREORESCENT GROWTHS COMPARABLE TO THOSE OF THE COTHAM MARBLE.

PLATE 4.13 CONTORTED LAMINATION, COTHAM MEMBER, ST. AUDRIES BAY, SOMERSET.

PLATE 4.14 DETAIL OF PLATE 4.13


YASHICA

PLATE 4.15 CONTORTED LAMINATION, COTHAM MEMBER, LILSTOCK, SOMERSET.

PLATE 4.16 CONTORTED LAMINATION PRESERVED IN AN EARLY DIAGENETIC NODULAR LIMESTONE, COTHAM MEMBER. BLUE HILL, NOTTINGHAMSHIRE.

PLATE 4.17 CONTORTED LAMINATION PRESERVED IN AN EARLY DIAGENETIC NODULAR LIMESTONE, COTHAM MEMBER, BUNNY ROAD CUTTING, NOTTINGHAMSHIRE.

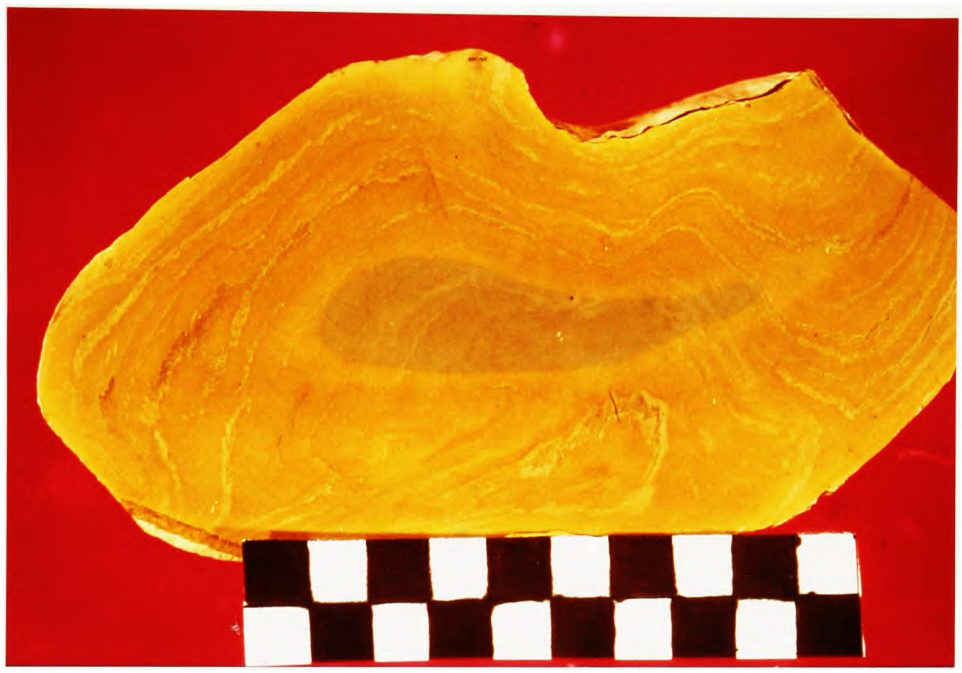


PLATE 4.18 CARBONIFEROUS OOSPARRITE CLAST IN - "RHAETIC" CONGLOMERATE, HAPSFORD BRIDGE, SOMERSET. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).

PLATE 4.19 CARBONIFEROUS CRINOIDAL-BIVALVE-FORAMINIFERAL BIOSPARRITE CLAST IN CONGLOMERATE, HAPSFORD MEMBER, HAPSFORD BRIDGE, SOMERSET. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).

1 mm.

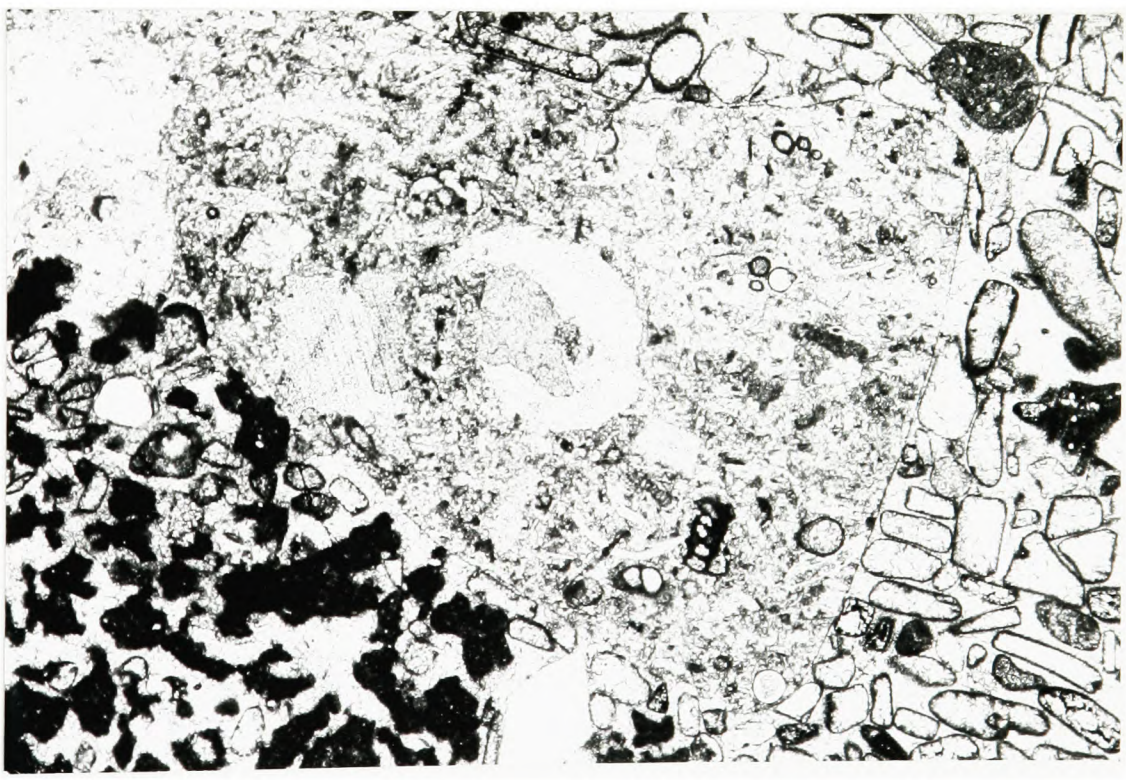


PLATE 4.20 MATRIX OF CONGLOMERATE COMPOSED PRINCIPALLY OF MICRITE-COATED AND MICRITIC GRAINS CEMENTED BY SPARRY CALCITE. HAPSFORD MEMBER, HAPSFORD BRIDGE, SOMERSET. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).

PLATE 4.21 CONGLOMERATE MATRIX CONTAINING QUARTZ, OOIDS, MICRITE-COATED GRAINS AND PELOIDS IN SPARRY CALCITE CEMENT, HAPSFORD MEMBER, HAPSFORD BRIDGE, SOMERSET. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).

1 mm.

500 μ

PLATE 4.22

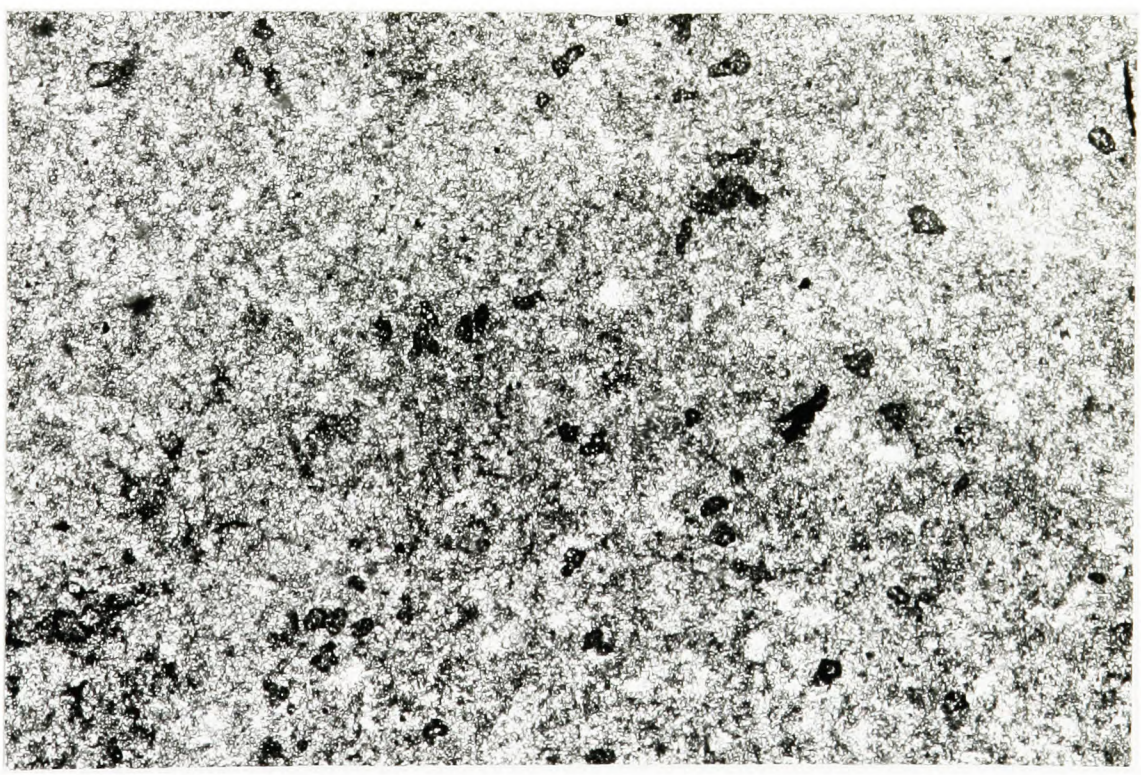
CLAST AT LEFT EDGE OF PHOTOMICROGRAPH WITH FAINT RIM CEMENT AND MAJOR SPARRY CALCITE CEMENTATION. DARKER AREAS IN THE SPAR REFLECT AN IRON ZONATION DISPLAYED BY POTASSIUM FERRICYANIDE STAINING. (PLANE POLARISED LIGHT).

100μ

PLATE 5.1 THE LANGPORT MEMBER, PINHAY BAY, DEVON. NOTE THE PROMINENT WAVY-BEDDED, MATRIX SUPPORTED CALCIRUDITE NEAR THE TOP OF THE PHOTOGRAPH.

PLATE 5.2 A THIN GASTROPOD/BIVALVE CALCARENITE BED IN THE PREDOMINANTLY MICRITIC LIMESTONES OF THE LANGPORT MEMBER, PINHAY BAY, DEVON.

PLATE 5.3 TYPICAL MICROSPAR FABRIC OF LANGPORT MEMBER, LIMESTONE, PINHAY BAY, DEVON. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).



500 μ

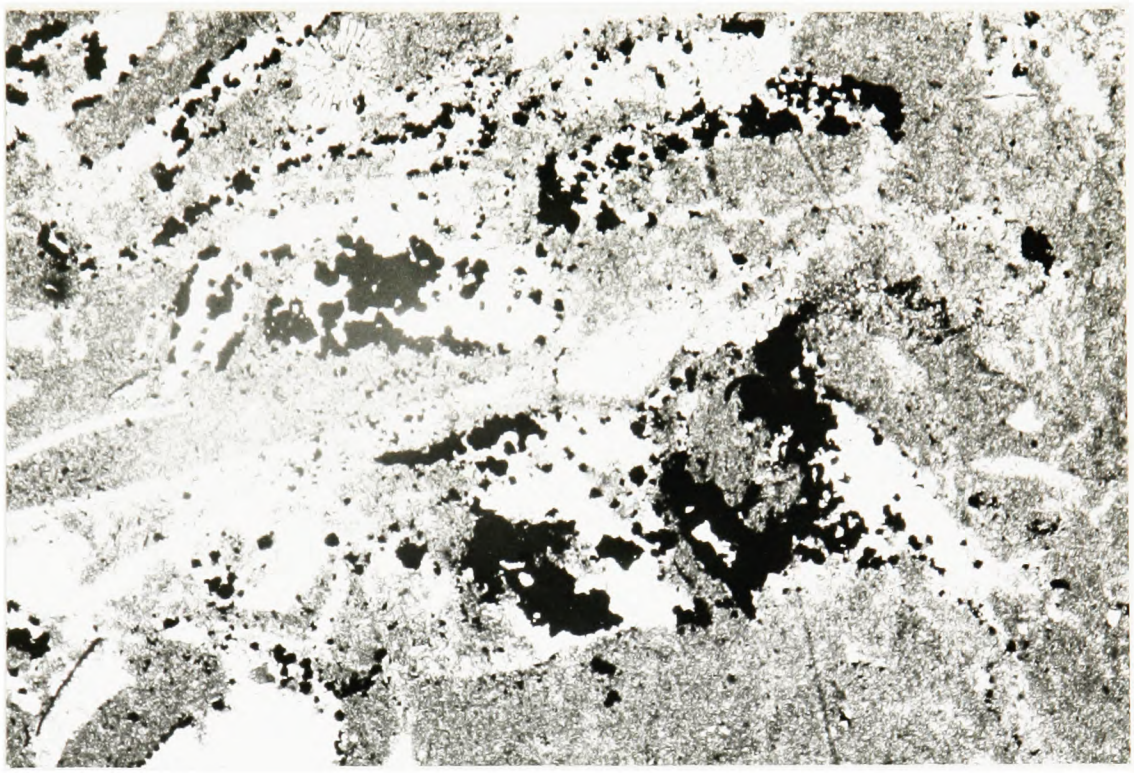
PLATE 5.4 BIVALVE SHELL FRAGMENT MOULD INFILLED WITH MICROSPAR: A THIN RIM CEMENT, NOT DISCERNIBLE HERE, IS ALSO PRESENT. LANGPORT MEMBER, PINHAY BAY, DEVON. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT)

PLATE 5.5 PYRITE RIMS VOIDS WHICH ARE INFILLED WITH SPARRY CALCITE, LANGPORT MEMBER, LAVERNOCK POINT, SOUTH GLAMORGAN (PHOTOMICROGRAPH PLANE POLARISED LIGHT).

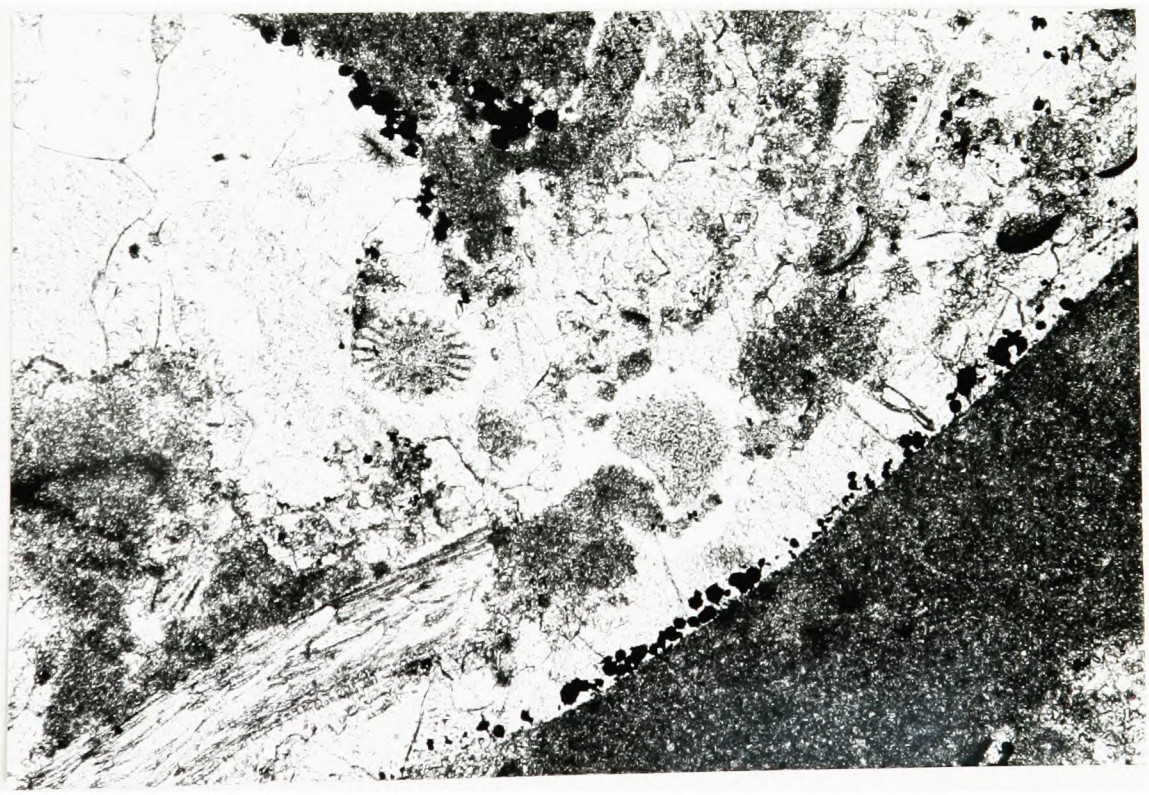
1 mm.

PLATE 5.6 VOIDS FILLED WITH SPARRY CALCITE WITH PYRITE AS A LATER REPLACIVE INFILL. LANGPORT MEMBER, ST. MARY'S WELL BAY, SOUTH GLAMORGAN. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).

PLATE 5.7 ECHINOID FRAGMENTS WITH SYNTAXIAL SPARRY CALCITE OVERGROWTHS SET IN SPARRY, FERROAN CALCITE, LANGPORT MEMBER, LAVERNOCK POINT, SOUTH GLAMORGAN. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).



1mm.



500 μ

PLATE 5.8 SYNTAXIAL OVERGROWTHS ON A BIVALVE AND AN ECHINOID FRAGMENT, LANGPORT MEMBER, LAVERNOCK POINT, SOUTH GLAMORGAN (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).

PLATE 5.9 AN ECHINOID SPINE FRAGMENT(AT EXTINCTION) WITH SURROUNDING OVERGROWTH AND LATER FERROAN SPAR CEMENT ALL IN OPTICAL CONTINUITY, LANGPORT MEMBER, LAVERNOCK POINT, SOUTH GLAMORGAN. (PHOTOMICROGRAPH X-POLARS).

500 μ

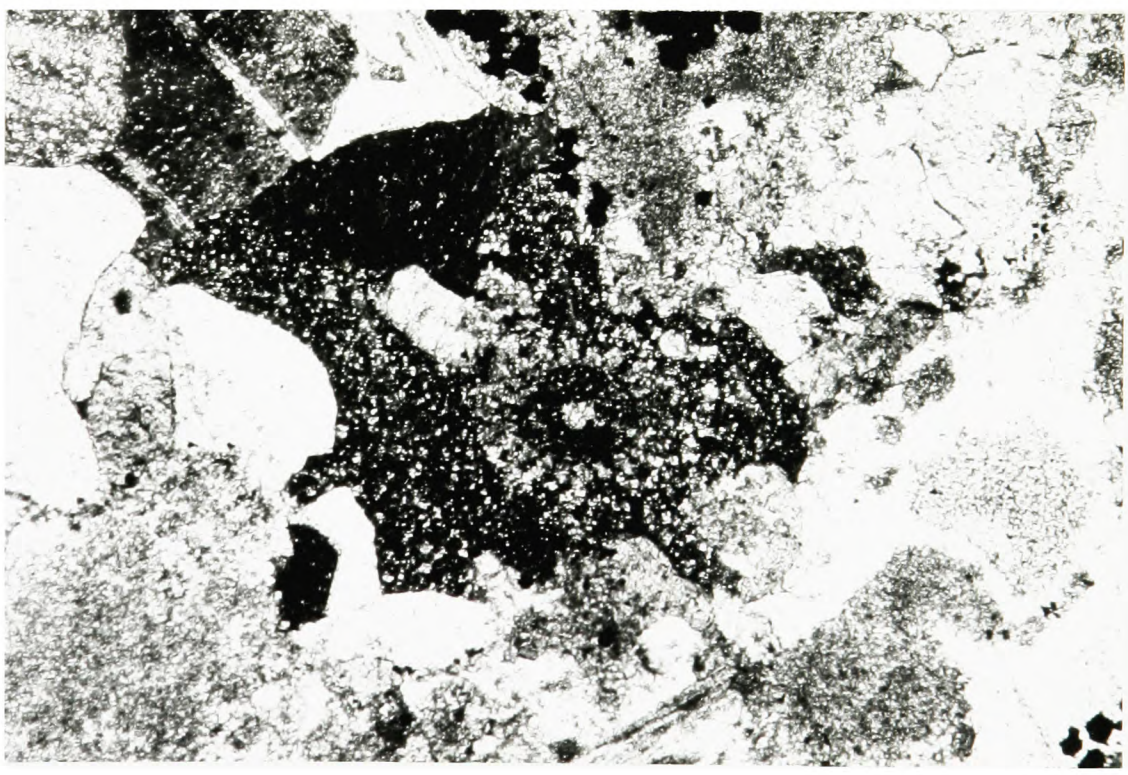
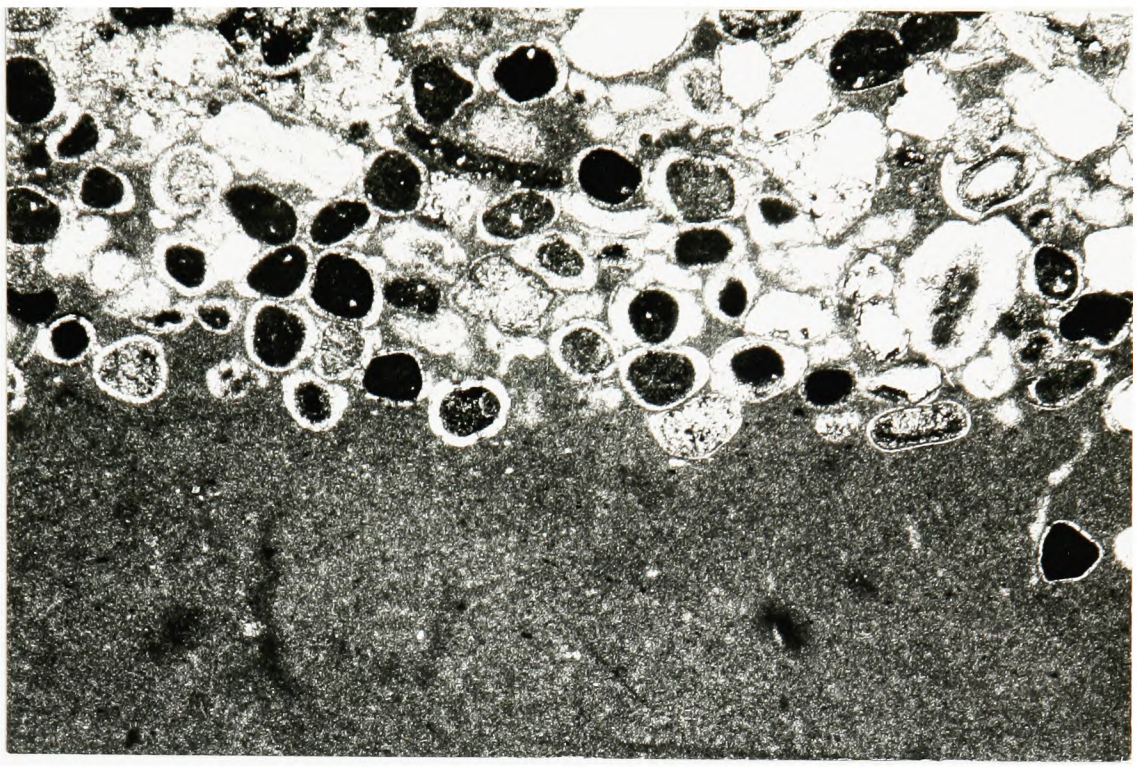


PLATE 5.10 OOMICRITE OVERLYING MICRITE, LANGPORT MEMBER, ST. MARY'S WELL BAY, SOUTH GLAMORGAN. NOTE DARKENED MICRITE NUCLEI TO OOIDS. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).

PLATE 5.11 INFERRED SOLUTION SEAMS AND FLASERS, LANGPORT MEMBER, PILTDAY BAY, DEVON.



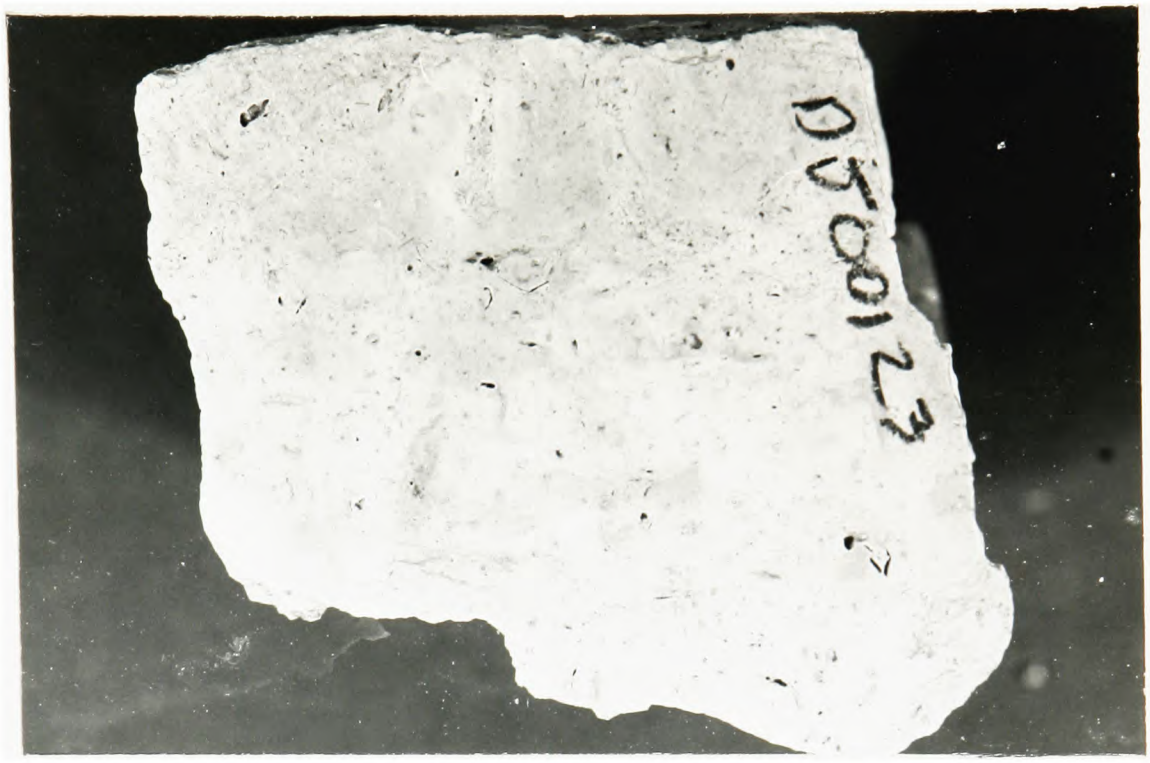
500 μ

PLATE 5.12 SLUMP BED BOUNDED BY UNDISTURBED STRATA,
LANGPORT MEMBER PINHAY BAY, DEVON.

PLATE 5.13 MUDSTONE - FILLED DESICCATION CRACKS,
LANGPORT MEMBER, LILSTOCK, SOMERSET.

PLATE 5.14 BURROW-MOTTLED LIMESTONE, LANGPORT MEMBER, LILSTOCK, SOMERSET.

PLATE 5.15 DIPLOCRATERION BURROWS WITH BLEACHED HALOES, LANGPORT MEMBER, CHARTON BAY, DEVON.



1 cm.

PLATE 5.16 *THALASSINOIDES* BURROWS, LANGPORT MEMBER, SHEPTON MALLET, SOMERSET.

PLATE 5.17 *SPONGELIOMORPHA* AND OTHER BURROWS AND BORINGS, LANGPORT MEMBER, PINHAY BAY, DEVON.

PLATE 5.18 UNIDENTIFIED ? CRUSTACEAN BURROW IN HIGHLY BURROWED AND BORED LIMESTONE, LANGPORT MEMBER, CULVERHOLE, DEVON. THE RIGHT HAND WALL OF THE BURROW IS PENETRATED BY A BORING.

PLATE 5.19 SPECTACULAR DIPLOCRATERION BURROWING FROM THE TOPMOST LANGPORT MEMBER. ("SUNBED") PINHAY BAY, DEVON.

PLATE 5.20 TRYPANITES CLAVATUS BORINGS INFILLED WITH DARK GAULT CLAY, LANGPORT MEMBER, CULVERHOLE, DEVON.

PLATE 5.21 THE BLOCKY CALCAREOUS SILTSTONES AND MUDSTONES OF THE WATCHET MEMBER OVERLAIN BY FISSILE LIASSIC SHALES AND LIMESTONES, LAVERNOCK POINT, SOUTH GLAMORGAN.

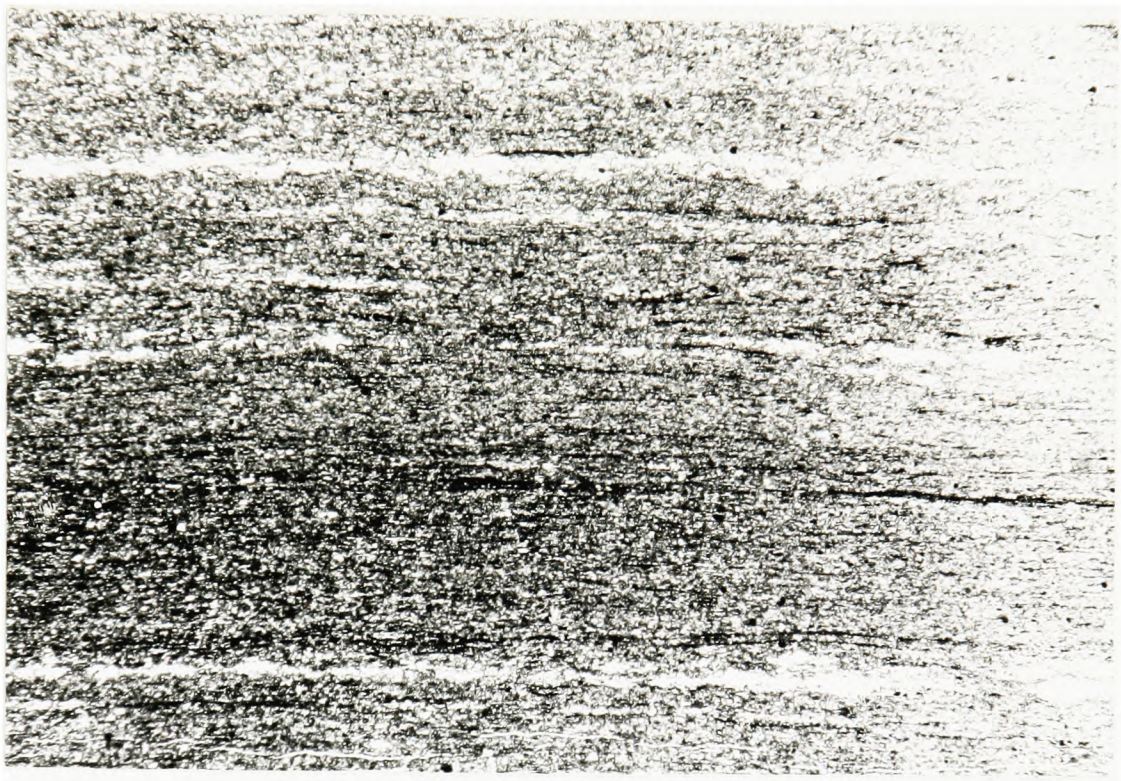
PLATE 5.22 CONCENTRATION OF LIOSTREA HISINGERI AND MODIOLUS HILLANUS IN CALCAREOUS SILTSTONES, WATCHET MEMBER, LAVERNOCK POINT, SOUTH GLAMORGAN.

PLATE 6.1 THE ALTERNATING LIMESTONE - ARGILLITE, BLUE LIAS, SEQUENCE AT ST. AUDRIES BAY, SOMERSET.

PLATE 6.2 THE BLUE LIAS AT LAVERNOCK POINT, SOUTH GLAMORGAN.

PLATE 6.3 A LAMINATED, BITUMINOUS SHALE FROM THE PRE-*PLANORBIS* BEDS, ST. AUDRIES BAY, SOMERSET. (PHOTOMICROGRAPH, PLANE, POLARISED LIGHT).

PLATE 6.4 DETAIL OF PLATE 6.3 SHOWING ALTERNATING ORGANIC-RICH AND QUARTZ SILT-RICH LAMINATIONS. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).



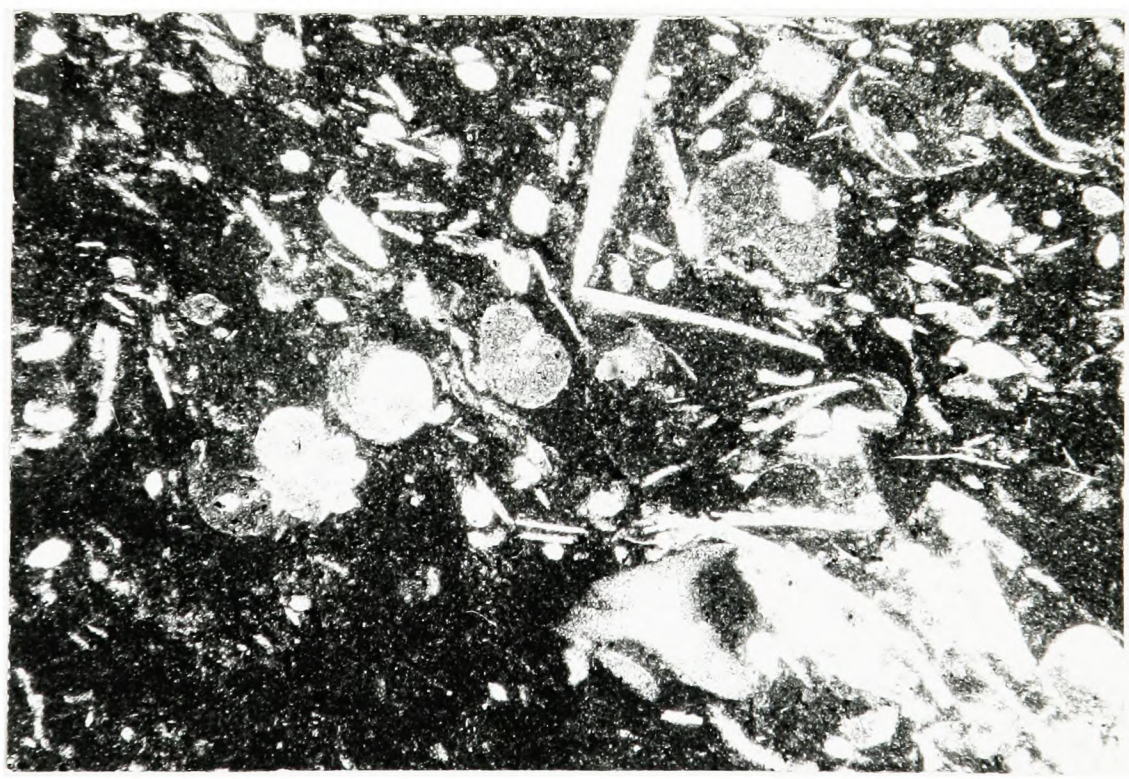
1 mm.

100μ

PLATE 6.5 PHOTOMICROGRAPH (PLANE POLARISED LIGHT), OF A TYPICAL BLUE LIAS MICRITIC LIMESTONE, LAVERNOCK POINT, SOUTH GLAMORGAN.

PLATE 6.6 A TYPICAL BLUE LIAS BIOMICRITE CONTAINING BIVALVE, OSTRACOD, FORAMINIFERAL AND ECHINODERM FRAGMENTS, LAVERNOCK POINT, SOUTH GLAMORGAN. (PHOTOMICROGRAPH, PLANE POLARISED LIGHT).

100μ



1 mm.