EXPLANATORY NOTES TO ACCOMPANY
TECTONIC ELEMENTS MAP AND DATA BASE OF THE
NORTH WEST SHELF, AUSTRALIA

H.M.J. Stagg

Marine Geoscience and Petroleum Geology Program
EXPLANATORY NOTES TO ACCOMPANY
TECTONIC ELEMENTS MAP AND DATA BASE OF THE
NORTH WEST SHELF, AUSTRALIA

H.M.J. Stagg

The Tectonic Elements Map and Data Base of the North West Shelf are a joint project of the Australian Geological Survey Organisation and Nopec Australia Pty Ltd.
The map to accompany this record has been made available as a separate download.
CAVEAT

The information contained in the map and data base of the tectonic elements of the North West Shelf has been compiled from a large variety of sources, both published and unpublished, including recent research by the Australian Geological Research Organisation (AGSO) in the region. Because of this range of sources, several caveats apply to use of the material:

1. The scale of the source material for the compilation ranges from 1:250 000 to 1:2 500 000 (except for oil and gas field outlines, in which the average compilation scale was about 1:20000). Consequently, caution should be exercised in using the data base at scales larger than about 1:1 000 000. At scales larger than 1:1 000 000, digitising errors or navigation errors (in the case of old data) will become significant.

2. The level of exploration activity along the North West Shelf is highly variable. In well-explored areas, such as the Carnarvon Basin, features are shown in some detail, and their trends are accurately known. In 'frontier' areas, such as the deep-water Rowley Sub-basin, Scott Plateau, and northern Exmouth Plateau, trends are interpreted from widely spaced lines and frequently from data of indifferent quality. Trends in these areas should be accepted with due caution.

3. The vintage of the source material also shows a large degree of variation. Whilst in the most actively explored areas the features shown represent the more recent interpretations of high-quality data, in areas such as the Scott Plateau, no new interpretations have been attempted since the late 1970s.

4. The onshore lineament study was based on AGSO national aeromagnetic and gravity data bases, Landsat imagery, and published geological maps. Coverage of these data sets is not necessarily complete. For instance, aeromagnetic coverage of the Kimberley Basin is incomplete and this is reflected in the absence of aeromagnetic lineations in the map and data base in that area.

These explanatory notes will attempt to indicate the level of reliability of features shown in each area.
INTRODUCTION

The Australian Geological Survey Organisation (AGSO; formerly the Bureau of Mineral Resources, Geology and Geophysics, or BMR) has had a long scientific interest in the North West Shelf, dating back to the earliest systematic surveys of the region, carried out by BMR in 1967. The Continental Margins Survey of 1970-73 was the first systematic survey of the continental margin extending to abyssal depths, and in many areas (eg Scott Plateau, northern Exmouth Plateau) it remains the only regional data set available. Since obtaining and fitting out the research vessel *Rig Seismic* in late 1984/early 1985, BMR/AGSO has carried out two rounds of research on the North West Shelf. The first round (1986) concentrated on heat flow studies on the Exmouth Plateau (Choi, Stagg, & others, 1987) and on multichannel seismic surveying of the margins of the Exmouth Plateau as a precursor to ODP drilling (references). The second round commenced in 1990 and is scheduled to run until late 1993 or early 1994. This round particularly concentrates on deep seismic surveying of the margin with the following general aims:

- To determine the broad regional structural framework of the North West Shelf by examining the relationships between the major structural elements;

- To determine the deep crustal structure of the region;

- To develop models of continental margins formation that apply to the North West Shelf region;

- To assess the influence of deep structure on the development of the major hydrocarbon fields and plays, and in particular the structural and depositional effects resulting from reactivation of these structures; and

- To acquire a set of high-quality seismic tie lines linking the deeper exploration wells throughout the region to allow regional seismic correlations.

In addition to application of the deep seismic technique, AGSO has also applied direct hydrocarbon detection (DHD, or 'sniffing'), high-resolution seismic (using a water gun array), and geological sampling via dredging and coring on the North West Shelf.

During the planning stages of the current round of work, it rapidly became apparent that, while the general locations of deep seismic lines could quite readily be established, the lack of any consistent modern tectonic elements map and data base for the entire North West Shelf made it difficult to locate lines to optimum advantage. The requirement for a digital data base of tectonic elements, as an aid to regional survey planning (and as a basis for subsequent interpretation) was the driving force behind initiation of this project.

The first effort in this area came with the digitising of the Woodside tectonic elements map of the offshore Carnarvon Basin (Woodside, 1988) to facilitate planning of the SNOWS-I Survey 101) and SNOWS-II (Survey 110) deep seismic cruises in the area in 1991/92 (Stagg, Brassil
& others, 1991; Stagg & Survey 110 Shipboard Party, 1992). From this, it immediately became apparent that a logical extension of our first attempts at tectonic elements mapping would be to extend the work to as much of the North West Shelf as possible by compiling the existing published data. Such a compilation was seen as having the following value:

1. As a project planning tool for future AGSO work on the North West Shelf;

2. As a regional data base that would give exploration companies access to contemporary regional interpretations outside their areas of immediate interest;

3. As a basic data base of information for overseas exploration companies considering exploring in Australia;

4. As a regional interpretation tool that would allow localised interpretations to be placed in a margin-wide perspective.

In 1992, the petroleum exploration consulting company Nopec agreed to provide funding to assist the production of a full-colour map and comprehensive data base. The opportunity was also taken to extend the map eastwards to 137°E to include the basins of the Arafura Sea (which while not generally considered part of the North West Shelf, are sufficiently closely related to the North West Shelf to justify their inclusion) and to commission a contract study of onshore lineaments in the area adjacent to the North West Shelf (subsequently carried out by Etheridge and Henley Geoscience Consultants). A limited study of onshore lineaments had previously been carried out in the Vulcan Sub-basin area (O'Brien & others, 1993) and was judged to be of high value in generating new ideas on the formation of the adjacent continental margin.

The purpose of this record is to provide background information to the compilation of the map and data base that will allow their use with confidence. Also included in this record as an aid to both new and old explorers in the region is a bibliography for the North West Shelf, including the Arafura Sea and the onshore Canning Basin (principal references only).

Acknowledgements: In the early stages of this project, exploration companies based in Australia were solicited for data. We are grateful to Ampol Exploration Ltd and the Petroleum Division of Western Mining Corporation Ltd for their subsequent contributions.

The basic well information in the data base is extracted from the PEDIN data base, a joint product of AGSO and the Bureau of Resource Sciences (BRS). Reserves data are courtesy of Petroleum Resource Branch, BRS, estimated from Western Australian Department of Minerals and Energy and Northern Territory Department of Mines and Energy publications.

The onshore lineament study, carried out by Drs Paul Pearson and Mike Etheridge of Etheridge and Henley Geoscience Consultants, was primarily based on data from the AGSO national gravity and aeromagnetic data bases. We are indebted to Mr Michael Morse and Dr Chris Tarlowski, respectively, for compiling these gridded data, and to Mr John Creasey and Mr
Matti Peljo of the Image Processing Centre, AGSO, for production of the interpreted images.

Thanks are also due to Jim Colwell for assistance with the editing of the map and record, Jenny Bedford for digitising the onshore lineaments, and to Messrs Chris Fitzgerald, Rainer Swoboda and John Gallagher of the Cartographic Services Unit, AGSO, for the production of the final map.

Coordination between AGSO and Nopec in the funding of the project was handled by Mr Chris Johnston of AGSO and Mr Halfdan Carstens of Nopec.

**DATA BASE ORGANISATION**

The original North West Shelf tectonic elements data base was digitised and compiled using the PETROSEIS culture data base facility (PETROSEIS exploration mapping system is a product of Petrosys Pty Ltd, Adelaide). The following notes on data base organisation apply particularly to the PETROSEIS implementation. To broaden the value of the data base to users, the tectonic elements are also available in the following formats:

1. PETROSEIS culture data base; VMS implementation; 5 separate files.
2. PETROSEIS culture data base; MS-DOS implementation; 5 separate files.
3. ASCII 'flat' files; magnetic tape or MS-DOS formatted floppy disc; 1 layer per file; PETROSEIS culture data base 'export' format.
4. ArcInfo (ArcInfo is a geographic information system produced by Environmental Systems Research Institute Inc.); 1 coverage for each layer of the data base; produced on a UNIX system.
5. Intergraph design files; design files are only available for the layers included in the map.

The format for the ASCII files is outlined in Appendix 1. All coordinates are specified in decimal degrees, with latitudes being negative in the southern hemisphere.

Each PETROSEIS culture data base contains a maximum of 16 groups (or 'layers'), with each group containing a variable number of data elements. Elements within each group are stored in one of three types, viz:

1. Point data - The position of each element in the layer is defined by a single coordinate pair, and each point may have multiple attributes (eg exploration wells, towns).
2. Line data - The position of each element in the layer is defined by a string of latitude/longitude pairs; no attributes are stored with the data (eg depocentres, pipelines). Where the element can sensibly have 'direction' then all elements within a group are digitised consistently (for example, all normal faults are digitised such that the downthrown block is to the left of the line).
3. Polygon data - These data are stored in similar fashion to the line data, except that the first coordinate pair is repeated at the end of the element, to ensure that the polygon is closed.
The North West Shelf tectonic elements data base is divided into five components - viz tectonic elements, minor geological features, geographical and political boundaries, exploration information, and bathymetry. The 'layers' in each component are listed below.

* Layers shown with an asterisk are included in the data base but are not shown in the map.

**Geological Features:** (culture data base file: TECTONICS.CUL)

All features within each layer have a unique name. This is either the name by which a feature is known in the literature (eg 'Lewis Trough', 'Scholl Island Fault') or a name created only for the data base. For instance, faults in the Timor Sea may be named 'Timor Sea 1', 'Timor Sea 2', etc. The layers are as follows:

1. **Major faults** - faults of major significance (particularly basin-forming faults)
   - Feature type: line
   - Direction of digitisation: down-thrown block to left
   - ASCII file name: majorflt.asc
   - ArcInfo coverage file name: major_faults.cov
   - Intergraph design file name: majorflt.dgn

2. **Minor faults** - lesser faults probably not of basin-forming significance. Note that the division between major and minor faults is rather arbitrary; a full assessment of the relative importance of all the faults on the North West Shelf is far beyond the scope of this project.
   - Feature type: line
   - Direction of digitisation: down-thrown block to left
   - ASCII file name: minorflt.asc
   - ArcInfo coverage file name: minor_faults.cov
   - Intergraph design file name: minorflt.dgn

3. **Reverse faults**
   - Feature type: line
   - Direction of digitisation: over-thrust block to left
   - ASCII file name: reverse.asc
   - ArcInfo coverage file name: reverse_faults.cov
   - Intergraph design file name: reverse.dgn
4. **Transfer faults or accommodation zones** - Given that transfer faults and accommodation zones are not readily identified in seismic data, this layer is more interpretive than other layers in the data base. Interpretation of these elements is either from combined interpretation of aeromagnetic and seismic data (eg Vulcan Graben) or from satellite imagery (North West Cape area).

- Feature type: line
- Direction of digitisation: arbitrary
- ASCII file name: transfer.asc
- ArcInfo coverage file name: transfer_faults.cov
- Intergraph design file name: transfer.dgn

5. **Strike-slip faults** - While many faults may have a strike-slip component, particularly during reactivation, this classification includes only those faults identified as primarily of strike-slip origin.

- Feature type: line
- Direction of digitisation: arbitrary
- ASCII file name: strkslip.asc
- ArcInfo coverage file name: strike_slip.cov
- Intergraph design file name: strkslip.dgn

6. **Hinges (= monocline)** - This is a rather ill-defined term used to delineate basement 'edges' where faults cannot obviously be mapped.

- Feature type: line
- Direction of digitisation: down-dip surface to left
- ASCII file name: hinges.asc
- ArcInfo coverage file name: hinges.cov
- Intergraph design file name: hinges.dgn

7. **Positive structural trends** - This layer includes conventional anticlines in sedimentary rocks (eg Barrow Island Anticline) as well as structurally positive areas that do not necessarily have an anticlinal structure (eg Bedout High).

- Feature type: line
- Direction of digitisation: arbitrary
- ASCII file name: positive.asc
- ArcInfo coverage file name: positive_trends.cov
- Intergraph design file name: positive.dgn

8. **Depocentres** - Includes conventional synclines, synclinoria, and general areas of sediment thickening.

- Feature type: line
- Direction of digitisation: arbitrary
- ASCII file name: depocent.asc
- ArcInfo coverage file name: depocentres.cov
- Intergraph design file name: depocent.dgn
9. **Magnetic lineations/fossil ridges** - This layer comprises sea-floor spreading magnetic anomalies, with their identification, and fossil (ie non-active) spreading ridges.

   Feature type: line
   Direction of digitisation: youngest crust to left (magnetic lineations)
   arbitrary (fossil ridges)
   ASCII file name: spread.asc
   ArcInfo coverage file name: spread.cov
   Intergraph design file name: spread.dgn

10. **Fracture zones** - oceanic fracture zones.

    Feature type: line
    Direction of digitisation: oldest to youngest oceanic crust
    ASCII file name: fracture.asc
    ArcInfo coverage file name: fracture.cov
    Intergraph design file name: fracture.dgn

11. **Anomalous oceanic crust** - areas of anomalously thick oceanic crust.

    Feature type: line
    Direction of digitisation: anomalous crust to right
    ASCII file name: volcanic.asc
    ArcInfo coverage file name: volcanic.cov
    Intergraph design file name: volcanic.dgn

12. **COB** - continent-ocean boundary.

    Feature type: line
    Direction of digitisation: oceanic crust to left
    ASCII file name: cob.asc
    ArcInfo file name: cob.cov
    Intergraph design file name: cob.dgn

**Onshore Lineaments** (culture data base file: LINEAMNT.CUL)

1. **Lineaments - aeromagnetic** - onshore lineaments interpreted from aeromagnetic data.

   Feature type: line
   Direction of digitisation: arbitrary
   ASCII file name: magline.asc
   ArcInfo coverage file name: magnetic_lineaments.cov
   Intergraph design file name: magline.dgn
2. **Lineaments - gravity** - onshore lineaments interpreted from gravity data.
   - Feature type: line
   - Direction of digitisation: arbitrary
   - ASCII file name: gravline.asc
   - ArcInfo coverage file name: gravity_lineaments.asc
   - Intergraph design file name: gravline.dgn

3. **Lineaments - Landsat** - onshore lineaments interpreted from Landsat satellite imagery.
   - Feature type: line
   - Direction of digitisation: arbitrary
   - ASCII file name: landsat.asc
   - ArcInfo coverage file name: landsat_lineaments.cov
   - Intergraph design file name: landsat.dgn

4. **Lineaments - geological** - onshore lineaments interpreted from geological mapping.
   - Feature type: line
   - Direction of digitisation: arbitrary
   - ASCII file name: landmap.asc
   - ArcInfo coverage file name: land_mapping.cov
   - Intergraph design file name: landmap.dgn

5. **Lineaments - combined** - onshore lineaments that are a coincidence of two or more of the gravity, aeromagnetic, Landsat, or geological mapping lineaments.
   - Feature type: line
   - Direction of digitisation: arbitrary
   - ASCII file name: combined.asc
   - ArcInfo coverage name: combined_lineaments.cov
   - Intergraph design file name: combined.dgn

**Minor Geological Features.** (culture data base file: DETAIL.CUL)
This component of the data base contains features of lesser geological significance that have been mapped in detail where they are available, and miscellaneous features that, while of interest in themselves, do not justify the allocation of an entire data base layer. No features from this component are included in the map.

1. **Vulcan Sub-basin faults** - This layer comprises fault traces digitised from AGSO's detailed mapping of the Vulcan Sub-basin.
   - Feature type: line
   - Direction of digitisation: down-thrown block to left
   - ASCII file name: vulcan.asc
   - ArcInfo coverage file name: vulcan_faults.cov
   - Intergraph design file name: not available
2. **Exmouth minor faults** - minor faults at top Triassic on Exmouth Plateau.
   - Feature type: line
   - Direction of digitisation: down-thrown block to left
   - ASCII file name: exmouth.asc
   - ArcInfo coverage file name: exmouth_faults.cov
   - Intergraph design file name: not available

3. **Miscellaneous** - features of geological significance that do not fit under a standard geological classification (e.g. northerly limit of Barrow Group prograding on the Exmouth Plateau).
   - Feature type: line
   - Direction of digitisation: arbitrary
   - ASCII file name: miscell.asc
   - ArcInfo coverage file name: miscellaneous.cov
   - Intergraph design file name: not available

**Geographical & Political Features** (culture data base: GEOGPOLI.CUL)
This component of the data base contains boundaries and points of geographical and political significance. Not all layers are included in the tectonic elements map.

1. **Coastline** - This layer includes all islands, as well as the mainland.
   - Feature type: line
   - Direction of digitisation: arbitrary
   - ASCII file name: coast.asc
   - ArcInfo coverage file name: coast.cov
   - Intergraph design file name: coast.dgn

2. **Reefs**
   - Feature type: line
   - Direction of digitisation: arbitrary
   - ASCII file name: reefs.asc
   - ArcInfo coverage file name: reefs.cov
   - Intergraph design file name: reefs.dgn
3. **Political boundaries** - including the Australia-Indonesia and Western Australia-Northern Territory boundaries, Zone of Cooperation, and Western Australia Adjacent Area.

- Feature type: line
- Direction of digitisation: arbitrary
- ASCII file name: politic.asc
- ArcInfo coverage file name: political.cov
- Intergraph design file name: politic.dgn

4. **Towns** - position of principal population centres adjacent to the North West Shelf.

- Feature type: point
- Associated information: name, latitude, longitude
- ASCII file name: towns.asc
- ArcInfo coverage file name: towns.cov
- Intergraph design file name: towns.dgn

**Exploration Information** (culture data base: EXPLORE.CUL)
This component of the data base contains exploration-related information. A notable omission from this component is exploration permits. This omission is deliberate and is because of the frequently changing of exploration leases in Australia (currently at least twice per annum).

1. **Wells** - includes exploration and appraisal wells, both offshore and onshore derived from AGSO's PEDIN data base. This layer includes only basic information for each well.

   - Feature type: point
   - Associated information: name, latitude, longitude, operator, date, total depth, water depth, status, shows
   - ASCII file name: wells.asc
   - ArcInfo coverage file name: wells.cov
   - Intergraph design file name: not available

2. **Oil & gas fields** - outlines of oil and gas fields, where such information is available. This information should particularly be treated with caution, since the source is typically published papers of limited drafting accuracy.

   - Feature type: polygon
   - Direction of digitisation: field to right
   - ASCII file name: fields.asc
   - ArcInfo coverage file name: fields.cov
   - Intergraph design file name: not available
3. **Oil and gas discoveries** - locations of all oil and gas discoveries of 'significance', together with initial reserves, where known. These positions are derived from the 'wells' layer. Where multiple wells have been drilled on a field, the position given is the well nearest to the geographical centre of that field.

   Feature type: point
   Associated information: name, latitude, longitude
   ASCII file name: discover.asc
   ArcInfo coverage file name: discoveries.cov
   Intergraph design file name: discover.dgn

4. **Production facilities** - locations of oil and gas production facilities. The sources of this information are quite variable, and caution should be used in their use, particularly for survey planning.

   Feature type: point
   Associated information: name, latitude, longitude
   ASCII file name: facility.asc
   ArcInfo coverage file name: facility.cov
   Intergraph design file name: not available

5. **Pipelines** - locations of known onshore and offshore pipelines. The same provisos apply as for the production facilities.

   Feature type: line
   Direction of digitisation: downstream
   ASCII file name: pipeline.asc
   ArcInfo coverage file name: pipeline.cov
   Intergraph design file name: not available

6. **ODP & DSDP wells** - locations of Ocean Drilling Program (ODP) and Deep Sea Drilling Program (DSDP) wells. This information was obtained from the initial reports of the Deep Sea Drilling and Ocean Drilling Programs.

   Feature type: point
   Associated information: name, latitude, longitude, operator, water depth, total depth, date

   ASCII file name: odp_dsdp.asc
   ArcInfo coverage file name: odp_dsdp.cov
   Intergraph design file name: not available
**Bathymetry** (culture data base: BATHYM.CUL)

This component of the data base contains bathymetric contours. The contours include the 200 m isobath, and then every 500 m. Each contour level is included as a separate layer within the data base, thereby allowing selected contours to be plotted. Only the 200 m and 2000 m isobaths are included on the map. As the sources of these data are both varied and at a regional scale, caution should be exercised in their use.

Feature type: line
Direction of digitisation: arbitrary
ASCII file name: nnnnm.asc, where nnnn is the contour level; eg the file 1500m.asc is the file for the 1500 metre contour level
ArcInfo coverage file name: nnnnm.cov; naming convention as above
Intergraph design file name: nnnnm.dgn; naming convention as above

**DATA SOURCES & QUALITY FOR BASIN ELEMENTS**

The purpose of this section is to list the data sources used for different parts of the tectonic elements data base, and to provide an estimate of the expected reliability of the data in each area.

**Oceanic Crust (including COB)**

Includes: Argo, Gascoyne, and Cuvier Abyssal Plains.

Sources: Fullerton & others (1989)

Comments:
While there has been some difference of opinion as to the age interpretation of ages of sea-floor spreading magnetic anomalies in the Wharton Basin (Argo, Gascoyne, and Cuvier Abyssal Plains), the identification of Fullerton & others (1989), which is also used in the AAPG map, is now the most widely accepted. With this identification, the age of inception of spreading in the Argo Abyssal Plain is taken as Oxfordian (Middle Jurassic), while the corresponding age in the Gascoyne and Cuvier Abyssal Plains is Neocomian. This project did not have ready access to the actual magnetic anomaly picks, and the magnetic lineation, oceanic fracture zone, and continent-ocean boundary (COB) locations in the data base have been digitised from the references above. The outlines of the Christmas Rise, Joey Rise, and Roo Rise areas of anomalously thick oceanics crust are taken from the AAPG map. The location of the boundary between the Australian and Eurasian Plates has been taken as the axis of the Java Trench - Roti Basin - Timor Trough.

Overall, the absolute accuracy of features in this area can be considered as fair; however, this is probably quite sufficient for the purposes of the map and data base.

12
Carnarvon Basin

Includes: Gascoyne, Merlinleigh, Ashburton, Exmouth, Barrow, Dampier, and Beagle Sub-basins; Rankin Platform.

Sources:  
Bint (1991)  
Blevin & others (1992)  
Howell (1988)  
McClure & others (1988)  
Malcolm & others (1991)  
Osborne & Howell (1987)  
Parry & Smith (1988)  
Symonds & Cameron (1977)  
Tait & others (1989)  
Veenstra (1985)  
Vincent & Tilbury (1988)  
Williams (1988)  
Williams & Poynton (1985)  
Woodside (1988)

Comments:  
In addition to the sources listed above, some use was also made of unpublished industry surveys acquired under the Petroleum (Submerged Lands) Act (PSLA). The original data source for the region was the tectonic elements map of Woodside (1988). While this has been refined or replaced in many areas by more detailed studies, the Woodside map remains a valuable starting point.

The Carnarvon Basin (particularly the Barrow and Dampier Sub-basins) is the best-explored region of the North West Shelf, and consequently the accuracy of the data base can generally be considered as good. Those areas where the accuracy is fair to moderate include the onshore Carnarvon Basin, Exmouth Sub-basin (adjacent to the Cuvier Abyssal Plain), and the Beagle Sub-basin.

The age of the structuring represented by the faults is highly variable. In general, faults near the coast are likely to be Palaeozoic basin-forming faults, those in and immediately adjacent to the main Mesozoic depocentres are likely to be Jurassic reactivation faults, while the faults beneath the outer margin of the sub-basins were mainly reactivated in the Triassic. It is likely that the Triassic and Jurassic faults of high along-strike continuity are reactivations of basin-forming structures (eg SE flank of the Rankin Trend).
Exmouth Plateau

Sources: Barber (1988)  
           Esso (1979)  
           Geophysical Service International (1976)  
           Exon & Willcox (1980)

Comments:  
The shallower parts of the Exmouth Plateau (water depths less than about 2000 m) were extensively explored during the late 1970s and early 1980s when the Exmouth Plateau was divided into 5 large exploration permits. Faulting on this part of the Exmouth Plateau in the data base is largely derived from those surveys and can be considered quite accurately located. The faults shown were generally most recently active in the Late Triassic; how these faults are related to underlying detachments, ramps, or other basin-forming structures is not clear with conventional data. The northern part of the Exmouth Plateau, generally lying in deep water was not explored at the same time as the remainder of the plateau, and the faults shown in the data base are those mapped by Exon & Willcox (1980) using the BMR Continental Margin Survey data together with sparse industry lines; while fault trends in this area are probably broadly correct, more recent data acquired by AGSO using Rig Seismic suggests that they generalisations rather than accurate representations.

Canning Basin

Sources: AGSO Canning Basin Study Group (unpublished work)  
           Stagg & Exon (1981)

Comments:  
Onshore Canning Basin structure was provided by M.J. Sexton and R.D. Shaw (Onshore Sedimentary and Petroleum Geology Program, AGSO) as a compilation of AGSO and industry studies during the 1980s and early 1990s. These elements can be considered to be of good quality, reflecting the most recent thinking on the origins of the Canning Basin. In contrast, tectonic elements in the offshore are poorly known and there is no recently available compilation using the best of the existing data.

Browse Basin

Sources: Bint (1988)  
           Willis (1988)

Comments:  
While the Browse Basin has been moderately extensively explored since the early 1970s, the available published maps of the basin generally only show the most significant features, and these have not changed significantly since 1978. This is probably due to two factors: firstly, the post-structuring sedimentary cover is very thick, which means that fault trends (particularly basin-forming fault trends) are very deep in the section; secondly, the thick Tertiary carbonate
section makes it very difficult for good-quality deep seismic profiles to be obtained. If the AGSO deep seismic program in the Browse Basin, scheduled for mid-1993, succeeds in obtaining good-quality deep data, then the tectonic elements of this part of the North West Shelf could be refined in the next few years. The major trends included in the data base are probably of moderate spatial accuracy; however, their relationship to deep basin-forming structures, other than on the basin margins, is entirely unknown at this time.

**Scott Plateau**

Sources: Stagg & Exon (1981)

Comments: The Scott Plateau and adjacent areas probably constitute the most poorly known area of the continental margin. The tectonic elements shown in the data base were interpreted in the late 1970s from a combination of early 1970s BMR Continental Margin Survey data and reconnaissance industry lines of about the same vintage. The average line spacing of these data sets is about 30+ km, and the data quality varies from fair to moderate. Consequently, the accuracy of interpretation and positioning of geological features can only be considered fair. While the Scott Plateau is scheduled to be traversed by deep seismic profiling at the same time as the Browse Basin (see above), it is unlikely that any significant update to the geology of this part of the margin will be made in the foreseeable future.

**Bonaparte Basin**

Includes: Petrel Sub-basin, Malita Graben, Sahul Syncline, Sahul Platform, Londonderry Arch (or Londonderry High), Vulcan Sub-basin, Ashmore Platform.

Sources: Gunn (1988a)  
MacDaniel (1988)  
Mory (1988)  
O’Brien & others (1992)  
Pattillo & Nicholls (1990)  
Petroconsultants (1990)

Comments: By Australian standards, the Bonaparte Basin and environs have been heavily explored since the early 1980s. While the Palaeozoic faulting in the Petrel Sub-basin and the Mesozoic faulting further offshore are now mapped quite accurately, basin forming faults are poorly imaged, except at the extreme basin margins. An improved understanding of the region in terms of detachment models of passive margin formation is now emerging (eg O’Brien & others, 1993); however, it will probably be some time before the tectonic elements can be mapped in a way that fully reflects their origins.
Onshore Basins

Includes: All Precambrian and Palaeozoic provinces (excluding Canning Basin) covered by the 1:1 000 000 sheet areas SD52, SD53, SE51, SE52, SF50, SF51, SF52.

Sources: Contract study carried out for AGSO by Etheridge & Henley Geoscience Consultants.

Comments:
The onshore lineaments in the map and data base were interpreted by Etheridge & Henley Geoscience Consultants, under contract to AGSO. The data sources included the AGSO National Aeromagnetic Data Base (1992) and National Gravity Data Base (1992), Landsat imagery, and published geological maps. The lineaments have been interpreted and digitised in 5 groups, as outline in the section Data Base Organisation. The sources used in the interpretation are not complete for all data sets - for instance, the existing aeromagnetic coverage does not include all of the Kimberley Basin - therefore not all lineament types are present over all areas onshore.

The interpretation was carried out in 2 phases. In the first phase, all possible lineaments were interpreted on a set of 1:1 000 000 compilation sheets, corresponding to the sheet numbers listed above. In the second stage, the raw lineaments were interpreted to produce a set of lineaments that have relatively high continuity. All the interpreted lineaments were digitised into the data base. Lineaments that coincided with previously digitised features on the continental margin and in the onshore Canning Basin have been deleted from the map, though they have been retained in the data base. Where lineaments have been interpreted as broad features (several km in width), they have been digitised as a pair of lines along each edge of the lineament; this particularly applies to the combined lineaments.

The naming convention for lineaments in the data base is, for example:

SD52-nn

where SD52 is the appropriate standard 1:1 000 000 map sheet on which the lineament is found, and nn is a unique sequence number within the map sheet for each lineament type. Where a lineament is digitised as multiple lines (eg for combined lineament pairs), the individual elements have the same sequence number, but with the suffix a, b, c etc.
APPENDIX 1: FORMAT OF ASCII FILES

There are three different ASCII file formats, corresponding to each of the three data types stored in the PETROSEIS culture data base - points, lines, and polygons. The formats are as follows:

1. **POINT data:**
   The file consists of a number of header records, a single record containing a hash ('#') character in column 1, and a number of fixed-format records containing actual data with 1 record per data point. The header records describe the format of the data records, and have the following form:

   STR 1 15 0 *NAME
   LAT 16 27 0 *LATITUDE
   LON 28 39 0 *LONGITUDE
   STR 40 59 0 *OPERATOR
   NUM 61 65 0 *WATER_DEPTH
   
   #
   North Rankin A -19.586667 116.133333 Woodside -125
   etc

   NAME of feature is in columns 1-15
   Latitude in columns 16-27
   Longitude in columns 28-39
   Operator columns 40-59 (characters)
   Water depth number in columns 65-70
   Header terminator record

2. **LINE data:**
   A line data file consists of a number of segments. Each segment commences with a header record that has and asterisk ('*') in column 1, and then the name of the element. Element names do not have to be unique. Following the header record for each element is a variable number of records containing the coordinates of every point in the element. The positions are stored as a single coordinate pair per record, with coordinates being given as longitude followed by latitude, in decimal degrees, with latitudes being negative in the southern hemisphere.

   An example of a line data file is as follows:

   *Humongous Fault
   114.345678 -19.987654
   114.456789 -19.876543
   114.567899 -19.765432
   114.665544 -19.665544
   * Caveat Fault
   ...
   etc

   fault name
   first coordinate pair
   last coordinate pair
   next fault name
   more coordinate pairs

3. **POLYGON data:**
   Polygon data are identical to line data, except that the first coordinate pair in each element is repeated at the end of the element to ensure closure of the polygon.
An example of a polygon file is as follows:

* Utopia Gas Field  
  118.049956 -12.123456  
  118.078999 -12.123450  
  118.078996 -12.321987  
  118.049922 -12.322456  
  118.049956 -12.123456  
  <--- gas field name  
  <--- first coordinate pair  
  <--- second coordinate pair  
  <--- last coordinate pair same as first pair  
  <--- name of next element  

*Serendipity Gas Field  
  .  
  .  
  etc
REFERENCES


Barber, P.M., 1982 - Palaeotectonic evolution and hydrocarbon genesis of the central Exmouth Plateau. APEA Journ., 22(1), 131-144.


Bradshaw, J., Nicoll, R.S., & Bradshaw, M., 1990 - The Cambrian to Permo-Triassic Arafura


Ehrhard, L.W., O'Reilly, J.B., & Wulff, K.J., 1992 - Stratigraphic framework of the Barrow group and implications for the hydrocarbon potential of the west Barrow area. APEA Journ., 32 (1), 123-137.


Ellyard, E.J., 1984 - Oil migration in the northern Canning Basin - a regional review. In


Exon, N.F., Williamson, P.E., Haq, B.U., & von Rad, U., 1988 - Sea level, climatic and


Gunn, P.J. & Ly, K.C., 1989 - The petroleum prospectivity of the Joseph Bonaparte Gulf area,
northwestern Australia. *APEA Journ.*, 29 (1), 509-526.


Koop, W.J., 1966 - Recent contribution of Palaeozoic geology in the south Canning basin, Western Australia. *APEA Journ.*, 6, 105-109.


Lehman, P.R., 1986 - The geology and hydrocarbon potential of the EP 104 permit, northwest Canning Basin, Western Australia. APEA Journ., 26, 261-284.


Osborne, M.O., 1990 - The exploration and appraisal history of Skua Field, AC/P2 - Timor Sea. *APEA Journ.*, 30 (1), 197-211.


Parry, J.C., 1967 - The Barrow Island oil field. *APEA Journ.*, 7(2), 130-133.


Bureau Mineral Resources Australia Record, 1980/42 (unpub.).


Percival, I.G. & Cooney, P.M., 1985 - Petroleum geology of the Merlinleigh Sub-basin, Western Australia. APEA Journ., 25(1), 190-203.


Quilty, P.G., 1974 - Tertiary stratigraphy of Western Australia. *Journal Geological Society Australia*, 21(3), 301-318.


Roberts, J. & Veevers, J.J., 1973 - Summary of BMR studies of the onshore Bonaparte Gulf


34-43.


Thompson, M., 1992 - The development geology of the Tubridgi Gas Field. *APEA Journ.*, 32


Weaver, O.D., 1980 - Western Australia's oil and gas potential. *Oil & Gas Journal*, 2, 139-142.


44