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Irish Rockall Basin region - a standard structural nomenclature system

Compiled and interpreted by

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*with important contributions from
members of the*

*Sub-Surface Technical Committee of the Petroleum Infrastructure Programme's
Rockall Studies Group*

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The Petroleum Affairs Division (PAD) is the licensing authority responsible for promoting and regulating hydrocarbon exploration and development activities in Ireland. The PAD comprises technical and administrative sections and is a Division of the Department of the Marine and Natural Resources.

The Petroleum Infrastructure Programme (PIP) was established by the PAD on 4 June 1997 in conjunction with the award of exploration licences under the first Rockall Trough licensing round. There are at present three groups contained within PIP - the Offshore Support Group, the Rockall Studies Group and the Porcupine Studies Group. The aim of PIP is to promote hydrocarbon exploration activities in Ireland by strengthening local support structures, by funding data gathering and research and by providing a forum for co-operation.

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FOREWORD

Prior to 1995 the Irish Rockall Trough had seen little exploration and was poorly understood. Regional geophysical studies by academic and research institutions, allied with a limited amount of work carried out by exploration companies and geophysical contractors, provided valuable structural insight, but detailed knowledge of the geology of the area was lacking due to a scarcity of data. It was not until 1996 that exploration efforts took off. In that year, within the context of a licensing round, the Petroleum Affairs Division (PAD) conducted a technical assessment of the area with the assistance of Robertson Research International Ltd and prompted a number of speculative seismic and other exploration surveys. In 1997, a successful frontier licensing round led to the award of 11 licences to 16 companies. The level of exploration activity then escalated, spawning intense academic and commercial interest in the area and a profusion of papers, particularly at the Barbican conference in 1997 and the PEIOB conference in 1999.

The 1997 licensing round also led to the PAD establishing the Petroleum Infrastructure Programme under which a joint Industry/Government consortium, the Rockall Studies Group (RSG), was set up to promote co-operation on various hydrocarbon-related technical projects in the area. While many of the projects undertaken involved large-scale data acquisition, it was one of the smaller projects that invoked a high level of interest from explorationists and researchers both within and outside the RSG. That project has now led to the publication of the first formal structural nomenclature system for any part of the Irish offshore, a system that is accepted for use by all major parties active in the Irish Rockall region, including the Irish licensing authority - the Petroleum Affairs Division of the Department of the Marine and Natural Resources.

The work involved in the original RSG nomenclature project was carried out by Dr David Naylor of ERA-Maptec Ltd and Professor Patrick Shannon of the Department of Geology, UCD, under the technical direction of the RSG Sub-Surface Technical Committee. Following completion of the work, a steering group was set up by the PAD to oversee the publication of a 'structural nomenclature system' based on the original RSG report. The publication, entitled "*Irish Rockall Basin region - a standard structural nomenclature system*", is now available just two years after work on the project commenced. This feat was accomplished through the active participation at all stages of the members of the RSG consortium. It was recognised by all involved that it would be important to establish a formal, rigorous system for naming structures while exploration activity was still at an early stage. Central to achieving this objective was the spirit of co-operation that evolved within the RSG, particularly in relation to the provision of data and interpretations as well as the critical review of various drafts, and more generally, in the provision of time, effort and encouragement. Permission for the use of non-proprietary seismic data by the geophysical contractors was also of great assistance.

This publication concentrates on the Rockall Basin and its 'borderlands'. While geological descriptions and type sections are also given for the Hatton and Porcupine areas, it is recognised that these areas will require further, more detailed, treatment in the future. The structural nomenclature system presented here is endorsed by the Petroleum Affairs Division of the Department of the Marine and Natural Resources and is recommended for use by all workers involved in the Irish Rockall Basin region.

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December 1999

1. INTRODUCTION

This publication is based on a project carried out for the Rockall Studies Group (RSG) under the Irish Petroleum Infrastructure Programme. The principal aim of the publication is to propose a formal structural nomenclature system for the Irish Rockall Basin and its immediate environs. As such, while the Hatton and Porcupine basin regions do extend into the geographical area covered, rigorous treatment of either region is beyond the scope of this publication. For practical purposes, therefore, it can be taken that detailed emphasis was confined to the Rockall Basin itself and to its bordering areas, extending out to about 100km on either side.

The work involved in the original project report was carried out by Dr David Naylor of ERA-Maptec Ltd and Professor Patrick Shannon of the Department of Geology, UCD, under the technical direction of the RSG Sub-Surface Technical Committee (SSTC). The adaptation and revision of the report for publication was performed by a Project Team involving the original authors and under the direction of the Petroleum Affairs Division (PAD).

The nomenclature project, from inception to publication, involved 4 phases:-

- Phase 1 - this phase commenced in December 1997 and comprised a desk study review of published information. The area covered by the first phase of the study was within 8° - 24° W (excluding the Celtic Sea basins) and 51° - 57° N. A data source map (at 1:1,500,000 scale) showing previously-named features, together with a comprehensive bibliography and brief review of nomenclature methodology in adjacent sectors, was presented to the SSTC members as an Interim Report in March 1998.
- Phase 2 - in the second phase of the project, the Rockall Trough (herein renamed in its geological sense the Rockall Basin) and its marginal basins received more detailed attention. The region was divided into practical working sub-regions on the basis of licence holdings and data availability. The area covered did not extend as far west as in the first phase. The limits of the final map area (1:1,000,000 scale) were:- UTM Zone 28, 5630-6400km N, 200-1000km E. The company groups holding licences in the Rockall provided interpreted maps, geoseismic sections or picked seismic sections and, together with the PAD, provided critical assessment of the draft map and geoseismic sections. The PAD facilitated the project by giving access to further seismic lines which allowed selection of the lines most useful in defining and illustrating important structures. The project authors reviewed all available data in the region and carried out an independent interpretation of the selected seismic lines. This process resulted in the preparation of a draft report, with working cross-sections and map, submitted for discussion to the SSTC at the end of 1998.
- Phase 3 - this phase consisted of the preparation of a final structural elements map and selected geoseismic sections. As part of this process a Workshop was held in Dublin in February 1999 at which the RSG members discussed the draft map and geoseismic sections and agreed the actual nomenclature. Suggested amendments and editing then took place, before final draft maps and sections were submitted. Final discussion was then undertaken prior to the presentation of the report for

approval by the RSG Management Committee. In April 1999, the final report, including digital GIS format products, was approved and the RSG Management Committee agreed that the report should be published.

- Phase 4 - the final phase saw the project report being passed to the PAD with a recommendation that it be published. After consideration, the PAD agreed to publish a formal structural nomenclature based on the RSG report and to provide the necessary funding. The PAD then contracted the original project authors (from ERA-Maptec Ltd and the Department of Geology, UCD) and administrators (CSA Group Ltd) to assist with this task and in September 1999 a Project Team comprising representatives from these organisations was set up to steer the report through to publication. The team was led by Mr Noel Murphy (PAD) who also performed the role of editor. The original report was edited and modified to a form suitable for publication. Some revisions to the maps and sections were agreed and the final version was approved for publication by the PAD in November 1999.

It is recognised that exploration in the Irish Rockall region is at a very early stage. In places, particularly in the central parts of the Rockall Basin, seismic data coverage is still very sparse. Drilling is restricted to the inboard basins, with no wells at this time in the Irish sector of the Rockall or Hatton basins. Nevertheless, major structures have been recognised in the region and it is desirable to define and name these at the outset, to avoid misunderstanding and to avoid a proliferation of names. It is also regarded as important to establish a formal, rigorous system for the naming of new features and structures at the earliest possible date. Refinements of these definitions, together with the recognition of additional structural elements, can be expected when further data become available, including the results of a shallow drilling project undertaken by the RSG in the Rockall area during 1999 which are being analysed at the time of going to press and which will remain, for the moment, confidential to the RSG consortium.

This publication includes a map of the major structural features which have been identified (Enclosure 1) and a series of geoseismic sections (Enclosure 2) which serve to illustrate and act as type sections for these features. The full length of the seismic lines are shown on the map, although in a few cases, where not essential, the ends of the lines have been omitted from the geoseismic sections to save space.

A description of each of the named structural features is given later in the publication. The formal name of a subsurface structural feature comprises (a) a feature name, usually with a local association, and (b) a category name, which places the element within a structural category. The existing names of a number of well-documented features have been retained; others are renamed, while a number of newly recognised or recently delineated features are described and named for the first time.

2. STRUCTURAL DEVELOPMENT OF THE IRISH ATLANTIC MARGIN

A number of Late Palaeozoic to Tertiary sedimentary basins lie along the western seaboard of Ireland. These follow a general NNE-SSW trend and form part of a chain of structurally-linked basins that extend from mid Norway to west of Iberia (e.g. Doré *et al.* 1997a,b). Within the Irish sector a band of narrow (inboard) basins, including the Slyne and Erris basins, lie landward of a set of larger (outboard) basins that include the Rockall, Hatton and Porcupine basins. Several small, elongate, probably early Mesozoic basins are located in the footwalls of the Rockall Basin. The inboard basins, noticeably the Slyne and Erris basins, typically change polarity along strike and are segmented by a series of transfer zones.

The crust beneath all these basins is continental in nature and is typically 15-25km thick beneath the inboard basins but thins to as little as 7km beneath the outboard basins (Makris *et al.* 1988, 1991, Shannon *et al.* 1994, Hauser *et al.* 1995). Crustal thinning was effected by differential stretching, with greater upper and middle crustal extension facilitated by rheologically-controlled detachments at the top of the lower crust.

The basins in the Rockall region have seen little exploration to date and consequently their geology is generally poorly constrained. Basement in the region probably consists of Lower Palaeozoic and older metamorphic rocks and granites. The basins contain a variable thickness of Upper Palaeozoic to Recent rocks. The thickest succession is in the Porcupine Basin where in excess of 10km of strata are preserved. The basins in the Rockall region contain up to 6km of strata (Shannon *et al.* 1995, 1999) while the thickness of strata in the Slyne and Erris basins is typically of the order of 3-4km (Scotchman & Thomas 1995, Chapman *et al.* 1999, Dancer *et al.* 1999).

Several rift episodes are recognized or suggested in many parts of the Atlantic Margin region. The major ones are of Permo-Triassic, Middle and Late Jurassic, and Early to Late Cretaceous age. The through-going rifting from Rockall to Vøring in Cretaceous times first created the unity of the region which, following Palaeogene igneous activity and Atlantic opening, finally became the NE Atlantic Margin. Rifting within the Rockall Basin appears to have become more localized with time and to have migrated from the basin edge to the centre, resulting in the preservation of 'perched' basins on the flanks of the main basin which record the oldest rift events.

Upper Palaeozoic sediments, largely undeformed, were encountered by drilling in the Porcupine (Croker & Shannon 1987), Slyne (Dancer *et al.* 1999), Erris (Chapman *et al.* 1999) and Donegal basins (Tate & Dobson 1989b) and are also predicted in the Rockall region (Shannon *et al.* 1995).

Permo-Triassic to Lower Jurassic basins in the region developed along reactivated NE-SW Caledonian features (Shannon 1991). These are well preserved in the Slyne-Erris region and on the flanks of the Rockall Basin, where they probably formed a linked rift system which became fragmented as a result of the large-scale rifting activity during the Cretaceous (Corfield *et al.* 1999). Permo-Triassic basins may be present in the Porcupine Basin (Croker & Shannon 1987) but their configuration is difficult to map on seismic sections. Such strata may be present within the Rockall and Hatton basins (Shannon *et al.* 1995) although it has been argued (e.g. Musgrove & Mitchener 1996)

that the main development of the Rockall Basin took place during the Cretaceous. Permo-Triassic to Lower Jurassic sequences are likely to comprise continental to shallow marine sandstones, evaporites, limestones and claystones deposited during the initial rift phase marking the breakup of the Pangean supercontinent. Rhaetian strata in marginal facies follow conformably upon the continental deposits.

Lower Jurassic rocks are known in the North Porcupine Basin where they appear to onlap irregular pre-Jurassic topography. A Lower Jurassic post-rift succession was encountered in the Slyne and Erris basins (Tate & Dobson 1989a, Murphy & Croker 1992, Chapman *et al.* 1999, Dancer *et al.* 1999). Here the Rhaetian is conformably overlain by Hettangian to early Sinemurian limestones with claystone, siltstone and sandstone interbeds, probably deposited in freshwater to shallow marine conditions.

Middle Jurassic strata have a widespread development throughout the Porcupine Basin and are also predicted over much of the Rockall region and most of the Slyne and Erris basins. In the Porcupine Basin a braided fluvial succession is locally preserved and is interpreted (Sinclair *et al.* 1994) as the product of an onset warp phase of tectonism prior to the Late Cimmerian rifting. The major rifting in the Slyne Basin occurred during the Middle Jurassic (Aalenian to Bathonian) resulting in a very thick, shallow marine and estuarine sequence similar to that along strike in the Hebrides basins west of Scotland (Trueblood & Morton 1991, Dancer *et al.* 1999). A thin non-marine to marginal-marine Middle Jurassic succession may also occur in the Erris Basin.

Upper Jurassic strata within the region reflect deposition in a syn-rift setting, with the development of a range of lithologies and facies. Within the Porcupine Basin these include basin-edge alluvial fans and braided to meandering fluvial strata and deep marine submarine fans (Croker & Shannon 1987, MacDonald *et al.* 1987). In the southern part of the Erris Basin a Middle to Late Jurassic rifting event produced a reversal of the earlier basin geometry with the generation of northwest- and west-throwing normal faults. Along the western margin of the Erris Basin, footwall uplift associated with this event induced uplift and erosion, implying Late Jurassic rifting within the Rockall Basin. Basin modelling, based on normal incidence and wide-angle seismic profiles from the Rockall Basin, also supports the hypothesis of a major rift episode there in Late Jurassic time (Shannon *et al.* 1999).

Lower Cretaceous strata are recorded in the Porcupine and Erris basins and are interpreted within the Rockall region. They represent the product of two rift episodes - the residual phase of Late Jurassic rifting and locally an Aptian-Albian rift phase. The Late Jurassic rifting waned during the early part of the Cretaceous and a major unconformity marks the approximate Jurassic-Cretaceous boundary in most of the basins (Naylor & Anstey 1987). The Cretaceous strata throughout most of the NE Atlantic margin region consist of shale-prone marine facies. In the Porcupine Basin, locally in the Erris Basin, and possibly along the margins of the Rockall Basin, these were interrupted by deltaic sandstones which reflect a rift episode of Aptian-Albian age. Upper Cretaceous chalk was deposited through most of the basins, but it is suggested (Shannon *et al.* 1994) that Upper Cretaceous strata in the basins of the Rockall region are marls rather than pure chalk. However, in some of the frontier basins (e.g. Hatton Basin) the Cretaceous succession is probably absent through basin inversion (Shannon *et al.* 1995).

During the Tertiary, rapid thermal subsidence occurred in the basins west of Ireland. A thick Tertiary succession was deposited in the Porcupine Basin. Here, a sandy succession in the Eocene is developed in deltaic to submarine fan facies (Moore & Shannon 1992, Shannon 1992) and was interpreted (Shannon *et al.* 1994) as resulting from ridge-push effects caused by sea-floor spreading and oceanic crustal development in the region to the west of the Rockall Plateau. The compressional stresses associated with these processes led to flank uplift on the margins of the Porcupine Basin. This produced sediment source areas, while coeval subsidence in the basin provided the accommodation space for the deposition of the thick clastic deposits. Westerly tilt of the Erris Basin was established during the Late Cretaceous and Early Tertiary due to down-flexing associated with thermal subsidence of the Rockall Basin. On the eastern Rockall margin, adjacent to the Slyne and Erris basins, a series of prograding fan deposits were deposited during the Tertiary. The post-Eocene succession in the region is generally represented by a deepening marine succession, interrupted locally in early Oligocene times by a number of unconformities (Naylor & Anstey 1987). Fluctuations in relative sea-level resulted in the development of slump structures and occasional submarine fans (Moore & Shannon 1992). The relative distance of the Rockall Basin from sediment sources led to a comparatively thin and shale-prone sedimentary succession and to the development of a deep bathymetric basin in which subsidence outstripped sedimentation. Sandy facies are likely to be concentrated towards the faulted basin margins and the re-entrant regions where the basin margins change orientation. Regional uplift and erosion occurred in the Erris Basin during the Oligocene-Miocene.

3. STRUCTURAL NOMENCLATURE IN RELATED REGIONS

3.1. United Kingdom

Structural nomenclature in the UK sector of the North Sea is addressed in Rhys (1974) and by Deegan & Scull (1977). Structural elements are also depicted on maps produced by the Petroleum Exploration Society of Great Britain (PESGB), most recently in 1997. In 1972 a proposal was put to the United Kingdom Offshore Operators' Association (UKOOA) to set up a committee to consider a formal nomenclature for the main lithostratigraphic and structural units of the North Sea. Seven industry members from UKOOA joined 5 Institute of Geological Sciences representatives on the committee. This resulted in 1974 in IGS Report 74/8 (compiled by G.H. Rhys), most of which is concerned with stratigraphic nomenclature. The brief structural section is based around a small-scale major elements map provided by P.A. Ziegler on which only major features were named and no detailed definitions were given. With regard to names, the statement is made that - 'Wherever possible established names on marine charts have been used in the proposed nomenclature, but for some features names which are already in use in the geological literature of the North Sea have been used and for others use is made of names giving a general indication of the position within the North Sea'. The small-scale map in Deegan & Scull (1977) incorporates the structural terminology from Rhys (1974) and, where appropriate, the preliminary results of the Norwegian structural nomenclature sub-committee (Rønnevik *et al.* 1975) for elements overlapping from the adjacent Norwegian sector.

The best regional depiction of UK offshore structural features is to be found on the map prepared by the PESGB (1997), with co-operation from industry through UKOOA. The features, with bounding faults, are carefully figured, and the names in common use are shown. Key cross-sections are also depicted in the borders of the map.

3.2. Norway

In 1974 collaboration between the Norwegian Petroleum Directorate (NPD) and the Stavanger Exploration Branch of the Norwegian Petroleum Society led to the formation of a lithostratigraphic nomenclature committee for offshore Norway. A committee was established by the sponsors from nominations submitted by Norwegian companies and institutions. One of the sub-committees established was to consider structural nomenclature. The outcome of these deliberations is to be found in Gabrielson *et al.* (1990) and Blystad *et al.* (1995).

4. PRINCIPLES OF NOMENCLATURE

4.1 General

The formal name of a subsurface structural feature comprises two parts, both capitalised:-

- the first part ('feature' name) usually has a local association
- the second part ('category' name) places the element within a structural category.

The Supporting Volume to the General Bathymetric Chart of the Oceans (GEBCO) Digital Atlas (1997) contains an Annex related to the Standardisation of Undersea Names. Although this is focused on bathymetric features in international waters, it is nevertheless of interest in terms of general naming procedures. In addition to the principles to be applied to the name specific to the feature, definitions are provided for the accompanying generic feature category - Basin, Trench etc.

4.2. Feature Name

The approach to the naming of geological structures taken here is in line with that adopted in Norway (see Blystad *et al.* 1995).

Geographical names in the vicinity of the feature - names of shelf bathymetric features, fishing grounds or ocean areas - are given priority. In the case of offshore west Ireland there is a relative dearth of such names, and existing names have already been used. Except for structural elements situated close to the coast, names taken from coastal features or towns are considered confusing and are not recommended. A number of feature names have been suggested in the geological literature for the Irish Atlantic margin which are in excess of 400km from the onshore location, and as such they are considered unsuitable. Where suitable geographical names are not available, names of marine fauna or names with cultural affinity may be used. However, seabird names have

been used for oilfields in the North Sea, and it is difficult to find a sufficient number of suitable names from marine fauna, few of which would be specific to Ireland. Cultural possibilities, such as famous Irish works of literature, or famous Irish literary figures, were felt to be too contentious - tempting though Joyce, Ulysses, Shaw, Beckett etc. might be.

In this publication, therefore, the names of Irish saints have been used for new basins, or in re-naming previously recognised basins (Table 1). This continues a practice begun in the Porcupine area (Mohr 1982, Tate 1993). The names relate to established figures in Irish history, albeit embellished by folklore, rather than fictional characters (Tolkien's 'Lord of the Rings' and similar fictional works, together with the Arthurian legends, were a popular source of names in the Rockall region twenty or thirty years ago). In the case of structural highs and prominent igneous features, names of mystical islands and associated waves/breakers, which are long established and well founded in Irish folklore are used. The names used herein have been researched for the project by Professor Dáithí Ó hÓgáin of the Department of Irish Folklore, UCD. For guidance, the acute *fada* accent in Irish has the effect of lengthening the vowel, so that the phonetic pronunciation of Rónán, for example, is 'Roh-nawn', while Ciarán is 'Key-rawn'.

In a few cases, names used for many years and embedded in the literature have been accepted, even where they do not strictly conform to the normal principles of nomenclature. On the other hand, an unsuitable or invalid name has not been retained simply because it has been used in a recent publication. An attempt has also been made to separate geological (normally subsurface geological) from bathymetric names, although the considerable overlap of usage in the literature makes this difficult. In most cases, the oceanographic usage was earlier, e.g. Porcupine Bank, and the second element (category) of the name has been changed to define the geological feature. Commonly used bathymetric names are shown on the inset map to Enclosure 1, and should be used only in this sense. Only geological features and names are shown on the main Enclosure 1 map. A summary of all proposed and previously used geological feature names is contained in Table 1.

Although the same full name (feature name + category) cannot be used for two different elements, the historical names such as Porcupine or Rockall may apply to more than one category.

4.3 Category Name

Structural geology and bathymetric terms generally form the second part (category) of the names put forward here. Many structural terms are not specific and have been used to cover a rather wide range of geological features. Sometimes, they also have a more general everyday or geomorphological usage. In the context of structural geology or oceanography, a number of key attributes should be possessed by any element to which the term is applied. To avoid confusion, the following structural and bathymetric definitions illustrate the meaning intended by their use as either a category name or as a descriptive term in the text or in the Enclosures of this publication. The definitions rely heavily on the A.G.I. Glossaries (1960, 1997) and GEBCO (1997).

Abyssal Plain

An extensive, flat, gently sloping or nearly level region at abyssal depths (Heezen & Laughton 1963, GEBCO 1997).

Bank

In the oceanographic sense, an elevation over which the depth of water is relatively shallow, but normally sufficient for safe surface navigation (GEBCO 1997).

Basin

In the sense of a sedimentary basin i.e. an area in which sedimentary strata have accumulated in substantial thickness. A segment of the Earth's crust which has been downwarped, usually for an extended period, but with intermittent risings and sinkings (Landes 1951).

Channel

Used in the maritime sense of a relatively narrow stretch of water connecting two larger bodies of water, or the deeper part of a moving body of water through which the main current flows.

Drift

In the sense of a wide slow movement of oceanic circulation or detrital material moved and deposited by such currents e.g. Feni Drift.

Embayment

In a structural geology sense (A.G.I. 1960, 1997) to designate a downwarped re-entrant of sedimentary rocks which extends into a terrain of older rocks.

Fracture Zone

An extensive linear zone of irregular topography characterised by steep-sided or asymmetrical ridges, troughs or escarpments (GEBCO 1997).

Graben

A depression produced by subsidence of an elongate area between two high-angle normal faults. A block, generally long compared with its width, which has been downthrown along faults relative to the rocks on either side (Billings 1954).

High

Used widely in geological literature for features such as a crest, culmination, anticline or dome. In this document it is used for a positive element which has persisted as a structurally high area over a period of time. *Also*: A contoured high feature on gravity and/or magnetic data which is believed to be caused by a structural feature.

Horst

A term first used for the older mountain massifs which limit the Alps to the north and west. It is used here for a block of the Earth's crust, generally long compared to its width, that has been uplifted along faults relative to the rocks on either side (Billings 1954).

Plateau

Used here in the oceanographic sense to mean a flat or nearly flat area of considerable extent, dropping off abruptly on one or more sides (GEBCO 1997).

Reef

Used here in the oceanographic sense of a rock lying at or near the sea surface that may constitute a hazard to navigation (GEBCO 1997).

Ridge

A long narrow submarine elevation with steep sides. The exception to this usage here is the retention of the established names *Barra Volcanic Ridge System* for the series of Late Cretaceous-Tertiary linear intrusives related to crustal stretching in the southern Rockall Trough, and *Porcupine Median Volcanic Ridge* for the linear volcanic feature in the Porcupine Basin.

Rise

That part of the continental margin lying between the continental slope and the deep ocean floor. It usually has a gradient of 0.5° or less and a generally smooth surface consisting of sediment.

Seamount

A large isolated elevation characteristically of conical form (GEBCO 1997).

Spur

In a structural geology sense is used for a subordinate elevation, usually with fault-controlled margins, projecting outward from a larger structural feature.

Trough

In the oceanographic sense is used for 'a long depression of the seafloor characteristically flat bottomed and steep sided and normally shallower than a trench, e.g. Rockall Trough' (GEBCO 1997).

5. BATHYMETRIC FEATURES

The named bathymetric or oceanographic features in the region are shown on the inset map to Enclosure 1. Often the earlier bathymetric feature name has also been loosely used in the literature for a coincident geological feature. To avoid confusion some renaming has been undertaken so as to have a clear distinction between geological and bathymetric features. The following is a brief description of the features shown on the inset map to Enclosure 1, including information on the derivation of each name.

Edoras Bank

References: Named by Roberts (1975a) as a bathymetric feature, with an assumed coincident basement feature with a thin sedimentary cover.

Name: From Tolkien (1954). The category '*Bank*' is retained for the bathymetric feature and '*High*' is preferred here for the underlying geological structure.

Description: One of several bathymetrically deeper banks forming part of the Rockall Plateau.

Fangorn Bank

References: Named by Roberts (1975a).

Name: From Tolkien (1954).

Description: One of several bathymetrically deeper banks forming part of the Rockall Plateau.

Feni Drift

References: Johnson & Schneider (1969) described the Feni Drift, which was named by Jones *et al.* (1970). Later work published by Ruddiman *et al.* (1972), Ruddiman (1972), Ellet & Roberts (1973), Lonsdale & Hollister (1979) and others.

Name: Named after an ancient Irish people (*féne*).

Description: A broad Neogene-Recent sediment build-up on the western side of Rockall Trough, best developed between 53° 30' N and 56° 00' N

Hatton Bank

References: Roberts (1975a).

Name: The origin of the name is uncertain. It may be named after Rear-Admiral Villiers Francis Hatton (born 1787) of the Royal Navy. Alternatively, the name may be associated with Sir Christopher Hatton (born 1540), Lord Chancellor of England and promoter of Sir Frances Drake's great voyage of 1577-80.

Description: A flat-topped feature on the Rockall Plateau near 58°N which narrows and deepens to the southwest.

Helen's Reef

References: Binns *et al.* (1975), Harrison (1975).

Name: The reef is named after the brigantine *Helen* which foundered there in 1824.

Description: 3.3km east of Rockall islet a curvilinear shoal area has Helen's Reef at its crest at a depth of only 1.5m, across which waves break. The reef lies within a 4km

wide negative magnetic anomaly and is composed of microgabbro and related dolerites and troctolites known as the *Helen's Reef Intrusive Centre*. These have yielded K-Ar

dates of 81 and 105 Ma (Harrison 1975), significantly older than intrusives related to the Tertiary Province.

Lorien Bank

References: Named by Roberts (1975a).

Name: From Tolkien (1954).

Description: One of several bathymetrically deeper banks forming part of the Rockall Plateau.

Irish Mainland Shelf

References: Naylor & Shannon (1982). Variations in the name of the feature include 'W. Irish Mainland Shelf' (Bailey 1979) and 'Irish Shelf' (Tate & Dobson 1989b).

Name: From the adjacent mainland.

Description: The shelf area along the Atlantic coastline of Ireland extending out to the 200m bathymetric contour.

Maury Channel

References: Le Pichon *et al.* (1971), Ruddiman (1972), Ruddiman *et al.* (1972), Cherkis *et al.* (1973), Lonsdale *et al.* (1981).

Name: After the 19th Century American oceanographer, Matthew Fontaine Maury.

Description: A deep-water channel extending along the western margin of the Rockall Plateau, fed by turbidity currents from Iceland.

Porcupine Bank

References: Surveyed c.1862 by the survey vessel HMS *Porcupine* and appearing on charts thereafter. Also employed in the geological literature for the geographically-coincident basement high with thin or absent Mesozoic cover - see *Porcupine High* below.

Name: From the survey vessel HMS *Porcupine*.

Description: A shallow bathymetric feature located at the northern end of the Porcupine Ridge in water depths of less than 200m.

Porcupine Ridge

References: Clarke *et al.* (1971).

Name: After the survey vessel HMS Porcupine.

Description: A shallow water bathymetric element extending southwards from Porcupine Bank.

Porcupine Seabight

References: Surveyed c. 1862 by the survey vessel HMS *Porcupine* and appearing on charts thereafter.

Name: After HMS *Porcupine*. *Bight* derives from the Old English *byht* - to bend, and probably from Original Teutonic *buhti* - to bow. Later to mean bending or a loop of rope. Geographical use from the late 15th century to indicate an indentation of the coast, recess of a bay or bend in a river.

Description: Porcupine Seabight is a conspicuous bathymetric embayment in the continental margin southwest of Ireland, which opens to the SW onto the Porcupine Abyssal Plain.

Rockall ('islet')

References: Fisher (1956), Sabine (1960), Holland & Gardiner (1975).

Name: The feature appeared on a chart of c.1550 as 'Rocholl' and on a map printed by Mercator in 1606 as 'Rookol'. Several variations on the spelling were used during the 17th century (Rokol, Rokel, Rookol, Rokele), including in 1698 'Rokal'. The inhabitants of St Kilda, the nearest inhabited land, knew the islet as 'Rokabarra' (Holland & Gardiner 1975). HMS *Endymion* used 'Rockall' in reporting the first authenticated landing in 1811 and this has been the accepted usage since that time.

Description: The islet, 20m high, is the only exposed part of Rockall Bank and consists of aegirine granite dated as early Tertiary (52±8Ma: Hawkes *et al.* 1975). Hasselwood Rock 100m to the NE is emergent to 1m.

Rockall Bank

References: Harrison (1975), Roberts (1975a).

Name: From the emergent islet.

Description: A shallow part of the Rockall Plateau, emergent at Rockall islet.

Rockall Plateau

References: Harrison (1975), Roberts (1975a), Roberts *et al.* (1979).

Name: After the emergent islet of Rockall.

Description: An extensive shallow water area (220,000 sq km above 1000m) around the Hatton Basin. The shallowest banks are the Rockall, Hatton and George Bligh Banks, with a number of deeper banks - Lorien, Fangorn and Edoras.

Rockall Trough

References: Roberts (1975a) and many others.

Name: From the emergent islet on Rockall Bank.

Description: A long bathymetric depression, elongate NE-SW, which extends from the area of the Anton Dohrn Seamount in the north to the Porcupine Abyssal Plain in the south.

Slyne Ridge

References: Clarke *et al.* (1971), Bailey *et al.* (1977).

Name: After Slyne Head on the adjacent Irish coastline.

Description: A bathymetric feature connecting Porcupine Bank to the Irish Mainland Shelf.

6. GEOLOGICAL FEATURES

The structural features identified and named in the Irish Atlantic region, extending from 51° N to 57° N, are shown on Enclosure 1. In general a series of small, elongate, presumed Mesozoic basins are identified along the margins of the Rockall Basin. Because many of the basins have a multi-phase origin, it is difficult to identify and represent all phases of structural development on a map. As a result, the most obvious and most important phase of basin development is represented in Enclosure 1. Basins are therefore classified into the following:

- Tertiary basins with thick fill, generally overlying Mesozoic strata. The Rockall and Porcupine basins are examples in this category. While underlying Mesozoic strata have either been identified or suggested beneath the thick Tertiary successions, the distribution and orientation of such basins cannot be mapped.

- Tertiary/Cretaceous basins resting on Palaeozoic or older rocks. Basins of this type are best developed on the flanks of the Porcupine High.
- Mesozoic basins with little or no preserved Tertiary strata. These occur in the footwalls of the Rockall Basin. While there is some seismic evidence to suggest that such basins extend beneath the thick Tertiary cover in the Rockall and Porcupine Basins, they cannot be mapped in these areas.
- Late Palaeozoic basins. These extend westwards from the onshore basins of Ireland. Again, they are likely to extend at least some distance beneath the Mesozoic and Tertiary basins but available data are insufficient to map them with any confidence.

The margins of basins shown on Enclosure 1 fall into four categories. In some cases, particularly in the west Rockall and Hatton Basin region, modern seismic data are sparse. In these cases the extent of a basin identified on only one seismic profile may be shown as uncertain (short dash), or where the basin margin is taken from a published source, the type of margin may be uncertain (long dash). Faulted margins comprise a common third category. The fourth basin margin type is shown on Enclosure 1 with a continuous black line and is designated as a 'pinch-out margin'. This category includes both thinning by onlap and erosional wedging beneath an unconformity.

There follows a systematic listing of each defined structural feature, with a brief outline of the source of the name, the type-section, a description of the feature and the main references to the feature.

Barra Volcanic Ridge System

References: First described and informally named by Bentley (1986). Figured and discussed by Megson (1987), Scrutton & Bentley (1988) and others.

Name: Derived from the island of Barra in the Outer Hebrides. In Irish, *barr* means top and in Welsh *barrŏg* means hilly and the Scottish place names Barra and Barrhead are derived from the same root. However, the island of Barra is named from the Irish St Barra. In view of this connection, and taking into account that the name has become firmly established in the geological literature, the name is retained. St Barra lived in the sixth century and was one of the great seafaring Irish saints/monks. His full name was Barrhind or Findbhairre (later Fionnbharra) and is anglicised as Barry or Finbar. His first church was at Aghboe in County Laois before he moved to east Limerick. He later established a school for clerics at the lake in west Cork which became known as Gúgán Barra. He then moved to the marsh at the mouth of the river Lee called Corcaigh where he established a celebrated monastery which acted as the centre around which the town and later city of Cork grew. He visited Rome to receive episcopal orders from Pope Gregory. The island of Barra, west of Scotland, bears his name following the establishment of a monastery founded under his direct or indirect influence. When Barra died he was buried at Cork. His feastday is 25th September.

Type section: Defined initially using magnetic and shallow seismic data. Here also recognised on seismic profiles GSI Line 1 and WI-32 (E & F, Enclosure 2).

Description: A series of curvilinear-shaped igneous bodies in south Rockall Basin. The structures are believed to be predominantly Early Cretaceous in age. Drape of Tertiary

sediments over the main ridges is clearly seen on seismic profiles GSI Line 1 and WI-32 (E & F, Enclosure 2). Scrutton & Bentley (1988) considered that the ridges were partly upstanding on the seabed until finally overtopped by sediment in Eocene time.

Breasal High

References: Described here for the first time.

Name: Breasal, also known as Uí Bhreasail occurs on maps as the name of an island off the western Irish coast from the 14th century onwards, and remained on some nautical charts as something of an anachronism even as late as the year 1865. So influential was the name of this wished-for land, that upon the founding by the Portuguese of a vast new colony in the western world in the year 1599 they decided to use this name, Brazil, for it.

Type section: Seismic profile GSR96-0204 (L, Enclosure 2).

Description: A southward-narrowing basement ridge extension between the Cillian and North Bróna basins which is 3-10km wide and 60km long. The high is fault-bounded on each side and is seen as a narrow well-defined feature on the type section. There is a thin cover of Tertiary strata and, based on seismic character, and the high is thought to be cored by a bedded Upper Palaeozoic sequence. Further south, on seismic line GSR96-0202 (M, Enclosure 2) no equivalent basement feature separates the South Bróna and Cillian Basins. The Breasal High is thought to link with the Clíona High which lies west of the South Bróna Basin via a narrow basement high separating the North and South Bróna basins.

Brendan Igneous Centre

References: Recognised on magnetic data by Riddihough (1975) and described by Riddihough & Max (1976). Named by Mohr (1982) as the 'Brendan Centre' and the 'Brendan Igneous Centre' by Tate (1993). Also figured by Croker (1995).

Name: Derivation after St Brendan, the Navigator, a sixth century saint also known as Bréanainn. His name in Latin was Brendanus, from which the English name Brendan is derived. He was a great founder of monasteries - the best known of these being at Clonfert and at Annaghdown in County Galway, Inishadroum in County Clare, and Ardfert in County Kerry. Reputedly also a great traveller he was said to have visited Scotland, Wales and Brittany. His fame owes much to a text *Navigatio Brendani* which has been interpreted both as a description of a spiritual journey and a physical journey from Ireland across the Atlantic Ocean via Iceland to North America. The journey reputedly commenced from the coast of County Kerry in the shadow of Mount Brandon (named after Brendan). He was buried at his monastery in Clonfert. His feastday is 16th May.

Type section: Identified from magnetic and gravity data - see for example Croker (1995). No type seismic section is designated.

Description: A presumed (unsampled) early Tertiary igneous centre. A 40km diameter zone in the magnetic data at the southern end of the Slyne Basin which shows both high frequency and strong positive anomalies. It possibly comprises a number of separate centres.

Bróna Basin (North & South)

References: Previously named the Bean Basin by Tate (1993) to define a NNE-SSW trending basin on the west side of Porcupine High.

Name: Named by Tate (1993), apparently after an Irish saint. However, research has not revealed a significant authenticated saint with this name, and the derivation is more likely to have been from the Irish *bean* - woman. The feature is therefore renamed as the Bróna Basin after a seventh-century female saint, also known as St Bronach and the Virgin of Glen-Seichis. Her church was among the mountains of Mourne within the modern parish of Kilbrony (anglicised from Cill Bróna - Bróna's church). There are numerous references to her in fourteenth and fifteenth century literature. Her feastday is 2nd April.

Type section: Seismic profile GSR96-0202 (M, Enclosure 2).

Description: A N-S aligned Mesozoic basin on the west flank of Porcupine High. The basin contains some 3 sec (TWT) of section interpreted as being Permo-Triassic, Jurassic and Cretaceous in age, overlain by Neogene strata, in places more than 0.5 sec in thickness. Much of the basin is probably underlain by Upper Palaeozoic strata. The Mesozoic succession is preserved as a rotated fault block bordered by a major fault system to the east. The thickness variation within the Permo-Triassic section as interpreted may be due to salt movement, but overall there is no evidence of significant syn-depositional growth at the basin margin during Permian to Jurassic time. The basin is divided into the North and South Bróna Basins by a narrow basement high linking the Clíona and Breasal Highs. The North Bróna Basin is 60km x 20km in extent, whilst the smaller South Bróna Basin is 50km x 15km.

Buí Igneous Centre

References: Recognised and described by Murphy & Croker (1992: Fig.3), Corfield *et al.* (1999). Named here for the first time.

Name: Buí, also known as Iomaire Buí (Yellow Ridge) and as Beag Árainn (Little Aran) is a mystical sunken land lying off the Galway coast. An account from the year 1684 describes the phantom isle as a great city, with apparitions of people running to and fro, and of ships and great stacks of corn. It is supposed to surface once in every 7 years on the Twelfth Night of Christmas.

Type section: Inferred from magnetic data. No defined or published type section.

Description: An elongate (50km x 10km) and well-defined magnetic feature along the eastern boundary of the Erris Basin, and probably plunging beneath the basin margin.

Canice Basin

References: Named by Tate (1992), further discussion in Tate (1993).

Name: After St Canice, also known as Cainneach and anglicised to Canice, Kenneth and Kenny, who was born c. 521 AD in Glangiven, County Derry. He was for a while a member of the community of Colm Cille on the island of Iona. He studied in Wales where he was ordained a priest. The literature describes Canice as a small bald-headed man. He was celebrated for his beautiful handwriting in copying sacred texts, and also for his eloquence in speech. He founded a church at Kilkenny, thus giving that place its name (Cill Chainnigh). He died c. 599 AD. His feastday is 11th October.

Type section: The seismic section (profile WI-18) in Tate (1992: Fig. 3) is the only published section across the basin. No type section is designated.

Description: A structurally-complex basin trending NNE-SSW at the southern end of the Porcupine High and containing up to approximately 1.8 sec (TWT) of strata (see Fig 3. of Tate 1992). Basin development was facilitated by early Tertiary faulting, which produced a complex basin, 90km long and up to 30km wide, with a number of intra-basinal horsts. These are covered by a thin (200 msec) layer of flat-lying, presumed Oligocene-Recent strata.

Charlie-Gibbs Fracture Zone

References: Johnson (1967), Fleming *et al.* (1970), Le Pichon *et al.* (1971), Olivet *et al.* (1974), Vogt & Avery (1974), Lonsdale & Shor (1979).

Name: Independently named the Charlie Fracture Zone, after the USCG Ocean Weather Station *Charlie* on the intersection with the Mid-Atlantic Ridge (Johnson 1967), and the Gibbs Fracture Zone, after the *R/V Gibbs* which first surveyed part of the zone (Fleming *et al.* 1970). The two names were subsequently combined into *Charlie-Gibbs* (Olivet *et al.* 1974).

Type section: None designated.

Description: A major North Atlantic feature with left-lateral displacement on the Mid-Atlantic Ridge. Displayed as a well-defined east-west zone on magnetic and gravity maps, extending eastwards to approximately 17° 50'W.

Ciarán Basin

References: Described and named here for the first time.

Name: After a saint of the fifth and early sixth century, founder of the monastery of Saighir (Seirkieran, near Birr in County Offaly). He was reputed to have been 'the first-born of the saints of Ireland'. His name implies that he was dark-haired and is anglicised

as Kieran. He was fostered in Clear Island. He went to Rome and met St Patrick (Pádraig) who told him to return to Ireland and found a monastery. When Patrick reputedly arrived in Munster, Ciarán went to join him on his missionary work. His association with Cape Clear seems to be historically accurate and the surviving literary accounts have him spending his youth there. His feastday is 5th March.

Type section: Seismic profile WI-32 (F, Enclosure 2).

Description: A Mesozoic basin abutting the northwest margin of Rockall Basin at its southern end. The basin is fault-bounded along the SE and NW margins. The northeastern and southwestern extensions of the basin are unconstrained due to lack of data. The basin is 35km wide on Line WI-32, but to the northeast no equivalent feature is seen on seismic profile GSI Line 1 (E, Enclosure 2). To the southwest, the basin may fringe the southern margin of the Lorient High.

Cillian Basin

References: New name introduced here. Previously known as the *Galway Graben* - figured and named by Tate & Dobson (1989a), with further detail in Tate (1993).

Name: The original name was derived from the county or town of Galway on the west coast of Ireland, which is, however, 400km distant and is therefore considered to be inappropriate. Here renamed the Cillian Basin. Several monks/saints had this name. The best known was St Cillian of Würzburg. He was born about 640 AD in Mullagh in County Cavan. He was commissioned a travelling bishop without a see by Pope Conon. His mission took him to Würzburg in Austria where Christianity was taking root. He was murdered there in 689 AD. Emperors from Charlemagne to Barbarossa visited his tomb and Würzburg became an emporium of Irish manuscripts, the greatest treasure being an ivory-bound manuscript of the Gospels in Gaelic and Latin called Cillian's Bible. His feastday is 8th July.

Type section: Seismic profile GSR96-0204 (L, Enclosure 2).

Description: An elongate Tertiary graben (150km x 15-20km) along the Porcupine High east of the North Bróna Basin. The basin trends NE-SW at its northern end, but is aligned NNE-SSW for much of its length, narrowing to a half-graben in the south. The infilling sequence is assumed to be Neogene in age, possibly underlain by Upper Palaeozoic strata. The narrow southern section of the basin is seen on Line WI-32 (F, Enclosure 2), but the basin probably closes a short distance south of this intersection. Further south along the continental margin at 51° 20'N the CYAPORC submersible found evidence of possible Mesozoic rocks (Masson *et al.* 1989) and these are shown as a small unnamed outlier on Enclosure 1.

Clare Basin

References: Defined and named by Croker (1995) based on gravity, magnetic and limited seismic reflection data.

Name: Derivation from County Clare on the adjacent coastline.

Type section: Seismic profile WIRE 1 (Croker 1995, Figs 7&8).

Description: E-W trending Carboniferous Basin which is an extension of the onshore West Clare Namurian Basin (Rider 1974, Gill 1979).

Clíona High

References: Named and described here for the first time.

Name: Clíona, also known as Clíodhna, is an 'otherworld' lady in Irish literary and oral tradition. She was drowned in the bay at Glandore, County Cork by a great flood at the breaker (a wave presumed to mark the site of a buried land) which bears her name (the Wave of Clíona). This was one of the three great waves of Ireland, according to the ancient topographical system and her association with it was an expression of the idea that the deities resided in water. In post-mediaeval tradition Clíona was regarded as one of the principal otherworld women of the province of Munster and was said to reside in a palace under Carraig Clíona, a conspicuous large rock south of Mallow in County Cork.

Type section: Seismic profile GSR96-0202 (M, Enclosure 2).

Description: A narrow (90km x 5-8km) N-S basement feature separating the South Bróna Basin from the main Rockall Basin. The high is covered by a veneer of Tertiary and probably consists of older Palaeozoic rocks and is fault-bounded along its western margin. In the north the high links with the Breasal High across the basement high separating the North and South Bróna Basins.

Colm Basin

References: Described and named here for the first time.

Name: After a saint and missionary, born at Gartán in County Donegal around 521 AD. In the year 546 he founded a monastery at a place known as his 'oakwood', Doire Cholm Cille (i.e. Derry), and later several other monasteries, including ones at Dairmhaigh (Dúrow, County Laois) and Ceannannas (Kells, County Meath). In 563 he left Ireland and settled on Iona off the southwest coast of Scotland where he died in 597. He is also known by his nickname of Colm Cille, meaning 'dove of the church'. The word 'colm' is derived from the Latin word 'Columba', which is also used as the saint's name in English. A copy of the Psalms, said to have been written by the hand of the saint himself, still survives, as does the casket in which it was carried. His feastday is 9th June.

Type section: Seismic profile DGER96-46 (H, Enclosure 2).

Description: A fault-bounded basin, which is currently poorly-constrained at its southern margin. The basin lies on the northern flank of the Porcupine High at the inflection caused by the change of strike of the Rockall margin from E-W to NE-SW. The basin infill comprises up to 0.5 sec (TWT) of presumed Neogene strata which are seen to downlap against the footwall uplift of the Rockall Basin bounding fault to the northwest. The basin is bounded to the south by the Porcupine High and to the east by the Slyne High, and is possibly underlain by Upper Palaeozoic rocks.

Colmán Basin

References: Described and named here for the first time.

Name: Colmán was born about 550 AD in Kiltartan in Galway and educated in St Enda's monastery in Aran. He was a contemplative given to a life of prayer and prolonged fastings, first in one of Aran's walled-in beehive cells, and afterwards in the Burren of County Clare. Colmán became the first bishop of all the territory subsequently to be the diocese of Kilmacduagh in Galway. His crozier is now in the National Museum in Dublin. His feastday is 29th October.

Type section: Seismic profile WI-32 (F, Enclosure 2).

Description: A small faulted basin, 25km wide on Line WI-32 (F, Enclosure 2), containing Tertiary and probably Mesozoic strata, and lying at the southeastern margin of Hatton Basin. The sediments are intruded by Tertiary sills which have impaired seismic data quality. Due to lack of seismic data the northeast limit of the basin is unknown, but no equivalent basin is seen on seismic profile GSI Line 1 (E, Enclosure 2). To the southwest the basin is assumed to terminate against the Lorient High.

Conall Basin

References: Identified as a feature by Corfield *et al.* (1999). Named here for the first time.

Name: Conall was a sixth and seventh century saint also known as Conall Caol. He had a monastery at Inniskeel, a small island off the coast of Donegal. Local folklore accounts indicate that before he became a saint he was a stone mason and had a wife. He was tricked by the Devil into murdering his father and as a penance he was flayed. The stone at which he was flayed is red to the present day! As soon as he recovered he became a hermit on Inniskeel. He is mentioned in several of the ancient literary sources, which state that he was a close relative of St Colm (also known as Colm Cille). His feastday is 22nd May.

Type section: Seismic profile GSR96-0116 (D, Enclosure 2).

Description: A broader (100km x 35km) basin between the Rockall High to the west and the main Rockall Basin to the east, south of the Rónán Basin and contiguous with it, but lacking an equivalent of the Ladra High at its eastern margin. The Permo-Triassic to Cretaceous sequence generally dips westwards away from the boundary fault which separates the Conall Basin from the Mesozoic sequence of the main Rockall Basin. However, unlike the Rónán Basin, the Conall Basin is overlain by up to 1 sec (TWT) of Tertiary sediments and is regarded as lying beneath the western margin of the Rockall Basin.

Donegal Basin

References: Described and named by Naylor & Shannon (1982). More detailed description by Dobson & Whittington (1992).

Name: Derived from the county on the adjacent coastline.

Type section: BIRPS WIRE 3 reflection seismic line (Dobson & Whittington 1992).

Description: A basin (approximately 80km x 60km) with ENE trend, oblique to the NE-SW alignment of the Slyne-Erris trend, extending parallel to the north coast of Ireland into the area of the Malin Sea. The basin fill is assumed to be largely Upper Palaeozoic in age (Dobson & Whittington 1992), as supported by the results of the Texaco 13/3-1 well, but Permo-Triassic to Jurassic strata may also be inferred from seismic character in structurally deeper parts of the basin, analogous to the proven Mesozoic occurrences in the adjacent Malin and Hebridean basins to the northeast.

Donn Igneous Centre

References: Identified, but not named, by Young & Bailey (1973) and Bailey (1979). Figured as Centre "A" by Tate & Dobson (1988). Named here for the first time.

Name: This 'otherworld' island was described by Plutarch in the 1st century AD. He documented how the Britons believed that an 'otherworld' lord reigned over the dead on an island lying a good distance from the southwest coast of Ireland. This personage corresponds to Donn in early Irish tradition, and his island, 'the house of Donn', is where the ancient Celts throughout Europe believed all spirits went after death. This tradition is documented in early (ninth century) Irish literature.

Type section: Inferred from magnetic data. No type seismic section is designated.

Description: An inferred, unsampled and, until now, unnamed igneous centre within the Porcupine High, identified by a number of authors.

Drol Igneous Centre

References: Described and figured here for the first time.

Name: The enchanted island of Drol is also known as An Chathair idir Dhá Dhrol ('City between Two Loops') and is said to lie outside Ballyguinn Point in Brandon Bay in County Kerry. Legends tell of the island surfacing as a boatman approached. He was brought into a dwelling there by a stranger and entertained to tea. Something sinister was felt to be connected with this, as with many of the mystical islands, with people reported to lose their sight or have their speech affected after seeing the island.

Type Section: Seismic profile GSR96-0114 (J, Enclosure 2).

Description: The largest of several intrusions fringing the eastern margin of Rockall Basin, adjacent to the Macdara Basin. On the type section the intrusion breaks through to the seabed, and is clearly seen to cut the inferred Palaeogene sequence on its eastern flank. There are sills and possibly lava flows in the proximity of the centre which inhibit seismic penetration, with the result that the form of the intrusion at depth is difficult to determine. The intrusions along this part of the Rockall margin may be distinct from the (probably older) Barra Volcanic Ridges. The intrusion is unsampled and the petrology unknown.

Erris Basin

References: Riddihough & Max (1976) proposed the name Slyne-Erris Trough, for the basins extending NE from the North Porcupine Basin. The extension to the previously defined Slyne Trough was also referred to as the Erris Trough, without definition of boundaries. Defined in the currently understood sense by Naylor & Shannon (1982), using the name Erris Trough. Detail shown by Chapman *et al.* (1999) and simplified on Enclosure 1.

Name: derived from Erris Head on the adjacent coastline. The category *Basin* is here preferred to *Trough*.

Type section: Seismic profile DGER96-37 (C, Enclosure 2).

Description: A Mesozoic half-graben, probably underlain by Upper Palaeozoic strata. In the south there is considerable thickness variation in the Mesozoic units, particularly at Permo-Triassic level. A buried basement feature at the western boundary fault represents the Erris High, above which the Permo-Triassic abuts against Cretaceous strata within tilted fault blocks along the margin of Rockall Basin. Thickness variation is less marked further north in the basin (seismic profile DGER-25: B, Enclosure 2) where there is little sign of growth or erosion at the western boundary against the Erris High. A diffuse faulted basement high at approximately 54° 30' N separates the Erris Basin from the northern Slyne Basin (see Chapman *et al.* 1999, Fig. 3G).

Erris High

References: An elongate high on the west margin of the Erris Basin. A broad feature in this approximate position is shown on a section (Fig. 2) of Riddihough & Max (1976) and termed the Erris Rise. Figured by Murphy & Croker (1992) and named the Erris

Ridge. Described by Cunningham & Shannon (1997), who retained the name *Erris Ridge*, with further detail in Chapman *et al.* (1999).

Name: After the associated basin, and from Erris Head on the adjacent coastline. Named here the Erris High.

Type section: Seismic profile DGER96-25 (B, Enclosure 2).

Description: A basement high, probably consisting of Lower Palaeozoic and/or older rocks. The feature separates the Erris Basin from the main Rockall Basin and is overstepped on the type section by relatively thin Palaeogene and Neogene sequences. The High is a fault-bounded elongate horst which plunges southwards, where it probably has a preserved Upper Palaeozoic cover, to form the core of a tilted Mesozoic fault block (Seismic profile DGER96-37: C, Enclosure 2).

Fangorn High

References: Named as a bathymetric feature by Roberts (1975a). Recognised as a subsurface high by Roberts (1975a) and Roberts *et al.* (1979).

Name: From Tolkien (1954).

Type section: No type section is designated.

Description: Believed on magnetic and single-channel seismic reflection evidence by Roberts (1975a) and Roberts *et al.* (1979) to comprise a basement element approximately coincident with the Fangorn Bank bathymetric feature. However, a basement high extending N-S between Fangorn and Hatton banks was recognised, mainly on magnetic data and named (Roberts 1975a) as the *Hatton-Fangorn High*. This feature rapidly develops more than 1 sec (TWT) of sediment cover north of the Fangorn High and its northern limit is uncertain. It is probably best regarded as a northward-plunging basement prolongation extending from Fangorn High.

Finnian's Spur

References: Defined and named by Tate & Dobson (1989a). Further detail in Tate (1993).

Name: After a 6th century Irish saint. The name is here shortened from *St Finnian's Spur* to *Finnian's Spur*, in line with the use of saints' names in this document. There are a number of instances of monks/saints with the name Finnian (also known as Finnen). The best known was Finnian of Clonard. He was born into Leinster nobility and studied there and later in Wales with St David. He was a bishop as well as an abbot and founded an abbey at Clonard in about 520 AD. This was one of Ireland's great monastic schools, and Finnian trained so many of Ireland's greatest saints (including Ciarán, Brendan, Colm and Canice) that he was called the Tutor of Saints. He wrote a handbook for penitents, called a penitential, which is one of the oldest on record. He died in the year 549 AD. His feastday is 12th December.

Type section: Recognised on a number of published maps e.g. Tate (1993), but no suitable seismic section has yet been published to designate as a type section.

Description: A fault-bounded basement feature on the western margin between the Porcupine and North Porcupine Basins - tonalitic gneisses were drilled on the feature in the Shell 26/26-1 well.

Fursa Basin

References: Recognised by Corfield *et al.* (1999). Named here for the first time.

Name: The mediaeval biographies of the 7th century state that St Fursa was the son of a Munster prince. When he came of age he decided to become a monk and went to a monastery on an island in Lough Corrib in County Galway. He later crossed to England, where he was well received by King Sigbert of East Anglia. From there Fursa proceeded to the Continent, where he was supported by the Frankish king Clovis II. He died in or about the year 648 and was buried at Peronne. He had a celebrated vision involving flames and angels and the earliest account of this is given by the English historian Bede in the year 731. The vision became widely known in mediaeval Latin literature, and it was very likely the source which suggested to Dante the plot of his *Divina Comedia*. His feastday is 16th January.

Type section: Seismic profile GSR96-0118 (I, Enclosure 2).

Description: A small (45km x 8km) Mesozoic (Permo-Triassic to Cretaceous) basin on the northern outer margin of the Porcupine High. The basin trends NE-SW oblique to the general run of the Rockall Basin margin, which is here E-W. The Mesozoic sequence is preserved as a rotated fault block, with some thickening of units into the southeast bounding fault.

Hatton Basin

References: A sedimentary basin lying between Hatton High and Rockall High. Defined and named by Roberts *et al.* (1970) as *Hatton-Rockall Basin*. Shannon *et al.* (1994) suggested shortening the name to *Hatton Basin*. This has tended to be used in recent publications, and to avoid confusion with the adjacent Rockall Basin, the name *Hatton Basin* is preferred here, despite the priority claim of the earlier name.

Name: From Hatton Bank bathymetric feature immediately to the west.

Type section: Seismic profile GSI Line 1 (E, Enclosure 2).

Description: The faulted margins of the basin are clearly seen on GSI Line 1. However, the presence of extensive lava flows in the Palaeogene section within the basin prevents imaging of any lower sequence, and the form and thickness of the pre-Tertiary rocks are consequently unknown.

Hatton High

References: Roberts (1995a), Roberts *et al.* (1979), who retained the term *Hatton Bank* for the geological feature. Newly defined here.

Name: From the bathymetric feature of the Hatton Bank, with which it is coincident. The term Hatton Bank has also been used in geological literature to cover the positive element which is re-named here.

Type section: Since only a portion of the eastern margin of the high is shown on the accompanying map (see also GSI Line 1: E, Enclosure 2) no type section is designated.

Description: High refraction velocities and reworked granulites and lavas in DSDP boreholes 403 & 404 on the southern margin of Edoras Bank suggest a positive element beneath the Bank. This evidence also suggests that the Bank, together with the adjacent Hatton High, is geologically similar to the Rockall High (Morton 1984, Morton & Taylor 1991, Roberts *et al.* 1979).

Ladra High

References: Recognised and figured by Corfield *et al.* (1999), who named it the *Rossan Ridge*, by reference to their name for the adjoining basin. Also figured by Walsh *et al.* (1999).

Name: Folklore says that the land of Ladra, also known as Mainistir Ladra, was seen from the coasts of south Donegal, Sligo and north Mayo. This was a great enchanted land which sank into the sea and appeared above water once in every 7 years. One reference to the 'island' dates as far back as the year 1636.

Type section: Seismic profile WRM96-107 (A, Enclosure 2).

Description: A NE-SW trending fault-bounded basement horst (75km x 8km) which separates the Rónán Basin from the Rockall Basin to the southeast. At its northern end it is intruded by an igneous body.

Lorien High

References: Roberts (1975a), Roberts *et al.* (1979).

Name: Bathymetric feature named by Roberts (1975a); derivation Tolkien (1954). The subsurface high was later recognised by Roberts *et al.* (1979), and is named formally here for the first time.

Type section: The feature has been identified on magnetic and gravity data, but no high-quality seismic section has yet been published, and therefore no type section is designated. The high extends northeastwards to merge with the Rockall High (seismic profile WI-32: F, Enclosure 2).

Description: A basement high which is coincident with the Lorien Bank bathymetric feature. Probably comprises Precambrian rocks overlain by a thin veneer of Tertiary sediments.

Macdara Basin

References: Recognised by Corfield *et al.* (1999). Named here for the first time. Faulting along this section of the Rockall margin was shown by Dingle *et al.* (1982) and Bentley & Scrutton (1987). The name Porcupine Salient was applied to this area by Bentley & Scrutton (1987). The Mesozoic basin more recently identified in this area by Corfield *et al.* (1999) has become known informally in the oil industry as the Salient Basin, and is here named the Macdara Basin.

Name: Macdara was a seventh century saint. His father's name was Dara and his own name was Sineach, but he is popularly known as Mac (son of) Dara or Macdara. He settled on a little island (Cruach Mac Dara) off the Galway coast in the present Ballynahinch Barony and in the parish of Moyrus. Near the landing place of this island Macdara is supposed to have built a small stone church, the ruins of which still remain in a good state of preservation, and show evidence of erection almost coeval with the first establishment of Christianity in Ireland. He lived here in quiet and friendly harmony with his herd of cattle and flock of sheep. Local folklore has it that when his animals were stolen by raiders they were miraculously restored. His feastday is 16th July.

Type section: Seismic profile GSR96-0114 (J, Enclosure 2).

Description: A relatively large Mesozoic basin northwest of Porcupine High, protruding into Rockall Basin. The basin, oriented NE-SW, is 90km long and is 40km across at its widest part. The basin fill is interpreted as ranging from Permo-Triassic to Cretaceous in age, underlain by Upper Palaeozoic basement. The southeast margin is bounded by a major fault and a series of basin margin-parallel NE-SW normal faults subdivide the basin into a number of elongate fault blocks. Variations in stratigraphic thickness, particularly in the Permo-Triassic unit, but also in the Jurassic, probably reflect syn-depositional fault growth. In the southeast of the basin, on the geoseismic section for seismic profile GSR96-0114 (J, Enclosure 2), a number of smaller faults appear to sole within the Permo-Triassic which may be indicative of evaporites in the sequence. In the west, the fault contact between the basin sequence and the pre-Tertiary succession at the margin of the Rockall Basin is rather obscure, due in part to poor seismic data quality.

Malin Basin

References: Recognised, named and described by Evans *et al.* (1980), Dobson & Whittington (1992), Fyfe *et al.* (1993) and others.

Name: From the Malin Sea marine area and ultimately from Malin Head on the adjacent coastline of County Donegal.

Type section: None designated.

Description: The main part of the Malin Basin is developed in Scottish waters and is bounded in the NW by the Skerryvore Fault and to the SE by the Colonsay Fault. The Basin contains up to 1.5 sec (TWT) of sediment of probable Permo-Triassic and Jurassic age, possibly underlain by Carboniferous rocks (Dobson & Whittington 1992, Fyfe *et al.* 1993). The Malin Basin extends SW into Irish waters. The half-graben at the SE margin may be regarded as an extension of the Colonsay Basin in Scottish waters, whilst the graben on the NE boundary (7° 50'W at the Ireland/UK boundary) is the SW part of the Skerryvore Trough (Dobson & Whittington 1992).

Mayo Basin

References: Recognised by Klemperer *et al.* (1991); defined and named the North Mayo Basin by Corfield *et al.* (1999). Renamed here as the Mayo Basin.

Name: Derived from County Mayo on the adjacent coastline.

Type section: Seismic profile WIRE 3 in Klemperer *et al.* (1991).

Description: A broadly E-W trending basin defined by its gravity expression. Seismic profile WIRE 3 images approximately 1 sec TWT of flat-lying reflectors interpreted as Carboniferous by Klemperer *et al.* (1991). The sequence is inferred to dip westward.

North Porcupine Basin

References: Defined and named by Naylor & Shannon (1982).

Name: Derived from existing names, and ultimately from the 19th century survey vessel HMS *Porcupine*.

Type section: No type section is designated.

Description: A structurally-complex small basin extending north from the Porcupine Basin. The basin fill comprises a Jurassic to Recent succession overlying Permo-Triassic strata, which in turn rest unconformably upon Carboniferous and older rocks. The degree of linkage between the North Porcupine Basin and the Slyne Basin is uncertain - compare, for example, Enclosure 1 of this report with Figure 1 of Chapman *et al.* (1999).

Pádraig Basin

References: Described and named here for the first time.

Name: The basin is known informally in the oil industry as the Patrick Basin, after St Patrick, and is here given the Irish version of that name. St Pádraig (anglicised to Patrick and derived from the Latin Patricius), the patron saint of Ireland, was born in

the fifth century somewhere in the west of Britain into a family of Romanised Celts. At the age of 16 he was seized by an Irish raiding party and brought to Ireland as a slave. After 6 years herding pigs and sheep he escaped to the Continent where he studied for the priesthood, before returning to Ireland as a missionary. The date of his mission was traditionally given as from 432 to 461 AD, but a more likely dating is from 456 to 493 AD. Two documents from his hand survive, the most famous being his *Confessio*. The earliest surviving biographies of his life date from the second half of the 7th century. Pádraig looms large in Irish folklore. The notion that he banished snakes from Ireland first became attached to him in the 12th century, although various writers more than a century before he was born had referred to their absence from Ireland. The custom of wearing a sprig of shamrock on St Patrick's day does not seem to be very ancient, the first known mention of it dating from 1681. His feastday is 17th March.

Type section: Seismic profile GSR96-0108 (K, Enclosure 2).

Description: A small (35km x 17km) Mesozoic basin on the western margin of Porcupine High. The basin is defined by a major fault at its eastern margin and cut by a sequence of smaller west-hading faults and their antithetic counterparts. In the west the Mesozoic sequence is in fault abutment with the pre-Tertiary sequence of the Rockall Basin. Within the Basin there is considerable thickness variation in the section interpreted as Permo-Triassic in age, which may be salt-related or may be syn-depositional.

Porcupine Basin

References: Gray & Stacey (1970) and many others. Defined and named as the *Main Porcupine Basin* by Naylor & Shannon (1982) to avoid confusion with the generalised use of *Porcupine Basin* at that time to cover all the basins in the Porcupine bathymetric embayment.

Name: Derived from existing named bathymetric features, and ultimately from the 19th century survey vessel HMS *Porcupine*. There was early recognition that the Porcupine Seabight bathymetric embayment was underlain by a deep sedimentary basin (Stride *et al.* 1969, Scrutton & Roberts 1971). The terms *Porcupine Seabight Basin*, *Porcupine Basin*, *Seabight Trough* or *Seabight Basin* were used by a number of authors to cover the entire basin area from Slyne Ridge to the Porcupine Abyssal Plain. The names *Main Porcupine Basin* and *North Porcupine Basin* were introduced by Naylor & Shannon (1982) for two parts of the basin north of 51°N. A difference in basin orientation and character at this approximate latitude had been noted earlier e.g. Buckley & Bailey (1975), Riddihough & Max (1976). The more restricted use of 'Seabight Basin' for the area south of 51°N was suggested by Tate (1992, 1993). The full name of *Porcupine Seabight Basin* is preferred here since it places the feature within a regional context. Although the name *Main Porcupine Basin* has achieved some usage (e.g. Tate 1993), in recent years the oil industry has tended to use *Porcupine Basin* in a more restricted sense for the equivalent feature. It is therefore proposed here that the name *Porcupine Basin* be adopted as the formal name for the basin lying between the North Porcupine Basin in the north and the northern limit of the Porcupine Seabight Basin at approximately 51°N in the south.

Type section: Seismic profile MS-81-27 (N, Enclosure 2).

Description: A N-S aligned Mesozoic-Tertiary basin, between, and contiguous with, the Porcupine Seabight Basin in the south and the North Porcupine Basin in the north. The basin contains a Jurassic-Recent (and locally Permo-Triassic) sequence, in excess of 8km thick, overlying Carboniferous and Devonian clastic strata.

Porcupine High

References: Gray & Stacey (1970), Clarke *et al.* (1971), Riddihough & Max (1976), Bailey *et al.* 1977) and others.

Name: From the bathymetric feature Porcupine Bank. The name is here used in a wider sense to cover the basement feature which underlies the bathymetric elements of the Porcupine Ridge, Porcupine Bank and part of the Slyne Ridge.

Type section: None designated.

Description: The high generally has a thin inferred Tertiary cover - e.g. as on Seismic profile GSR96-0118 (I, Enclosure 2), but the bathymetrically higher parts may be bald. The pre-Permian geology probably comprises Precambrian, Lower Palaeozoic and Upper Palaeozoic sequences, strongly influenced by major faults in the Porcupine Bank-Slyne Ridge area (Riddihough & Max 1976, Bailey *et al.* 1977, Max 1978).

Porcupine Median Volcanic Ridge

References: Noted on seismic data by Roberts *et al.* (1981). Discussion of age and descriptions in Ziegler (1982, 1988), Masson & Miles (1986), Naylor & Anstey (1987). Described and named by Tate & Dobson (1988).

Name: From the name of the basin.

Type section: Seismic profile MS-81-27 (N, Enclosure 2).

Description: An elongate NW-SE non-penetrative volcanic ridge along the axis of the Porcupine Basin. It is overlapped by probable Cretaceous strata and appears to be underlain by the Jurassic-Cretaceous unconformity surface. It exhibits extrusive characteristics in places but appears intrusive in others. The ridge is thought to be predominantly of early Cretaceous age, possibly with a later phase of Tertiary intrusion.

Rockall Basin

References: Scrutton & Roberts (1971), Whitbread (1973), Roberts (1975a) and many others.

Name: From the emergent granite islet of Rockall on Rockall Bank. The name *Rockall Trough* has previously been used for both the deep bathymetric feature and the broadly

coincident underlying sedimentary basin (e.g. Roberts 1975a). The geological feature is here categorised as a *Basin* rather than a *Trough*.

Type section: Seismic profile GSR96-0116 (D, Enclosure 2).

Description: The term is here used to describe the Tertiary sag basin which is broadly coincident with Rockall Trough bathymetric feature. Tilted pre-Tertiary fault blocks are imaged on a number of seismic lines e.g. seismic profile GSR96-0116 (D, Enclosure 2) and zones of these are indicated on the map (Enclosure 1) along both the western and the eastern margins of the basin. Pre-Tertiary fault blocks have also been described within the central part of the southern Rockall Basin by Corfield *et al.* (1999). The deeper section is poorly imaged over much of the central part of the basin, due in part to sill development associated with the Barra Volcanic Ridge system or to Tertiary intrusions. Two areas of widespread sill development are designated on Enclosure 1, although the northern area has a 'window' containing few sills. A faulted high in the central part of the basin, seen on Seismic profile GSR96-0116 (D, Enclosure 2), is interpreted as an Eocene compressional feature. Drape of Tertiary sediments is clearly seen overlying the structure.

Rockall High

References: Sabine (1960), Harrison (1975), Hawkes *et al.* (1975), Roberts (1975a), Roberts *et al.* (1979).

Name: Derived from the emergent islet. The category name is changed from the commonly used *Bank* to *High* to distinguish the subsurface geological element from the bathymetric feature.

Type section: No suitable seismic profile is available for formal designation although the feature is expressed on seismic profile GSI Line 1 (E, Enclosure 2).

Description: A positive structural element approximately coincident with the Rockall Bank bathymetric feature which forms part of the Rockall Plateau. The feature comprises Precambrian granulites locally overlain by Lower Tertiary lavas. From magnetic data Roberts & Jones (1978) identified an important wide E-W fault zone at about 56°40' N which was thought to separate an area of granulites to the south (irregular wavelengths and amplitudes) from more extensive lavas to the north (short wavelengths/high amplitudes). Other fault zones were also recognised.

Rockall islet, c. 20m high, is the only exposed part of the Rockall Bank and consists of aegirine granite dated as early Tertiary (52± 8Ma: Hawkes *et al.* 1975). The feature is associated with arcuate shoals and high-amplitude magnetic anomalies which Roberts (1969) interpreted as a planated Tertiary igneous centre (*Rockall Igneous Centre*).

Dredge and drill samples have been dated from the southern part of the Rockall Bank (Miller *et al.* 1973, Morton & Taylor 1991, Daly *et al.* 1995). It was initially thought, based on petrographic and age data, that Lewisian (Scourian and Laxfordian) together with 'Grenvillian' metamorphic rocks were represented in the samples. Roberts (1975b) suggested that the Scourian/Laxfordian belts of Scotland extended across the Rockall

Plateau, whilst the Grenville Front in eastern Canada could be projected eastwards into the south Rockall region. However, more recent dating techniques (Morton & Taylor 1991) indicate formation of the Rockall High basement rock sample suite at about 1625Ma (Late Laxfordian) by derivation from the mantle, rather than by reworking of older Lewisian rocks as occurred in northwest Scotland. This contrasts with the West Shetland Shelf, where Ritchie & Darbyshire (1984) have shown that the Scourian and Laxfordian complexes of Scotland extend onto the continental shelf west of the Shetland Isles. The Rockall rocks are considered by Daly *et al.* (1995) to be directly comparable to those of the Annagh Gneiss Complex of north Mayo, onshore Ireland, although those rocks have had a more complex thermal history. This would suggest a somewhat older age of about 1750Ma for the main phase of crustal growth in Rockall. However, the southernmost of the sample suite on Rockall Bank, south of a major fault zone at about 56° 40'N (Sample B of Roberts & Jones 1978), is possibly younger (987±5Ma) and may represent the Grenvillian episode (Miller *et al.* 1973).

Rónán Basin

References: Recognised and described by Corfield *et al.* (1999) and also figured by Walsh *et al.* (1999). Named the Rossan Basin by Corfield *et al.* (1999) after the distant Rossan Point (a headland in northwest Ireland) to reflect similarities with the Erris Basin (also named after a headland in northwest Ireland). Here re-named the Rónán Basin.

Name: There were several early Irish monks/saints called Rónán, which means 'little seal', an obvious maritime name. Cill Rónáin is a dedication to one of these saints in west Galway. The best known was Rónán who came from Ireland and settled in Brittany in the 6th or 7th century. There is a village called St Ronan in the diocese of Laon and also in Quimper. Relics of the saint are preserved in Lacronan in France. His feastday is 1st June.

Type section: Seismic profile WRM96-107 (A, Enclosure 2).

Description: A narrow (90km x 15km) NNE-SSW trending fault-bounded Mesozoic basin lying between the Rockall High to the west and the Ladra High to the east. The basin fill comprises Permo-Triassic, Jurassic and Cretaceous units, which in the deeper parts of the basin probably rest on Upper Palaeozoic rocks. The main basin sequence dips westwards to the easternmost, and more important, of two western bounding faults. There is evidence of thickening of units towards the fault, particularly at Upper Jurassic and Lower Cretaceous levels. The Cretaceous sequence oversteps the first (eastern) of the two western bounding faults and terminates against the second fault. The Lower Cretaceous rocks are interpreted as resting on pre-Upper Palaeozoic basement between the two faults, and the latter forms the Rockall High to the west.

Slyne Basin

References: Recognised and named as the Slyne Trough by Clarke *et al.* (1971). The name was extended to cover the basin system developed northwards from Slyne Ridge by Bailey (1979) and referred to by him as being composed of three grabens, incorporating what was later renamed as the Erris Trough. Defined in the current sense by Naylor & Shannon 1982, using the name *Slyne Trough*.

Name: Derived from the previously named bathymetric feature of the Slyne Ridge and ultimately from Slyne Head on the adjacent coastline. Here categorised as a *Basin* rather than a *Trough*.

Type section: Seismic profile E93-IE07-21 (G, Enclosure 2).

Description: An elongate (140km x 25km) NNE-SSW-trending half-graben system which changes polarity along strike. The basin contains a thick development of Lower and Middle to Upper Jurassic strata, overlain by a relatively thin Tertiary section. The underlying Permo-Triassic sequence includes a development of Zechstein evaporites which have important implications in terms of Permian palaeogeography (Chapman *et al.* 1999). Upper Palaeozoic strata are thought to underlie a substantial part of the basin.

Slyne Embayment

References: Dancer *et al.* (1999).

Name: From the adjacent basin, and ultimately from Slyne Head on the coastline of Connemara, County Galway. A basinal feature in this position is shown and named by Dancer *et al.* (1999) and their name is adopted here.

Type section: Seismic profile DGER96-46 (H, Enclosure 2).

Description: A narrow (50km x 5km) fault-bounded re-entrant extending from the western margin of the Slyne Basin in a SW direction, interpreted as containing up to 2 sec (TWT) of Triassic and Jurassic sediments. The shape of the embayment is poorly constrained, and there is considerable difference between the shape suggested by Dancer *et al.* (1999) and that shown on Enclosure 1.

Slyne High

References: Bailey *et al.* (1977), Dancer *et al.* (1999).

Name: Derived from Slyne Head on the adjacent coast of Connemara in County Galway. The feature is shown and named by Dancer *et al.* (1999), and this name is formalised here.

Type section: Seismic profile DGER96-46 (H, Enclosure 2).

Description: Slyne Ridge is a bathymetric feature connecting Porcupine Bank to the Irish Mainland Shelf, and the name has also been employed geologically for the coincident basement high (the larger part of which is considered in this document to be part of the *Porcupine High*), with thin or absent Mesozoic cover. As described by Bailey *et al.* (1977) the feature included the element now designated as the Slyne High. The high is a narrow northwards prolongation from the Porcupine High and separates the Colm Basin from Slyne Basin. It is bifurcated by the elongate Slyne Embayment.

Stifin High

References: Described and named here for the first time.

Name: The mystical island of Stifin, also known as Cill Stuífín and Cill Stúithín was said to have been a tract of land which had sunk long ago under the waves outside Liscannor Bay, County Clare. Accounts of Stifin are similar to those of other mystical islands - it had gold-roofed towers and large buildings, a monastery, and luscious fields on which cattle and horses grazed. It surfaced once in every 7 years and there is a strong tradition that whoever sees it dies within the year.

Type section: Seismic profile GSI Line 1 (E, Enclosure 2).

Description: A small narrow (2km) horst which separates part of the Macdara Basin from the main Rockall Basin. The feature is seen only on GSI Line 1 and its length is uncertain. The High is interpreted as being formed by Upper Palaeozoic strata.

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