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AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

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Executive Summary

This report presents the preliminary results of Australian Geological Survey Organisation RV *Rig Seismic* survey 202. It was conducted for the Law of the Sea project, as part of the continuing effort to optimise Australia's definition of its 'legal' Continental Shelf. Its purpose was to determine the maximum extent of the Continental Shelf beyond the 200 nautical mile Exclusive Economic Zone around southern Tasmania. This claim is based on the natural continental prolongation of the South Tasman Rise and East Tasman Plateau features. All objectives of the cruise proposal were met. In addition, data in support of two proposed Ocean Drilling Program sites along with two deep seismic transects of the South Tasman Rise were acquired.

The cruise commenced in Hobart on 13 January, 1998, and ended in the same port on 18 February, 1998. A total of some 3900 kilometres of deep seismic coverage was obtained. Gravity and bathymetry data was acquired continuously, but magnetics data was limited to seismic lines and long transits. Navigation was provided entirely by two independent differential GPS systems. Ten sonobuoys were successfully deployed in order to determine sonic velocities for the underlying rocks.

The seismic lines for the survey area were designed to add to existing seismic and bathymetric coverage, and provide not only positions for the foot-of-slope and the 2500 metre isobath, but also to determine the thickness of sediment beyond the Hedberg line. By identifying these points along lines separated no further than 60 nautical miles, Australia is in a position to maximise its extended Continental Shelf beyond the Australian Exclusive Economic Zone, under rules outlined in Article 76 of the United Nations Convention on the Law of the Sea.

Introduction

The area of ocean floor beyond the Australian Exclusive Economic Zone (AEEZ) off southern Tasmania has been identified as potentially extending Australia's entitlement to 'legal' Continental Shelf (CS) (Symonds and Willcox, 1989). The area in question represents seabed, with associated subsoil, approximately three times the size of the Tasmanian landmass. It is based on the continental affinity of two seafloor plateaus: the South Tasman Rise (STR) and the East Tasman Plateau (ETP), that are considered to form part of the natural prolongation of Tasmania. Although the ETP is wholly positioned within the AEEZ, about half of the STR lies outside it.

As part of the Australian government's continuing effort to acquire scientific data to support its CS limits beyond the AEEZ, the Australian Geological Survey Organisation (AGSO), through its Law of the Sea (LOS) project, proposed a marine survey for the STR area. For this, a series of combined seismic and bathymetric traverses were designed. The geometry of these lines and pre-existing subsea data, were such as to ensure that the requirements laid out in Article 76 (Appendix 1) of the 1982 United Nations Convention on the Law of the Sea (UNCLOS) could be met. As a result of this proposal, LOS survey 202 was carried out using AGSO's chartered marine vessel RV *Rig Seismic* (Appendix 3).

A total seismic coverage of some 3400 km over 11 lines was originally planned. The lines were devised to acquire data over the eastern and southern margins of the STR as well as the southern and northeastern margins of the ETP. This planning was aided by a set of pre-existing sparse seismic lines, and by interpretation of the regional gravity field from satellite altimetry (Sandwell and Smith, 1997). The gravity dataset outlines the general structural setting for the region. The seismic traverses were positioned both to satisfy the 60 nautical mile (n mile) maximum separation criteria (Appendix 1) and to determine those margin areas likely to support a more distal foot-of-slope (FoS) pick. In addition, two short seismic lines were included to traverse to intersect a proposed Ocean Drilling Program (ODP) site on the southern nose of the STR.

The survey began in Hobart on Tuesday, 13 January 1998, and ended in the same port on Wednesday, 18 February 1998. Good weather conditions in the first three weeks of the survey allowed several of the proposed lines to be extended, thus resulting in a final seismic line total of about 3900 kilometres. However, the final two weeks of the cruise were beset with equipment and weather problems. This was further compounded by dominant west-southwest swells causing high levels of cable noise for the last two lines. In response, cable depths of between 14 and 17 metres were used to alleviate the problem, which has resulted in some degradation of the high frequency content of the seismic data.

This report[1] covers the preliminary results of the survey. A basic overview of both the geological and UNCLOS parameters is given along with a day-by-day summary of survey conditions and events. These are, in turn, supported by relevant appendices. No

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[1] The data, and the interpretations based on that data, contained in this report are preliminary only. It is not necessarily indicative or representative of the final information that might be used by Australia to support the location of the outer limit of the continental shelf beyond 200 nautical miles.

detailed geological or morphological interpretation is presented, but some of this information can be found in the references cited.

Geological and Morphological Setting

The STR is a continental fragment centred at approximately 47° S, 148° E with an area covering about 200 000 km^2. It can be described as a core of planated Palaeozoic basement that is flanked on all sides by sedimentary basins of Cretaceous and Cenozoic age (Willcox, 1989). Morphologically, it can be described as a northwest-southeast oriented bathymetric high rising from abyssal depths of between 4000 - 5000 m to a central high reaching to within 900 m of sea level, where it is a broad dome with low-gradient slopes in all directions. The STR is separated from Tasmania to the north by the west-northwesterly trending South Tasman Saddle. To its east and south lie broad expanses of abyssal sediment on oceanic crust. To its west lies thinly covered oceanic crust beyond a major north-northeasterly trending cliff-like feature, known as the Tasman Escarpment. This tectonic element is the northern expression of the Tasman Fracture Zone (TFZ) that extends southward to Antarctica, and is considered to be Australia's most spectacular physiographic feature (Exon and Crawford, 1997b).

The southern margin of the STR is steep and characterised by both south-dipping normal faults and north-south strike-slip faults. Around and to the north along the eastern margin the slope becomes more gradual and a more gentle transition down to the abyssal region prevails. Here, the geology is dominated by moderate levels of sedimentation, often thickening under the continental rise, which is interrupted, in places, by substantial volcanic developments. This volcanic character is further emphasised by the widespread emplacement of seamounts. These appear to have formed part of a series of hotspots that have migrated down the eastern margin of Australia to the Balleny chain near Antarctica. In contrast to the bare western side of the STR, oceanic crust to the east of this margin supports a substantial development of sedimentary cover.

The ETP is a smaller continental fragment than the STR, of approximately 50 000 km^2, and lies just to the southeast of Tasmania. Its continental affinity was confirmed by dredging (Exon et al., 1997a). The Cascade Seamount, a large volcanic guyot, occurs in the centre of the ETP at about 44° S, 150.5° E. The remainder of the plateau, except for some of its margins, is covered by substantial Cenozoic sedimentation. Topographically, apart from the seamount which rises to within 600 m of the sea surface, much of the plateau lies deeper than 2500 m.

To the northwest and west of the ETP the margin descends gradually to a deep depression that separates it from Tasmania, and is termed the East Tasman Saddle (Exon et al., 1997d). The slope to the east and southeast of the ETP is defined by a high-angle escarpment, while the remaining margins appear to be characterised by a low-gradient slope down to the abyssal plain.

The structural style of the STR, ETP and intervening L'Atalante Depression reflects the multi-phase break-up of East Gondwana. Briefly, the latest Cretaceous was characterised by east-west extension and subsequent sea-floor spreading between the STR and ETP. Oceanic crust was emplaced and later formed basement for the large amount of sediment deposited in the L'Atalante Depression. By the end of the Cretaceous, spreading ceased here and was initiated further to the east between the ETP and the Lord Howe Rise continental fragment. Further to the west, fast north-south spreading between Australia and Antarctica began in the Middle Eocene. The STR then began to subside beneath the sea, and by the mid-Oligocene the Circum-Antarctic Current moved eastwards across the rise. This resulted in extensive erosion and is evident today as widespread planation over its crest. A more detailed description of the tectonic and stratigraphic framework is to be found in Exon et al. (1997a, 1997d), Exon and Crawford (1997b), Hill et al. (1995) and Royer and Rollet (1997).

Survey Line Design

UNCLOS requires that at sampling intervals no greater than 60 n mile[2], data must be able to support the following to justify a maximum possible claim to CS:

- definition of the maximum cut-off, 100 n mile beyond the 2500 m isobath;
- definition of the Hedberg Line, 60 n mile beyond the foot-of-slope (FoS); and
- determination of the sediment thickness distribution beyond the Hedberg Line up to the maximum allowable claim[3].

In consideration of these rules, AGSO devised a survey plan of 11 seismic lines. These were named STR-A, STR-C, STR-D, STR-F to STR-M. The proposed line way points are presented in Appendix 5 while the proposed and final line geometries are shown in Figure 1. The survey was to concentrate over the eastern and southern slopes of the STR, as a substantial amount of swath bathymetry had been acquired over the western margins of Tasmania and the STR (ie. using the NO *l'Atalante* of IFREMER[4]) in 1994. This more than adequately delineated the western extremities of the FoS and 2500 m isobath. Seismic was not proposed for this western region as the geological setting meant that there was little chance of substantial sediment coverage beyond a Hedberg Line. This was confirmed by the passage of several swath bathymetry tracks indicating widespread exposure at the seafloor of oceanic crust (Bernardel, 1997). In devising the layout of these lines it is important to note that beyond the LOS requirements there was also general interest in recording deep seismic transects for scientific and hydrocarbon prospectivity purposes, as the STR is considered a frontier area for petroleum exploration.

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[2] Survey time constraints coupled with the imminent loss of AGSO's charter of the RV *Rig Seismic* meant that the survey could not be designed according to AGSO's "safe minimum approach", which incorporates a survey line spacing of 30 n mile.
[3] The rules of Article 76 stipulate a maximum claimable limit as the greater of either 350 n mile from the baselines defining the territorial sea, or 100 n mile beyond the 2500 m isobath (Appendix 1).
[4] Institut Français de Récherche et Exploitation de la MER.

Lines STR-D, STR-K, STR-F to STR-H were positioned in parallel down the eastern slope of the STR (Figure 1). This served primarily to obtain picks for the FoS and determine sediment thickness beyond the associated Hedberg arc constructions. To the south, STR-G and STR-H were placed equidistantly about a pre-existing seismic line of the RV *Maurice Ewing*. Further to the north, STR-K and STR-F were designed such that STR-K is within 60 n mile of the more southerly placed STR-G, should STR-K support a greater sediment thickness than STR-F for a Hedberg Line arc drawn from a possible FoS position at the base of the more distal seamount on STR-F (see Figure 1). In addition, STR-D was extended substantially to the southwest to obtain a deep seismic transect across several basins perched on the western flank of the STR.

Lines STR-I and STR-J were designed to test the positions of the southernmost projections of the FoS and 2500 m isobath on the STR. Although these lines extend out to the likely Hedberg Line boundary, the satellite gravity image and pre-existing RV *Maurice Ewing* seismic data indicated little prospect for substantial sediment thickness.

Line STR-L had no UNCLOS parameter significance, but was intended to provide a seismic tie along the eastern margin of the STR.

Lines STR-M, STR-A and STR-C were planned to locate FoS positions for the ETP. STR-M was also required to provide a deep seismic transect across the L'Atalante Depression. This line, however, was extensively modified during the survey to include a second traverse across the entire STR. Furthermore, the configurations of STR-A and STR-C allowed for the proposed ODP site ETP02A to be crossed at their common junction (Figure 1).

Two short lines, STR-R and STR-S, were included late in the survey design stage to survey a second proposed ODP site, STR02A, on the southern STR. They were not significant in terms of UNCLOS requirements.

Survey Line Summary

The following listing details the lines planned and acquired in the survey area (Figure 1). Altered configurations are indicated with respect to the proposed lines defined by the way points presented in Appendix 5. The order given is that recorded.

			Length (km)	
Planned Line	Actual Line	Alteration	Planned	Actual
STR-C	202/01	none	350	350
STR-D (eastern)	202/02	shortened	364	329
STR-F	202/03	lengthened	318	328
STR-K	202/04	lengthened	234	304
STR-R	202/05	straightened	30	36
STR-S	202/06	straightened	30	32
STR-G	202/07	lengthened	177	186
STR-H	202/08	lengthened	170	210

STR-I[5]	202/09	shortened	232	183
STR-J	202/10	lengthened	192	202
STR-L	202/11	lengthened	352	417
STR-D (western)	202/02	shortened	332	316
STR-M	202/12	lengthened	368	758
STR-A	202/13	shortened	243	224
		Total:	3392	3875

Survey Line Descriptions

It should be emphasised that the following line descriptions, and the interpretation of LOS parameters, in particular, are preliminary and may not necessarily represent the arguments that will be put forward by the Australian Government in its submission supporting Continental Shelf in the survey area.

The following survey line descriptions present a broad overview of the geology seen and significant UNCLOS parameters dealt with. Simple line diagrams are found in Figure 2. A more detailed discussion on both stratigraphy and structure is to be found in Exon et al. (1997a, 1997d) and Exon and Crawford (1997b). Much of the discussion below is based on either single-channel seismic monitor records or onboard-processed brute stacks. While UNCLOS picks are presented here, a more comprehensive summary is included in Appendix 7. Additional information on sonobuoy deployments can be found in Appendix 6 - see Figure 1 for positions.

Line 202/01 - East Tasman Plateau and abyssal plain transect (Fig. 2a)

Source: 3000 in^3 sleeve guns
Streamer: 3000 m, 240 channels
Record: 16 seconds, 4 ms sample
Orientation: southeast

Objective: Line STR-C was designed primarily to determine the position of the FoS and the sediment thickness beyond the Hedberg Line for the southeast margin of the ETP. This objective was broadened to include a deep seismic transect across both the plateau and the proposed ODP site ETP02A (Exon et al., 1997c).

Actual configuration: The line began as 202/0101 and ran southeast, crossing the proposed ODP site at 43° 57.6' S, 149° 55.7'E, and ending at the proposed end-of-line (EOL) as 202/0102.

Sediment: The line is dominated by three broad depocentres that have varying sediment thickness of 1.5 - 2.0 seconds TWT. Two of these are perched on the ETP (SPs 1000-3000 and 4000-5000, Fig. 2(a)), while the third extends out from the plateau's FoS to the EOL. The sedimentary section on the plateau is masked in places by multiple diffractive events indicating the presence of volcanics. These are

[5] Actually shot in two parts - before and then after STR-J.

concentrated midway down the plateau, close to the Cascade Seamount feature. Rugged basement on the abyssal plains has promoted differential compaction in the overlying strata.

Basement: Basement is a strong event across much of the section, though strongly faulted and masked by diffractions in places. It shallows to form a major wall on the southern edge of the plateau against which plateau sediments onlap. A deep reflector in the vicinity of SP 5600 may be Moho, though final processing should confirm this.

Initial UNCLOS parameters: A clear FoS pick can be made on the southern ETP edge (about SP 5600, Fig. 2(a)). This places a Hedberg arc point down the line at about SP 7800. Sediment thickness at this point is approximately 800 ms TWT and so does not appear to support an extended CS claim beyond the Hedberg Line.

Line 202/02 - east South Tasman Rise and abyssal plain transect (Fig. 2b)

Source:	1500 and 3000 in^3 sleeve guns
Streamer:	3000 m, 240 channels
Record:	16 seconds, 4 ms sample
Orientation:	east-northeast

Objective: The eastern half of line STR-D was devised to sample sediment thickness beyond two widely-spaced potential Hedberg arcs, a FoS down the eastern margin of the STR as well as to obtain a good deep seismic transect of the sedimentary section implied by the regional gravity field for the margin and abyssal plain region. The inner potential Hedberg Line is based on a proposed FoS for the current line while the outer Hedberg point rests on the Hedberg arc drawn from a possible outer FoS on line STR-F further to the south (see below). The western half of the line, which does not form part of the LOS objectives for this survey, aimed to obtain a deep seismic and high-fold transect of the sedimentary basins of the STR out to the edge of the TFZ. Its description is given below.

Actual configuration: The line was commenced as 202/0201. The actual start-of-line (SOL) was started about 35 km further down the line from that proposed to make up for some lost time due to bad weather. This was not thought to be detrimental to the survey objectives as it was well beyond the outermost potential Hedberg Line. Nevertheless, the gravity image indicated that at the SOL sediment overlying oceanic crust was thinning towards a neighbouring seamount. This was subsequently supported by the seismic data. The EOL was chosen at a point on the STR where a crossing to a previous NO *l'Atalante* seismic line enables a tie should the rest of the line to the west not be completed within the allotted survey time. A short 30 km stretch of the line was shot with alternate single arrays to allow for along line gun maintenance. This was commenced about 80 km into the line where thin sediment on oceanic basement meant that full source energy could be spared.

Sediment: A large seamount lies at the foot of the STR slope (SP 5800, Fig. 2(b)). Inboard to the STR, it appears to have acted as a barrier to down-slope sediment movement. Consequently, a thick sedimentary pile has developed on the underlying basement and contains some 1.5 sec TWT of section. The reflectors here are mostly continuous, but are masked by diffractions at deeper levels. To the east of the seamount reflectors are strongly continuous and sediment cover varies from a thickness of about 2.0 sec TWT in a depocentre (SP 5000, Fig. 2(b)) at the seamount's base, thinning to an average of 1.0 sec TWT for the remainder of the line. At the line's eastern end it onlaps onto basement rising towards a seamount. Parts of the section are masked by probable complexes of volcanic intrusions and extrusions as indicated by multiple diffractive events. Reflectors across the line are mostly continuous, but vary in character due to differential compaction, basement movements and volcanic disruptions.

Basement: Basement across the line is clearly identified where overlain by sediments. To the east it is characterised by widespread diffractions indicating oceanic composition. Sections of high basement relief (SPs 2500-4500, Fig. 2(a)) indicate seamount developments and large-scale block faulting. Below the STR slope basement is often difficult to identify because of widespread diffractions.

Initial UNCLOS parameters: The 2500 m isobath was sampled at approximately SP 7015. The eastern base of the seamount to the east of the STR is a potential FoS pick. This FoS defines a potential Hedberg Line at about SP 3500, where sediment thickness is approximately 700-800 ms TWT. This is unlikely to support a CS boundary extension. However, if the outer seamount base on line STR-F (SP 5300, Fig. 2(c)) is accepted as a FoS then the constructed Hedberg arc is projected onto the line at about SP 1900. Sediment thickness here is over 1200 ms TWT thick and thins to about 1000 ms TWT within 8 km. Therefore, a short extension to CS could be made. A second, more proximal, FoS pick is possible at about SP 6740, and defines a potential Hedberg arc at about SP 4510. Sediment here is 1200 ms TWT thick and thins quickly over uplifted basement, so that any possible extension to CS is likely to be small.

Line 202/02 - west South Tasman Rise transect (Fig. 2b)

Source:	3000 in^3 sleeve guns
Streamer:	3000 m, 240 channels
Record:	16 seconds, 2 ms and 4 ms sample
Orientation:	northeast

Objective: The southwestern extension of line STR-D was designed so that should time remain once the major LOS requirements of the survey had been met then a major deep seismic transect should be acquired down the western margin of the STR. This would provide good high-fold coverage of the basinal sediments therein.

Actual configuration: The line was treated as an extension to 202/0201, which was shot earlier in the survey. That is, a full-fold join was made at about 46° 55.47' S, 148° 31.30' E. The line was then shot as 202/0202 and 202/0203.

Sediment: The first quarter of this western extension to STR-D traverses the central north-northwesterly striking axis of the STR. Here, a high basement arch is thinly covered by sediment (SPs 7500-9000, Fig. 2(b)). Down the western margin several sedimentary basins are developed. These basins are separated by high-relief and faulted basement blocks with partial rotation. The depocentres vary in thickness from approximately 900 ms TWT to at least 2 sec TWT in a steeply-bounded half-graben at about SP 10400 (Fig. 2(b)). Most of the basin reflectors are parallel to sub-parallel and strongly continuous with evidence of at least two unconformities acting as widespread sequence boundaries. The pockets of section developed here are less disrupted by diffractions in comparison to those on the eastern margin and may suggest that volcanic activity was not as active in the west. The TFZ is characterised by sedimentary build-ups in two deeply-incised north-northwesterly striking trenches. Sediment is very thin or absent over oceanic crust to its west.

Basement: The basement reflection event is well defined over most of the line as a clear interface between overlying continuous reflectors and a series of diffractive events suggesting rugged crystalline basement. Its uplifted and faulted form down the margin suggests a major extensional phase in its evolution, which is likely to be related to the separation of Australia and Antarctica in the Late Jurassic. From SPs 12000-12500 basement is characterised as an angular unconformity over older dipping strata.

Initial UNCLOS parameters: The 2500 m isobath was sampled with a likely FoS position at about SP 12600, which is the base of the Tasman Escarpment.

Line 202/03 - east South Tasman Rise and abyssal plain transect (Fig. 2c)

Source:	1500 and 3000 in^3 sleeve guns
Streamer:	3000 m, 240 channels
Record:	16 seconds, 4 ms sample
Orientation:	east-northeast

Objective: Line STR-F was designed to sample potential FoS picks at the base of the eastern margin of the STR and at the base of the more distal of two seamounts positioned at its foot. It was also required to go beyond the furthest potential Hedberg Line and determine sediment thickness.

Actual configuration: The line 202/0301 followed the coordinates given in Appendix 5 up to the second dogleg. A small tangent line at the more westerly dogleg was implemented to lessen the severity of the angle. After a loop for gun maintenance at the easterly dogleg the line was recommenced as 202/0302 until EOL. Furthermore, a 10 km extension to the EOL was planned to include the capture of a recomputed Hedberg Line point for the outer seamount. As there appeared to be sufficient sediment coverage at this outer potential Hedberg Line, seismic was extended by a further 10 km until sediment began thinning.

Sediment: Sediment cover is localised in two small basins perched on the STR at the line's western end and is widespread on the over the Tasman Basin in the abyssal regions to the east of the seamounts, where it averages 800 ms TWT in thickness. The central portion of the line, at the foot of the STR, is dominated by two large seamounts that are devoid of sediments. A small basin is developed at the base of the rise and to the west of the more westerly seamount (at SP 3500, Fig. 2(c)). Reflectors in the abyssal plain fill are poorly continuous, while those in the STR basins are more so.

Basement: Basement on the STR slope is obscured, in part, by large-scale volcanic activity. At the base of the abyssal plain section it is highly diffractive indicating an oceanic origin. A 40 km stretch at the eastern extremity, however, is continuous with faulting and slight rotation. This may support an extensional phase between the STR and some other feature prior to the onset of ocean-floor spreading.

Initial UNCLOS parameters: An inner FoS was sampled at about SP 3450 with an outer FoS at the base of the seamount at about SP 5300. The outer FoS produces a Hedberg Line point at SP 7500, where sediment is 1150 - 1200 ms TWT in thickness. Once more accurate velocity information is determined for the sediment column, a small CS extension beyond this potential Hedberg Line may be possible. The inner FoS defines a Hedberg arc point just beyond the outer seamount. Sediment thickness averages 700 - 800 ms here and is thus not able to support an extension. Down the slope to the east the 2500 metre isobath was intersected at about SP 2720. It is then crossed a further four times over the two large seamounts cited.

Line 202/04 - east South Tasman Rise and abyssal plain transect (Fig. 2d)

Source:	3000 in^3 sleeve guns
Streamer:	3000 m, 240 channels
Record:	16 seconds, 4 ms sample
Orientation:	east-northeast

Objective: Line STR-K was designed to sample a FoS pick and determine sediment thickness beyond two potential Hedberg Line positions. A deep seismic transect down the eastern slope of the STR and across sediment cover on the abyssal plain was also intended.

Actual configuration: Line STR-K was shot as 202/0401 until the proposed dogleg. The SOL was chosen some 70 km further back from that proposed because of the possibility of meeting sediment thickness requirements beyond a Hedberg Line arc defined by the outermost potential FoS on STR-F (see above). After a gun maintenance loop it was continued as 202/0402 until the proposed EOL.

Sediment: Sediment cover is variable across the line. The STR at the line's western end supports an average thickness of 100 ms TWT on basement where widespread peneplanation has occurred. The sedimentary section down the slope is difficult to identify because of widespread volcanism. At the base of the slope a major angular unconformity appears to have eroded a large section of sediment (SP 6000, Fig. 2(d)). Further to the east, under the continental rise, the pile appears to thicken as it extends out to the abyssal regions into the Tasman Basin. Here, there may be up to 2.0 sec TWT of sediment, though much is obscured by diffractive events. This section then gradually thins out to an average thickness of 600 - 800 ms TWT over uneven basement for most of the line. The reflectors are dominantly continuous and parallel for most of the line where not obscured by volcanics. A slight thickening of the pile occurs to the east where a maximum thickness of 1300 ms TWT develops on faulted basement. The abyssal section is pierced in places by probable seamount formations.

Basement: Basement is masked under parts of the continental slope and rise by widespread volcanism. For much of the abyssal section it is highly diffractive indicating its ocean basaltic composition. To the east, however, it is more continuous in character and partly faulted with slight rotation about the faults. This rotated character was also seen along the eastern part of line STR-F and again suggests an extensional phase.

Initial UNCLOS parameters: A more proximal potential FoS pick was found at about SP 6280 defining a Hedberg Line arc at about SP 4200. Sediment thickness here, however, is of the order of 600 ms TWT so that an extension to CS is not possible. If the outer FoS for STR-F is considered instead, then the associated Hedberg arc strikes STR-K at about SP 1190. At this point, there appears to be some 1200-1300 ms TWT of sediment thickness and so an extension to the Hedberg Line may be possible. However, the extension will not be great as the section thins to about 1100 ms TWT within some 10 km (ie. at about SOL). Two more distal FoSs were picked at about SPs 6100 and 5450. Their potential Hedberg Lines are at approximately SPs 3900 and 3130, respectively. Both of these Hedberg arc points overlie an uplifted basement complex, which supports insufficient sediment coverage to promote extended claims.

Line 202/05 - seismic traverse over proposed ODP site STR02A (Fig. 2e)

Source:	3000 in^3 sleeve guns
Streamer:	3000 m, 240 channels
Record:	16 seconds, 4 ms sample
Orientation:	south-southeast

Objective: Line STR-R was designed as a short seismic transect across the proposed ODP site STR02A (Exon et al., 1997c) for the STR at 48° 30.000' S, 149° 6.700' E.

Actual configuration: The line was shot as 202/0501 on a bearing of 153.8° from approximately 48° 21.29' S, 149° 0.26' E to 48° 39.49' S, 149° 13.73' E for a length of 36 km. This involved a slight alteration to the way points proposed (Appendix 5).

Sediment: The sedimentary section is concentrated in two depocentres separated by a basement complex high. The central depocentre is about 2.0 sec TWT thick and is defined by a tight, faulted half-graben (SPs 1250-1500, Fig. 2(e)). Reflectors within this feature onlap opposing basement blocks; that to the south as it rises and breaks through to the sea floor. Reflectors are parallel and mostly continuous. Slight deformation and faulting is evident due to the effects of differential compaction and movements along the basement faults.

Basement: Basement is uplifted as a block in the north and then plunges to a deep low before rising through to the seafloor in the south. It is readily identifiable across the line.

Initial UNCLOS parameters: This is not a LOS line so no LOS parameters were sought.

Line 202/06 - seismic traverse over proposed ODP site STR02A (Fig. 2f)

Source:	3000 in^3 sleeve guns
Streamer:	3000 m, 240 channels
Record:	16 seconds, 4 ms sample
Orientation:	east-northeast

Objective: Line STR-S was designed to run over the same proposed ODP site as line STR-R, but at right-angles to it.

Actual configuration: The line was shot as 202/0601 on a bearing of 64.4° from approximately 48° 33.73' S, 148° 54.98' E to 48° 25.91' S, 149° 19.54' E for a length of 32 km.

Sediment: The sediment cover characteristics are similar to those on line STR-R. The central depocentre, however, is somewhat broader and so probably indicates its general strike in the direction of this line. The basement high at the eastern end is covered by about 500 ms TWT of sediment.

Basement: A basement high to the east appears to be the continuation of that in the south of STR-R, but with lower relief as it fails to break through to the seafloor (SPs 1400-1670, Fig. 2(f)).

Initial UNCLOS parameters: This is not a LOS line so no LOS parameters were sought.

Line 202/07 - east South Tasman Rise and abyssal plain transect (Fig. 2g)

Source:	3000 in^3 sleeve guns
Streamer:	3000 m, 240 channels
Record:	16 seconds, 4 ms sample
Orientation:	east-northeast

Objective: Line STR-G was designed to determine potential FoS picks along the eastern margin of the STR and the sediment thickness beyond the respective potential Hedberg Lines further to the east. In addition, a deep-penetration transect of the STR slope and Tasman Basin section was sought.

Actual configuration: The line was shot as 202/0701 with the actual SOL beginning some 9 km back from the proposed SOL as the system was ready early for seismic acquisition.

Sediment: To the line's west sediment cover down the STR slope averages 800 ms TWT in thickness. Reflectors are generally strong and continuous, except where there is slight masking by probable volcanics. The section deepens to 1.4 sec TWT at the base of the slope and rise region and then thins gradually to the east over faulted basement. The sediment character here is masked by diffractions off a seamount and associated volcanism. Reflectors in the abyssal region are strong and parallel except at the eastern end, where they are deformed and broken by basement-controlled faulting.

Basement: Basement is readily identified except in the vicinity of the STR slope-rise region where overlying diffractions mask its identification (SPs 2100-2500, Fig. 2(g)). Its character is diffractive in the abyssal regions where it probably indicates oceanic composition. Mounding in places is probably related to minor seamount developments. In the eastern half it has a block-faulted form with slight rotation indicating some extension. Slight stepping at the sea floor suggests the reactivation of basement faults.

Initial UNCLOS parameters: Two candidates for the FoS pick were identified. An inner FoS pick is found at SP 2040, while that more distal is at about SP 2275. The latter is found at the base of a small seamount. The former FoS pick defines the Hedberg Line at about SP 4250, where sediment cover of 600 ms TWT will not support a claim to extend CS, while the latter supports even less sediment depth at the potential Hedberg position of about SP 4490. In the possible situation that the outer FoS on line STR-F is considered (see above), then the Hedberg arc would fall at or just beyond the EOL for this line. However, the line was not extended to test the sediment thickness as it was clear from the seismic monitors that sediment was thinning well beyond the required minimum thickness (300 ms TWT at EOL, Fig. 2(g)).

Line 202/08 - east South Tasman Rise and abyssal plain transect (Fig. 2h)

Source:	3000 in^3 sleeve guns
Streamer:	3000 m, 240 channels
Record:	16 seconds, 4 ms sample
Orientation:	northeast

Objective: Line STR-H was designed to obtain a pick for the FoS and check for sediment thickness beyond the associated Hedberg Line. A good deep seismic transect across the STR slope and adjoining abyssal region over the Tasman Basin was sought as well.

Actual configuration: Line STR-H was shot as 202/0801 commencing and ending at the proposed way points.

Sediment: The lower part of the STR continental slope, the continental rise and abyssal regions is covered by sediment. This section averages 400 ms TWT in thickness for the slope to around 800 ms TWT over much of the abyssal region. Reflectors here are strongly continuous and parallel. Sedimentary cover is absent from much of the upper slope due to the presence of volcanism. The pinching out of the shallower sequence against the slope defines a probable FoS pick. The section ends to the east by onlap onto a rising seamount. A shallow sedimentary pile is developed on the STR plateau at the top of the slope (SPs 4200-4600, Fig. 2(h)).

Basement: Basement is discernible across most of the line excepting for the upper slope of the STR where it is masked by seafloor diffractions, a probable consequence of volcanism. The basement's highly diffractive character across the abyssal section implies oceanic composition. Here, minor mounding may point to volcanic piling.

Initial UNCLOS parameters: The 2500 m isobath was intersected at about SP 4590. A probable FoS pick is to be found at SP 3320 with the associated Hedberg Line point at about SP 1090. There is no sediment at this potential Hedberg Line point so an extension to CS is not possible. A second less likely FoS pick is found further up the rise/slope at about SP 3740, which defines a Hedberg arc point at SP 1525. Sediment thickness here, too, is unable to provide justification for an extended CS claim.

Line 202/09 - south South Tasman Rise and abyssal plain transect (Fig. 2i)

Source:	3000 in^3 sleeve guns
Streamer:	3000 m, 240 channels
Record:	16 seconds, 4 ms sample
Orientation:	southeast

Objective: Line STR-I was designed to determine a FoS pick for a stretch of the southeastern corner of the STR, as well as obtain a deep seismic transect part way out onto the abyssal plain. The gravity image indicated minor sediment coverage towards the inferred Hedberg Line point, which is at the proposed EOL. If this were to be supported by seismic along line then, it was decided, recording would be stopped short of the EOL.

Actual configuration: Line STR-I was shot in two parts: the first as 202/0901 from the tie-point with STR-H out to a point towards the proposed EOL and as 202/0902 from the proposed SOL to a full-fold overlap where 202/0901 began. In effect, this was achieved by shooting 202/0902 after the completion of line STR-J at its northern end.

Sediment: There is no uniform sediment coverage across the line, but is concentrated in several minor depocentres. The northern half of the section is characterised by the high plateau of the STR, where a thin veneer of flat-lying section is extensive over what appears to be deeper basinal sediments (SPs 1400-2000, Fig. 2(i)). Small seamounts have developed at the southern edge of the plateau and mask identification of underlying sedimentary section. At the base of the slope a small, partly folded section of sediments has formed (SPs 3300-3500, Fig. 2(i)). Further to the southeast, out on the abyssal plain, sedimentary cover is present over uplifted basement. Here, two moderately-sized basins have developed; the deeper with about 1200 ms TWT of sediment at the foot of the STR rise/slope. Within the abyssal section reflectors are generally continuous and parallel to sub-parallel, though deformed in places as a result of basement-controlled faulting.

Basement: Basement is clearly identified across the line where it is overlain by sediment. It is heavily faulted and uplifted below the abyssal section, which indicates a period of extension and is associated with fault reactivation.

Initial UNCLOS parameters: The 2500 m isobath was intersected at approximately SP 2760. Further down the STR slope two FoS picks are possible: one more proximal to the STR at about SP 3270 and another more distal at about SP 3600. The line was ended before the associated Hedberg point determinations, as a gradually thinning sediment cover over rugged and faulted basement into the abyssal region indicated that the sediment thickness criteria would not be met.

Line 202/10 - south South Tasman Rise and abyssal plain transect (Fig. 2j)

Source:	3000 in^3 sleeve guns
Streamer:	3000 m, 240 channels
Record:	16 seconds, 4 ms sample
Orientation:	north-northeast

Objective: Line STR-J was designed to determine a FoS pick and obtain a deep seismic transect across the abyssal regions to the south of the STR. The satellite gravity image suggested that sediment cover would be marginal and concentrated in small elongate basins. Nevertheless, the line SOL was proposed a short distance beyond the expected Hedberg Line position.

Actual configuration: Line STR-J was shot as 202/1001 with an SOL and EOL as proposed.

Sediment: Three small basins are found in the abyssal plain. The largest basin lies at the base of the STR slope and contains up to 1200 ms TWT of sediment (SPs 2700-3300, Fig. 2(j)). The deeper sequence characteristics are masked by diffractions and may indicate the presence of volcanics within the sedimentary column. All three basins are separated by basement highs and are covered by a thin shallow sequence of mostly continuous reflectors. A considerably smaller basin is perched on the upper reaches of the STR slope (about SP 3800, Fig. 2(j)). The plateau itself is characterised by planated basement with small seamounts at the edge of the slope.

Basement: Basement is identified as a series of diffractions at the base of the sedimentary sections in the abyssal regions. It is the seafloor on the STR.

Initial UNCLOS parameters: The 2500 m isobath was intersected at about SP 3900. Two FoS picks can be identified at about SP 3210 and SP 3560. The latter pick defines an associated Hedberg Line point at about SP 1340, where there is approximately 400 ms TWT of sediment. This indicates that an extension beyond this potential Hedberg Line point for CS is unlikely. The former FoS pick positions the Hedberg arc at the SOL, where there is little evidence of sediment.

Line 202/11 - eastern slope South Tasman Rise transect and seismic tie (Fig. 2k)

Source:	3000 in^3 sleeve guns
Streamer:	3000 m, 240 channels
Record:	16 seconds, 4 ms sample
Orientation:	southeast

Objective: Line STR-L was designed as a seismic tie line for the western ends of those LOS lines proposed over the eastern margin of the STR.

Actual configuration: To tie into a modified line STR-M (see below) to the north line STR-L was extended by some 65 km. It began in the south at the proposed SOL and ran northwestwards to end at about 46° 14.43' S, 148° 24.75' E. The minor dogleg was traversed without looping.

Sediment: As an extensive traverse of the eastern slope of the STR this line is characterised by areas of uniform sediment cover, several small basins and seamount developments. The southern third of the line is dominated by sediment of 600 - 1000 ms TWT thickness made up mostly of strong and parallel reflectors. Parts of this section are masked by volcanics. The middle third is dominated by three seamounts separated by two minor basins of sedimentary section. The more northerly basin is characterised by strong, parallel to sub-parallel reflections and attains a maximum thickness of 1000 ms TWT (SPs 5600-6000, Fig. 2(k)). The northern third of the line has a thicker sedimentary cover of between 1200 - 1800 ms TWT. The reflectors here are strongly continuous and parallel, but masked in places by the effects of volcanic extrusives/intrusives.

Basement: Basement is generally obscured by diffractions across much of the line. Where apparent under a sedimentary cover it is often diffractive and highly rugged, which probably suggests the piling up of volcanic extrusives. In other places, it is characterised by a strong and continuous reflector indicating a boundary with probable crystalline basement. Draping of lower sequence sediments over basement mounding in the northern part of the line suggests syndepositional basement movements. This may be related to the early rifting phase of the L'Atalante Depression feature. Deep intrabasement reflectors may represent shallower features out of the plane of the section.

Initial UNCLOS parameters: As this line was not designed to determine FoS positions none are provided. Several major slope changes exist, though, but are of little use in delineating Hedberg arcs, as they are all inner to those found on the margin dip lines.

Line 202/12 - South Tasman Rise and East Tasman Plateau transect (Fig. 2l)

Source:	3000 in^3 sleeve guns
Streamer:	3000 m, 240 channels
Record:	16 seconds, 2ms and 4 ms sample
Orientation:	northeast

Objective: Way points for line STR-M were modified during the cruise. The SOL was altered to commence on oceanic crust at the base of the western margin of the STR and run firstly east-northeast and then more northeast as a means of traversing both the STR and ETP, and intervening L'Atalante Depression. This configuration was meant to obtain a good deep-seismic transect across these large-scale morphological features. The original objective of obtaining a FoS pick for the northeastern margin of the ETP was retained.

Actual configuration: The line began at the modified SOL and ended in the northeast at about 43° 9.8' S, 151° 45.48' E. This actual EOL represents an 80 km extension to that originally proposed, and was warranted by the presence of substantial amounts of sediment on the abyssal plain to the northeast of the ETP.

Sediment: Line STR-M is an extensive transect of the STR, ETP and intervening L'Atalante Depression. It is characterised by widespread sediment coverage with deeper basinal sediments on the STR. The western third of the line bisects the STR at right angles to its general north-northwesterly strike. Several basins are developed here with the largest containing up to 2.0 sec TWT of sediment infill against a faulted basement block (SPs 4000-5000, Fig. 2(l)). This large block represents the central axis of the STR and its thin cover of sediment indicates the effects of large-scale peneplanation by ocean currents. Reflectors here are mostly continuous and parallel. To the east the line descends down the eastern margin of the STR out across the L'Atalante Depression and up onto the ETP. Apart from a large seamount positioned midway across the depression much of this broad morphological feature is filled in by up to 1500 ms TWT of sediment. Deeper parts of the sedimentary section to the seamount's west indicate the presence of volcanics (SPs 7500-8500, Fig. 2(l)). That to the east of the seamount is disturbed in places by small-scale seamount intrusions. The reflectors across the depression are continuous and parallel. The remaining eastern third of the line rises over the ETP and extends for some 60 km beyond its eastern margin FoS into the abyssal plain regions of the Tasman Basin. The plateau itself is covered by an average of 1200 ms TWT of sediment, except where interrupted both by a southeasterly spur of the Cascade Seamount (about SP 13400, Fig. 2(l)) and a basement-block high forming the eastern margin of the ETP. Sediment out beyond this margin into the abyssal regions averages 1200 ms TWT in thickness and is made up predominantly of continuous and flat-lying reflectors.

Basement: Basement is well defined over most of the line excepting for part of the L'Atalante Depression where widespread diffractive events, probably associated with volcanics, mask its presence. Furthermore, the appearance here of faulted and partly rotated basement blocks indicates an early extensional phase.

Initial UNCLOS parameters: A FoS pick for the western side of the STR was made at about SP 1950, while that for the eastern side of the ETP was found at about SP 15250. The 2500 m isobath for both the western and eastern side of the STR was intersected at about SPs 3325 and 7060, respectively. It was not crossed for the ETP.

Line 202/13 - East Tasman Plateau transect (Fig. 2m)

Source:	3000 in^3 sleeve guns
Streamer:	3000 m, 240 channels
Record:	16 seconds, 4 ms sample
Orientation:	southwest

Objective: Line STR-A was designed as a low priority LOS line to establish a FoS pick for the northeastern margin of the ETP and obtain some deep seismic coverage across its sedimentary cover through to the proposed ODP site ETP02A. The ODP site forms the tie with line STR-C. The orientation of the line across the margin also included the traverse of a large seamount at the base of the slope/rise. From its position and form argument may be made as to its attachment to the plateau and so potentially define a more distal FoS pick.

Actual configuration: The actual line configuration matches that proposed except for a shortening by 20 km at its northeastern end. This was done to recover some lost survey time given the encroaching deadline for arrival in Hobart.

Sediment: The line traverses abyssal plain sediment to the northeast, both rise and slope sediment in the middle portion and sediment infill on the ETP to the southwest. The cover is continuous across the section excepting for a large seamount to the northeast (SPs 1700-2100, Fig. 2(m)) and a high basement arch at the plateau's edge. To the northeast of this seamount the cover is up to 1400 ms TWT in thickness and is characterised by parallel reflectors that are interrupted by diffractive events. These most likely indicate volcanic extrusives. Up the ETP rise and slope the reflectors are both continuous and parallel. Sediment cover here averages 800 ms TWT in thickness. On the plateau itself sediment averages 1200 ms TWT in thickness and is made up of continuous and mostly parallel reflectors. Basement mounding, which appears to be the result of small buried seamount formations, has produced slight deformation in the overlying section.

Basement: The basement reflective event is clearly discernible across much of the line. It is generally a strong diffractive event, but absent in those parts where volcanics in the sedimentary column mask its characteristics.

Initial UNCLOS parameters: A potential FoS pick at the northeastern end of the seamount was found at about SP 1550, while a second pick is possible, more proximal to the ETP, at about SP 2510. The 2500 m isobath that encircles the crown of the seamount was intersected at SPs 1800 and 2020. It was not crossed on the ETP.

Cruise Narrative

The following is a brief overview of both weather and equipment conditions for the survey. Where given UTC means Universal Time Constant. More detailed information may be gleaned from the seismic and navigation line logs as well as the respective cruise Electronic, Quality Control and Parameter reports. Concise daily weather details, as noted by the ship's bridge, are to be found in Appendix 8. Sonobuoy deployment details and preliminary Law of the Sea parameters can be found in appendices 6 and 7, respectively.

January 13
Left Macquarie wharf, Hobart, 6.00 pm local time. Conditions heading out of Hobart are very calm.

January 14
Cable deployment began at UTC 013:1500 (2.00 am local). Deployment completed at 7.10 am with tow leader set at 71 metres. Running into line lost power to the cable for about 5 minutes (GFI). Began line 202/0101 (ie. STR-C) at UTC 014:0103 but

stopped recording after 50 shots because of GFI causing loss of power to the cable. Cable is being retrieved to determine GFI cause and to re-right the tailbuoy.

January 15
Sea conditions worsened during the night to force 9-10 and we are awaiting better states to recommence shooting line STR-C. Cable is in water and have lost power to it again indicating continued presence of GFI problem. Tailbuoy has gone over again! Not a good start to the survey. Cable partly retrieved and two bad sections changed out - one with large fish bites. Line 202/0101 started at UTC 015:1121 (ie. about 10.00 pm) with both gun arrays and the tailbuoy upside down again - will attempt re-righting at next cable repair or retrieval opportunity.

January 16
Shooting on 202/0101 continues in low swell and slightly choppy seas. Two sonobuoys launched over proposed ODP site, but both failed - need to conserve those that remain for the remainder of the cruise, so no more were attempted. Magnetometer controller repaired and head placed in water at UTC 016.0200 though data is very noisy. Line was broken at about the mid-point for preventative gun maintenance - recommenced as 202/0102.

January 17
Continuing down 202/0102 in moderate seas with slight swell. Apart from swell noise and high feather angles (about 17°) the seismic monitors indicate that the data is of good quality. 202/0102 was completed in calm-moderate seas at 7.00 pm local time. Making way to eastern end of STR-D. STR-D's eastern end has been shortened by about 35 km from that proposed in order to make up for some lost time on STR-C. This end lies over predominantly oceanic crust as indicated by the gravity image and subsequently supported by the monitors.

January 18
Weather deteriorating during the night as a low pressure system makes its way across southern Tasmanian waters. The beginning of STR-D was abandoned as it worsened further to about force 9-10. Though noise levels were moderate with the cable set at 12 m, it was decided to hold off the commencement of the line because of concerns by the bridge as to possible worsening conditions and given pitch requirements with both cable and guns in water and heading into the swell. While hove-to GFI faults indicate another possible fish-bite. Weather continues to be bad during day with gusts up to 60 knots. Await improvements though synoptic chart indicates 2 approaching fronts in succession once this low pressure system moves to the south-east.

January 19
Cable retrieval began at 5.30 am in calm seas with moderate swell. Line 202/0201 (ie. STR-D) began at UTC 019.0552.

January 20
Line 202/0201 continuing in light seas with a moderate swell. The gun mechanics have requested a 24-hour turn-around-time for gun maintenance. This equates to about 220 km of recording without a line break. I was reluctant to do this as the line is 350 km long and I wanted to make use of the good shooting conditions whilst they lasted.

As a compromise, therefore, at about 80 km into the line I allowed the alternate bringing in of each array for maintenance. This meant that we were down to one array for about 3 hours of the line, but was not considered significant as the gravity image indicated, and seismic monitors supported, thin sediment cover over oceanic basement. In cases of thick sediment cover I would prefer breaking the line to loop so as to maintain full penetration potential. The magnetometer was retrieved about midday. Its performance has been less than satisfactory so far despite constant attention by the electronic technicians.

January 21
Line 202/0201 ended at UTC 20.1901 in calm seas. Transiting to eastern end of STR-F. Line 202/0301 commenced at UTC 21.0928 in calm-moderate seas with cable set to 12 m. 5 km short of SOL 2 guns on starboard array failed. To get them repaired and avoid looping it was decided to commence the line with one gun string as the gravity image indicated thin sediment cover. The array was redeployed about 1 hour later meaning that the first 3 km of the line was recorded with one string.

January 22
Continuing 202/0301 (ie. STR-F) in moderate seas with winds picking up around midday as a front approaches. The line was ended at UTC 22.0027 midway at a 26° dogleg to loop and allow for gun maintenance. The magnetometer was brought in early on as its data was very noisy - the saga continues. The electronic technicians will attempt to fit a spare head and monitor its performance. Recommenced STR-F as 202/0302 at UTC 22.0446 in moderately rough seas. The cable was set to 14 m depth to lessen noise levels. Although cable noise is moderate and it is worth continuing to acquire data, conditions are making it difficult for the Bridge to keep the line within a conservative CCE (ie. +/- 20 m).

January 23
Continuing 202/0302 in moderately rough seas with gusts up to 50 knots. The cable appears to be well behaved at 14 m and shows moderate amounts of noise with peaks in the high 30s microbar range. Due to sausage buoy problems one gun array had to be brought in and so part of the line (ie. about 2 hours) was shot with one string. Sediment cover was not great and so a loop was not thought necessary. 202/0302 was completed at UTC 22.0446 some 20 km beyond the originally supplied EOL. 10 km of this was due to a recomputed potential Hedberg Line. The remaining 10 km extension was performed to test and capture terrain where sediment thickness appeared to warrant it. The magnetometer continues to fail to provide a good signal. The tailbuoy has commenced to communicate its position intermittently. Started STR-K as 202/0401 at UTC 23.0840 with cable set to 12 m.

January 24
Continuing 202/0401 in excellent conditions. Sonobuoy launched at UTC 023.2103 and worked. Ended 202/0401 at dogleg at UTC 024.0448 to allow for gun maintenance - STR-K continued as 202/0402 at UTC 24.0838.

January 25
Ended 202/0402 at UTC 024.2250 in excellent sea states. Two sonobuoys launched in early morning - the second transmitting for a good period. Began STR-R as 202/0501

at UTC 025.0743. This line and STR-S are designed to cross over a proposed ODP drill site. Cable set to 10 m for these two lines, sample rate maintained at 4 ms. 202/0501 ended at UTC 025.1140.

January 26
Began 202/0601 (STR-S) at UTC 025.1558. Successful recording of sonobuoy for most of the line. Line ended at UTC 025.1921 and transit began to western end of STR-G. Began STR-G as 202/0701 at UTC 026.0500 9 km before the designated SOL. Seas are quite calm but there is a general 2 m swell. The cable was left at 10 m depth as the noise monitors indicate low levels.

January 27
Finished 202/0701 at UTC 027.0120 in calm seas again. Although there is always a constant swell of between 2 - 4 m the general conditions are extraordinarily good for these latitudes. After surfacing cable to replace bird 6 by boat we will transit down to eastern end of STR-H.

January 28
Began STR-H as 202/0801 at UTC 027.1709. Cable set at 12 m, seas calm with 15-20 knot winds. Magnetometer with 'New Zealand' head has finally gone into the water at UTC 028.0605 and is producing a good signal.

January 29
Completed STR-H at UTC 028.1630. Began STR-I as 202/0901 at an approximate SOL of 80 km at UTC 028.2110. The line will most likely be finished early as sediment thickness is not expected to warrant progress of the line to the Hedberg point. Ended STR-I at UTC 029.0743 at an EOL of about 50 km. This was completed early as sediment thickness was not uniform across the section and the gravity image indicated no substantial sediment cover out to the Hedberg Line and beyond. The cable was retrieved at UTC 029.1100 and we began the long transit to the southern end of STR-J.

January 30
Began STR-J as 202/1001 at UTC 030.0333 in moderately rough seas. Although conditions are rough most of the swell is side-on meaning that at 12 m the cable is registering relatively low levels of noise.

January 31
Ended 202/1001 at UTC 031.0135. Day began in moderately rough seas that abated later in the morning. Recommenced STR-I from northern end as 202/0902 at UTC 031.0649. Conditions are moderate with cable set at 12m.

February 1
Completed 202/0902 at UTC 031.1526. Commenced STR-L as 202/1101 at UTC 031.2300 in moderate seas with cable set at 12m. Noise levels reasonable at less than 10 mbars averaged (ie. 8 Hz low-pass filtered).

February 2
Continuing on 202/1101 and then looped for preventive gun maintenance at UTC 032.1950 before recommencing line at UTC 032.2330 as 202/1102. Conditions are beginning to worsen by about midday as winds reach 30-40 knots.

February 3
Line 202/1102 abandoned at UTC 033.1356 due to worsening sea state (gusts of 55 knots and high seas). Most of day spent hove-to and looping back to try recommencing line as conditions abated by midday. Line was restarted as 202/1103 at UTC 034.0641 in moderately rough seas. Seas have begun to worsen towards midnight with wind gusts beyond 40 knots. Noise levels are up into the 20 mbar range (ie. filtered at 8 Hz).

February 4
Line 202/1103 abandoned at UTC 034.1458 due to bad sea state - wind gusts up to 50 knts and cable at 14 m being affected by swell. As we were ready to re-shoot the line as 202/1104 around midday the cable developed an electrical fault by which it failed to communicate. Cable retrieval and fault-finding was implemented. 202/1104 was designed to reshoot about the last 20 km of 202/1103 where noise levels were moderately high. Two sections of cable were replaced and the whole was redeployed by midnight.

February 5
Line 202/1104 was begun at UTC 035.1648 at about an EOL (ie. with the new extension) of approximately 65 km. 202/1104, and so STR-L, was finally completed at UTC 035.2253. Bird 9 had a frozen wing angle of -15° so at the end of the line the cable was retrieved to replace it. This would normally be performed by changing the bird in the water, assisted by boat, but the moderate-swell sea state precluded this. Unfortunately, once the cable was back in the water and we began transiting south to complete the western half of STR-D, channels 41 to 48 ceased transmitting back any data. This meant that the cable had to be retrieved to active 6, and that section swapped out.

February 6
The western half of STR-D was begun as 202/0202 at UTC 036.1326. Early in the line the cable suffered from frame parity errors and had to be repowered. This meant that 12 shots were lost. I was willing to accept this and will mean that one CDP gather will have 30 -12 = 18 fold with those 'before' being less degraded. Therefore, a loop was not enforced and we continued. However, at UTC 036.2013 the line had to be abandoned as our primary navigation had dropped out from DGPS for nearly 1/2 hour. A loop was implemented to wait till it came back (apparently due to a problem at the uplink base at Perth). The system was back up within 1 hour and so the line was recommenced at UTC 036.2359 as line 202/0203. The cable was initially set at 12 m, but a prevailing swell saw the cable holding depth better at 14 m. The opportunity was taken during this loop to service the guns meaning that we may run to EOL without a maintenance loop. A large quantity of "frame-parity errors" are appearing during recording. These number about 10% of all shots and are not evenly spaced. These generally have to be edited out so that many CDP gathers will not have the full fold complement of 30 channels to stack. The system QC officer believes the problem to

be in the cable and would require another retrieval effort of several hours down time. The amount of errors are within specification and so it was decided to continue on till the EOL when cable work would be undertaken. I was reluctant to fix the problem along line because of the lost time involved given that a low-pressure system is heading our way and may make finishing the line without major delays a real probability. Nevertheless, if the line has to be stopped short of the EOL we will loop and take the opportunity to trace the intermittent fault by cable retrieval (ie. probably bad section/connection).

February 7
Frame-parity errors appeared less frequently during the early part of today as we continued along 202/0203. The weather is worsening gradually with the onset of a low pressure system, but the cable is still maintaining depth with low-moderate levels of noise. The cable developed serious frame-parity problems at UTC 037.0600 necessitating a repowering of it. This happened at about 12 km from the original EOL and resulted in the loss of too much seismic-fold. I decided to forego a reshoot and therefore acquisition for the rest of the line was abandoned. Much of the last 50 km of the line was over hard-bottom oceanic crust with no sign of sediment. Cutting the line short enabled an earlier retrieval of the cable and tracking down of the parity problem before the onset of the front associated with the low mentioned above. The replacement of sections 13 and 14 did not solve the problem. Changing tow-leaders by attaching the cable to the port reel resulted in the problem being fixed. Once this had been done we commenced the transit to STR-M.

February 8
Line STR-M was begun as 202/1201 at UTC 038.1626 with the cable set at 12 m. Conditions are good for recording. Sea state began to pick up at about UTC 039.0600 with consequent increases in noise levels. The cable was dropped to 14 m as a result.

February 9
Sea state worsened on 202/1201 to the point that at about UTC 039.1541 it became no longer possible to control cable depth. For this reason the line was terminated and a loop begun to await improved conditions. The weather appeared to improve in the afternoon so two attempts were made to come back on line and recommence shooting. Unfortunately, a very persistent swell from the west was effecting the cable depth at 15 m with consequent high noise levels. Therefore, the line was not commenced.

February 10
A third attempt was made in the morning. The cable was set at 17 m. Although this degrades the high frequency content of the signal it was thought best to restart the line and live with the moderately high noise levels. The fact that much of the sea bottom is hard volcanic terrain with only a thin sliver of sediment cover swayed my decision towards continuing to record the line. The line then was recommenced as 202/1202 at UTC 040.1900. Due to a major GFI the line was stopped at UTC 041.0304. Retrieval of the cable then began. Section 17 with a fish bite was replaced. STR-M was again recommenced at UTC 041.1032 as 202/1203. The swell had abated remarkably over the period of cable work so the line began with the cable set at 14 m.

February 11

Continued recording 202/1203 in calm seas. The cable was set to 12 m in the morning. The line was stopped at UTC 042.1030 due to a cable GFI. These GFIs are a real hindrance to maintaining production levels and appear to be due to fishbites. Perhaps there has been some recent fishing in the area that has attracted a great number of sharks and tuna.

February 12

Further GFI problems with the cable developed in the early morning. STR-M was once again restarted, this time as 202/1204 at UTC 043.0253. Unfortunately, another GFI developed in the afternoon and we were unable to power up the cable. Recording was then stopped at UTC 043.0424 and a loop implemented to retrieve the cable and commence fault-finding. GFI's, fish and swell have been an enormous problem on line STR-M and have greatly impeded our progress to date. The earlier forecasts of being well ahead of schedule are now clearly in jeopardy. Eventually, the cable fault was traced to a bad stretch section at the front.

February 13

STR-M was once again recommenced as 202/1205 at UTC 043.1517. Moderate swell saw the cable being deployed at a depth of 14 m. Increasing swell later in the morning forced me to set the cable to 16 m depth. This could not fix the front third of the cable which was riding high and contributing large noise values. An attempt was made to increase the tow leader length whilst recording, but this failed in that it brought the cable to the surface. Therefore, the line was abandoned at UTC 044.0005 and a loop implemented. The line was recommenced as 202/1206 at UTC 044.0640. The cable was set to 16 m depth and appears to keep depth much better with the additional tow leader let out. It is general practice not to allow the cable to run at this depth because of the consequent degradation of high frequency signal - around 100 Hz in this case. The great water depths, however, make it unlikely that any valuable signal at this level of frequency would be present. Continuing high swell conditions and another approaching front make it impractical to wait around to continue shooting at a more opportune occasion. The data will suffice for Law of the Sea purposes.

February 14

Finally completed STR-M on UTC 045.0111 after extending the line by 80 km beyond the original EOL proposal. The FoS was sampled at the Plateau's northeastern margin and continued along line to acquire a seismic traverse over a moderately thick sedimentary section from its base out into the abyssal regions. Line STR-A was commenced as 202/1301 at UTC 045.1132 with both arrays. Cable depth was set to 16 m as the southwestern aspect of the line meant we were recording directly into the prevailing swell of up to 4 m. Noise levels continued to be moderately high even though the cable was maintaining depth better into the swell. This is most probably due to cable jerking as the vessel pitches up and down.

February 15

Line 202/1301 had to be cut short at UTC 045.1132 due to multiple cable GFIs. A loop was begun to begin part retrieval and start fault-finding. Section 28 had to be replaced because of a fish bite. The cable was redeployed and the line recommenced as 202/1302 at UTC 046.1256. A large swell necessitated leaving the cable at 16 m depth.

February 16
202/1302 continued in moderating conditions - noise levels got below 10 mbars for the first time in about a week. Unfortunately, at UTC 046.1256 the cable suffered more intermittent GFIs and the line was stopped. The port tow leader was suspect and various combinations of tests showed it to be okay. This means that the problem is in the water and so cable retrieval was begun. Another fish bite?!!! A few hours of bad weather postponed cable retrieval till the evening. Section 10 had suffered a fish bite and was replaced with the one remaining spare 12.5 m active.

February 17
Line STR-A was recommenced as 202/1303 at UTC 047.1338. At UTC 047.1453 the line had to be stopped because a series of frame-parity errors meant that seismic fold was lost. A loop was commenced and tests indicated that a stretch was at fault. This was replaced and the line recommenced at UTC 047.1930 as 202/1304. Some 20 kms remain for the line to be finished and time is running out as we should be steaming for Hobart by midday. Fortunately, the line was completed without further problems. The cable was retrieved and the transit for Hobart began at UTC 048.0138.

February 18
Arrived Macquarie wharf in Hobart at 8.00 am local time.

Conclusion

AGSO Survey 202 successfully completed its intended LOS and proposed ODP site-survey objectives. In addition, one of the lines was extended to provide a major deep-seismic traverse of the South Tasman Rise, L'Atalante Depression and East Tasman Plateau crustal features. There is a possibility that Australia may be able to enhance its claim to 'legal' Continental Shelf over the Tasman Basin, to the east of the South Tasman Rise, using the sediment thickness approach.

Acknowledgments

I would like to thank, on behalf of the Law of the Sea project, Bob Hardinge and his AMSA crew for all aspects of ship operations, as well as the AGSO scientific staff for their professionalism in obtaining results beyond those required for the proposed survey effort.

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Appendices

Appendix 1

1982 United Nations Convention on the Law of the Sea (UNCLOS)

Article 76 : Definition of the continental shelf

1. The continental shelf of a coastal State comprises the seabed and subsoil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its land territory to the outer edge of the continental margin, or to a distance of 200 nautical miles from the baselines from which the breadth of the territorial sea is measured where the outer edge of the continental margin does not extend up to that distance.

2. The continental shelf of a coastal State shall not extend beyond the limits provided for in paragraphs 4 to 6.

3. The continental margin comprises the submerged prolongation of the land mass of the coastal State, and consists of the seabed and subsoil of the shelf, the slope and the rise. It does not include the deep ocean floor with its oceanic ridges or the subsoil thereof.

4. (a) For the purposes of this Convention, the coastal State shall establish the outer edge of the continental margin wherever the margin extends beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured, by either:

   (i) a line delineated in accordance with paragraph 7 by reference to the outermost fixed points at each of which the thickness of sedimentary rocks is at least 1 per cent of the shortest distance from such point to the foot of the continental slope; or

   (ii) a line delineated in accordance with paragraph 7 by reference to fixed points not more than 60 nautical miles from the foot of the continental slope.

   (b) In the absence of evidence to the contrary, the foot of the continental slope shall be determined as the point of maximum change in the gradient at its base.

5. The fixed points comprising the line of the outer limits of the continental shelf on the seabed, drawn in accordance with paragraph 4 (a) (I) and (ii), either shall not exceed 350 nautical miles from the baselines from which the breadth of the territorial sea is measured or shall not exceed 100 nautical miles from the 2,500 metre isobath, which is a line connecting the depths of 2,500 metres.

6. Notwithstanding the provisions of paragraph 5, on submarine ridges, the outer limit of the continental shelf shall not exceed 350 nautical miles from the baselines from which the breadth of the territorial sea is measured. This paragraph does not apply to submarine elevations that are natural components of the continental margin, such as its plateaux, rises, caps, banks and spurs.

7. The coastal State shall delineate the outer limits of its continental shelf, where that shelf extends beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured, by straight lines not exceeding 60 nautical miles in length, connecting fixed points, defined by coordinates of latitude and longitude.

8. Information on the limits of the continental shelf beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured shall be submitted by the coastal State to the Commission on the Limits of the Continental Shelf set up under Annex II on the basis of equitable geographical representation. The Commission shall make recommendations to coastal States on matters related to the establishment of the outer limits of their continental shelf. the limits of the shelf established by a coastal State on the basis of these recommendations shall be final and binding.

9. The coastal State shall deposit with the Secretary-General of the United Nations charts and relevant information, including geodetic data, permanently describing the outer limits of its continental shelf. The Secretary-General shall give due publicity thereto.

10. The provisions of this article are without prejudice to the question of delimitation of the continental shelf between States with opposite or adjacent coasts.

Appendix 2

Informal Terms relating to Article 76

Application of Article 76 of United Nations Convention on the Law of the Sea (UNCLOS) raises several concepts and terms which will be referred to frequently in interpretations of seismic/bathymetric survey lines for the purposes of 'legal' Continental Shelf (CS) definition. Following are simplified definitions of the more important terms that we commonly use. Some aspects of the application of Article 76 remain unclear, and will only be resolved following further deliberation by the Commission on the Limits of the Continental Shelf.

Firstly, a *Hedberg arc* may be drawn, with a radius of 60 n miles, from an interpreted foot-of-slope (FoS) position. The location at which this arc intersects the seaward extension of the survey line is called the *Hedberg point*. With a series of FoS positions established around a continental margin, at a spacing of less than 120 n miles, a series of intersecting Hedberg arcs may then be constructed. Clearly, as the spacing between survey lines (and therefore, the FoS positions) decreases, the envelope of the intersecting Hedberg arcs approaches a 60 n mile buffered locus of the FoS, except in some cases where the latter contains embayments. This is part of the reason for AGSO's 'safe minimum' approach, where we aim to space survey lines ~30 n mile apart, where logistically possible. The final outcome, the true *Hedberg Line* (the informal name for the line that defines the outer edge of the 'legal' continental margin, as contained in Article 76, paragraph 4(a)(ii), of UNCLOS), is constructed by joining selected points on the Hedberg arcs by straight lines, not more than 60 n mile long. This would normally be done in a manner so as to maximise the size of the enclosed 'legal' continental margin. This true Hedberg Line will normally only intersect the survey line at the Hedberg point where the locus of the FoS points is a straight line. Such situations are unusual in the context of CS beyond 200 n mile, since it is normally associated with irregularly shaped marginal plateaus.

Secondly, a *Sediment Thickness point* may be determined, by interpretation of a seismic survey line (or possibly by drilling), where the 1% sediment thickness criterion is satisfied. That is, the point at which the thickness of sedimentary rocks is at least 1% of the shortest distance from such point to the FoS. In contrast to the Hedberg arc, this is strictly a single point, which may be joined to adjacent Sediment Thickness points to form the *Sediment Thickness Line* (the informal name for the line that defines the outer edge of the 'legal' continental margin, as contained in Article 76, paragraph 4(a)(i), of UNCLOS), or to selected points on Hedberg arcs, again by straight lines, not more than 60 n mile in length.

Finally, the fixed points (not more than 60 n mile apart) comprising the line which defines the outer limits of the CS, may not lie beyond one or other of two cut-offs. The first cut-off is 350 n mile from the baseline (informally called the *350 n mile cut-off line*), and the second is 100 n mile beyond the 2500 m isobath (informally called the *isobath cut-off line*). The former is purely a geometrical construction from the Territorial Sea baselines, whereas the latter depends on definition of the 2500 m isobath.

Appendix 3

Description of RV *Rig Seismic*

The research vessel RV *Rig Seismic* is chartered and equipped by the Australian Geological Survey Organisation (AGSO) of the Australian Commonwealth Government. Its mission is to support the primary geoscientific requirements of acquiring data for Australia's Law of the Sea claims and the Australian Ocean Territory Mapping Program. It was constructed in Norway in 1982 and later commissioned by AGSO in 1984. The vessel is registered in Newcastle, New South Wales, and is operated for AGSO by the Australian Maritime Safety Authority (AMSA).

Gross tonnage:	1545 tonnes
Length:	72.5 metres
Breadth:	13.8 metres
Draft:	6.0 metres

Engines:	
Main:	Bergen KVMB-12 2640 H.P./825 r.p.m.
Auxiliary:	3 x Caterpillar 564 H.P./482 kVA 1 x Mercedes 78 H.P./56 kVA
Shaft Generator:	AVK 1000 kVA; 440 V/60 Hz
Side Thrusters:	2 forward, 1 aft; each 600 HP

Helicopter Deck:	20 metres diameter
Accommodation:	3 double-berth cabins 38 single-berth cabins

Appendix 4

Crew List

Australian Maritime Safety Authority

Master	Bob Hardinge
1st Mate	Otto Weysenfeld
2nd Mate	Danny Watson
Chief Engineer	Roger Thomas
1st Engineer	John Vitner
Electrician	Lazlo Polgardi
Chief IR	Lee Gritt
IR	Frank Rochford
IR	Dave Kane
IR	Matt Stapleton
Chief Cook	Geoff Conley
Cook	Adrian Clark
Catering Attendant	Don Joyce
Catering Attendant	George Lilja

Australian Geological Survey Organisation

Ship Manager	Paul Lashko
Client Representative	George Bernardel
Quality Control	Mark Alcock
Seismic Processor	Bill Plumridge
Science Technician	John Ryan
Science Technician	Lyndon O'Grady
Science Technician	Stephen Ridgway
Science Technician	Fleur Wiley
Science Technician	Andrea Cortese
Science Technician	Linda Philippa
Electronics Technician	Steve Thomas
Electronics Technician	Wojciech Wierzbicki
Gun Mechanic	Simon Milnes
Gun Mechanic	Craig Wintle
Gun Mechanic	Alan Radley
Gun Mechanic	John Keyte
Visiting Student	Ian Faichney

Appendix 5

Proposed Survey Way Points

Line Name	Latitude	Longitude	
STR-A	42 30.000 S	152 03.733 E	
STR-A	43 55.028 S	149 59.363 E	
STR-A	43 56.293 S	149 57.552 E	
STR-A	43 57.600 S	149 55.700 E	ODP site ETP02A
STR-A	43 58.480 S	149 54.302 E	
STR-A	43 59.757 S	149 52.423 E	
STR-C	45 14.417 S	152 39.933 E	
STR-C	43 57.600 S	149 55.700 E	ODP site ETP02A
STR-C	43 30.000 S	149 00.000 E	
STR-D	46 06.343 S	153 05.543 E	
STR-D	46 46.778 S	148 59.315 E	
STR-D	48 09.567 S	144 29.600 E	
STR-F	46 53.067 S	152 46.633 E	
STR-F	47 22.767 S	150 29.617 E	
STR-F	47 45.300 S	149 55.317 E	
STR-F	48 04.000 S	149 01.000 E	
STR-G	47 30.817 S	152 47.667 E	
STR-G	47 47.700 S	151 52.708 E	
STR-G	48 04.583 S	150 57.750 E	
STR-G	48 05.950 S	150 53.833 E	
STR-G	48 07.317 S	150 50.117 E	
STR-G	48 08.517 S	150 46.233 E	
STR-G	48 10.765 S	150 38.373 E	
STR-H	48 51.550 S	152 52.083 E	
STR-H	49 32.250 S	150 47.000 E	
STR-I	50 21.250 S	152 26.600 E	
STR-I	49 00.967 S	149 59.183 E	
STR-J	49 00.867 S	150 03.650 E	
STR-J	50 42.333 S	149 31.917 E	
STR-K	46 46.833 S	151 53.700 E	
STR-K	47 01.867 S	150 37.317 E	
STR-K	47 33.800 S	149 03.100 E	
STR-L	49 18.517 S	151 36.183 E	
STR-L	48 15.467 S	150 47.883 E	

STR-L	46 42.417 S	148 57.367 E	
STR-M	43 45.533 S	151 10.067 E	
STR-M	45 00.000 S	149 55.167 E	
STR-M	46 10.233 S	148 00.333 E	
STR-R	48 23.842 S	149 02.663 E	
STR-R	48 30.000 S	149 06.700 E	ODP site STR02A
STR-R	48 38.500 S	149 13.000 E	
STR-S	48 33.550 S	148 55.550 E	
STR-S	48 30.000 S	149 06.700 E	ODP site STR02A
STR-S	48 26.703 S	149 17.622 E	

Appendix 6

Sonobuoy Deployments

Note: the end shots and times refer only to the end of onboard monitor displays - data continues to be recorded by the system.

No.	UTC time	Line	Shot	Latitude	Longitude	Comment
1	15.2040	STR-C	2613	43 54.542	149 49.520	never transmitted
2	15.2050	STR-C	2641	43 54.986	149 50.367	
	15.2059		2668	43 55.357	149 51.152	early end
3	20.0108	STR-D	4454	46 32.243	150 28.143	
	20.0436		5066	46 36.067	150 04.846	
4	23.2103	STR-K	3140	46 51.594	151 29.553	
	24.0013		3750	46 56.142	151 06.471	
5	24.1539	STR-K	6880	47 17.786	149 50.463	
	24.1558		6940	47 18.492	149 48.357	early end
6	24.1605	STR-K	6962	47 18.773	149 47.552	
	24.1923		7577	47 26.171	149 25.683	early end
7	25.1558	STR-S	1001	48 33.732	148 54.979	
	25.1902		1610	48 26.629	149 17.273	early end
8	32.1328	STR-L	3724	48 13.267	150 45.241	
	32.1624		4310	48 01.014	150 30.515	
9	37.0928	STR-D	12176	47 24.539	146 59.191	
	37.1228		12746	47 30.869	146 36.560	
10	39.0241	STR-M	3004	47 22.929	146 01.381	
	39.0543		3596	47 14.354	146 21.198	
11	41.1640	STR-M	9950	46 09.822	148 43.256	
	41.1741		10140	46 05.522	148 47.726	early end
12	41.1748	STR-M	10160	46 05.021	148 48.223	
	41.2148		10930	45 48.175	149 05.684	
13	42.0556	STR-M	12513	45 13.540	149 41.262	
	42.0930		13202	44 58.463	149 56.639	
14	45.2100	STR-A	2740	43 09.445	151 06.400	

	45.2308		3131	43 16.658	150 55.856	cable GFI
15	46.2210	STR-A	5815	43 47.705	150 10.191	
	46.2237		5898	43 49.235	150 07.929	cable GFI
16	47.1959	STR-A	8066	43 50.837	150 05.556	
	47.2053		8212	43 55.018	149 59.360	1° dogleg
	47.2119		8280	43 56.301	149 57.543	
	47.2145		8349	43 57.608	149 55.707	3° dogleg
	47.2205		8397	43 58.449	149 54.339	2° dogleg
	47.2242		8499	44 00.337	149 51.563	

Appendix 7

Preliminary Law of the Sea Parameter List

Note that the parameters given were interpreted on board, and are subject to modification following final data processing and interpretation.

Parameter definitions are:

SOL	- start of line;
EOL	- end of line;
FoS	- potential foot of slope;
2500 m	- 2500 metre isobath; and
Hedberg	- potential Hedberg Line position.

Depths are in meters, sediment thickness in milliseconds of seismic two-way-time, SP is survey shot point, UTC is time in Universal Time Constant, and positions are given with reference to the WGS84 datum.

Line No.	Name	LOS parameter	Depth	SP	Sediment	Latitude	Longitude	UTC	Comments
202/0101	STR-C	SOL	3493	1000	2000	43 29.994	149 00.000	15.1121	
		2500 m		3525	500 ?	44 08.217	150 18.181	16.0142	just crossed it
		FoS	4311	6580	0	44 38.573	151 22.843	16.1850	formed by sed wedge against slope
		Hedberg	4688	8810	800	45 11.423	152 33.474	17.0643	
		EOL	4645	9039	1000	45 14.863	152 40.894	17.0803	
202/0201	STR-D	SOL	4400	1001	200	46 10.705	152 39.098	19.0552	
		Hedberg	4700	3470	800	46 26.157	151 05.265	19.1952	from seamount FoS
		Hedberg	4606	4510	1200	46 32.646	150 25.723	20.0125	
		FoS	4202	5700	0	46 40.015	149 40.696	20.0814	base of seamount
		FoS	3211	6740	1300	46 46.494	149 1.063	20.1420	
		2500 m		7015	400	46 49.411	148 50.837	20.1551	
		EOL	1249	7600	100-200	46 55.871	148 30.053	20.1901	
202/0301	STR-F	SOL	1839	1001	200	48 04.004	149 01.003	21.0928	
		2500 m		2720	0	47 41.303	150 01.417	21.1851	
		FoS	4028	3450	100	47 27.924	150 21.783	21.2250	
		EOL	3510	3750	0	47 22.169	150 30.514	22.0027	looping on dogleg
202/0302	STR-F	SOL	3447	4751	0	47 22.766	150 29.616	22.0446	continuation of 202/0301 after dogleg
		2500		4875	0	47 21.809	150 34.086	22.0528	towards seamount
		2500		5242	0	47 18.739	150 48.283	22.0744	down off seamount
		2500		5675	0	47 15.281	151 04.260	22.1017	towards seamount
		2500		5920	0	47 13.284	151 13.499	22.1148	down seamount
		FoS	4600?	6300	100 ?	47 10.130	151 28.107	22.1410	outer seamount
		Hedberg	4549	8520	1150	46 51.955	152 51.746	23.0211	
		EOL	4462	8818	1150	46 49.546	153 02.807	23.0352	
202/0401	STR-K	SOL	4376	1001	1100	46 35.660	152 50.240	23.0840	
		Hedberg	4489	1190	1200	46 37.080	152 43.077	23.0947	based on outer seamount of STR-F
		Hedberg	4934	3130	800	46 51.500	151 30.029	23.2100	based on FoS1
		Hedberg	4850	3900	300	46 57.000	151 0.000	24.0100	based on FoS2
		Hedberg	4815	4100	600	46 58.759	150 53.120	24.0210	based on FoS3
		EOL	4467	4551	1200	47 02.101	150 36.112	24.0448	

202/0402	STR-K	SOL	4480	5557	1200	47 01.867	150 37.317	24.0838	
		FoS	4086	6450	?	47 12.431	150 06.253	24.1320	FoS ?
		FoS	3243	7100	> 600	47 20.438	149 42.629	24.1650	FoS ?
		FoS	3276	7280	> 200	47 22.687	149 35.998	24.1751	FoS ?
		2500		7488	100	47 25.081	149 28.914	24.1855	
		EOL	1280	8242	0	47 34.176	149 01.985	24.2250	
202/0501	STR-R	SOL	2050	1001	1200	48 21.286	149 00.256	25.0743	
		EOL	1877	1753	400	48 39.491	149 13.730	25.1140	
202/0601	STR-S	SOL	2424	1001	1200	48 33.732	148 54.979	25.1558	
		EOL	1986	1672	400	48 25.906	149 19.540	25.1921	
202/0701	STR-G	SOL	2684	1001	200	48 12.669	150 31.691	26.0500	
		FoS	4229	2040	900 ?	48 01.073	151 09.220	26.1030	inner to STR
		FoS	4437	2275	300 ?	47 58.283	151 18.297	26.1150	outer to STR
		Hedberg	4850	4250	500	47 36.237	152 30.027	26.2241	based on inner FoS
		Hedberg	4774	4490	300	47 33.450	152 39.145	26.2359	based on outer FoS
		EOL	4718	4762	300	47 30.471	152 48.799	27.0120	
		Hedberg?	4732		300	47 30.359	152 49.156	27.0123	based on outer seamount of STR-F
202/0801	STR-H	SOL	4406	1001	0	48 41.956	153 21.335	27.1709	
		Hedberg	4389	1090	0	48 43.084	153 17.941	27.1741	based on outer FoS
		Hedberg	4628	1525	800	48 48.132	153 2.510	27.2003	based on inner FoS
		FoS/EoAP	4287	3320	500	49 09.731	151 56.434	28.0544	outer to STR
		FoS	3804	3740	?	49 14.745	151 41.017	28.0805	inner to STR
		2500		4590	100	49 25.090	151 09.143	28.1310	
		EOL	2138	5225	0	49 32.620	150 45.835	28.1630	
202/0901	STR-I	SOL	2174	1001	0	49 28.714	150 49.680	28.2110	start is part way down proposed line
		2500		1160	0	49 31.770	150 55.267	28.2204	
		FoS	3626	1670	0	49 40.464	151 11.194	29.0040	
		FoS/EoAP	4039	1975	200	49 45.591	151 20.607	29.0212	
		EOL	4367	3062	400	50 04.455	151 55.429	29.0743	
202/1001	STR-J	SOL	4112	1001	0	50 47.619	149 30.226	30.0333	
		Hedberg	3525	1340	400	50 38.669	149 33.082	30.0524	to inner FoS pick
		FoS/EoAP	4194	3210	400	49 49.273	149 48.663	30.1525	outer to STR
		FoS	3609	3560	?	49 39.927	149 51.554	30.1725	inner to STR
		2500		3900	0	49 30.981	149 54.350	30.1916	
		EOL	1510	5071	0	49 00.024	150 03.929	31.0135	
202/0902	STR-I	SOL	1476	1001	0	49 00.970	149 59.180	31.0649	
		EOL	2269	2633	0	49 29.268	150 50.696	31.1526	
202/1101	STR-L	SOL	3107	1001	0	49 18.519	151 36.178	31.2300	
		2500 m		4750	0	47 51.795	150 19.440	32.1841	seamount peak ?
		EOL	2920	4845	0	47 49.713	150 16.958	32.1912	gun maintenance
202/1102	STR-L	SOL	2939	5846	0	47 49..691	150 16.933	33.0023	first chargeable SP
		EOL	3107	8240	1400 ?	46 59.368	149 17.266	33.1440	bad sea state
202/1103	STR-L	SOL	3102	9241	1000	46 59.347	149 17.242	34.0654	first chargeable SP
		EOL	3166	10570	1000 ?	46 31.415	148 44.483	34.1458	bad sea state
202/1104	STR-L	SOL	3175	11271	1000 ?	46 37.709	148 51.855	35.1659	first chargeable SP
		EOL	3368	12378	800	46 14.426	148 24.753	35.2253	
202/0202	STR-D	SOL	1259	8565	0	46 55.474	148 31.304	36.1326	
		EOL	901	9671	100	47 07.840	147 51.319	36.2013	loss of navigation
202/0203	STR-D	SOL	904	10530	100	47 06.224	147 56.626	36.2359	
		2500 m		13320	600 ?	47 37.289	146 15.602	37.1536	
		FoS	4274	14580	0	47 51.392	145 29.450	37.2240	
		EOL	4335	15900	0	48 05.970	144 41.443	37.0531	cable problems
202/1201	STR-M	SOL	3296	1001	0	47 51.955	144 53.945	38.1626	
		FoS	4028	1950	0	47 38.088	145 26.242	38.2120	
		2500 m		3325	0	47 18.307	146 12.062	39.0418	
		EOL	1284	5470	1000	46 47.329	147 23.273	39.1541	bad sea state

202/1202	STR-M	SOL	1304	6365	200	46 48.721	147 20.091	40.1900	
		EOL	2185	7750	800 ?	46 28.655	148 5.880	41.0304	cable GFI
202/1203	STR-M	SOL	2155	8715	200	46 29.163	148 04.727	41.1032	
		2500 m		9060	700	46 23.888	148 16.696	41.1223	
		EOL	3581	13400	1400	44 54.305	150 00.875	42.1030	cable GFI
202/1204	STR-M	SOL	3617	14345	1500 ?	44 55.335	149 59.825	43.0253	
		EOL	3338	14641	1500 ?	44 48.854	150 06.398	43.0424	cable GFI
202/1205	STR-M	SOL	3381	15606	1500 ?	44 49.623	150 05.627	43.1517	
		EOL	3054	17206	1000 ?	44 14.603	150 40.979	44.0005	loss of cable control
202/1206	STR-M	SOL	2888	17971	1200	44 19.743	150 35.801	44.0640	
		FoS	4194	20010	400 ?	43 34.838	151 20.713	44.1853	
		EOL	4283	21166	1000	43 09.809	151 45.479	45.0111	
202/1301	STR-A	SOL	4491	1001	1400	42 37.380	151 53.062	45.1132	
		FoS?	4394	1550	400	42 47.770	151 37.990	45.1440	base of seamount
		2500 m		1800	0	42 52.217	151 31.505	45.1557	going up seamount
		2500 m		2020	0	42 56.200	151 25.722	45.1706	going down seamount
		FoS ?	4098	2510	600	43 05.231	151 12.550	45.1945	
		EOL	3546	3131	1000	43 16.658	150 55.856	45.2308	cable GFI
202/1302	STR-A	SOL	3669	4055	1000	43 15.525	150 57.903	46.1256	
		EOL	2622	5898	1300	43 49.235	150 07.929	46.2237	cable GFI
202/1303	STR-A	SOL	2630	6841	1000	43 48.175	150 09.471	47.1338	
		EOL	2607	7077	800	43 52.541	150 03.058	47.1453	cable problems
202/1304	STR-A	SOL	2616	7985	800	43 50.837	150 05.556	47.1930	
		EOL	2680	8499	1400	44 00.337	149 51.563	47.2242	

Appendix 8

Weather Diary

Compilation of 6-hourly weather observations made by the Bridge, RV *Rig Seismic*. Note that blank entries indicate that no measurement was taken.

Date	Time (UTC)	Lat	Long	Temperature Dry	Wet (C°)	Sea	Wind Dir.	Speed (knts)	Waves Sea	Swell	Pressure (mbars)
15-Jan	0:00	43.40	148.70	12.0	10.5	14.5	230	40		6.0	1007.8
	6:00	43.30	148.60	13.0	11.1	17.5	180	28	5.0	6.0	1016.2
	12:00	43.60	149.10	12.0	10.5	14.8	180	18			1019.8
	18:00	43.80	149.60	11.0	9.0	14.6	70	10	2.0	6.0	1020.3
16-Jan	0:00	44.10	150.20	13.5	11.5	13.9	330	20	2.0	5.0	1019.2
	6:00	44.30	150.70	16.5	15.5	15.5	320	20	2.0	4.0	1017.7
	12:00	44.40	150.80	15.0	15.0	14.6	320	10			1017.6
	18:00	44.60	151.30	14.1	14.1	14.8	340	10	2.0	4.0	1014.3
17-Jan	0:00	44.90	151.90	15.0	15.0	13.9	340	10	2.0	4.0	1012.3
	6:00	45.10	152.50	15.0	15.0	14.5	360	28	4.0	4.0	1006.3
	12:00	45.60	152.70	16.0	15.4	14.0	360	35			999.7
	18:00	46.00	152.70	14.1	13.1	14.3	280	25	4.0	5.0	991.7
18-Jan	0:00	46.10	152.60	18.0	16.3	14.0	280	40	6.0	5.0	991.0
	6:00	46.20	152.70	11.9	10.8	14.0	260	40	8.0	11.0	1003.4
	12:00	46.20	152.40	10.0	7.5	11.0	240	26			1013.3
	18:00	46.20	152.60	10.5	8.0	12.0	210	24	3.0	8.0	1016.5
19-Jan	0:00	46.10	153.00	11.5	10.0	11.4	210	15	3.0	6.0	1014.4
	6:00	46.20	152.60	12.5	10.5	12.5	280	14	2.0	5.0	1018.7
	12:00	46.30	152.00	12.0	11.0	12.5	330	10			1018.2
	18:00	46.20	151.30	12.0	11.0	11.5	350	7	1.0	4.0	1015.9
20-Jan	0:00	46.50	150.60	11.5	11.0	12.0	270	7	1.0	1.0	1017.1
	6:00	46.60	149.90	14.5	13.8	13.0	270	13	1.0	1.0	1016.9
	12:00	46.70	149.30	13.0	13.0	12.2	280	18			1017.8
	18:00	46.90	148.60	13.0	12.5	12.5	290	20	3.0	5.0	1016.8
21-Jan	0:00	47.40	148.50	13.5	13.0	14.0	270	15	3.0	4.0	1017.3
	6:00	47.90	148.70	13.8	13.5	13.6	290	20	3.0	5.0	1016.4
	12:00	48.00	149.30	12.5	12.0	12.2	310	22			1015.2
	18:00	47.60	150.00	12.0	12.0	12.8	360	24	3.0	5.0	1011.8
22-Jan	0:00	47.40	150.40	12.6	12.4	11.5	10	30	4.0	7.0	1008.3
	6:00	47.30	150.60	13.0	13.0	11.7	350	35	5.0		1003.2
	12:00	47.20	151.20	12.0	12.0		350	40			1000.9
	18:00	47.10	151.90	12.1	12.1	12.2	320	20	3.0	6.0	996.8
23-Jan	0:00	46.90	152.60	10.6	8.6	13.0	240	25	4.0	6.0	1004.8
	6:00	46.70	153.00	10.8	9.5	13.0	210	20	4.0	5.0	1010.8
	12:00	46.70	152.50	11.5	10.0	12.2	220	10			1015.0
	18:00	46.80	151.90	12.0	10.0	12.6	340	12	1.0	4.0	1015.8
24-Jan	0:00	46.90	151.20	13.0	11.5	12.6	350	10	1.0	3.0	1016.9
	6:00	47.00	150.60	13.2	12.0	12.4	350	14	2.0	3.0	1017.3
	12:00	47.10	150.30	12.4	12.0	12.0	350	10			1019.1

	18:00	47.40	149.60	12.8	12.0	12.3	270	5	1.0	4.0	1019.2
25-Jan	0:00	47.70	149.00	11.0	10.7	12.6	270	10	1.0	2.0	1020.5
	6:00	48.20	148.90	12.9	11.4	13.5	250	16	2.0	3.0	1018.8
	12:00	48.70	149.20	11.5	11.0	12.5	290	12			1019.2
	18:00	48.50	149.10	11.0	10.6	12.6	290	14	2.0	4.0	1015.7
26-Jan	0:00	48.30	150.00	11.4	11.1	12.9	300	12	2.0	3.0	1014.3
	6:00	48.20	150.60	14.8	13.2	12.5	220	12	1.0	3.0	1012.1
	12:00	47.90	151.30	11.0	11.0	12.0	360	12			1012.2
	18:00	47.80	152.00	11.5	11.5	12.4	200	8	1.0	4.0	1009.2
27-Jan	0:00	47.60	152.70	12.0	11.5	14.1	270	5		3.0	1007.9
	6:00	47.80	152.90	12.7	12.3	12.8	300	16	2.0	4.0	1005.3
	12:00	48.30	153.20	12.5	12.0	12.5	290	15			1004.0
	18:00	48.70	153.20	12.3	11.6	12.5	290	15	2.0	4.0	1001.6
28-Jan	0:00	49.00	152.60	11.4	11.2	12.0	220	18	2.0	4.0	1001.2
	6:00	49.20	151.90	10.0	8.2	11.7	180	7	1.0	5.0	1002.0
	12:00	49.40	151.30	9.0	7.7	11.7	260	10			1001.6
	18:00	49.50	150.60	8.6	6.6	11.5	310	9	1.0	4.0	997.7
29-Jan	0:00	49.70	151.10	10.0	9.0	11.0	340	15	1.0	4.0	995.3
	6:00	50.00	151.70	10.6	10.5	11.0	340	25	3.0	4.0	991.1
	12:00	50.30	151.90	10.0	10.0	10.0	270	25			989.6
	18:00	50.60	150.70	8.5	8.5	10.2	290	25	3.0	6.0	986.3
30-Jan	0:00	50.90	149.70	8.0	7.0	9.9	220	28	3.0	6.0	988.0
	6:00	50.60	149.60	8.2	7.5	9.6	290	33	5.0	7.0	991.3
	12:00	50.10	149.70	8.5	8.0		270	30			1002.4
	18:00	49.60	149.90	8.5	7.5		240	28	5.0	10.0	1009.7
31-Jan	0:00	49.10	150.00	10.2	9.8	10.8	280	25	5.0	8.0	1013.7
	6:00	49.00	149.90	12.0	11.1	10.6	310	20	3.0	7.0	1012.8
	12:00	49.30	150.50	10.0	11.0	10.8	380	25			1012.5
	18:00	49.50	151.20	10.7	10.2	11.0	310	25	4.0	7.0	1011.0
1-Feb	0:00	49.70	151.60	10.2	10.1	10.6	310	18	3.0	6.0	1013.5
	6:00	48.80	151.20	11.6	11.5	12.2	300	17	2.0	5.0	1016.2
	12:00	48.30	150.90	11.5	11.5	10.9	340	12			1017.6
	18:00	47.90	150.40	12.2	12.0	11.8	360	15	2.0	5.0	1014.1
2-Feb	0:00	47.90	150.30	12.0	11.6	12.1	20	22	4.0	5.0	1010.1
	6:00	47.50	149.90	14.0	13.5	12.2	360	28	6.0		999.7
	12:00	47.10	149.50	14.0	13.5	13.0	310	28			998.2
	18:00	46.90	149.10	12.1	10.5	13.0	290	35	6.0	9.0	1002.9
3-Feb	0:00	46.80	149.00		10.0	13.0	290	23	6.0	9.0	1008.7
	6:00	47.00	149.30	14.5	11.5	13.2	320	25	5.0	9.0	1009.7
	12:00	46.70	148.90	13.5	12.0	13.2	320	32			1009.5
	18:00	46.40	148.60	15.0	13.5	13.5	310	28			1010.0
4-Feb	0:00	46.70	148.90	14.0	13.5	12.9	290	18	4.0	6.0	1012.4
	6:00	46.70	149.00	15.0	14.0	13.0	310	27	5.0	8.0	1012.6
	12:00	46.70	149.10	13.0	12.5	12.5	310	18			1012.8
	18:00	46.60	148.80	12.2	12.0	12.8	260	18	3.0		1013.2
5-Feb	0:00	46.20	148.50	14.3	12.4	14.0	200	18			1015.4
	6:00	46.50	148.70	14.0	12.0	13.4	340	16			1016.2
	12:00	46.80	148.70	13.0	12.5	13.5	340	15			1016.7
	18:00	47.10	148.10	12.2	11.0	13.5	260	14			1016.7

6-Feb	0:00	47.10	148.00	14.2	11.4	13.8	260	15	2.0	5.0	1020.0
	6:00	47.30	147.30	14.0	11.5	14.0	320	18	2.0	5.0	1020.6
	12:00	47.50	146.70	13.0	11.8	13.8	320	18			1019.9
	18:00	47.70	146.70	12.6	10.5	14.0	360	20			1014.0
7-Feb	0:00	47.90	145.40	13.0	12.0	12.9	290	18	2.0	5.0	1008.8
	6:00	48.10	144.70	11.5	10.1	12.7	260	15	3.0	6.0	1003.6
	12:00	48.10	145.00	11.0	9.5	11.0	300	18			1003.8
	18:00	47.80	150.00	11.4	8.9	12.5	240	20			1003.1
8-Feb	0:00	47.50	145.70	11.8	8.3	11.0	240	25	3.0	5.0	1004.6
	6:00	47.20	146.40	11.4	9.8	14.1	260	28	4.0	4.0	1005.6
	12:00	46.80	147.00	12.5	11.5	13.5	280	35			1006.6
	18:00	46.70	147.50	12.5	12.0	13.8	270	38			1007.9
9-Feb	0:00	46.70	147.20	13.8	12.0	12.7	240	33	4.0	8.0	1014.3
	6:00	46.80	147.20	13.4	10.8	12.4	240	24	3.0	8.0	1020.0
	12:00	46.90	147.10	12.0	10.0	12.0	230	12			1023.7
	18:00	46.90	147.20	11.5	11.0	12.6	320	17			1023.3
10-Feb	0:00	46.60	147.80	14.4	13.5	14.8	320	30	3.0	8.0	1022.2
	6:00	46.50	148.30	14.8	14.5	13.3	300	17	3.0	7.0	1019.4
	12:00	46.50	148.10	14.3	13.3	15.0	300	15			1019.4
	18:00	46.10	148.80	14.3	14.0	14.8	300	14			1018.3
11-Feb	0:00	45.60	149.20	15.0	14.5	15.5	320	12	2.0	4.0	1013.1
	6:00	45.20	149.70	15.8	15.5	15.0	340	10	1.0	4.0	1015.2
	12:00	44.90	150.10	18.3	17.9	16.8	360	20			1013.6
	18:00	45.00	150.00	17.3	17.0	16.2	350	30			1007.5
12-Feb	0:00	45.10	150.00	15.5	15.5	14.6	330	12	2.0	4.0	1004.1
	6:00	44.80	150.20	16.0	16.0	15.0	250	15	2.0	6.0	1001.6
	12:00	44.90	150.10	14.4	14.4	15.0	260	32			1003.2
	18:00	44.60	150.30	13.6	13.6	15.2	260	33			1007.8
13-Feb	0:00	44.30	150.60	12.5	14.5	15.1	260	20	4.0	8.0	1012.4
	6:00	44.40	150.50	15.0	14.9	15.3	310	33	5.0	8.0	1009.9
	12:00	44.00	150.90	16.0	15.9	15.0	320	36			1008.4
	18:00	43.60	151.30	16.4	15.9	15.3	310	20			1009.5
14-Feb	0:00	43.30	151.70	17.0	15.6	18.5	290	15	4.0	8.0	1013.3
	6:00	42.80	151.90	16.9	13.5	18.0	220	17	2.0	9.0	1015.5
	12:00	42.60	151.90	16.5	13.5	16.2	130	12			1015.5
	18:00	43.00	151.30	15.7	15.0	18.0	130	10	1.0	7.0	1010.1
15-Feb	0:00	43.30	150.90	17.1	16.4	15.0	170	25	3.0	7.0	1003.3
	6:00	43.10	150.90	15.6	12.6	17.6	170	14	2.0	7.0	1013.1
	12:00	43.20	151.00	14.5	12.0	16.0	130	12			1014.1
	18:00	43.50	150.50	13.6	11.0	16.0	130	20			1008.3
16-Feb	0:00	43.80	150.10	13.1	12.6	14.5	110	20	3.0	7.0	1004.4
	6:00	43.60	150.10	11.6	10.6		190	35	5.0	6.0	1003.5
	12:00	43.70	150.20	12.0	10.0	13.0	190	35			1008.2
	18:00	43.90	150.10	12.6	10.3	13.8	250	20			1008.4

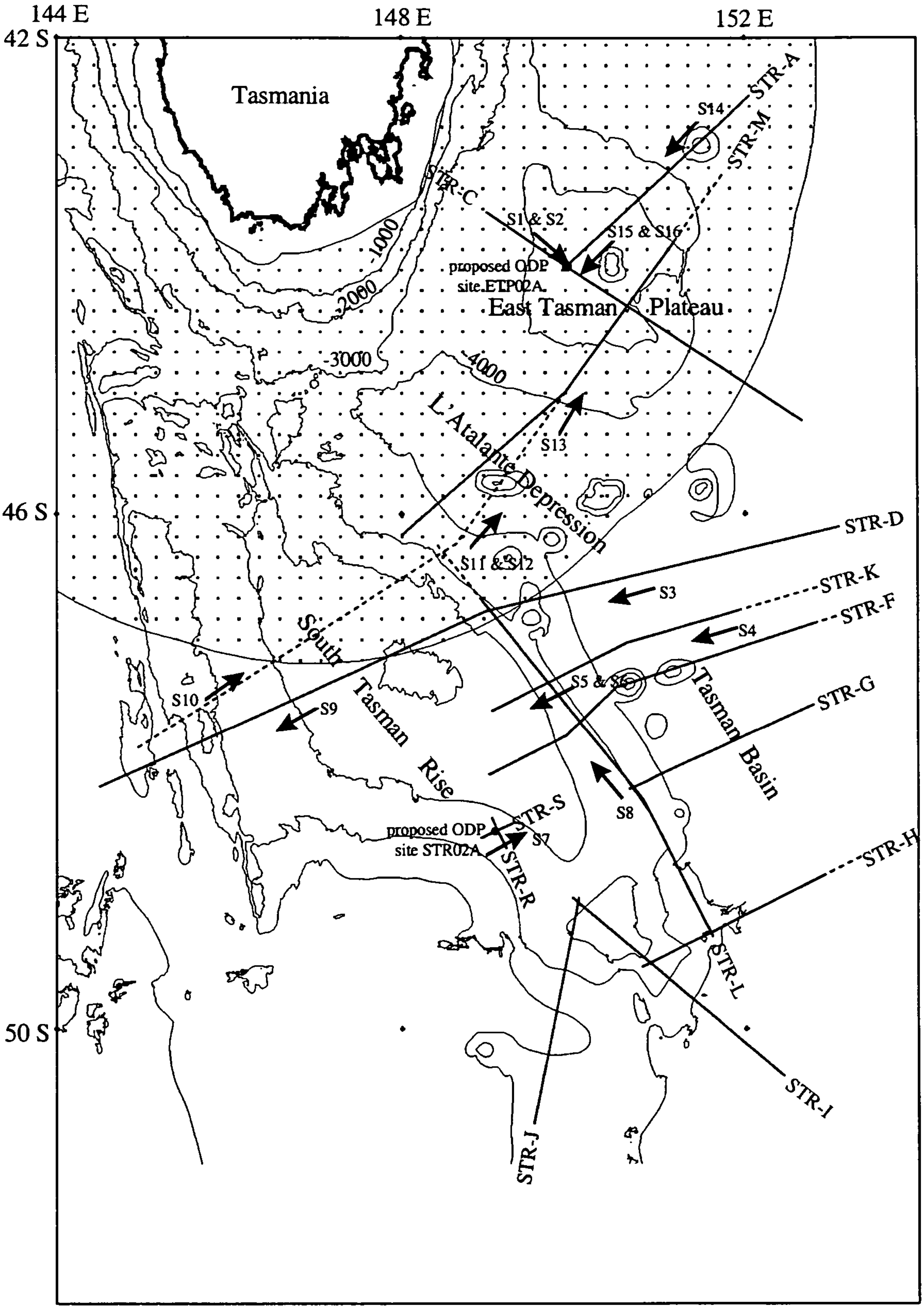
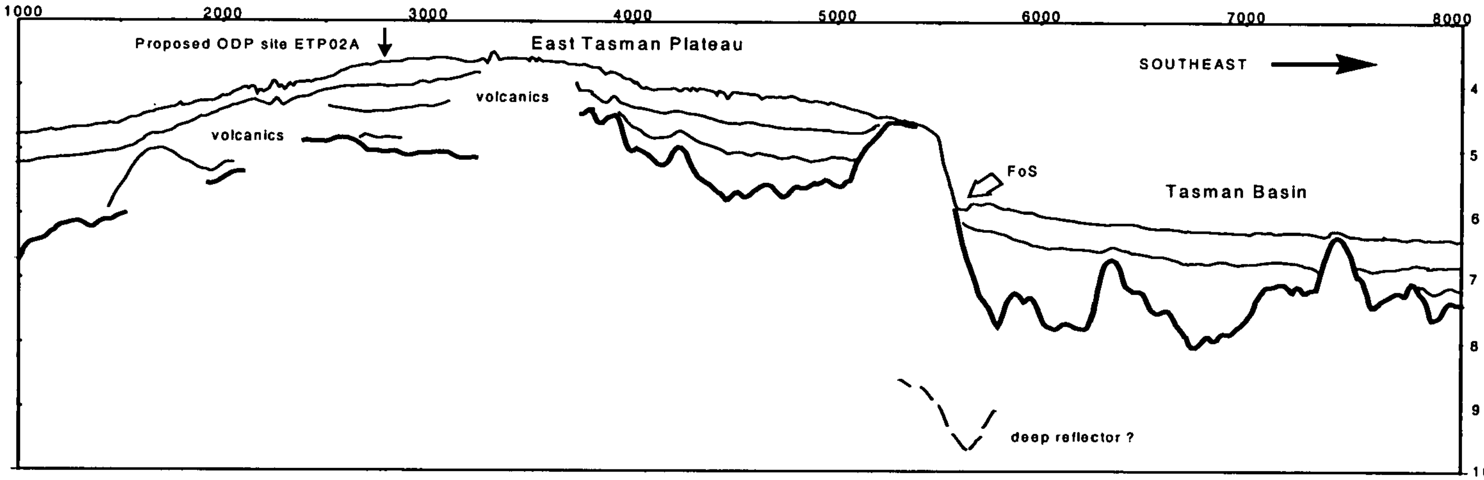
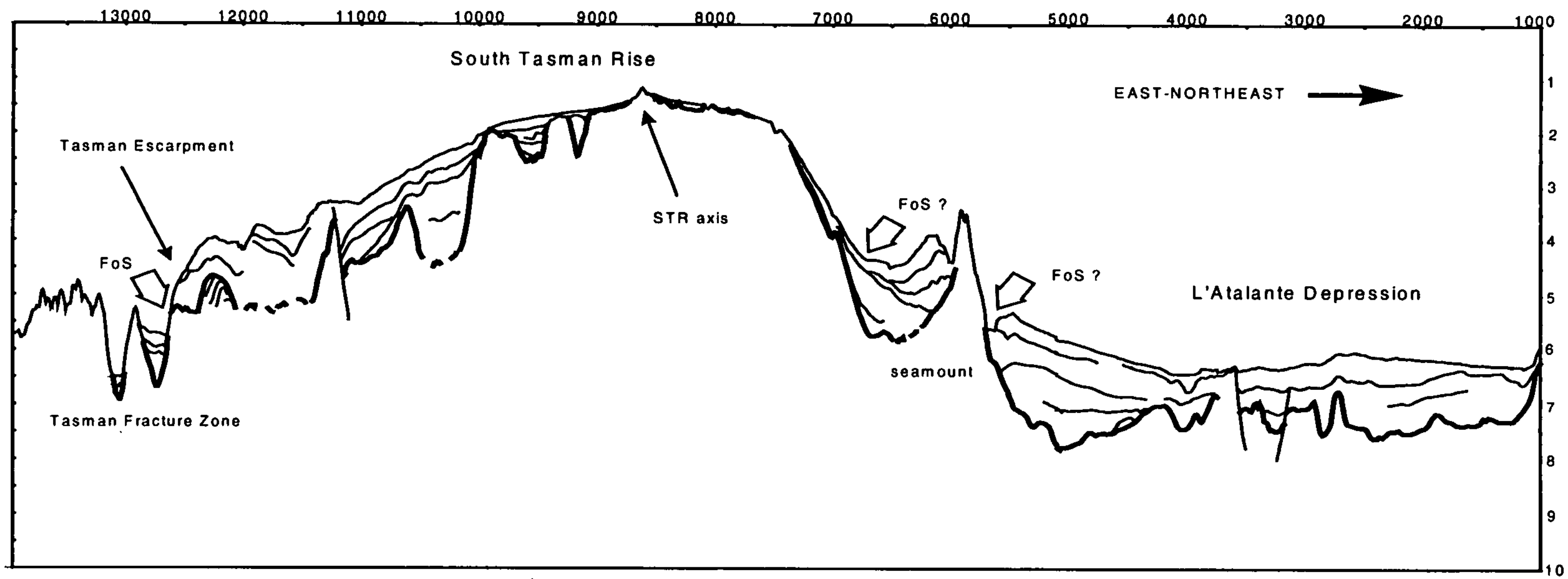


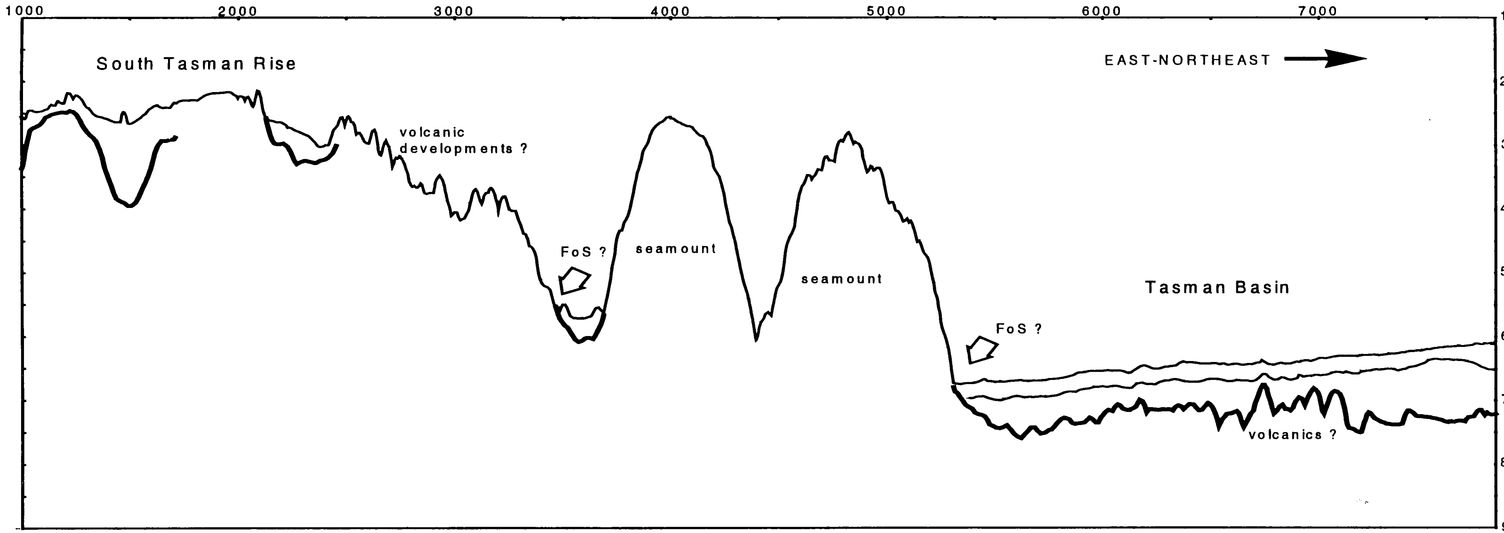
Figure 1. Map of LOS South Tasman Rise AGSO Survey 202 showing EEZ (stippled area), proposed seismic (solid), actual seismic (dashed) and main morphological features (Sx are sonobuoy positions - see Appendix 6).



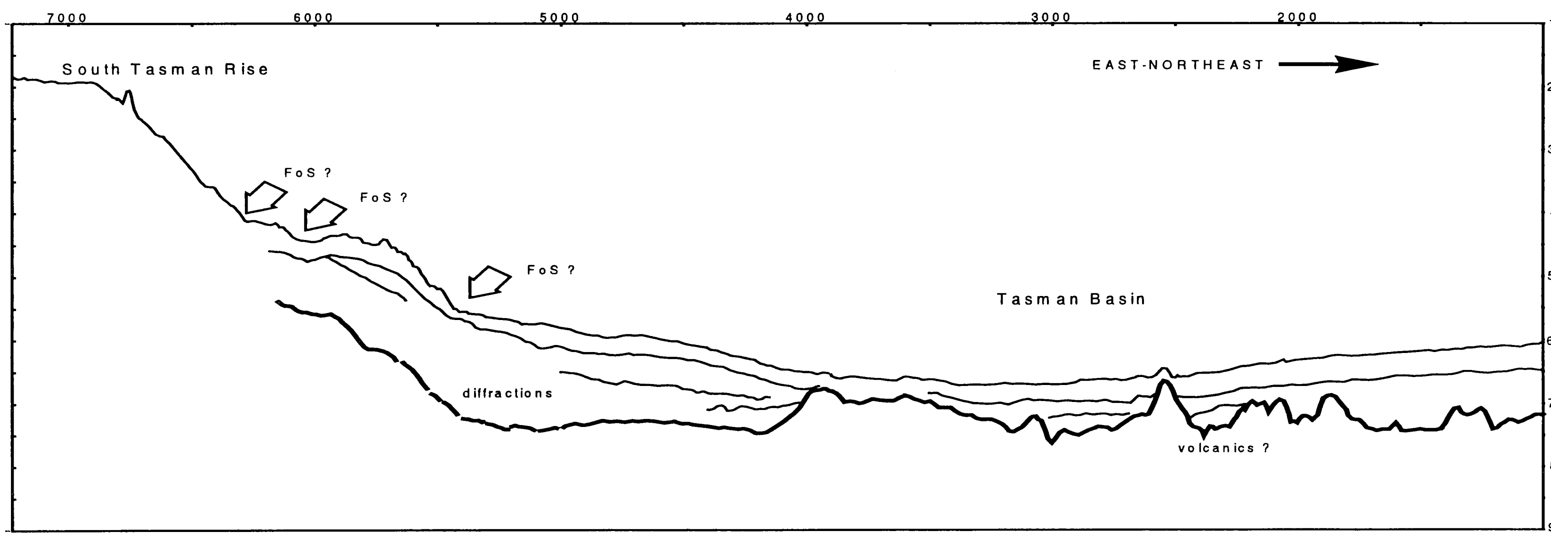
(a) Seismic line 202/01 (ie. STR-C).



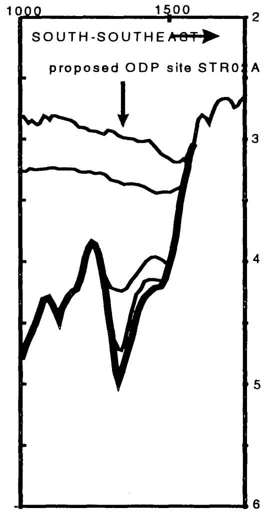
(b) Seismic line 202/02 (ie. STR-D).



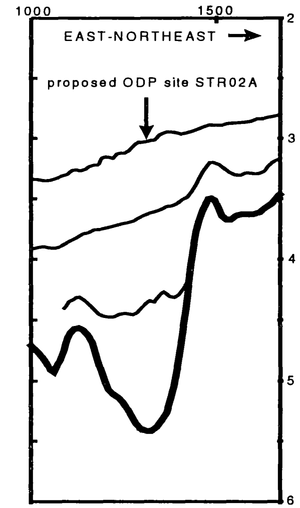
(c) Seismic line 202/03 (ie. STR-F).



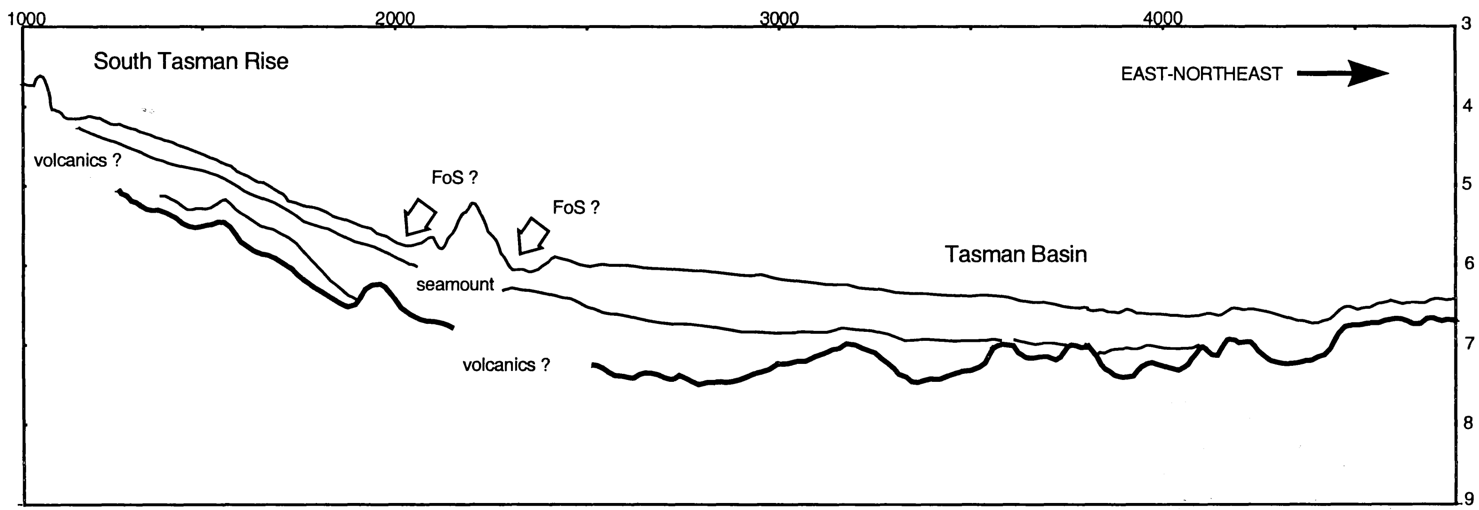
(d) Seismic line 202/04 (ie. STR-K).



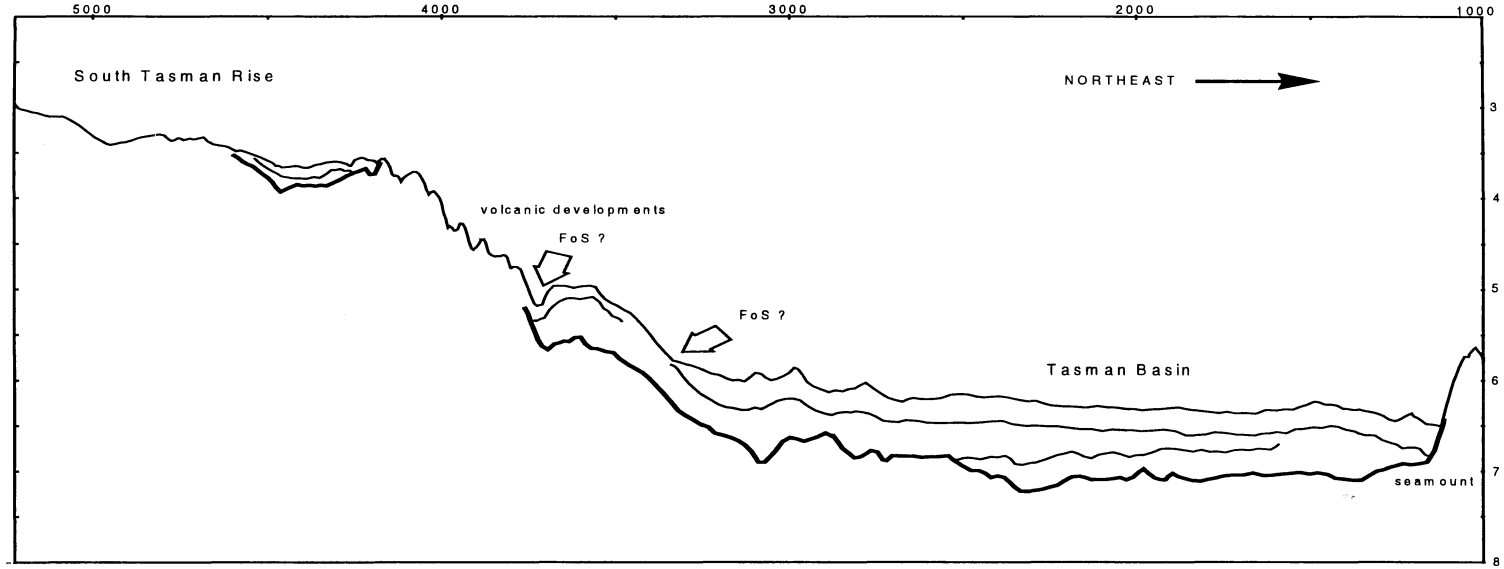
(e) Seismic line 202/05 (ie. STR-R).



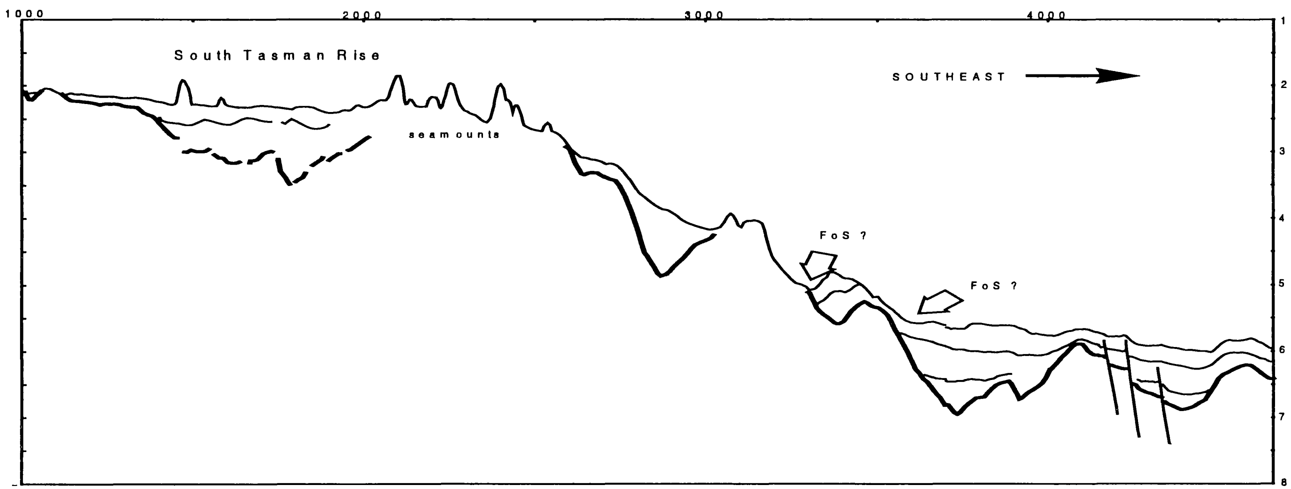
(f) Seismic line 202/06 (ie. STR-S).



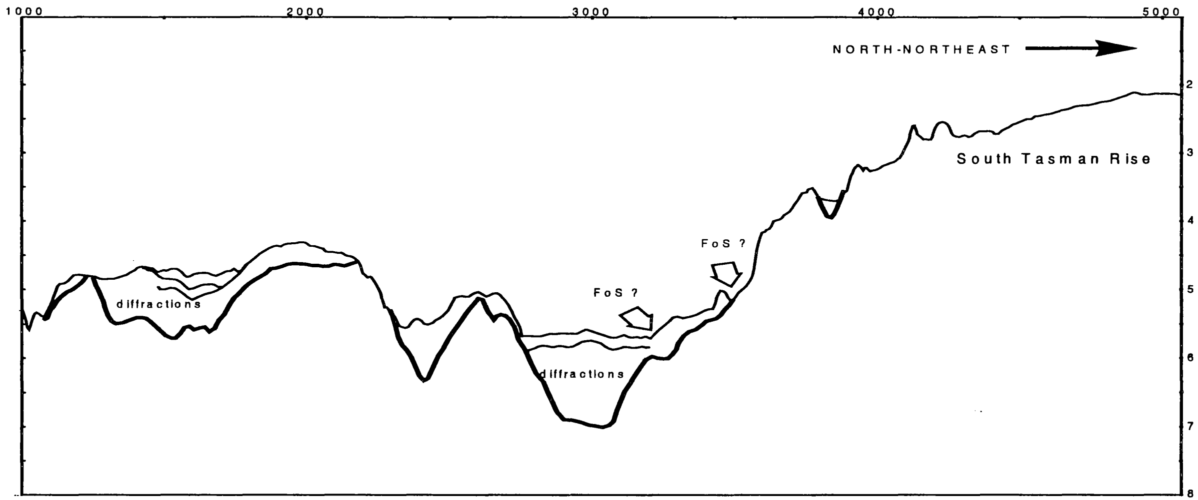
(g) Seismic line 202/07 (ie. STR-G).



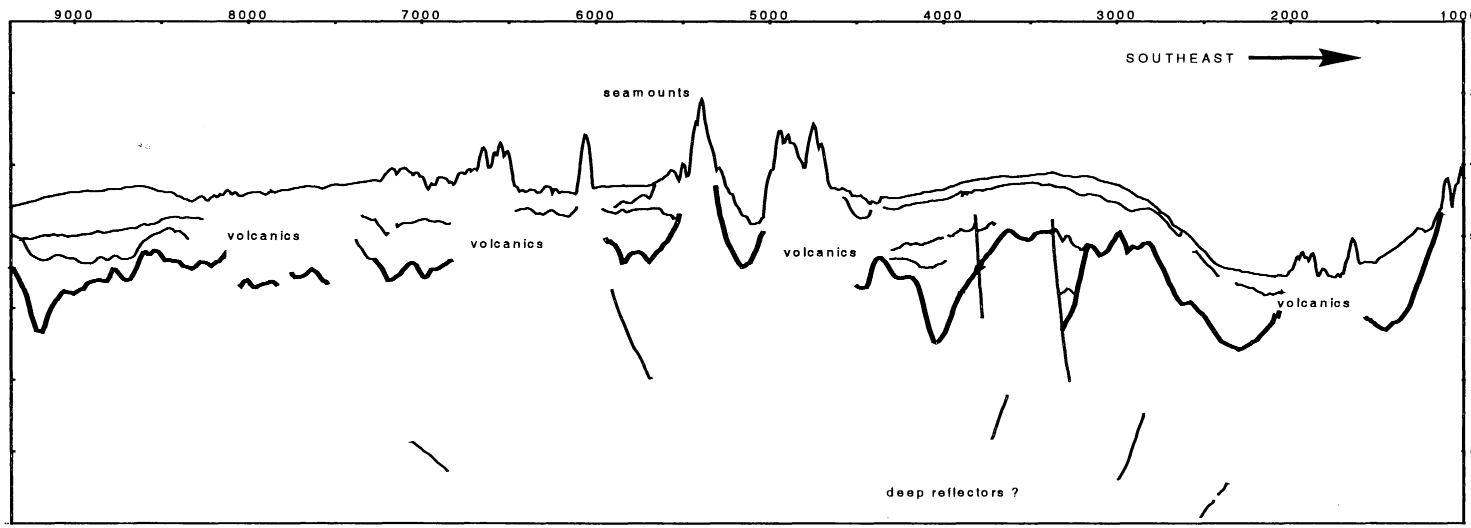
(h) Seismic line 202/08 (ie. STR-H).



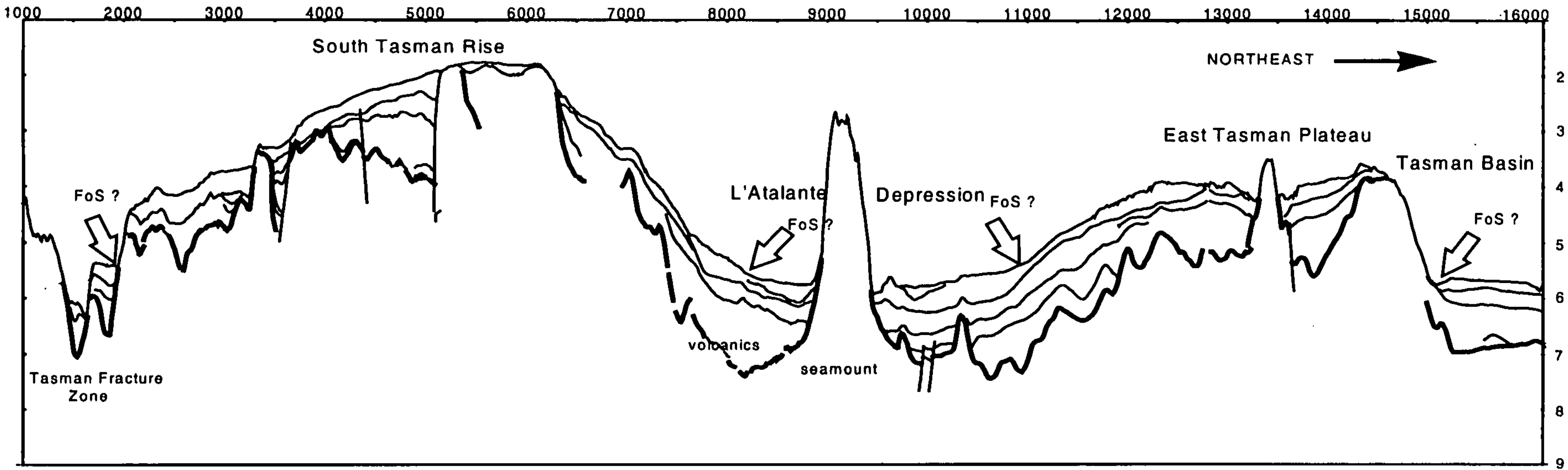
(i) Seismic line 202/09 (ie. STR-I).



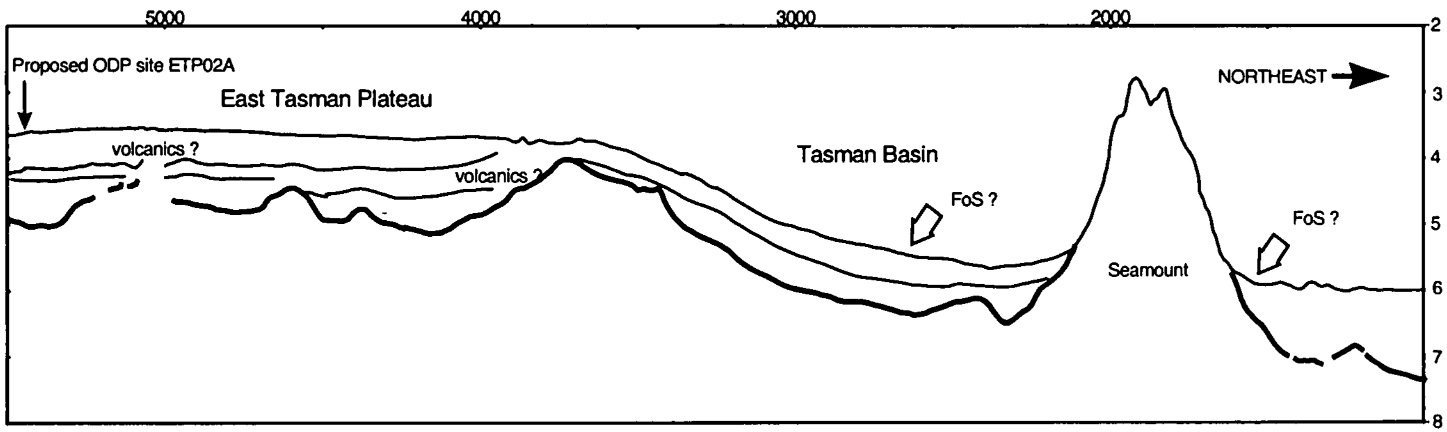
(j) Seismic line 202/10 (ie. STR-J).



(k) Seismic line 202/11 (ie. STR-L).



(l) Seismic line 202/12 (ie. STR-M).



(m) Seismic line 202/13 (ie. STR-A).

Figure 2. Line diagrams for seismic acquired. Seismic lines given in terms of shot points (1000 SPs = 50 km) and TWT in seconds.