

QUATERNARY NEWSLETTER

No. 12

February 1974

Quaternary Newsletters are issued in February, June and November. Closing dates for submission of copy for the relevant Number are 1st February, 1st June and 1st November. Contributions, comprising relevant reviews, notices of forthcoming meetings, news of personal and joint research projects etc. are invited. They should be sent to the Secretary of the Quaternary Research Association, Dr. W.G. Jardine, Department of Geology, University of Glasgow, GLASGOW, G12 8QQ, U.K.

QUATERNARY GEOLOGY IN NORDEN

At the 1974 annual Nordiska Geologiska Vintermötet held at Oulu, Finland, from 3rd to 5th January, a major part of the programme was devoted to papers on the Quaternary Geology of Norden. Lecture sessions in this section occupied all three days of the meeting, with papers presented by workers from all the Scandinavian countries on a wide variety of Quaternary topics. The papers presented were as follows, giving a good impression of the range of Quaternary research currently under way in Scandinavia.

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| Henner Dahmsen | The new boring Skaerunhede No. 2, in the Quaternary deposits at Skaerunhede, Northern Jutland. Drilling method, sample treatment and lithology. |
| Peter B. Konradi | The new boring Skaerunhede No. 2, in the Quaternary deposits at Skaerunhede, Northern Jutland. The Foraminifera in the lower part. |
| Kaj Strand Petersen | The Macrofauna - particularly the Molluscs - from a new boring in the Quaternary deposits at Skaerunhede, Northern Jutland, Denmark. |
| Karen Luise Knudsen | Foraminifera from the upper part of a new boring at Skaerunhede, Denmark. |
| Kauko Korpela and Pauli Mänttö | Topography of bedrock surface in esker areas. |
| Ole Fr. Bergersen | New localities with sub-till sediments in Central South Norway. |
| Kari Gernes | Various types of moraines in Jotunheimen and Gudbrandsdalen, Southern Norway. |
| Sylvi Maldorsen | Investigations of ground moraine deposits in south-eastern Norway. |
| Gunnar Glöckert | Glacial-geological studies in middle Finland. |
| Niels Schrøder | Meltwater rivers in northern Jylland and Kattegatt. |
| Helge Gry | Grain size analyses of some indicators in Denmark and Sweden. |
| Harald Agrell | Some aspects of the deglaciation of the southern Swedish uplands. |
| Gunnar Larsen, J. Liboriussen and O.D. Nielsen | Formation of Weichselian and presumed Saalian landscapes near Randers, Eastern Jutland. |
| R.W. Feyling-Hanssen | The Weichselian section of Foss-Eigeland, South-west Norway. |
| Elen Roaldset | Interstadial sub-till clays in lower Nemdal, Norway. |
| Johan Rodhe | Sediment transport and accumulation at the Skagerrak - Kattegatt border. |

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Hennar Dahmsen

Trace of dust storms in early Iron Age pointed out in some raised bog profiles by ignition.

Lena Adrielsson and
Erik Lagerlund

Lithostratigraphic investigations in western Scania.

Rolf Sørensen

Ice recession in the Oslo-fjord area.

In addition, there was an interesting paper by L.A. Simonarson entitled "Interglacial marine deposits in West Greenland" and one by Dr. Åke Millefors on the action of Kattegatt ice on the islands off the mid-Johuslan coast. Several other papers on glacial and fluvio-glacial sediments were presented in the "Applied Geology" section.

The afternoon of 3rd January was devoted to a symposium entitled "Stratigraphic classification and terminology of the Quaternary", led by Dr. Svend Andersen (Denmark), Dr. Jan Mangerud (Norway), and Prof. Björn Berglund (Sweden). Some of the problems of stratigraphical and chronological correlation between the Scandinavian countries were outlined, and the results of some recent research were summarised. Various suggestions made concerning a standardised terminology revealed some clear differences of opinion. After discussion, it was agreed that the three speakers should prepare a discussion document for circulation to interested persons, Scandinavian Institutes of Quaternary Geology etc., with a view to eventual publication in Boreas.

Abstracts of the various papers, details of section programmes, lists of delegates etc. were published in advance in three booklets distributed to Conference participants. The Secretary of the Organising Committee was Dr. Juhani Paakkola, Geologiska Institutionen, University of Oulu, Kasarmintie 15, 90100 Oulu 10, Finland.

The above report was provided by Dr. Brian John, Department of Geography, University of Durham, England, presently at the Naturgeografiska Institutionen, Stockholm University, during the tenure of a Royal Society European Fellowship.

PROBLEMS ASSOCIATED WITH PLEISTOCENE RAISED BEACHES

A discussion meeting of the Quaternary Research Association on the above subject was held in University College, London, on 2nd January 1974. Summaries of the papers presented are given below.

1. The interpretation of Pleistocene beaches in the context of present-day shore processes. C. Kidson, University College of Wales, Aberystwyth.

Three aspects of contemporary beaches are considered in terms of the interpretation of Pleistocene deposits: composition, textural characteristics, height.

Modern beaches made up solely of detritus from adjacent cliffs are the exception rather than the rule. Most beaches include far-travelled material brought to the littoral zone at some time from the furthest limits of the catchments of local rivers. In addition, they include the "sweepings" of the sea flood introduced into the present nearshore zone by transgressing Flandrian and interglacial seas. The seafloors around Britain were periodically occupied by a great deal of glacial detritus and material gleaned from them and added to the beaches consequently includes much erratic material. Most beach material has been recycled many times. Only the most durable, such as quartz sand, chalk flints, chert and the like, survives for long in the surf zone. Where local rocks, particularly limestones, show relatively poor resistance to littoral processes, the far-travelled components in a beach become increasingly important. It is clear that in determining the origins of Pleistocene deposits, the mere presence of non-local material, even including "giant erratics", does not rule out a beach origin or make a glacial origin more likely.

Beach materials tend to have easily recognised textural characteristics. They are most often negatively skewed. They tend to be well rounded, well sorted and to have distinctive surface markings. These characteristics are, however, only fully acquired in high energy environments or after a long sojourn in a moderate energy zone. They are usually only fully developed on the foreshore. Both the breaker zone and the backshore tend to exhibit poor sorting. The interaction between dune and beach can result in backshore samples showing a positive skew. Since many surviving beach deposits come from high on the beach, mechanical analysis has limitations as well as potential for interpretation.

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Great care is needed in relating deposits which can be regarded as of beach origin to the sea "level" to which they are to be referred. The sea is not level. On a calm day high water on a coast with a large tidal range can be 3 to 5 metres (in relation to O.D.) above high water mark where tidal range is small. Variations in wave energy can mean that beach materials can be emplaced to heights differing by as much as 10 m or more between adjacent beaches or parts of the same beach. The situation is made more complex when the intricacies of coastal outline are taken into account. Where old deposits of restricted extent are under consideration, the dangers of using height as a principal diagnostic factor should be obvious.

All the characteristics of an old deposit are important in determining its origin. There are dangers in giving undue prominence to any one. Where a beach origin is a possibility, a comparison with the materials of the present beach should always be made.

2. Pleistocene beaches: some results of Oxygen Isotope Analysis. N.J.Shackleton, University of Cambridge. (summary by W.G.J.)

Oxygen Isotope studies of oceanic Foraminifera suggest that approximately 17,000 years ago summer temperatures were only about 1° C less than now, winter temperatures were perhaps about 2° to 3° C less than now. Also, in the same time interval the isotopic composition of the oceans has changed by approximately 1.4 to 1.6 per mil (cf. 1.5 per mil indicated on the basis of radiocarbon dating) - this change being related to changes in the size of ice sheets.

Similar studies suggest the following with regard to sea level:

1. 20,000 years ago sea level was approximately 120 m lower than now.
2. 70,000 years ago sea level could not have been as high as at present.
3. 120,000 years ago there was more water in the oceans than now.
4. 220,000 years ago sea level was not as high as at present.
5. It is unlikely that any Pleistocene beaches at heights above present sea level (unless raised by tectonic or other movements) will be found, except those formed approximately 120,000 years ago.

3. Two problems of Quaternary high sea levels. Andre Guilcher, University of Western Brittany, Brest, France. (summary by W.G.J.)

1. The problem of the significance of the very high Pleistocene beaches.

In North Central Chile a set of Pleistocene marine terraces at heights of 120-130 m, 75-80 m, 35-40 m, 15-20 m, and 5-7 m occur near Coquimbo. All are tectonically undisturbed in the neighbourhood of Coquimbo, although disturbed elsewhere. It appears that the Coquimbo terraces resulted from eustatic shifts in sea level following glaciation and deglaciation, yet this apparently is impossible, because melting of the present Antarctic and Greenland ice-caps would allow a sea-level rise of approximately 65 metres only. Various hypotheses have been put forward to explain a progressive lowering of the general level of the sea during the course of the Pleistocene (e.g. Dietz 1961, Rona 1972; see also Lliboutry 1965, pp.887-9). As far as Central Chile is concerned, it may be that a decrease in the volume of the mid-oceanic ridge, causing a regression, has contributed to the distribution of the marine terraces from 130 m to present level, although this factor is by no means proved. A progressive uplift of the Coquimbo coastal area during the Quaternary, without any noticeable warping or tilting, and combined with glacio-eustatic shifts in sea level, was perhaps a more efficient cause.

A detailed analysis of Mount Liban, Lebanon, by Sanlaville (1973) has shown that this area is truncated by rocky benches at 500-550 m, 440-460 m, 400-430 m, 340-360 m, 290-320 m, 250-260 m, 190-220 m, 150-170 m, 100-130 m, 40-70 m, and 10-20 m. No deposits were found on the benches above 300 m, but from 300 m downwards evidence of marine action includes marine pebbles and sands, traces of boring organisms, and frequent coatings of Vernetidae. The benches essentially are horizontal in a north-south direction, and there appears to have been tectonic stability in this area during the Pleistocene epoch. Apparently Lebanon was quite evenly uplifted during the formation of the terraces; Mount Liban was raised progressively during the Quaternary, so that benches of moderate width, and small cliffs backing the benches, were formed. Partly on the basis of archaeological evidence, the following chronology is suggested for the Pleistocene shorelines in Lebanon:

(see Table overleaf)

<u>Altitude</u>	<u>Industry</u>	<u>Traditional glacial chronology</u>
lower terrace: up to 20 m	Middle Palaeolithic	Riss - Würm
middle terrace: up to 85 m	Tayacian & Middle Acheulian	Mindel - Riss
upper terrace: up to 130 m	Borj Ginnarit flints	Günz - Mindel
150-170 m		Fre - Günz
190-220 m		} Lower Pleistocene
250-260 m		
290-320 m		

In the New Hebrides (south west Pacific Ocean), emerged marine terraces differ from those of Central Chile and Lebanon in being largely of fringing coral reefs rather than beaches. In summary, the coral terraces of this area occur as steps or staircases rising commonly to 200 metres and almost 400 metres in places. A combination of observation and interpretation leads to the following conclusions regarding the terraces of the New Hebrides. General uplift, superimposed on general Pleistocene shifts in sea level, affected these islands during the Quaternary. In some places no significant warping occurred (e.g. at Santo Island); in this case the result is the same as at Coquimbo, Chile, and on the coast of Lebanon. At other places (e.g. Efate and Malekula Islands), warping, tilting and faulting occurred to various extents, and the combination with the uplift and the eustatic changes in sea level are diverse.

The Huon Peninsula on the north-east coast of New Guinea possesses perhaps the best set of elevated coral terraces in the world. Over 20 uplifted reef terraces make a complex flight of warped terraces (differential in uplift rates exceeds 10 : 1) rising to over 700 m above sea level (Veeh and Chappell 1970). Radiocarbon and Thorium - Uranium dating indicate high sea levels at 210-250,000 years B.P. (very imprecise), 180-190 ka, close to 74 ka and between 35 and 50 ka B.P. The present period of high sea level begins at about 6 ka B.P. (ka = 1000 yrs).

2. The problem of the age of the low level (0 to 20 m) old beaches in Brittany and Normandy.

In Brittany, Normandy and the Channel Islands, Lower Normannian beaches occur approximately between highest spring tide level and 4 to 5 metres above this, Upper Normannian beaches occur between approximately 12 and 18 metres above highest spring tide. Lower Normannian beach remnants are more widespread than those of the Upper Normannian. Until the 1960's most continental workers regarded the Normannian beaches as Eemian in age. Recently it was suggested that the lower group of beaches belong to an interstade which occurred during the last cold period, but this conclusion seems extremely doubtful; there is no conclusive evidence in Brittany or Normandy of an interstadial high sea level during the last 40,000 years at the altitude of the Lower Normannian beaches - on the contrary, archaeological evidence suggests an Eemian age for those beaches.

On the basis of investigations within the Bay of Saint Brieuc, Brittany, Monnier (1972) suggested that most of the Upper Normannian beaches are Eemian in age, but some belong to a Saalian interstade or to the Holsteinian interglacial. Also, Morzadec, Giot and Monnier assign Upper Normannian beaches outside the Bay of Saint Brieuc to the Holsteinian on the grounds that if the Eemian sea had risen higher than 5 m above present high spring tides, the waves would have removed loose deposits which actually are preserved. Guilcher, however, is of the opinion that the waves would not necessarily have removed the loose deposits they found in their way; evidence apparently in support of this view occurs in the case of a Lower Normannian pebble beach at Leon, north-west Brittany and also in a different form in the Isles of Scilly. There is no conclusive stratigraphical evidence to suggest a Holsteinian age of the Upper Normannian beaches of Brittany and Normandy, but it is possible that some Upper Normannian beaches in the Armorican massif are Holsteinian in age.

Finally, Lalou *et al.* (1971) claimed that two distinct high sea levels occurred at about 120 ka and at 80 ka B.P., the older being slightly higher. Steinen *et al.* (1973) claimed that evidence in Barbados, West Indies, suggests high sea levels at 125 ka and 105 ka B.P. separated by a "low" sea level at 71 ± 11 m above present sea level.

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4. Pollen-analytical evidence for interglacial sea levels. C. Turner, The Open University.

In the study of interglacial sea levels, pollen analysis is a valuable stratigraphical tool because, for time-stratigraphic subdivision, it has a finer resolving power than any other method. In marine transgression sequences, data on the age and altitude of transgression horizons need critical analysis. In particular, pollen analysis can reveal hiatuses in sedimentation due to non-deposition or erosion. This is well illustrated by the Hoxnian transgression sequences of Eastern England. Often evidence is quoted of marine transgression between zones Ho II and Ho III: at 2.7 m O.D. at Clacton and at 5.8 m O.D. in the Nar Valley. In both cases there are major hiatuses in the pollen record as well as marked evidence of erosion, so that these figures are minimum values for non-marine deposition. At Peterborough, however, the transgression is well stratified within zone Ho IIc at 11.5 m O.D. (L.M. Phillips, unpublished), and at Kirmington, from new borehole data, the marine level was at least approximately 23.0 m O.D. during the same zone. There is some evidence from Walton-on-the-Naze that sea level continued to rise even during zone Ho IIIB. This would correspond well with the again rather fragmentary evidence from north Germany where sea level appears to have risen during zones II and III of the Holsteinian and fallen abruptly with the onset of zone IV.

Both interglacial data and comparative data for the Flandrian along the east coast of England are at present too scanty to allow isostatic effects to be distinguished from eustatic effects and thus permit a hypothetical sea-level curve for the Hoxnian to be constructed. Also, the data are not sufficiently good to substantiate or even justify certain arguments about the subsidence of South-East England, the upwarping of parts of the lower Thames valley or differential trends between this area and western Britain, where there is singularly little evidence for any high Hoxnian sea level.

4. Last interglacial sea levels in the U.K. and eastern North America. J.T. Hollin, University of Maine, U.S.A.

According to A.T. Wilson (1964), the Pleistocene ice ages were triggered by Antarctic ice sheet "surges", injecting vast quantities of ice into the world's oceans, every 100,000 years or so. Hollin (1965, 1972) has suggested that Wilson's last surge might have been the cause of a postulated sudden, temporary rise of sea level late in the last interglacial, to Zeuner's "Main Monastirian", 17 m level. The idea that this level may be as young as this has kept appearing in the literature for 50 years now (Charlesworth 1957, p.1271).

In the U.K., during the first half of the last interglacial, in the mixed-oak zone, brackish-water indications in the flora at Ilford (West et al. 1964) suggest that the sea reached a maximum then of very roughly +4 m. This maximum may be represented by some of the rock platforms and cliffs of the "British and French infraglacial beach" (Charlesworth 1957, p.1251), and also by tidal (?) laminations at Little Thurrock and Purfleet (visited on 3rd January 1974 by some participants in the Q.R.A. meeting of 2nd January). By the middle of the interglacial, freshwater deposits at -1 m at Trafalgar Square (Franks 1960) suggest that the sea had fallen away from its early maximum. But then, in the second half of the interglacial, arguably late in the hornbeam zone, aggradation occurred in the Thames estuary: at +5 m at West Thurrock and at +8 m at Aveley (two sites visited on 3rd January 1974), and possibly up to +13 m at Ilford (Hollin 1965). This aggradation deposit at Ilford, and its natural fauna, have frequently been attributed to some unusual flood or floods. However, apart from one report of brackish-water

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molluscs at Ilford, there is no good evidence yet to link the aggradation to a rise of sea level, rather than to e.g. early Devensian alluviation. On the other hand, on or near the coast, lithostratigraphical and molluscum evidence which might fit this late rise is found in the March Gravels (Baden-Powell 1934), a sand and gravel sheet in Sussex (Hodgson 1964), the raised beaches at Portland and Hope's Nose (Arkell 1947), and possibly the Trebetherick boulder bed and the Heritoides bench at Minchin Hole.

In eastern North America, deposits in Bermuda, S. Carolina (two areas), Virginia and Washington D.C. have been attributed to a last interglacial sea stand at roughly +16 m. In each case there is some evidence that this stand may have been late (Hollin 1972). Hollin is now studying some of these deposits to see if they yield pollen spectra and uranium dates (on non-reef corals) indicating the end of the interglacial.

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6. Abandoned marine erosion features in Scotland. J.B. Sissons, University of Edinburgh.
(summary by W.G.J.)

In the past, two main groups of raised marine abrasion platforms (a higher and a lower) with associated abandoned cliffs have been recognised in parts of western Scotland. The higher features are particularly well seen in Islay, Jura and Mull, and some of the smaller islands nearby. It has been claimed that the platform was formed before the last glaciation because striae, ice-moulding and superincumbent till are present on its remnants. On the basis of similar evidence the lower platform (which falls from 11 to 12 m near Oban to 4 to 5 m above O.D. along the coast of Mull) has also been considered to pre-date at least the last glaciation, though there may have been post-glacial "freshening" of the feature. The possible formation of the higher platform in interglacial times is not inconsistent with the survival of its remnants in places relatively sheltered from glacial erosion, but in the case of the lower platform - well preserved in eastern Mull, around Oban and in lower Loch Linnhe, areas believed to have been subjected to intense glacial erosion - an interglacial time of origin is unlikely. There is a possibility that the lower platform originated during the Devensian interstadial which ended perhaps around 25,000 years B.P., but this does not explain why the feature should show few signs of the erosive effects of a major ice-sheet.

In south-eastern Scotland, four erosional features occur in the vicinity of the coast between Berwick and Dunbar. Two of the features are shore platforms which can be shown to pre-date the last glaciation. The third feature appears to be a modification of one of the first two. The fourth feature is a submerged marine abrasion platform with associated cobbles and boulders (reported by R.A. Men and others of the I.G.S.) which occurs at about 18 m below O.D. The profile of this feature is very similar to that of the Bariel Gravel Shoreline (reported by Sissons e.g. in The evolution of Scotland's Scenery, 1967), which occurs at about 0 to 1 m above O.D. around Grampianouch on the Firth of Forth.

The submerged or buried erosional shore-line has not yet been identified outside S.E. Scotland, but it might be expected to occur above Ordnance Datum near the centre of isostatic uplift, for example in western Scotland including the area of eastern Mull, Oban and Loch Linnhe. It is suggested that the well-developed lower rock platform and cliff of the Mull - Oban - Loch Linnhe area is the equivalent of the buried and submerged features of south-eastern Scotland. The only time

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when such features, which required exceptional conditions for their formation, could have originated is at the end of the late-Devensian age, around the time of the Loch Lomond Readvance. The formation of this coastal rock feature probably was assisted by intense frost shattering, especially in the intertidal zone.

COASTAL "GIANT" ERRATIC Boulders of Southern Britain and "A MOST INGENUOUS PARADOX"

Dr. D. C. Dowen, University College of Wales, Aberystwyth, has contributed the following note - appropriate as an "appetiser" for the Q.U.A. excursion to South West England in April 1974.

"Giant" erratic boulders (up to 50 Mg) lying on shore-platforms up to 9 m O.D. have been used to suggest that the latter were fashioned long before deposition of raised beach material on them. Stephens (1966) favoured ice-rafting during a "pre-Saale" cold period when, on a Fairbridge (1961) sea-level curve, a cold climatic glacio-eustatic "low" would have coincided with the present coast. Volumes of sea water inferred from oxygen isotope data (Shackleton and Opdyke 1973) make this explanation unlikely. The height and coastal mode of the erratics mitigates against Kellaway's (1971) explanation of extensive glaciation. Mitchell (1972) believes that the erratics were ice-rafted at the end of the Hoxnian. This is unlikely as the pattern of glacial cycles is a highly asymmetric ("saw-toothed") curve with only minor advances (= ice accumulation) early in the cycle (Fairbridge 1972).

The peculiar distribution of the erratics points to ice-rafting and a glacio-eustatic mechanism as most likely, while the foregoing suggests timing at the end of a glacial cycle. Thus the paradox of glacio-eustatic "high" and climate appropriate for ice-rafting at least to northern France, seems inevitable. Comparison of Holocene sea levels and ice volumes (e.g. Fennoscandia) makes the paradox unlikely. Yet crude though these data may be for analogy with earlier interglacials, they are not so inconceivable as to render comparison forever improbable. Inspection of Shackleton and Opdyke's glacio-eustatic curve allows inference that the last interglacial transgression (128 ka B.P.) was more rapid than the Holocene marine incursion. This, following a glaciation less extensive than the Anglian, which resulted in comparatively minor isostatic complication - a pre-requisite for rafting (above) - may have allowed emplacement of the erratics. Certainly the geomorphic perfection of the Pleistocene coastline requires a fashioning as recently as possible.

If the foregoing be accepted as the most economic working hypothesis available (there is no contrary stratigraphic evidence as, for example, in the U.S.A., e.g. Alt and Brooks 1965) the following implications are significant: 1. platform cutting, erratic emplacement and beach deposition all occurred during the same glacio-eustatic transgression; 2. drift ice, heavily armed, may have assisted platform cutting (Lyell 1872), also explaining excessive width on hard rocks - often gratuitously attributed to the effect of several successive interglacial seas; 3. a climatic explanation is provided for "head" often found, sometimes prolifically, in raised beaches of western Britain.

Discussion with Professor R.W. Fairbridge and his stimulating ideas on the potential role of drift ice in this context is acknowledged.

References: Alt and Brooks 1965: Journ. Geol. Fairbridge 1961: Phys and Chem of the Earth; 1972: Quaternary Research. Kellaway 1971: Nature, Lond. Lyell 1872: Principles of Geology. 11th Ed. Mitchell 1972: Sci. Proc. R. Dublin Soc. Shackleton and Opdyke 1973: Quaternary Research. Stephens 1966: Bull. Perryglac.

INQUA NEWS

The 9th Congress of the International Union for Quaternary Research (INQUA) was held in Christchurch, New Zealand, from 2nd to 9th December 1973. The congress was attended by 432 Participating Members (mainly from Asia and Australasia), 78 Accompanying Members and about 50 other registrants. The scientific programme took the form of papers presented at Symposia on Early Man and Natural Environments, Boundaries of the Pleistocene, Loess, Tropical Vegetation during the Pleistocene (these four being sponsored by UNESCO), Neotectonics and Seismotectonics, Tephrochronology, Quaternary Shorelines, The deep-sea Quaternary record, Circum-Pacific glacial chronology, and Till, or papers presented at Sessions on Geology and Geomorphology, Quaternary climates, Quaternary volcanism, Palaeolimnology, Antarctic environments, Quaternary maps and mapping, Chronology and correlation of Quaternary events, Palynology and palaeoecology, Palaeontology and palaeoecology, Palaeotemperatures, Palaeomagnetism and Isotope Dating, Palaeopedology, and three Common Topic sessions.

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In the course of the congress there were also several meetings of each of the various Commissions and Sub-commissions of INQUA, and frequent meetings of the International Council.

Pre-Congress and post-Congress field excursions ranging from 5 to 9 days in length were held in the North Island and the South Island of New Zealand, in southern and eastern Australia, and in New Guinea.

At the closing session of the General Assembly it was announced that the International Council had elected the following Executive Committee for INQUA for the inter-congress period, 1973-1977.

President	V. Sibrava (Czechoslovakia)
Secretary/Treas.	H. Paape (Belgium)
Vice-Presidents	K.V. Nikiforova (U.S.S.R.) F.W. Shotton (United Kingdom) J.M. Soons (New Zealand) A.L. Washburn (U.S.A.)
Immediate Past President	G.F. Mitchell (Ire)

An invitation from Professor F. W. Shotton, on behalf of The Royal Society, for the 10th Congress of INQUA to be held in Birmingham, England, in 1977 was accepted by the unanimous applause of the General Assembly.

NOTICES

1. North of England Soils Discussion Group

The annual field meeting of the North of England Soils Discussion Group will be held at Newton Rigg, Penrith, Cumberland, on September 9th, 10th and 11th 1974. The theme of the meeting is Problems associated with Periglacial Features in soils. Further information may be obtained from Dr. P. Howard, Hon. Secretary, North of England Soils Discussion Group, Institute of Terrestrial Ecology, Merlewood Research Station, Grange-on-sands, Lancs.

2. Europe from Crust to Core - Meeting of European Geological Societies, Reading, U.K., 1975.

The First Circular, giving details of the meeting of European Geological Societies at Reading in September 1975 is now available from: Mrs. D. M. Powell, Local Organising Secretary of MEGS, Geology Department, University, Whiteknights, Reading, RG6 2AB. Further particulars will be announced in the Second Circular (autumn 1974), which will be distributed only to those who return the Preliminary Enquiry Form (attached to the First Circular) by 30th April 1974.

CALENDAR OF MEETINGS

1974

- 5 - 9 Quaternary Research Association. Exeter. Annual Field Meeting and
April Annual General Meeting. Local Secretary: Dr. R.A. Cullingford, Department of Geography, The University, EXETER, EX4 4QH.
- 9 & 10 Symposium on Soil Pollution, Harold Building, University of Manchester
April Institute of Science and Technology. Application forms from The Secretary, Manchester University Radiological Protection Service, 327 Oxford Road, Manchester, M13 9PL.
- 17 - 20 Quaternary Research Association. Aberystwyth. Pingos, nivation forms
May and slope-deposits. Local Secretary: Dr. P. Watson, Department of Geography, University College of Wales, Penglais, Aberystwyth, SY23 3DA.
- 9 - 11 North of England Soils Discussion Group. Annual Field Meeting, Newton Rigg,
Sept. Penrith, Cumberland. Information from: Dr. P. Howard, Honorary Secretary, North of England Soils Discussion Group, Institute of Terrestrial Ecology, Merlewood Research Station, Grange-on-sands, Lancs.

1975

- 4 - 8 Quaternary Research Association. Aberdeen. Annual Field Meeting and
April Annual General Meeting. Local Secretary: A. R. Gunson, Department of Geography, University of Aberdeen, St. Mary's, High Street, OLD ABERDEEN, AB9 2UF.

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