The Palaeogeography of *Homoceras* Times in Western Europe (*),

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CONTENTS.

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SUMMARY. — *The distribution and lithology of beds of* Homoceras *Age in Britain, Ireland, France, Belgium, Holland and Western Germany is summarised and the stratigraphy interpreted in terms of the palaeogeography of the times. A palaeogeographic map showing the basins of deposition and the major facies of the sediments within these basins is presented.*

I. — INTRODUCTION.

Refinements of the zonal scheme for the Namurian based upon goniatites as stratigraphical indices, enable very precise correlation to be effected over considerable distances. This paper is concerned with the recognition of different macro-facies within the former Sabdenian Stage of the Namurian which the author (HODSON, 1957) divided into Chokierian (H_1) and Alportian (H_2). The geographical distribution of these macro-facies enables a palaeogeographical reconstruction of the sedimentary environments of the times.

II. — STRATIGRAPHY.

The zonal framework within which the events of *Homoceras* times can be dated is as follows :

	Homoceras magistrorum faunal band	Base of R_1.
H_2 = Alportian	*Homoceratoides prereticulatus* faunal band	H_{2c}.
	Homoceras undulatum faunal band	H_{2b}.
	Hudsonoceras proteum/Homoceras smithi faunal band ...	H_{2a}.
H_1 = Chokierian	*Homoceras beyrichianum* beds	H_{1b}.
	Homoceras subglobosum beds	H_{1a}.
	Eumorphoceras bisulcatum/Nuculoceras nuculum faunal band	Top of E_2.

The distribution of these faunal bands up to the time of writing was described by HODSON (1957) but since that time a number of new discoveries have been made, particularly in France, Belgium and Western Germany, which add considerably to our knowledge of this particular part of the Namurian in Western Europe and enable a reasonably accurate synthesis to be made. Also, for the first time, the sedimentary basins of Ireland are revealed by the researches of a number of workers whose efforts have been made in the last decade.

III. — FACIES OF BEDS OF *HOMOCERAS* AGE.

Four facies are recognised in deposits of *Homoceras* age :

(i) Deltaic or Follifoot grit facies.

(ii) Muddy marine or black shale facies.

(iii) Culm facies.

(iv) Paralic coal basin facies (« zone des murs »).

(i) The *deltaic facies* is, in the North of England, styled the Follifoot Grit facies. It consists of sandstone (associated with thin coals) and interbedded marine shales with goniatites. The succession consists of a single cyclothem plus the commencement of a second.

(ii) The *muddy marine facies* consists of highly carbonaceous, pyritic, black shales with a pelagic fauna of cephalopods and lamellibranchs. HODSON and VAN LECKWIJCK (1958) have indicated the importance of a sub-facies in which the anaerobic nature of the aforementioned shales gives place to sediments deposited on an oxygenated floor. Such sediments usually contain some mica and the goniatite fauna consists exclusively of the genera *Anthracoceras* and/or *Dimorphoceras*. This sub-facies in uncommon in the beds of *Homoceras* age being confined to a thin bed at the top of the Chokierian Stage.

(iii) The *Culm facies* is best seen in beds of *Homoceras* age in South West England where shales (sometimes containing goniatites) alternate with thinner siltstones or fine-grained sandstones.

(iv) The *paralic coal basin facies* is confined mainly to beds of Upper Chokierian age around the eastern tip of the Irish-Welsh-Brabant Massif (or St. George's Land of British geologists). This facies is the « zone des murs » of the French geologists. Succeeding typical muddy marine facies, lies a belt of sandy strata above which alternations of sandy shales, fireclays and coals continue until the muddy marine facies resumes in the Alportian Stage. Some of the coal seams have been worked and are known under a variety of local names.

The geographical distribution of these facies is shown on the palaeogeographic map where the muddy marine and culm facies are unshaded and labelled « persistent seaway ».

IV. — LOCAL STRATIGRAPHY.

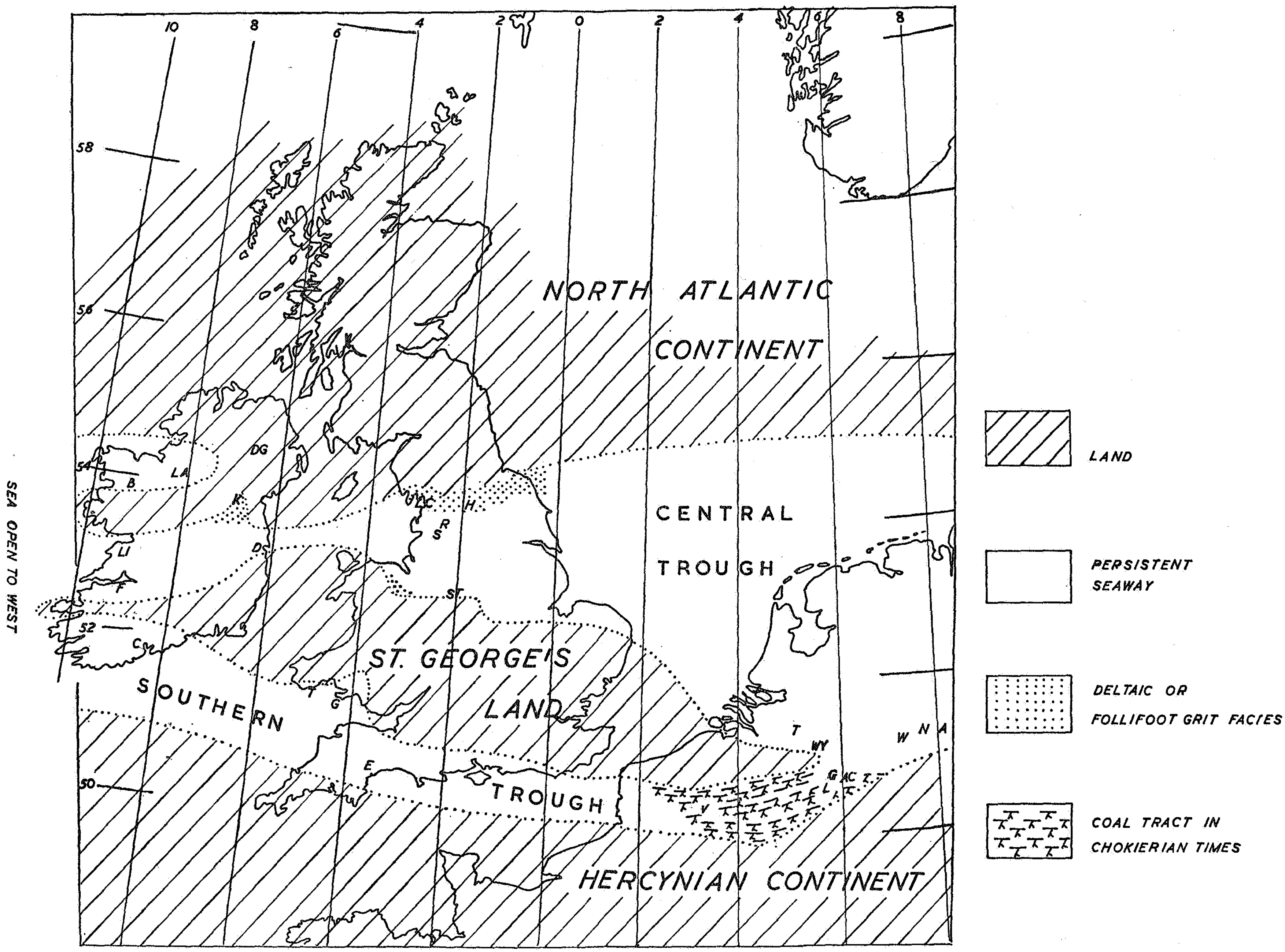
1. SCOTLAND. — In Scotland the base of the Namurian is taken at the horizon of the base of the Top Hosie Limestone (CURRIE, 1954) because of the occurrence of *C. scoticum*, a species allied to *C. leion*. It includes the Limestone Coal Group which has yielded no goniatites but which is assumed to represent the Pendleian (E_1) Stage. The base of the overlying Upper Limestone Group is the base of the Index Limestone which, on the basis of the occurrence of *A. glabrum*, two species of the genus *Cluthoceras* and an early form of *E. bisulcatum* s. l. is referred with some confidence to basal Arnsbergian (E_2). This latter Stage ranges throughout the Upper Limestone Group into the base of the overlying « Millstone Grit » where (30 feet; 9 m. above the top of the Castlecary Limestone) *Anthracoceras* is recorded. Apart from the latter, the Scottish Millstone Grit (300-1,200 feet; 91-365 m. thick) has yielded no goniatites. The occurrence of the *communis* Zone at the base of the overlying Productive Coal Measures shows that the upper part of the Scottish « Millstone Grit » could include some Westphalian beds of the *lenisulcata* zone. If the sequence contained no hiatus in deposition, this formation would include a portion of the E_2 Zone, the whole of the H_1, H_2, R_1, R_2, G_1 Zones and the basal beds of the Westphalian, a sequence which eslewhere is represented by a considerable thickness of sediments. The absence of fossils diagnostic of the zones listed above, is generally interpreted to mean that these zones are in fact not present in Scotland and that the district was elevated above sea level in those times. Erosion in mid-Namurian times is recorded from this area (MACGREGOR and MACGREGOR, 1948, p. 44.) It is because of the above considerations that Scotland is shown as part of the North Atlantic Continent in *Homoceras* times.

2. CUMBERLAND. — A somewhat similar story must be told for Cumberland, although the presence of *G. cumbriense* above the Udale Coal testifies to the presence of the G_1 Zone there. The measures below this horizon and above the Viséan « First Limestone » are of Namurian age. They comprise the Hensingham Grit Group and the Snebro Gill Beds, which together vary in thickness from 100 feet (30 m.) at Whitehaven to about 1,600 feet (480 m.) near Maryport. The Snebro Gill Beds have yielded *A. glabrum* and *Tylonautilus nodiferous* indicative of

their E_2 age. As in Scotland there are no records of faunas of either *Homoceras* or *Reticuloceras* age and certainly in the Whitehaven district there would appear to be no room for beds of this age. Thus the seaward edge of the North Atlantic Continent is placed to the South of this district.

3. County Tyrone, Ireland. — In the Dungannon Coalfield the base of the Westphalian is marked by the occurrence of *G. subcrenatum* above the Derry Coal. *Tylonautilus nodiferous*, indicative of the Arnsbergian (E_2), is found about 1,500 feet (457 m.) below the base of the Westphalian but no diagnostic faunas are known between the two (Fowler, 1955, pl. 1 opp. p. 142). As in Scotland and Cumberland, we have the alternative suppositions that there existed a hiatus in sedimentation cutting out beds of H and R age or that there exists a condensed sequence associated with facies which precludes the collection of faunas elsewhere diagnostic of those levels. The former explanation is adopted here.

4. North-West Ireland. — About the same latitude as the Dungannon Coalfield but further to the west, the facies of the Pendleian and Arnsbergian Stages differs completely from that of the same horizon in County Tyrone. The sandstones and calcareous shales with their brachiopod faunas are replaced by grits and sandstones alternating with black shales containing goniatite/lamellibranch faunas. In County Leitrim, these succeeded the Viséan conformably (Yates, 1958, and Hodson and Moore, unpublished). The highest beds met with are E_2 (*C. nitidus* subzone) age. Although no beds of *Homoceras* age are found, it is assumed that beds of this age and of goniatite-lamellibranch facies were present above the goniatite-bearing Arnsbergian shales but were removed by erosion in relatively recent times. On the map (Plate 1) an embayment is shown in this region forming a northern basin of sedimentation in *Homoceras* times. Good evidence is to hand from unpublished work by Hodson and Kelk for the placing of the southern side of this embayment. Thus, north of Balla, Co. Mayo on the Slieve Carna outlier, there is seen a succession of sandstones and shales which overlap to the south-west so that P zone and E_1 zone shales are overlapped by E_2 shales and sandstones which thus come to rest on the Carboniferous Limestone in the south-western part of the outlier.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NORTH ATLANTIC
CONTINENT
CENTRAL
TROUGH
ST. GEORGE'S
LAND
SOUTHERN
TROUGH
HERCYNIAN CONTINENT
SEA OPEN TO WEST
LAND
PERSISTENT SEAWAY
DELTAIC OR FOLLIFOOT GRIT FACIES
COAL TRACT IN CHOKIERIAN TIMES

The similarity in fauna and lithology of the beds deposited in this embayment to those of beds of the Central Trough (see on) points to a marine connection between the two. This could only be to the West somewhere off the present coast of Ireland.

To the South of the North Atlantic Continent lay a Central Trough of sedimentation during *Homoceras* times. The northern edge of this trough received some sandy sediments during *Homoceras* times and these are best seen in N.W. Yorkshire and in North Lancashire and are known also in County Meath, Ireland. These sandy beds are known as the Follifoot Grits and are indicated on the map (plate 1) by stippling. They are the products of denudation of the southern fringe of the North Atlantic Continent deposited in the shallow margin of the Central Trough.

5. North Lancashire and North-West Yorkshire. — In this region the general succession in beds of *Homoceras* age is similar. Above high Arnsbergian shales lies the Lower Follifoot Grit and its equivalents the Croasdale, Silver Hills and Middleton Grits. The succeeding shales contain goniatites of the *H. beyrichianum* group indicative of H_1 beds. There is no faunal evidence to indicate whether the Lower Follifoot Grit should be regarded as Arnsbergian or Chokierian but it is usually assigned to the former. Above the H_1 shales lies another grit — the Upper Follifoot Grit and its equivalents the Clintsfield and Brocka Bank Grits. Thin coals are associated with these grits. Both in Lancashire and in Yorkshire beds of *Homoceras* age have been found above the Upper Follifoot Grit (Moseley, 1954, p. 437, fig. 8; and Stephen and Others, 1942, fig. 1, p. 347). These faunas are of Alportian age and at Backstone Beck, Ilkley, Yorks, the *H. magistrorum* faunal band marks the base of the Lower *Reticuloceras* beds. There is thus no doubt that the Upper Follifoot Grit is of *Homoceras* age.

6. County Meath, Ireland. — Dr. J. S. Jackson of the National Museum of Ireland will describe the Kingscourt outlier in Co. Meath and show that here also the *Homoceras* zone is of Follifoot Grit facies. He will demonstrate the northerly overlap of the Namurian. Similar overlap to the North in the Lisdoonvarna District of County Clare has already been demonstrated in Namurian unconformable on the Viséan by Hodson (1954) but in this area the beds are consistently of black shale,

goniatite/lamellibranch facies. Again in North County Dublin the Namurian is unconformable to the Viséan and an overlap to the North has been demonstrated (NEVILL, 1957, p. 294, fig. 1). The absence of E_1 beds was shown by SMYTHE also in 1950 (p. 303). Beds of *Homoceras* age are known in the Summerhill Basin of this region (NEVILL, 1957, p. 299, fig. 3) consisting of about 30-40 feet (9-12 m.) of shales assigned to the Chokierian on the basis of the occurrence of *Homoceras beyrichianum* succeeded by 25 feet (7.6 m.) of similar shales terminating in the *H. magistrorum* faunal band belonging to the Alportian.

7. COUNTY CLARE AND COUNTY LIMERICK, IRELAND. — The limits of the Central Trough of sedimentation in *Homoceras* times is best known in the West of Ireland. Details of the northern edge are given in HODSON (1945 *a*) and a section somewhat south of the axis of the trough at Foynes Island, Co. Limerick in HODSON (1954 *b*). Full details of the form and depth of the trough will be given by HOSDON and LEWARNE in a forthcoming paper. At the extreme northern limit on Slieve Elva, Co. Clare the base of the Alportian lies about a foot above the top of the Carboniferous Limestone. As one proceeds southwards lower Namurian beds come to repose on the Carboniferous Limestone until, on the north of the bank of the River Shannon, a thick E_1 succession is known and the break between the top of the Viséan and the base of the Namurian must be relatively small. Still further to the South, these low Namurian beds are overlapped until, south-west of the town of Newcastle West in Co. Limerick, *Homoceras* Shales again lie on the Carboniferous Limestone. Exposures south of this latitude are very poor due to drift cover but it can be shown that unfossiliferous sandy shales and sandstone come to lie very close to the Carboniferous Limestone and, although the age of these beds yet remains to be proved, it is probable that they are not lower than the middle of R_1. It is therefore certain that to the south of the Central Trough in *Homoceras* times lay an elevated area. Exposures still further south in Co. Cork show that *Homoceras* beds return and although few details are known of the Namurian of the South of Ireland it is clear that it formed another basin of deposition which is equated on the palaeogeographic map with that of S.W. England which lies between the Irish-Welsh-Brabant massif (or the St. George's

Land of the English geologists) and the Hercynian Continent which had been elevated in the Sudetian orogeny during the Lower/Upper Carboniferous interval.

8. Eastern Ireland. — Namurian beds are known from the Castlecomer and Slieveardagh Coalfields. The stratigraphy of the Namurian of the Castlecomer Coalfield has been described by Nevill (1956). At the north-eastern tip of the coalfield, Arnsbergian beds rest on the Carboniferous Limestone but these are gradually overlapped to the South until by the time the latitude of Old Leighlin is reached, it is probable that R_2 beds rest on the Carboniferous Limestone. It is therefore possible to estimate the position of the « feather edge » of the *Homoceras* beds. In the Slieveardagh Coalfield, the Carboniferous Limestone is succeeded by grey sandy mudstones like those south of Newcastle West in the West of Ireland. It is evident that this area was elevated in *Homoceras* times and this elevation is considered to be the western extension of St. George's Land and to connect up with the ridge already demarcated as the southern limit of the Central Trough in the West of Ireland.

9. Lancashire, North Wales, Derbyshire and Staffordshire. — These regions usually display typical black shale lithologies in beds of *Homoceras* age and the goniatite faunas are always found in the same invariable succession whenever the beds are sufficiently explored.

(i) Lancashire. — The sections at Roughlee and Samlesbury Bottoms vere reviewed by Hodson (1957) which elaborated previous works by Moore (1930) and by Bisat and Hudson (1943).

(ii) Derbyshire. — A typical Derbyshire section was described from the Alport borehole by Hudson and Cotton (1943) and was chosen by Hodson (1957) as the type section of the Upper *Homoceras* (H_2) beds.

(iii) North Wales. — The occurrence of beds of *Homoceras* age is recorded by Jones and Lloyd (1943). These fringe the faulted rim of the Flintshire Coalfield and form a part of the Holywell Shales. At Holywell itself, these authors claim a full succession between the Lower and Upper Carboniferous. The junction bed between the Chokierian and the Alportian is fixed by the record of the *Hudsonoceras proteum*/*Homoceras*

smithi faunal band. Five miles south of Holywell however, *Gastrioceras cancellatum* (G_1) lies a short distance above the top of the Lower Carboniferous indicating that near this locality at least we can estimate the position of the *Homoceras* shoreline. But still further south *Eumorphoceras* beds are known and sandstones appear in the E. ,H. and R. zones which indicated to WILLS (1951, pl. VII), a deltaic fringe (the Cfen-y-Fedw Sandstone facies) perhaps analogous to the Follifoot Grit facies bordering the northern shoreline of the Central Trough.

(iv) Staffordshire. — In Staffordshire at Congleton Edge, HESTER (1932) reviewed the Namurian goniatite-bearing beds which included the well known *Hd. proteum/H. smithi* faunal band. This is the basal band of the Alportian and at Congleton edge there are shales with brachiopod faunas lying both above and below it. This littoral facies is unusual in beds of *Homoceras* age and is interpreted as the result of the proximity of the northern margin of St. George's Land. The exact position of this cannot be determined but cannot lie far south of Congleton and is here drawn as passing through Stoke-on-Trent. To the south-east however, the occurrence of *E. bisulcatum* on the northern fringe of the Leicestershire Coalfield might indicate that the northern margin of the land mass swung southwards. From this point to Northern Belgium the line is wholly conjectural although it is not likely to be denied that the northern edge of St. George's Land and the northern margin of the Brabant massif are part of the same shoreline.

10. NORTHERN BELGIUM. — To the north of the Brabant massif is the buried Campine Coalfield. Evidence for this region is obtained from deep boreholes. The Turnhout and Wijvenheide boreholes revealed beds of *Homoceras* age about 35 feet (11 m.) thick and entirely marine.

11. RUHR. — East of the Brabant massif and situated north of the extrapolated easterly extension of its axis, strata of *Homoceras* age have been found near Wuppertal, Neheim and Arnsberg. In all cases there is no suggestion of any coal or seat-earth in beds of this age which links them with those of the Campine Coalfield, and, further west, with those of the Pennines and Central England, north of St. George's Land.

(i) Wuppertal. — SCHONEFELD and LEGGEWIE (1957) record the *Hd. proteum/H. smithi* faunal band from Uhlenbruch, 50 feet (15 m.) above the Lower Carboniferous. The whole of this 50 feet (15 m.) of beds must be ascribed to the Chokierian (H_1). The beds are all black shales of marine facies without coals or seat-earths and provide the best section of beds of this age yet recorded from the Ruhr.

(ii) Neheim. — The *H. magistrorum* bed was recorded from Neheim (HODSON, 1957) but only a few feet of the Alportian below can be seen in the section and contribute little to the problem here discussed.

(iii) Arnsberg. — SCHMIDT (1933) recorded *H. beyrichianum* at the top of his section on the bank of the R. Ruhr at Arnsberg. Neither at Neheim nor Arnsberg have any seat-earths or coals been reported from beds of *Homoceras* age.

To the south of the easterly prolongation of the axis of the Brabant massif we encounter, in beds of Chokierian age, a facies which includes coal seams. The Alportian, on the other hand, is almost entirely marine, although the paralic coal basin facies may occur at the base.

12. AACHEN DISTRICT. — Commencing in the East we have the section at Busbach in the Indemulde, south-east of Aachen. This was described by HODSON and VAN LECKWIJCK (1958). The group of coal seams known as the Wilhelmine Gruppe can be shown to lie immediately below the *Hudsonoceras proteum/Homoceras smithi* faunal band and are therefore of Chokierian age.

13. HOLLAND. — To the north-west of Aachen we have the information provided by the Gulpen borehole (JONGMANS, 1927). This is situated in Holland near the German border and is the only Dutch borehole which penetrates beds of *Homoceras* age. *Ht. prereticulatus* is recorded from a depth of 200 metres and another goniatite bed (whose fauna is not recorded) occurs at 246 metres depth whilst *H. subglobosum* occurs at 310 metres, this latter having yielded solid specimens from a bullion. Due to a tectonic disturbance the actual thickness of the beds between these bands is not known with accuracy. Seat-earths are recorded commencing below the goniatite bed at 246 metres and it is possible that this band occurs near the junction of the Chokierian and Alportian Stages. The situation of this

borehole, south of the easterly prolongation of the axis of the Brabant massif, and its lithological succession in beds of *Homoceras* age show that this area must be linked with the area to the South and not with the Campine Coalfield to the North.

14. Liège District. — Proceeding south-west to the Liège Coalfield we find that the paralic coal basin facies continues in beds of Chokierian age. In the Berwinne Valley at Mortroux (Lambrecht, 1958) the base of the Alportian is known with certainty by the occurrence of the *Hudsonoceras proteum/Homoceras smithi* faunal band and above it are some 90 feet (27 m.) of beds up to the first recorded appearance of *Reticuloceras*. Although immediately above the *proteum* bed there are some sandy beds, no coals are known in the Alportian. However, immediately below the *proteum* bed, the 30 feet (9 m.) of beds exposed to the base of the section reveal the presence of thin coals and root beds as at Büsbach.

In the Soumagne borehole, the Alportian, whose base is precisely known by the recognition of the *proteum* bed, is 55 feet (17 m.) thick and the basal beds are sandy as in the Motroux section. At Soumagne a film of coal occurs 23 feet (7 m.) above the base but, apart from this, coals are absent. The Chokierian is 340 feet (104 m.) thick, and the upper part, as usual contains many thin coals and seat-earths.

15. Java Gallery. — Some 30 km. to the south-west, we have the Java Section (Ancion and Van Leckwijck, 1947, Hodson, 1957). Hodson thought that the base of the Alportian might occur in Bed 52 of the described section of Ancion and Van Leckwijck. If this were so the Chokierian coal seams would be well represented by a group of seams which include the Grande Veine de Marsinne and the Derrière Veine. Just above the postulated base of the Alportian however, there occur three thin seams which include the Petit Veine de Marsinne.

16. Hordin Gallery, Spy. — In the district of Namur in the Hordin Gallery at Spy (Demanet and Biot, 1953; Hodson, 1957), the Chokierian coal seams are again encountered. Hodson (1957) correlated the Veine du Calvaire seam with the Grande Veine de Marsinne of Java.

17. Ben Gallery, Andenne. — In this area, as in the former, a good guide to the stratigraphical level is given by the « Calcaire à Crinoïdes de Spy » which, as it underlies the *Homoceratoides prereticulatus* faunal band, provides a striking

lithological marker bed. Below it, in the Ben Gallery, occur a group of seams including the Six Mai which may be above the base of the Alportian. Below this seam and probably of Chokierian age are seams which include the Dry Veine perhaps the equivalent of the Grande Veine de Marsinne of Java.

18. Northern France. — The Namurian of Northern France will be described by Dr. J. Chalard in a forthcoming memoir. He is able to recognise the belt of Chokierian coal seams, and which include the workable St. George seam, with certainty over a distance of about 40 km. west of the Franco-Belgian border. This belt of seams is known here as the « *zone des murs* » and lies above the horizon of *Homoceras beyrichianum*, between which and the base of the *zone des murs* occurs a sandstone, the Grès de Suchemont. Above the *zone des murs* at one place, the *Hudsonoceras proteum/H. smithi* faunal band occurs (Chalard, 1958 *a* and *b*). Elsewhere the Alportian age of the beds above the *zone des murs* is revealed by the occurrence of the *Homoceras undulatum* faunal band and more commonly the *Homoceratoides prereticulatus* faunal band.

Thus from Aachen to Valenciennes we have a tract of country which in Upper Chokierian times was a coal-measure swamp of typical paralic character. This lay between the fold-front at the northern edge of the Hercynian Continent, which was elevated in mid-Carboniferous times, and the ancient ridge of the Brabant massif. The transient terrestrial conditions to which the coal seams testify would provide a land bridge between the two elevated areas and would cut off the eastern marine connection between the Central Trough and the Southern Trough.

19. Kent. — The absence of the Namurian in the Kent Coalfield shows that the southern edge of the Brabant massif lay to the south of Kent in Namurian times. We have no knowledge of Namurian stratigraphy along the belt of the presumed Southern Trough between Northern France and South-West England where again beds of *Homoceras* age are encountered.

20. South-West England. — A review of the goniatite occurrences in South-West England (Butcher and Hodson, M. S.) shows beds of *Homoceras* age present in the Exeter district and probably on the North Cornish coast. In the

former area both the Chokierian and Alportian Stages occur in beds which consist of alternations of thin sandstone and siltstones with somewhat thicker shales, usually sandy. This sort of succession has long been known as Culm, a term used both in a stratigraphical sense and also for this particular facies. It is not separately distinguished on the map (Pl. 1) although it is certainly different from the muddy marine facies of the South-Wales Coalfield. The relationship of the South-West England Culm and the Namurian of South-Wales is not known. It may be that the differences are to be related to their relative positions within the Southern Trough where South-Wales is continuous to the Irish-Welsh-Brabant massif and South-West England approaching the Hercynian Continent. But thrusting in the intensely disturbed Culm beds has certainly foreshortened the trough in this region. It may be that the Culm lies on a major basal thrust zone below which the Namurian of South Wales type might exist comparatively undisturbed. This would recall the relationships of the autochthonous and the overlying allochthonous sheets to the South of the Brabant massif as in the Liège Coalfield for instance. There, however, there seems to be no difference in facies in beds of the same age above and below the thrust zone.

21. South Wales. — *Homoceras* Age beds overlap *Eumorphoceras* Age beds and are in turn overstepped by *Reticuloceras* Age strata (Pringle and George, 1948, p. 65, fig. 19). It is thus possible to reconstruct the landward « feather edge » of these beds with some certainty, and when this is done they are shown to lie in a small embayment in the southern edge of « St. George's Land ». At Tenby, beds with *Homoceras beyrichianum* lie close to the top of the Lower Carboniferous indicating a near approach to the shoreline on to which the Namurian oversteps northwards.

22. Southern Ireland. — The Southern Trough in this region awaits detailed investigation. Records of *Homoceras* sp. from Kilbeheny (Nevill, personal communication) and of *Eumorphoceras* West of Cork Harbour (Jackson, personal communication) show that to the South of the narrow westerly prolongation of the Irish-Welsh-Brabant massif, sedimentation occurred at a time when this ridge emerged.

V. — DISCUSSION.

The fragmentary nature of the evidence upon which the palaeogeographic reconstruction is based will be gathered from the local stratigraphical details already presented. As certain areas, at present little known and understood, such as South-West England and Southern Ireland, become better known, minor adjustments may become necessary. Moreover, exposed tracts of Namurian of *Homoceras* Age constitute but a small proportion of the lengths of coastline depicted and the extrapolated lines between them must always remain conjectural. The stratigraphy, however, is unimpeachable and the beds whose facies are here interpreted in terms of the lithogenic environments which gave rise to them are certainly homotaxial within the precise limits defined for the Age.

Previous reconstructions of the geography of *Homoceras* times have been attempted by WILLS (1951) and TROTTER (1952). In his Palaeogeographical Atlas, WILLS shows, on plate 7, a composite reconstruction for *Eumorphoceras* and *Homoceras* times. However, if we interpret the non-recognition of beds of *Homoceras* and *Reticuloceras* Age in Scotland and the North of England as evidence of emergence during those times rather than their presence in a cryptofaunal guise, we must admit a considerable shrinkage of the seas in the *Eumorphoceras*/*Homoceras* interval. It would not thus be possible to do justice to both Ages on the same map. Nevertheless, WILLS shows the areas occupied by *Eumorphoceras* beds of Scottish Carboniferous Limestone facies and of the North of England Yoredale facies and if these are considered as land areas in *Homoceras* times, the general line of the southern margin of the North Atlantic Continent can be inferred from his map. It was not possible at the time of compilation for WILLS to give any detail for Ireland. Also the recognition of beds of *Homoceras* Age in South-West England, completely alters the palaeogeographical picture given by him for the South of England. It must be admitted, however, that the repeated failure to find beds of *Eumorphoceras* Age in South-West England seems to suggest that this region was elevated in earliest Namurian times and hence WILLS' map for the South of England might well represent the geography of *Eumorphoceras* times correctly.

TROTTER (1942, p. 101, fig. 2) shows the distribution in North-West England of three facies recognised by him. These are (i) land, (ii) grit-shale-facies and (iii) marine-shale-facies. In respect of the first, TROTTER accepts the evidence of the failure to prove beds of *Homoceras* Age, to the north of the Craven Fault as implying their non-deposition. Since the same conclusion is accepted by the present author, the southern limit of the North Atlantic Continent as given by TROTTER corresponds with that of Plate 1 so far as North-West England is concerned. His marine-shale-facies is the same as the muddy marine or black shale facies of this paper. The grit-shale facies is regarded by TROTTER as estuarine and so far as the *Homoceras* Stage is concerned ought to be coextensive with the Follifoot Grit type of lithology, here regarded as deltaic facies. It will not be argued here whether the Follifoot Grit succession should be regarded as estuarine or deltaic. We are dealing with a macrofacies which would include both as constituent elements at one time or another, and it is a matter of emphasis which constituent is used to name the *ensemble*. In showing the distribution of his equivalents of the muddy marine and the deltaic facies of this paper, TROTTER separates them by a line approximately at right angles to the postulated southern margin of the North Atlantic Continent. This is completely at variance with the distribution of the Follifoot Grit development which occupies a belt of country trending east-west between Lancaster and Harrogate. TROTTER's line would in fact assign the Lancaster Fells and the Harrogate areas to different facies developments whereas, in fact, they are similar. Moreover, his line would separate the black shale development of the Samlesbury River Darwen section from the similar development on the west and east side of the Pennines.

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EXPLANATION OF PLATE I.

The Palaeogeography of that part of the Namurian Stage deposited during *Homeceras* Times.

The following abbreviations are used for certain localities:

A : Arnsberg, Sauerland, Western Germany.
AC : Aachen, Western Germany.
B : Balla, Co. Mayo, Republic of Ireland.
C : Cork, Co. Cork, Republic of Ireland.
D : Dublin, Co. Dublin, Republic of Ireland.
DG : Dungannon, Co. Tyrone, Northern Ireland.
E : Exeter, Devon, England.
F : Foynes, Co. Limerick, Republic of Ireland.
G : Gower, Glamorgan, Wales, and Gulpen, South Limburg, Netherlands.
H : Harrogate, Yorkshire, England.
K : Kingscourt, Co. Meath, Republic of Ireland.
L : Liège, Eastern Belgium.
LA : Lisdoonvarna, Co. Clare, Republic of Ireland.
LI : Limerick, Co. Limerick, Republic of Ireland.
N : Neheim, Sauerland, Western Germany.
R : Roughlee, Lancashire, England.
S : Samlesbury, Lancashire, England.
ST : Stoke on Trent, Staffordshire, England.
T : Turnhout, Campine, Northern Belgium.
TE : Tenby, Pembrokeshire, Wales.
V : Valenciennes, Nord, France.
W : Wuppertal, Ruhr, Western Germany.