The Expedition ANTARKTIS-XIV/4 of RV "Polarstern" in 1997

Die Expedition ANTARKTIS-XIV/4 mit FS „Polarstern" 1997

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1. Zusammenfassung

Auf dem Rückreiseabschnitt (ANT-XIV/4; Fig 1.-1) der 14. Antarktisreise von FS *Polarstern*, der am 21. März 1997 in Kapstadt begann, wurden von 13 eingeschifften Wissenschaftlern einige zusätzliche Forschungsprojekte im Kapbecken und im südlichen Angolabecken durchgeführt. Für die Untersuchung der Ausbreitung des Antarktischen Zwischenwassers (AAIW) wurde vom Institut für Meereskunde der Universität Kiel im Rahmen eines internationalen Projektes ein System von Schallquellen im Kapbecken verankert und 35 Driftkörper (RAFOS-Floats) zur Lagrangeschen Strömungsmessung ausgesetzt. Bathymetrische und sedimentakustische Untersuchungen wurden vom Fachbereich Geowissenschaften der Universität Bremen im Rahmen des von der Deutschen Forschungsgemeinschaft geförderten Sonderforschungsbereichs "*Der Südatlantik im Spätquartär: Rekonstruktion von Stoffhaushalt und Stromsystemen*" im Kapbecken und en route durchgeführt. Ergänzt wurden diese Arbeiten durch kontinuierliche Messungen zur Meridionalverteilung des atmosphärischen Aerosols über dem Atlantik. Die gesamte Reise, auch im Gebiet südlich 40 °S, war von insgesamt ruhigen Wetterverhältnissen (Fig 1.-2) begünstigt, so daß alle Projekte ohne Ausfälle wie geplant durchgeführt werden konnten. Am Morgen des 25. April lief FS *Polarstern* in Bremerhaven ein.

2. Summary and Itinerary

The return cruise of RV *Polarstern* (ANT-XIV/4, Fig 1.-1)) from Cape Town to Bremerhaven was extended by several days to carry out additional research projects in the Cape Basin. One focus was on multibeam swath sounding bathymetric and sediment acoustic measurements to trace the bottom water circulation as it is documented in the bottom sediments of the Cape Basin. These investigations were part of a long term research project of the Earth Sciences Department of the University of Bremen and AWI "*The South Atlantic in the late Quaternary: Reconstruction of sediment fluxes and current systems*". Another main focus was on physical oceanographic investigations on the drift and spreading of the Antarctic Internediate Water (AAIW) in the southeastern Atlantic Ocean. Additional investigation were carried out en route by continuously measuring the meridional distribution of atmospheric Aerosols over the Atlantic.

RV *Polarstern* departed from Cape Town in the morning of 22 March heading southwesterly for the first oceanography station which started with a CTD cast when the shelf edge was reached. Soon an efficient routine was established comprising alternating station work for CTD casts and deployment of RAFOS floats and en route dropping of Bathyythermograph sondes (XBT) and profiling for bathymetry and subbottom sounding. The first sound source mooring (K7, Fig 3.2.-1) was deployed on 24 March favoured by bright weather and calm sea. The southernmost position was reached at 43 °S, 8 °E on 27 March. More detailed information of the oceanographic station pattern is given in Fig 3.2-1while an overview of the geophysical profi

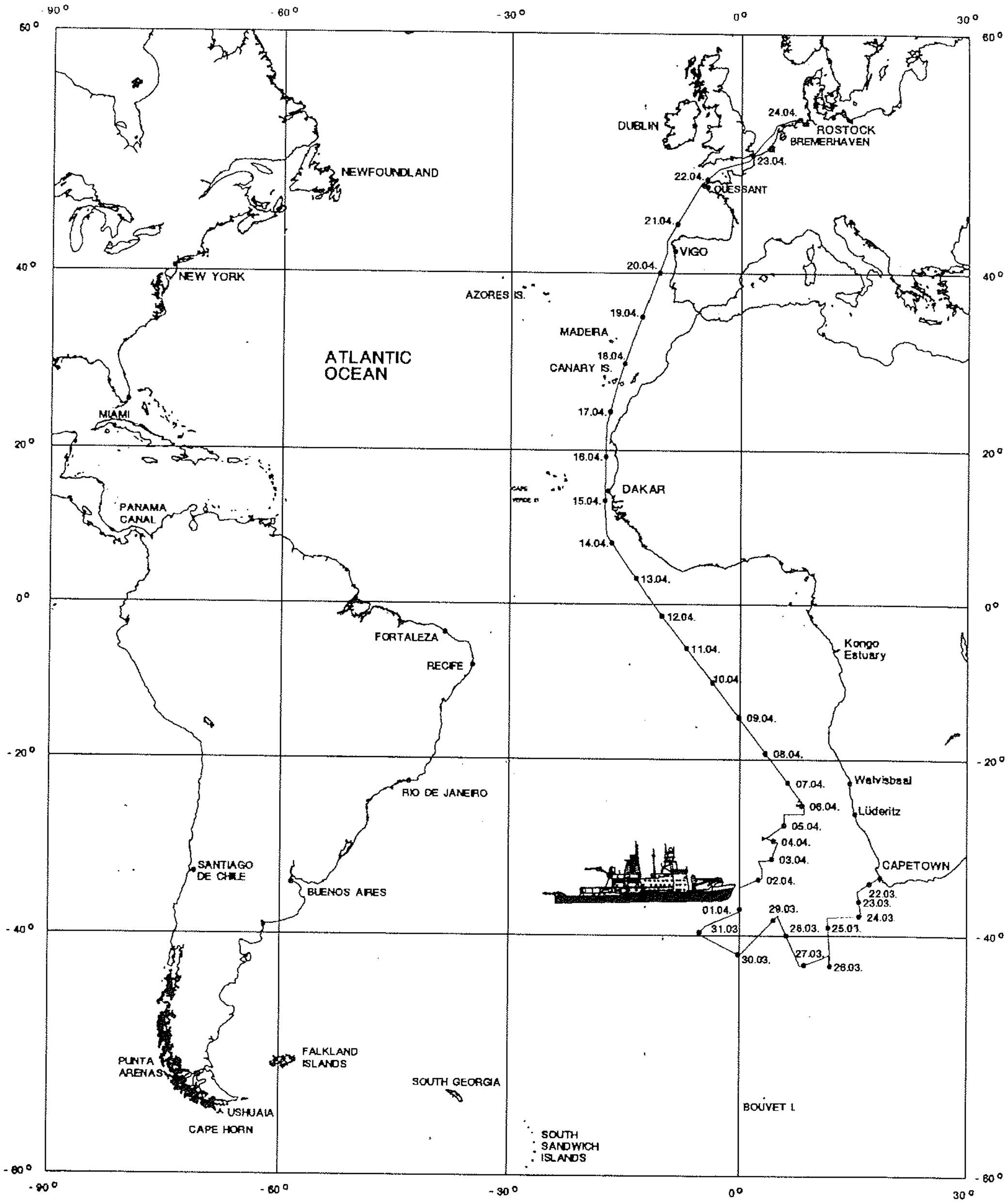

Fig. 1-1: Cruise track of RV *Polarstern* during ANT-XIV/4

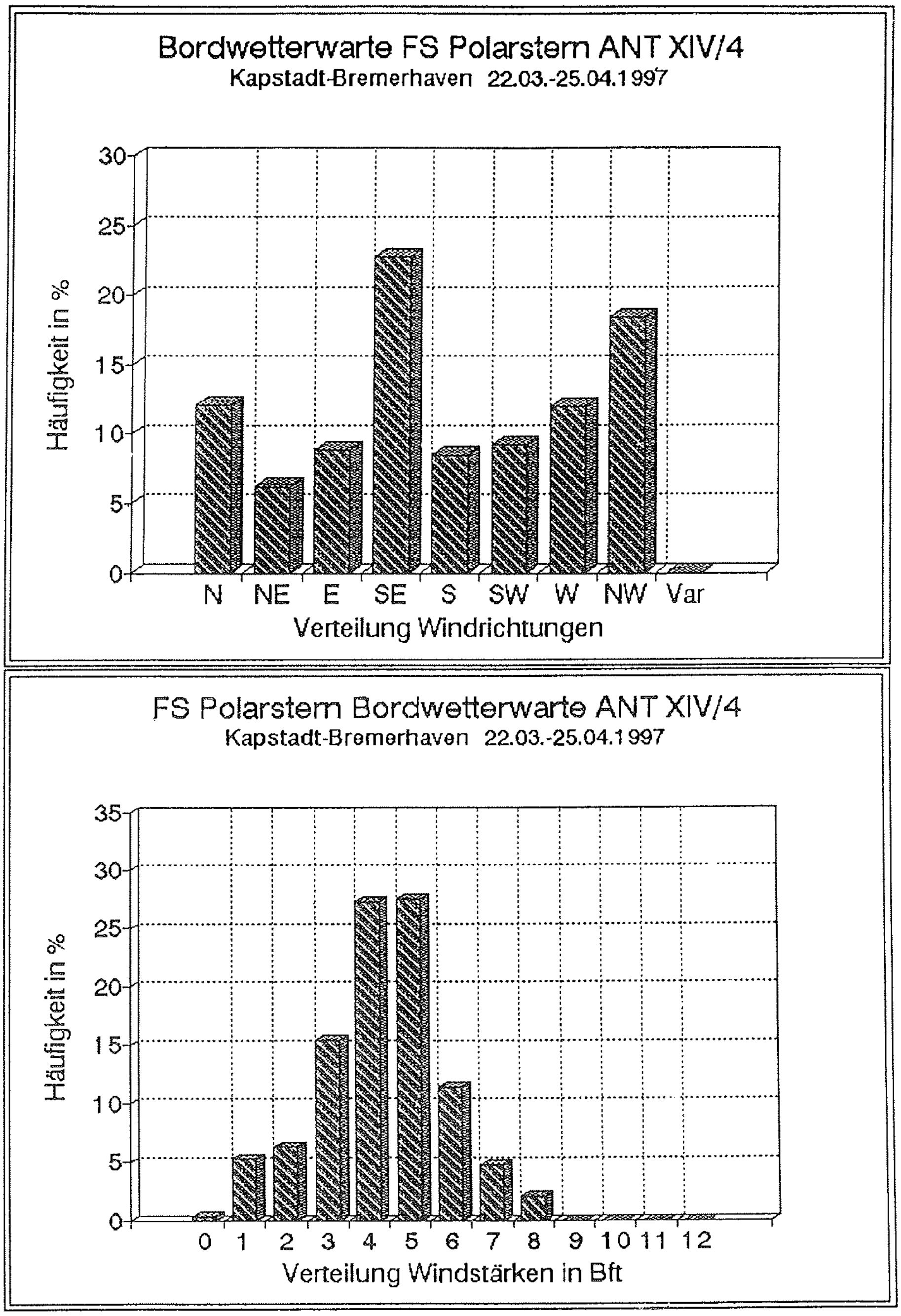

Fig. 1-2: Frequency of wind strength and direction during *Polarstern* cruise ANT-XIV/4

ling tracks are presented in Fig 3.3-1. Scientific station work was finished on 8 April when a sound source mooring was deployed in the southernmost Angola Basin for the WHOI/LDEO "Benguela Current Experiment". The following transit to Bremerhaven was favoured by predominantly fine weather only interrupted at Cape Finistere by a fresh gale. RV Polarstern arrived at her home port Bremerhaven in the early morning of 25 April to terminate her 14th Antarctic cruise.

3. Research Programmes

3.1 Meridional Distribution of the Atmospheric Aerosol

(Hartwig Gernandt, Jürgen Gräser, AWI Potsdam)

During the transect ANT-XIV/4 a meridional cross section of the spectral aerosol optical depth was obtained for the Atlantic sector under undisturbed stratospheric conditions. One of the aims of the measurements was the investigation of the influence of tropospheric transport processes on the atmospheric aerosol concentration. The aerosol concentration depends strongly on the actual wheather situation and the atmospheric transport processes. For the measurements of the spectral aerosol optical depth the Sun photometer SP2H was used. This instrument measures the direct solar light in the spectral range from 350 nm to 1100 nm at different wavelengths. Aerosol optical depth measurements were carried out from 43 °S to 51 °N, on 24 days during the cruise ANT-XIV/4. The first analysis of the measurements is completed. The uncertainty of the measurement is not more than 0,008 in the aerosol optical depth.

Figure 3.1-1 shows the meridional distribution of the spectral aerosol optical depth (daily mean values) at the wavelengths 413 nm and 866 nm. The solid and dashed lines show the mean values of both wavelengths for the northern and southern hemisphere. The mean values show very clearly the differences between the northern and southern hemisphere. The southern hemisphere is characterized by low aerosol optical depth, like 0,074 $\pm$ 0,039 at 413 nm and 0,067 $\pm$ 0,042 at 866 nm. This is a typical optical depth for background areas. But in the northern hemisphere we observed higher aerosol optical depth with high variability, like 0,229 $\pm$ 0,185 at 413 nm and 0,121 $\pm$ 0,069 at 866 nm. This is the typical behaviour of an atmosphere, which is enriched with anthropogenic or natural aerosol. Because of the ITC as border between northern and southern troposphere an exchange of tropospheric airmass cannot be seen.

Figure 3.1-2 shows the comparison of the aerosol optical depth at 413 nm between ANT-XIV/1 and ANT-XIV/4. The daily mean value for October 1996 were 0,176 $\pm$ 0,034 for the southern hemisphere and 0,344 $\pm$ 0,186 for the northern hemisphere. We found a seasonal mean difference of about 0,1 at 413 nm for both, the northern and the southern hemisphere between October and 1996 and March/April 1997. Interesting is also the extremely high value north of the ITC arround 10 °N during the cruise ANT-XIV/1 (October 1996), probably caused by transport of Sahara dust into the Atlantic region. Further analysis is necessary and will be performed in 1997/98.

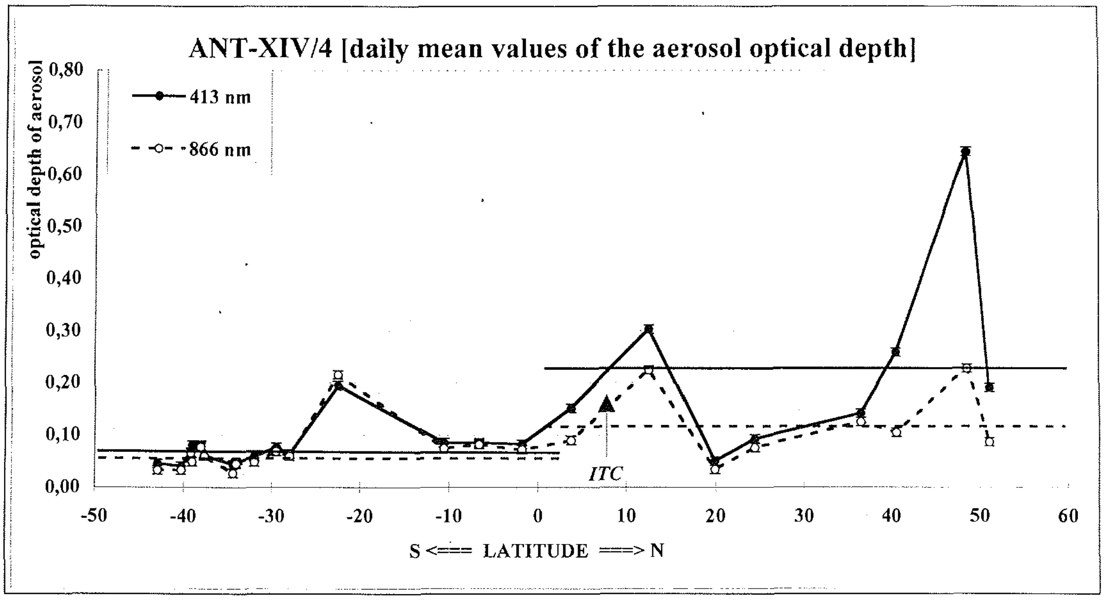

Fig. 3.1-1: Meridional distribution of the spectral aerosol optical depth

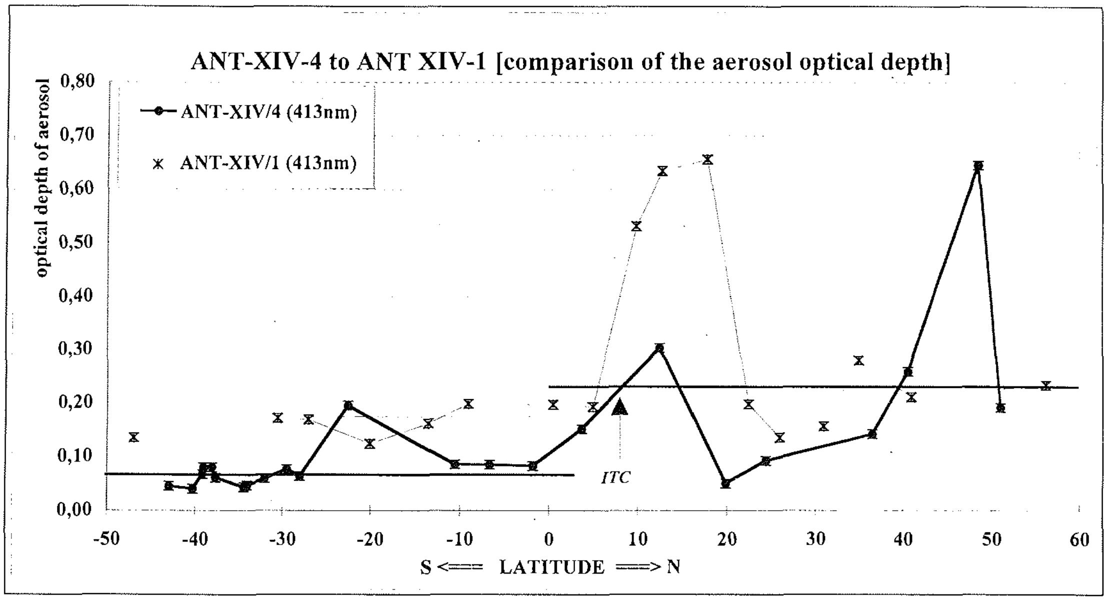

Fig. 3.1-2: Composition of the aerosol optical depth between ANT-XIV/4 and ANT-XIV/1

3.2 **Physical Oceanography** (Olaf Boebel, Claudia Schmid, M. Jochum, IfMK)

The World Ocean Circulation Experiment (WOCE; WCRP 1988) has been a driving force in the development of Lagrangian instrumentation during the last decade. Sub-surface drifters in particular were used extensively for the first time to explore directly the oceanic deep and intermediate advection. The Antarctic Intermediate Water (AAIW), found at mid-depth (around 900 m) in the southern hemisphere is appropriate for examination by the RAFOS Technology (Rossby et al. 1986). Due to the low salinity of the AAIW layer, it provides an excellent sound channel. This makes it apt for the long-distance (up to 3000 km) underwater acoustic navigation used by RAFOS floats. But beyond technical feasibility, its low salinity and recent ventilation makes the AAIW of particular importance to the global ocean circulation and the world climate (Broecker 1991, Gordon et al. 1992).

Lagrangian results (Boebel et al. 1997, Ollitrault 1995) obtained at mid-depth during the Deep Basin Experiment in the western South Atlantic are supportive of an intermediate intra-basin anticyclonic circulation cell across the South Atlantic (Buscaglia 1971, Reid 1989, Taft 1963, Warner & Weiss 1992). These findings, along with results from recent model studies (England & Garçon 1993, Marchesiello 1995 urged the extension of Lagrangian measurements into the South Atlantic eastern basins.

During the final stage of WOCE, scientists from the United States (Lamont Doherty Earth Observatory, LDEO; University of Rhode Island, URI, and Woods Hole Oceanographic Institution, WHOI), Germany (Institut für Meereskunde Kiel, IfM) and South Africa (Sea Fisheries Research Institute, SFRI, and the University of Cape Town, UCT) are now in the process of launching a triplet of Lagrangian experiments. The joint effort, termed KAPEX (Kap der Guten Hoffunung Experimente), focuses on the exchange and advection of water at intermediate depth (1,000m) around southern Africa. A total of over 100 RAFOS drifters will be used to track the Benguela Current and the fate of the Agulhas and South Atlantic Currents' water during their head-on collision south of the Cape of Good Hope. A total of 10 moored sound sources shall generate continuous tracking facilities all around southern Africa.

Initiating this multi-lateral effort, the south-western component of KAPEX was jointly launched by members of the IfM-Kiel and UCT during FS *Polarstern* cruise ANT-XIV/4. This component, termed South Atlantic Current Experiment, focuses on the intermediate water in the Cape Basin and its major source, the South Atlantic Current (SAC) (Stramma & Peterson 1990) The SAC crosses the Atlantic at approximately 40 °S from west to east. Bound by the Subtropical Front to the south, it represents the southern rim of the subtropical gyre. It feeds into the Cape Basin from the south-west after crossing the Walvis Ridge. Close to the prime meridian it bifurcates (Garzoli & Gordon 1996). An eastward continuation as well as a northward branch is generated. The fraction of mass flux going either way remains unknown. The latter leg feeds the re-circulation of the anticyclonic subtropical gyre. The eastward flow passes to the south of the Cape of Good Hope around 40 °S, continuing into the Indian Ocean. There part of it might become involved in the Agulhas Current retroflection, subsequently feeding the Benguela Current (Gordon 1996), being probably trapped by migrating Agulhas Rings.

Agulhas rings, shed by occlusions of the Agulhas Current loop at its Retroflection (e.g. (Lutjeharms 1996) are an integral part of the hydrographic elements south-

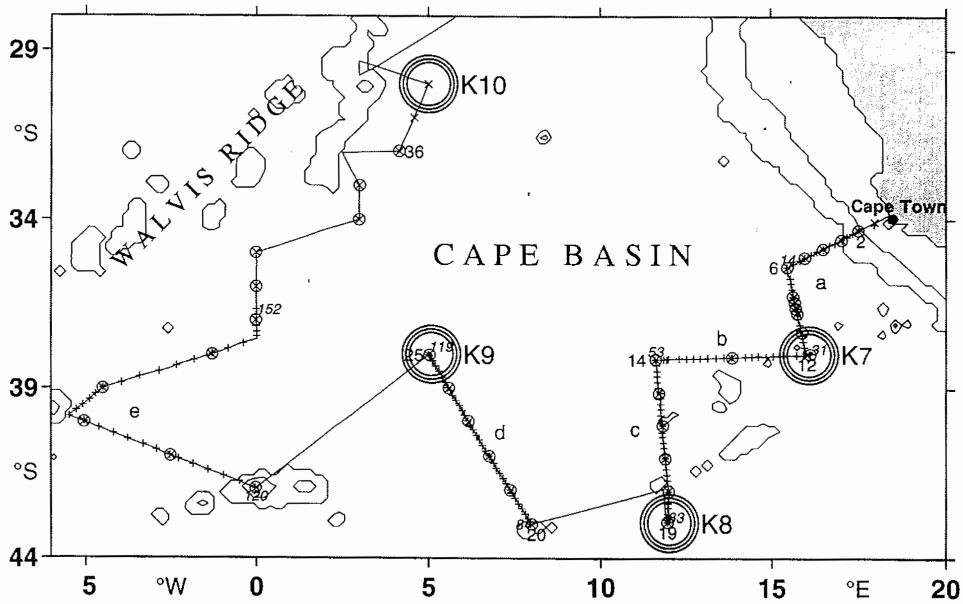

Fig 3.2-1: Map of the Cape Basin, including topographic lines at 1000 m and 3000 m. The cruise track of Polarstern cruise ANT-XIV/4, departing from Cape Town on 21 April 1997, is indicated by the thin solid line. Circles indicate the launch sites of RAFOS floats, crosses CTD casts and plus signs the sites of XBT drops. Triplets of large concentric circles labeled K7 through K10 indicate the mooring positions of sound sources. An additional sound source (M10) was deployed north of the Walvis Ridge in the Angola basin (not shown).

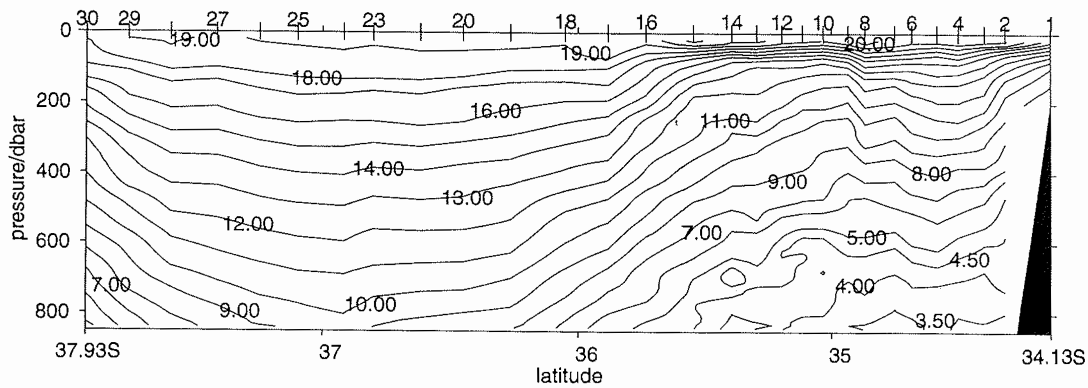

Fig. 3.2-2: Section "a" (Fig 3.2-1): Temperature distribution as recorded during *Polarstern* cruise ANT-XIV/4. Selected XBT drops are indicated by numbers on the upper axis. Note the change of course (Fig 3.2-1) at XBT drop no. 14.

west of the Cape of Good Hope. These energetic rings transport warm and salty water of Indian Ocean origin into the Cape Basin from the south-east. Due to evaporative cooling, they rapidly lose their high temperature contrast with the atmosphere and the embedding watermasses (Duncombe Rae et al. 1996). Therefore they can only be recognised for a limited time by satellite borne Sea Surface Temperature (SST) observations. However, their dynamic signal reaches down to the AAIW level (Duncombe Rae 1991), making RAFOS floats suiTab to track their drift across the Cape Basin and beyond.

During the RV *Polarstern* cruise ANT-XIV/4 in April-May 1997, a total of 35 RAFOS floats were deployed at intermediate depth (Tab 3.2-1 and Fig 3.2-1). They were programmed to carry out an underwater mission of 1.5 years in the average. Each float deployment was accompanied by CTD hydrocasts (Tab 3.2-3 and Fig 3.2-1) and expendable Bathythermograph sonde (XBT) drops (Tab 3.2-4) every 10 nm. The hydrography was used to identify the various watermasses in order to optimally place the floats and will be used to interpret the subsequent trajectories (Boebel et al. 1995). Special attention was given to recognise possible Agulhas Rings, based on online ship-borne Acoustic Doppler Current Profiler (ADCP) measurements, the ships drift and the XBT survey. Thermosalinograph measurements provided information on the corresponding near sea surface temperature and salinity signals. 4 moorings were launched, forming the Cape Basin sound source array (Fig 3.2-1, K7-10 and Tab 3.2-2). An additional sound source was moored in the Angola Basin (M10) on behalf of the neighbouring WHOI/LDEO "Benguela Current Experiment".

The cruise track intersected the three possible major pathways of intermediate water into this area. The south-westward leg, departing from Cape Town towards mooring K7 (Fig 3.2-1), focuses on the inter oceanic transport of AAIW, e.g. the inflow from the south-east. As mentioned above, Agulhas Rings might be a possible conveyor of such an exchange. A prominent depression of all but the near-surface isotherms is observed in the temperature section "a" (Fig 3.2-2). The 10 °C isotherm drops from 200 dbar to nearly 800 dbar over 100 km distance. The symmetric feature is centred around hydrocast station no. 10 at 36° 46'S 15° 46'E (Fig 3.2-3) and spans 300 km in diameter. The density distribution (Fig 3.2-4) indicates an anticyclonic deep reaching feature, suggesting that this feature could be a juvenile Agulhas Ring or the Retroflection loop itself. The dynamic signal encompasses all of the intermediate layer, reaching down as deep as 2000 dbar, the truncation depth of the deeper CTD stations (most of the stations were truncated at 1500 dbar, once the AAIW layer was passed). Around 1100 dbar depth, the proposed import of Indian Ocean intermediate water is recognised (Fig 3.2-3). There, a weak but deep salinity minimum close to 34.4 replaces the stronger and shallower salinity minimum typical for this regions Atlantic AAIW (S lower than 34.3 at approximately 700 dbar) (Fig 3.2-8 and Fig 3.2-10).

Simultaneous ship borne ADCP measurements (Fig 3.2-11) indicate a strong current shear along the quasi-meridional section "a". Velocity signals averaged over 50 m to 200 m depth depict a westward flow stronger than 60 cm s^{-1} at the northern end of the segment. After a steady decrease towards station no. 10 (unfortunately a larger data segment is missing due to technical problems at the time) an eastward flow was observed in the southern segment, reaching peak values of more than 110 cm s^{-1} at its southern limit. Judging from the flow fields orientation, the rotational centre was located slightly to the east from RV *Polarstern*s cruise track.

While crossing this feature, it was decided to seed 3 floats (Fig 3.2-3) north of the centre at 1050 m (nos. 183, 200 and 215). 2 further floats were seeded at and south of the centre, (Fig 3.2-3), but at a depth of 850 dbar (no. 184) and 900 dbar (no. 216). The expected trajectories of these instruments will hopefully give final evidence whether this feature is an Agulhas ring or the Agulhas Retroflection loop. The shallower central floats are aimed to observe the long-term migration of the possible ring and its mixing with the surrounding Atlantic AAIW. The deeper floats shall monitor the trapping depth of the Agulhas Ring with increasing distance from its origin and the fate of the intermediate water of Indian Ocean origin. During the subsequent sections "b", "c" and "d" (Fig 3.2-1) from K7 to the west it was attempted to capture the direct escape of AAIW into the Indian Ocean as well as the AAIW inflow into the Cape Basin. The zonal section "b" (Fig 3.2-5, top) captured a smooth thermal structure, as to be expected for the South Atlantic Currents zonal flow field. When taking a perpendicular southward course from XBT drop no. 53 onward (section "c"), a steady shoaling of the isotherms and isohalines was detected. This might be associated with a large scale eastward flow through this section and farther east along section "b".In the south of section "c", a thin and weak salinity maximum (Fig 3.2-6) separates the low salinity of the sea surface from the minimum at intermediate depth. Probably a continuos minimum might have been found farther south, reaching down from the surface to mid-depth. As a result, fresh AAIW might have been introduced there by direct downwelling to the intermediate layer. Continuos Thermosalinograph temperature measurements and the XBT sections (Fig 3.2-5) indicated that the 10 °C isotherm outcropped around 42 °S with slightly higher latitudes in the east. During section "c" the two southernmost floats were seeded south of the 10 °C isotherm outcropping, which was used as a proxy for the southern border of the subtropical gyre, whereas it was only one during section "d". The fate of these floats will hopefully serve to establish a border line between the expected northward branching of the SAC and its direct eastward continuation. On transit from station no. 19 (end of section "c") to station no. 20 (beginning of section "d") the ADCP measurements (Fig 3.2-11) revealed another anticyclonic ring. This structure, featuring homogenous velocities over the upper 400 m of up to 100 cms^{-1} was located around 42° 30' S, 11° 00' E. The horizontal extension was of approximately 200 km in diameter. Whether this structure is of Agulhas Current or Brazil Current origin remains obscure, due to the lack of further hydrographic data during this transit. When approaching this feature from the north during section "c" no indications towards this eddy were observed (Fig 3.2-5, bottom, cast nos. 77-83). Directly north of it, however, a near surface depression of the isotherms is associated with a divergent average flow field (Fig 3.2-11) near the surface. Finally, leg "e" transects the proposed intermediate subtropical gyre. Both temperature and salinity sections (Fig 3.2-7 and Fig 3.2-8) indicate a near surface front near 37.5 °S, separating the central waters of the subtropical gyre from less saline water to the south. Underneath the central waters the low-salinity tongue of AAIW is found, which experiences some vertical constraint due to the overlying high salinity waters. The observed density profile (Fig 3.2-9) suggests an intermediate westward flow north of 35 °S and to the east south of this latitude. The latter, however, is restricted to the frontal area at 37.5 °S. This interpretation, however, is very susceptible to the unknown barotropic component. Nevertheless, the direct velocity measurements (Fig 3.2-11) confirm this general trend, depicting north-eastward to south-eastward flow south of 33 °S and a more north-west ward to the north. The floats seeded during this leg are hoped to be trapped in the recirculation of the subtropical gyre and thus could serve to estimate the splitting ratio of the intermediate SAC.

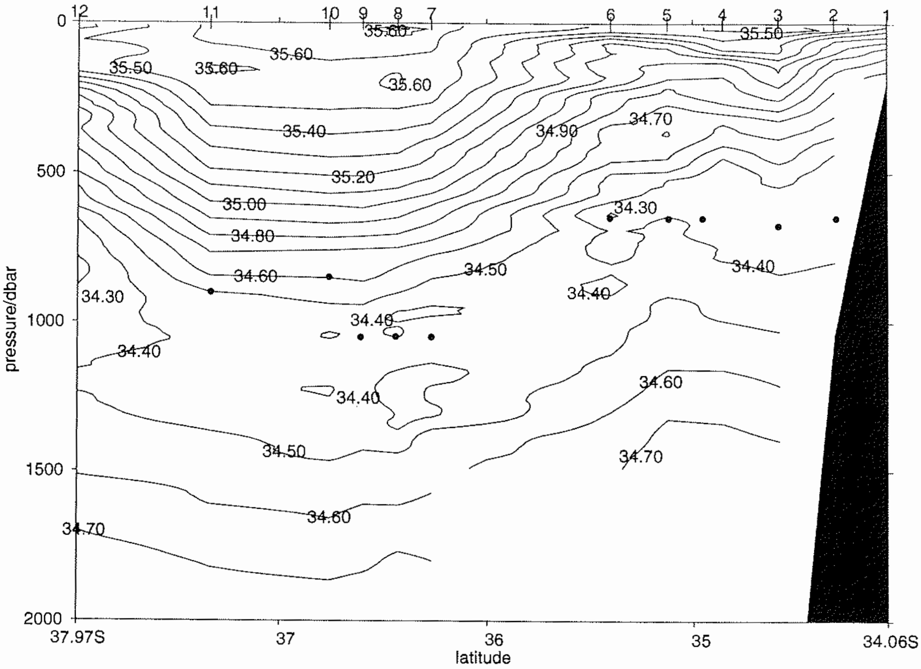

Fig. 3.2-3: Section "a" (Fig 3.2-1): Salinity distribution as recorded during *Polarstern* cruise ANT-XIV/4. CTD casts are indicated by numbers on the upper axis. Note the change of course at station no. 6. Solid dots indicate the launch position and estimated depth of RAFOS floats seeded during the cruise.

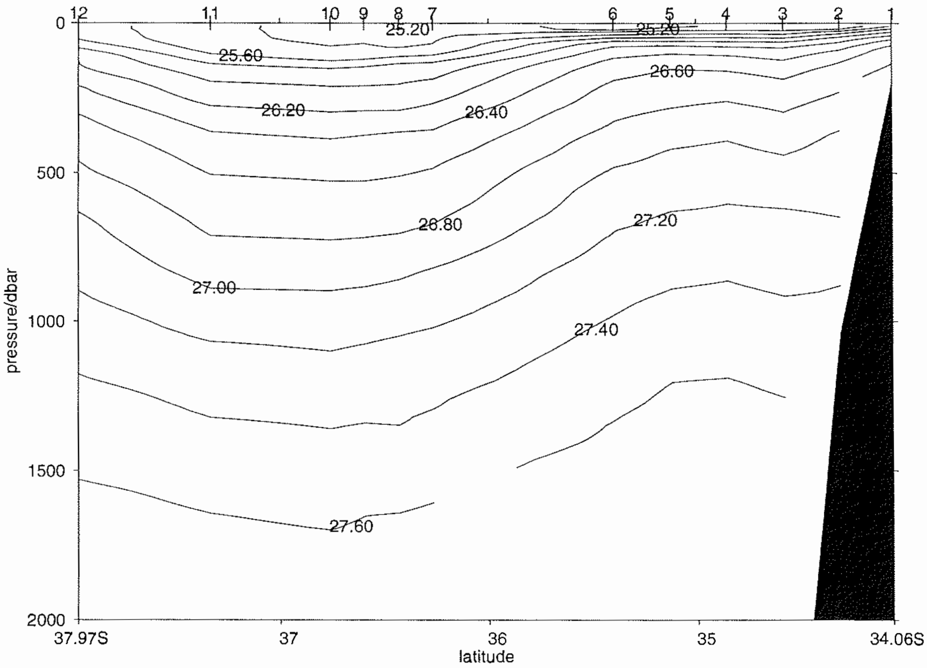

Fig. 3.2-4: Section "a" (Fig 3.2-1): Potential density (s_q) distribution **as** recorded during *Polarstern* cruise ANT-XIV/4. Selected CTD casts are indicated by straight numbers. Note the change of course at station no. 6. Solid dots indicate the launch position and estimated depth of RAFOS floats launched during the cruise.

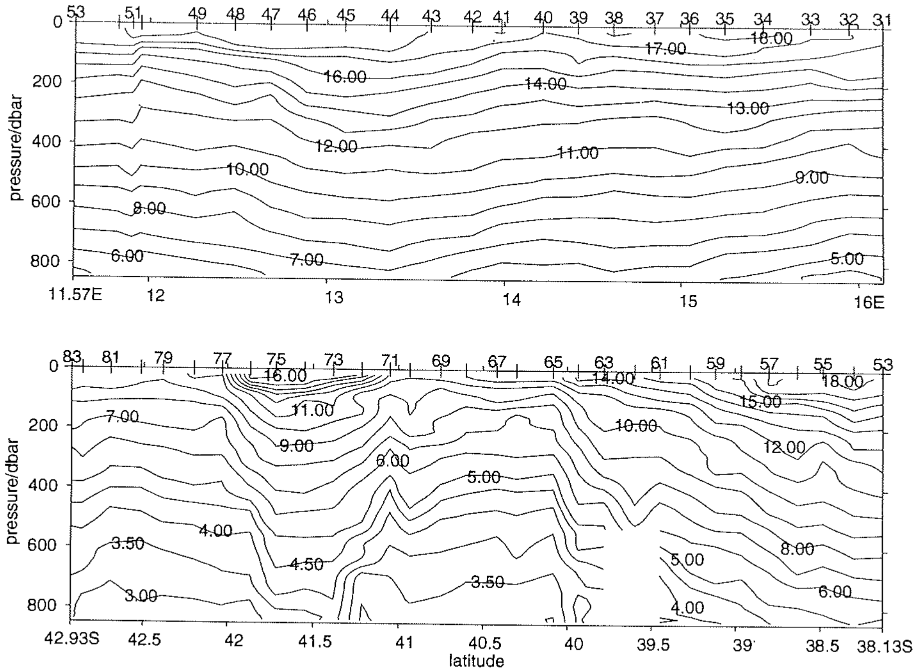

Fig. 3.2-5: Section "b" (top) and "c" (bottom) (Fig 3.2-1): Temperature distribution as recorded by XBT drops in the upper 800 dbar during *Polarstern* cruise ANT-XIV/4. Selected XBT drops are indicated by numbers on the upper axis.

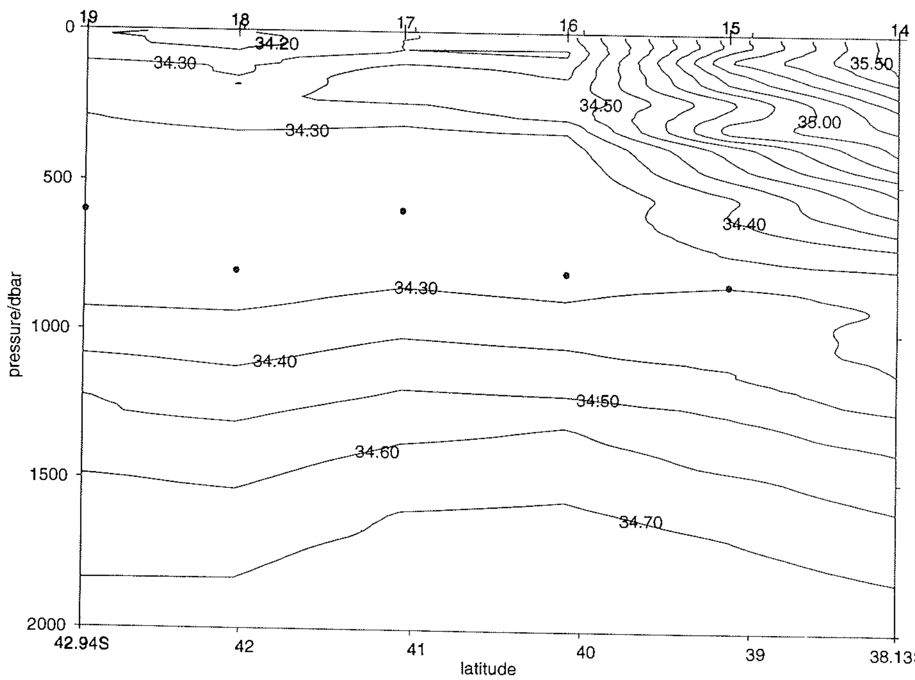

Fig. 3.2-6: Section "c" (Fig 3.2-1): Salinity distribution as recorded during *Polarstern* cruise ANT-XIV/4. CTD casts are indicated by numbers on the upper axis. Solid dots indicate the launch position and estimated depth of RAFOS floats seeded during the cruise.

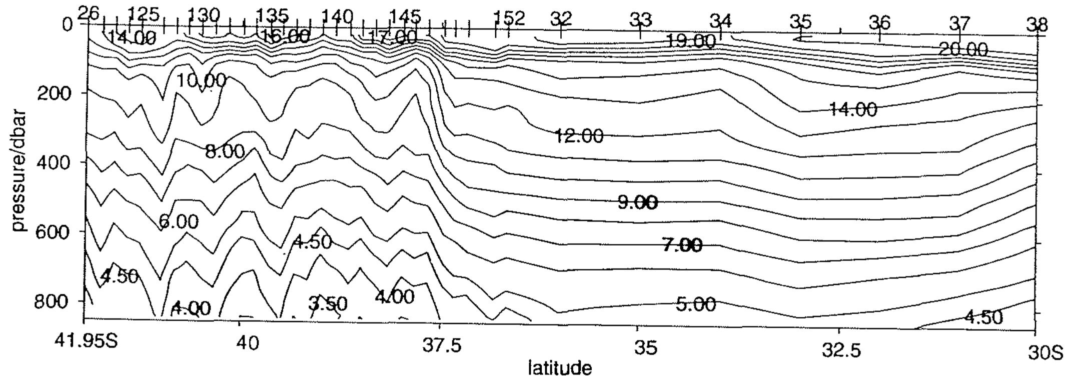

Fig. 3.2-7: Section "e" (Fig 3.2-1): Temperature distribution as recorded during *Polarstern* cruise ANT-XIV/4. Selected XBT drops are indicated by three digit numbers, CTD casts by two digit numbers. This section is composed from XBT data in the southern (up to drop 152) and from CTD data in the northern part(starting with cast no. 32). Note the extreme change of course at XBT cast nos. 133 and 148 (Fig 3.2-1).

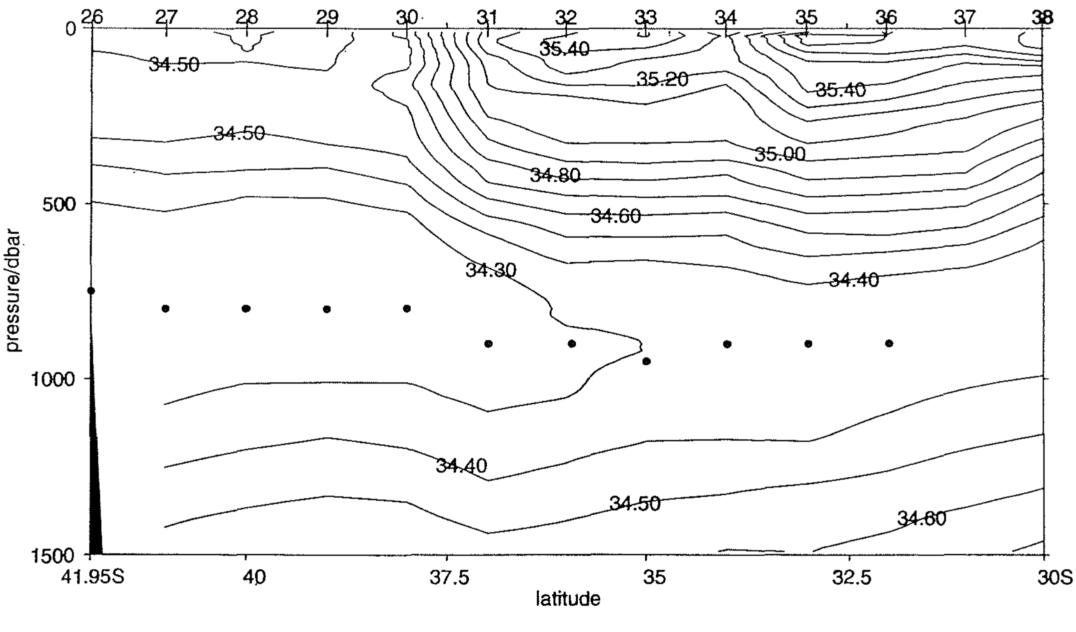

Fig. 3.2- 8: Section "e"(Fig 3.2-1): Salinity distribution during *Polarstern* cruise ANT-XIV/4. CTD casts are indicated by numbers on the upper axis. Note the extreme change of course at CTD cast nos. 28 and 31.

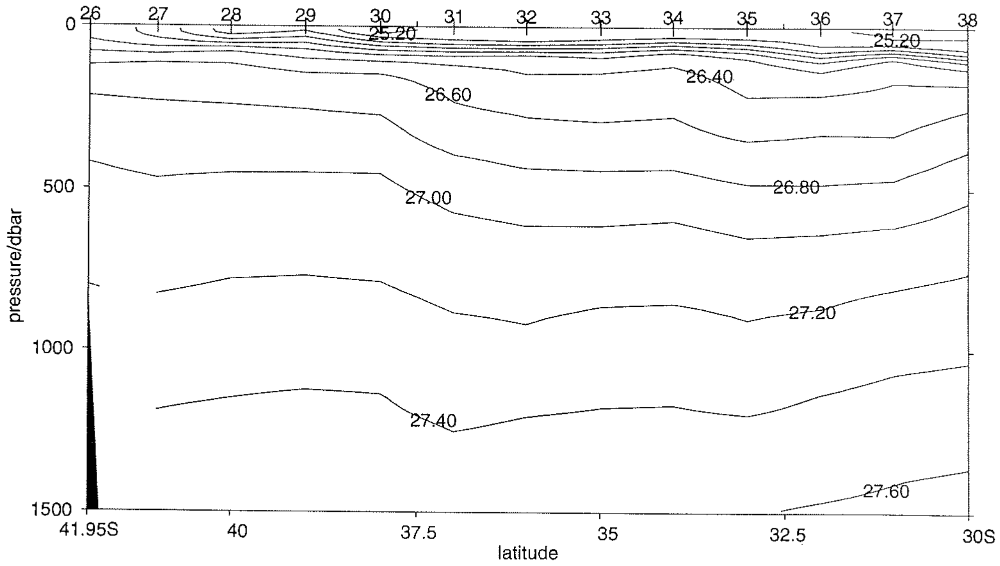

Fig. 3.2-9: Section "e" (Fig 3.2-1): Potential density (sq) distribution as recorded during *Polarstern* cruise ANT-XIV/4. The data was calculated from CTD data only. Note the extreme change of course at CTD cast nos. 28 and 31.

References

Boebel, O., Schmid, C. & Zenk, W. (1997): Flow and recirculation of Antarctic Intermediate Water across the Rio Grande Rise.- J. Geophys. Res., in press.

Boebel, O., Schultz Tokos, K. & Zenk, W. (1995): Calculation of salinity from neutrally buoyant RAFOS floats.- J. Atmosph. Oce. Technol., 12: 923-934.

Broecker, W.S. (1991): The great ocean conveyor.- Oceanogr., 4 (2): 79-88.

Buscaglia, J.L. (1971): On the circulation of the Intermediate Water in the soutwestern Atlantic Ocean, J. Mar. Res. 29: 245-255.

Duncombe Rae, C.M. (1991): Agulhas retroflection rings in the South Atlantic Ocean; an overview.- South African J. Mar. Sci. 11: 327-344.

Duncombe Rae, C.M., Garzoli, S.L. & Gordon, A.L. (1996): The eddy field of the southeast Atlantic Ocean: A statistical census from the Benguela Sources and Transoprts Project.- J. Geophys. Res. 101: 11949-11964.

England, M.H. & Garçon, V. (1993): South Atlantic Ocean ventilation: a numerical model study with geochemical tracers.- Ann. Geophys. 11 (Suppl II), C163.

Garzoli, S.L. & Gordon, A.L. (1996): Origins and variability of the Benguela Current, J. Geophys. Res. 101: 897-906.

Gordon, A.L. (1996): Comment on the South Atlantic's role in the Global Circulation.- In: G. WEFER, W.H. BERGER, G. SIEDLER, & D.J. WEBB (EDS.), The South Atlantic: Present and Past Circulation, 121-124, Springer-Verlag, Berlin Heidelberg.

Gordon, A.L., Weiss, R.F., Smethie, W.M. & Warner, M.J. (1992): Thermocline and intermediate water communication between the South Atlantic and Indian Ocean.- J. Geophys. Res. 97: 223-7240.

Lutjeharms, J.R.E. (1996): The exchange of water between the South Indian and South Atlantic Oceans.- In: G. WEFER, W.H. BERGER, G. SIEDLER, & D.J. WEBB (EDS.), The South Atlantic: Present and Past Circulation,The South Atlantic: present and past circulation, 122-162, Springer-Verlag, Berlin-Heidelberg.

Marchesiello, P. (1995): Simulation de la circulation océanique dans l'Atlantique Sud avec un modèle numérique à coordonée sigma.- PhD thesis, Universite Joseph Fourier, Grenoble.

Ollitrault, M. (1995): Results from the SAMBA Experiment, 2nd circular note.

Reid, J.L. (1989): On the total geostrophic circulation of the South Atlantic Ocean: Flow patterns, tracers and transports.- Progr. Oceanogr. 23: 149-244.

Rossby, T., Dorson, D. & Fontaine, J. (1986): The RAFOS System.- Journal of Atmosph. Oce. Technol. 3: 672-679.

Stramma, L. & Peterson, R. (1990): The South Atlantic Current.- J. Phys. Oceanogr. 20 (6).

Taft, B.A. (1963): Distribution of salinity and dissolved oxygen on surfaces of uniform potential specific volume in the South Atlantic, South Pacific, and Indian oceans.-, J. Mar. Res. 21: 129-146.

Warner, M.J. & Weiss, R.F. (1992): Chlorofluoromethanes in the South Atlantic Antarctic Intermediate Water.- Deep Sea Res. 39: 2053-2075.

WCRP (1988): WOCE Implementation plan, World Climate Research Programm 11, WMO/ITD No. 242: 1-74.

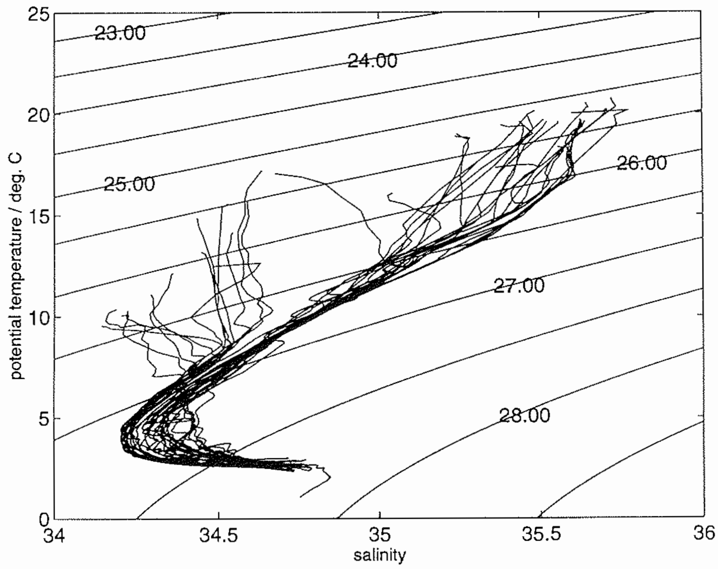

Fig. 3.2-10: q-S diagram of all stations taken during *Polarstern* cruise ANT-XIV/4.

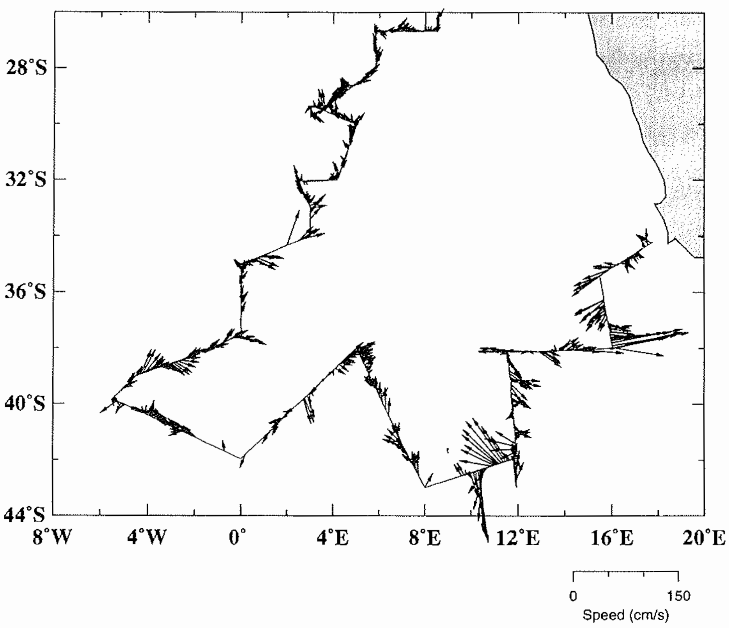

Fig. 3.2-11: Average flow field between 50 m and 200 m as derived from ship-borne ADCP measurements. The standard deviation of the current's cross-track and along-track velocity component was estimated to be 8 cm s^{-1} and 6 cm s^{-1}, respectively.

IfM-Float Nr.	CTD-Profile	Launch Date	Launch Lat	Launch Lon	Target depth [dbar]	Duration [days]	$s_{p,T,S}$ [g cm^{-3}]
186	2	22.03.97	34°18,51'S	17°32,27'E	650,2	540	30,17
195	3	22.03.97	34°35,35'S	17°02,86'E	675,8	540	30,34
176	4	22.03.97	34°51.35'S	16°30,99'E	650,5	720	30,23
196	5	22.03.97	35°07.11'S	15°58,92'E	650,7	540	30,21
199	6	23.03.97	35°24.01'S	15°28.39'E	649,0	540	30,13
183	7	23.03.97	36°16,08'S	15°38,49'E	1049,0	720	32,01
200	8	23.03.97	36°26,39'S	15°41,39'E	1048,0	540	31,98
215	9	23.03.97	36°36,52'S	15°43,06'E	1050,0	540	31,97
184	10	23.03.97	36°45,57'S	15°45,54'E	849,5	720	30,76
216	11	23.03.97	37°19,56'S	15°54,00'E	900,7	540	31,07
217	12	24.03.97	37°58,44'S	16°08,07'E	838,8	540	31,00
185	13	24.03.97	38°04,21S	13°49,50'E	961,5	540	31,60
218	14	25.03.97	38°07,91'S	11°34,88'E	874,9	540	31,16
219	15	25.03.97	39°07,73'S	11°40,56'E	838,7	540	31,06
203	16	25.03.97	40°05,59'S	11°47,15'E	801,8	540	31,00
220	17	26.03.97	41°03,81'S	11°51,30'E	596,5	540	29,95
221	18	26.03.97	42°01,94'S	11°57,15'E	800,6	540	30,95
204	19	26.03.97	42°56,12'S	11°55,20'E	601,7	630	29,95
222	20	27.03.97	42°59,47'S	08°00,01'E	700,6	540	30,45
223	21	27.03.97	41°59,59'S	07°22,61'E	749,2	540	30,66
205	22	28.03.97	40°59,62'S	06°46.10'E	652,0	690	30,19
224	23	28.03.97	39°57,59'S	06°09,96'E	800,0	480	30,90
225	24	28.03.97	38°58,88'S	05°35,57'E	750,4	480	30,65
206	25	29.03.97	38°00,30'S	05°01,63'E	751,0	690	30,60
226	26	30.03.97	41°56,82'S	00°01,17'W	749,2	540	30,61
227	27	30.03.97	40°59,67'S	02°31.24'W	800,0	540	30,87
207	28	31.03.97	40°00,14'S	05°02,96'W	800,6	690	30,60
228	29	31.03.97	39°00,18'S	04°29,98'W	802,7	480	30,92
229	30	01.04.97	37°59,88'S	01°18,25'W	799,5	480	30,90
208	31	01.04.97	36°59,10'S	00°00,30'W	900,8	690	31,36
210	32	01.04.97	35°59,91'S	00°00,17'W	899,4	690	31,33
117	33	02.04.97	34°59,33'S	00°00,47'W	950,2	360	31,62
230	34	02.04.97	34°00,13'S	03°00,15'E	900,5	630	31,37
201	35	02.04.97	33°00,06'S	03°00,91'E	900,2	30	31,33
202	36	03.04.97	31°59.07'S	04°09,50'E	899,5	360	31,36

Tab. 3.2-1: List of RAFOS float deployments.

Mooring	Site	Date [UTC]	Latitude	Longitude	Depth [m]	Sound #	Beep [UTC]t
380-1	K7	24.03.97	37°59,3'S	16°05,7'E	1000	18	00:30 12:30
381-1	K8	26.03.97	42°57,6'S	11°58,3'E	1000	21	01:00 13:00
382-1	K9	11.11.07	37°59,0'S	05°05,1'E	1000	19	01:30 13:30
383-1	K10	04.04.97	30°00,1'S	05°00,4'E	1000	20	01:00 13:00
	M10	0.04.978	19°56,1'S	03°46,6'E	736	21	00:30 12:30

Tab. 3.2-2: Positions of Sound Source Moorings

Station	Pro-file	Date [UTC]	Time [UTC]	Latitude	Longitude	Max. [dbar]	Depth	Depth [m]
43/1	1	22.03.97	02:45	34°03.80'S	018°00.80'E	186		200
43/2	2		05:40	34°18.85'S	017°32.47'E	1020		1030
43/3	3		10:40	34°35.06'S	017°02.93'E	1500		2850
43/4	4		15:20	34°51.35'S	016°30.98'E	1500		3790
43/5	5		19:35	35°07.34'S	016°00.22'E	1500		4410
43/6	6		23:35	35°23.66'S	015°29.65'E	1500		4650
43/7	7	23.03.97	07:45	36°16.01'S	015°39.80'E	1900		4709
43/8	8		10:22	36°25.72'S	015°41.88'E	2004		4710
43/9	9		12:49	36°35.85'S	015°43.34'E	2001		4720
43/10	10		15:12	36°45.46'S	015°45.34'E	2000		4720
43/11	11		20:01	37°19.88'S	015°52.99'E	2001		4684
43/12	12	24.03.97	03:00	37°58.26'S	016°01.75'E	2000		4780
43/13	13		19:35	38°04.39'S	013°48.55'E	2002		5040
43/14	14	25.03.97	05:04	38°07.94'S	011°35.02'E	2000		5300
43/15	15		11:10	39°07.76'S	011°40.53'E	97		5040
43/16	16		17:27	40°05.74'S	011°46.11'E	2016		4780
43/17	17		23:15	41°03.64'S	011°51.42'E	2001		4480
43/18	18		05:25	42°01.65'S	011°56.57'E	1999		5200
43/19	19		15:06	42°56.26'S	011°55.21'E	97		4545
43/20	20	27.03.97	14:20	42°59.92'S	007°59.93'E	2001		4153
43/21	21		20:40	41°59.53'S	007°23.16'E	2000		4931
43/22	22	28.03.97	03:10	40°59.90'S	006°45.78'E	2001		5105
43/23	23		10:32	39°58.81'S	006°09.89'E	2003		5230
43/24	24		19:00	38°58.83'S	005°35.73'E	2003		5039
43/25	25	29.03.97	04:07	38°00.01'S	004°59.94'E	2001		5011
43/26	26	30.03.97	10:25	41°56.99'S	000°00.45'W	818		826
43/27	26		20:35	41°00.11'S	002°30.44'W	1500		4825
43/28	28	31.03.97	07:52	40°00.04'S	005°02.84'W	1500		3758
43/29	29		15:59	39°00.13'S	004°30.02'W	1500		4016
43/30	30	01.04.97	24:28	38°00.05'S	001°18.66'W	1500		5092
43/31	31		13:30	36°59.44'S	000°00.45'W	1501		5090
43/32	32		19:20	36°00.13'S	000°00.00'W	1500		4777
43/33	33	02.04.97	01:30	34°59.36'S	000°00.09'W	1500		4622
43/34	34		13:55	34°00.25'S	003°00.14'E	1501		4952
43/35	35		19:15	33°00.15'S	003°00.18'E	1506		4824
43/36	36	03.04.97	08:32	31°59.73'S	004°09.91'E	4004		4828
43/37	37		17:59	30°59.89'S	004°35.34'E	1501		4685
43/38	38	04.04.97	05:55	29°59.98'S	004°59.93'E	1504		5167

Tab. 3.2-3: List of hydrographic stations during ANT-XIV/4

Drop	Date [UTC]	Time [UTC]	Latitude	Longitude	Depth [m]
1	22.03.97	03:08	34°08'S	18°00'E	200
2		08:00	34°19'S	17°32'E	1070
3		08:45	34°24'S	17°22'E	2024
4		09:42	34°30'S	17°12'E	2536
5		12:20	34°35'S	17°03'E	2740
6		13:17	34°41'S	16°51'E	3140
7		14:14	34°45'S	16°42'E	3366
8		16:40	34°52'S	16°31'E	3794
9	22.03.97	17:38	34°56'S	16°20'E	4083
10		18:38	35°02'S	16°10'E	4277
11		20:50	35°07'S	15°59'E	4420
12		21:42	35°12'S	15°50'E	4515
13		22:40	35°18'S	15°40'E	4603

Drop	Date [UTC]	Time [UTC]	Latitude	Longitude	Depth [m]
14	23.03.97	01:00	35°24'S	15°28'E	4660
15		02:03	35°33'S	15°29'E	4681
16		03:15	35°44'S	15°34'E	4685
17		04:36	35°53'S	15°35'E	4684
18		05:54	36°03'S	15°37'E	4694
19		09:18	36°16'S	15°38'E	4715
20		11:55	36°27'S	15°41'E	4714
21		14:21	36°37'S	15°43'E	4721
22		16:51	36°46'S	15°45'E	4710
23		16:58	36°48'S	15°46'E	4715
24		17:38	36°55'S	15°47'E	4708
25		18:47	37°06'S	15°50'E	4713
26		19:41	37°15'S	15°52'E	4722
27		22:21	37°25'S	15°54'E	4720
28		23:48	37°36'S	15°56'E	4722
29	24.03.97	01:14	37°46'S	15°58'E	4750
30		02:37	37°56'S	16°01'E	4755
31		09:51	37°58'S	16°08'E	4733
32		10:50	38°00'S	15°57'E	4800
33		11:56	38°00'S	15°44'E	4820
34		13:03	38°00'S	15°28'E	4856
35		13:58	38°01'S	15°15'E	4592
36		14:49	38°02'S	15°03'E	3242
37		15:39	38°03'S	14°51'E	4300
38		16:40	38°02'S	14°37'E	4752
39		17:16	38°03'S	14°25'E	4826
40		18:00	38°03'S	14°13'E	4970
41		18:48	38°04'S	13°59'E	4974
42		21:07	38°04'S	13°49'E	5031
43		22:03	38°04'S	13°35'E	5034
44		22:50	38°05'S	13°21'E	5042
45		23:42	38°05'S	13°06'E	4956
46	25.03.97	00:26	38°06'S	12°53'E	5021
47		01:15	38°06'S	12°41'E	5026
48		01:58	38°07'S	12°29'E	5102
49		02:41	38°06'S	12°16'E	5147
50		03:17	38°07'S	11°57'E	5100
51		03:53	38°08'S	11°54'E	5122
52		04:06	38°08'S	11°49'E	5000
53		06:35	38°08'S	11°34'E	5291
54		07:26	38°18'S	11°36'E	5154
55		08:15	38°29'S	11°37'E	5051
56		08:53	38°38'S	11°37'E	5037
57		09:35	38°48'S	11°38'E	4993
58		10:21	38°58'S	11°39'E	5140
59		12:55	39°07'S	11°43'E	5080
60		13:43	39°16'S	11°43'E	5170
61		14:20	39°27'S	11°43'E	5070
62		15:07	39°36'S	11°44'E	4970
63		15:54	39°47'S	11°44'E	5025
64		16:35	39°56'S	11°45'E	4788
65		18:58	40°05'S	11°47'E	4775
66		19:55	40°18'S	11°46'E	4883
67		20:27	40°25'S	11°47'E	4898
68		21:09	40°36'S	11°48'E	4823
69	25.03.97	21:49	40°45'S	11°49'E	4736
70		22:35	40°56'S	11°51'E	4550
71	26.03.97	00:48	41°03'S	11°51'E	4450

Drop	*Date [UTC]*	*Time [UTC]*	*Latitude*	*Longitude*	*Depth [m]*
72		01:40	41°13'S	11°52'E	4450
73		02:23	41°23'S	11°53'E	4450
74		03:10	41°33'S	11°54'E	4710
75		03:53	41°43'S	11°55'E	3491
76		04:44	41°52'S	11°56'E	2487
77		07:13	42°02'S	11°57'E	4573
78		07:58	42°12'S	11°57'E	4463
79		08:47	42°23'S	11°56'E	3890
80		09:24	42°31'S	11°56'E	4699
81		10:12	42°42'S	11°56'E	4655
82		10:57	42°52'S	11°55'E	4650
83		16:46	42°56'S	11°55'E	4610
84	27.03.97	15:55	42°59'S	07°59'E	4390
85		16:40	42°50'S	07°54'E	4943
86		17:21	42°42'S	07°49'E	4718
87		18:03	42°32'S	07°43'E	4927
88		18:43	42°24'S	07°37'E	4774
89		19:29	42°14'S	07°31'E	4720
90		20:08	42°05'S	07°26'E	4889
91		22:16	41°59'S	07°22'E	4930
92		23:07	41°48'S	07°15'E	4930
93		23:50	41°39'S	07°10'E	4970
94	28.03.97	00:33	41°30'S	07°04'E	4950
95		01:18	41°21'S	06°58'E	5110
96		01:59	41°12'S	06°54'E	5005
97		02:40	41°06'S	06°50'E	5240
98		04:45	40°59'S	06°46'E	5173
99		05:38	40°51'S	06°40'E	5034
100		06:33	40°41'S	06°34'E	5273
101		07:29	40°31'S	06°29'E	5330
102		08:13	40°23'S	06°24'E	5230
103		09:04	40°13'S	06°18'E	5191
104		09:55	40°05'S	06°13'E	5298
105		12:17	39°57'S	06°09'E	5380
106		13:20	39°47'S	06°03'E	5260
107		14:20	39°39'S	05°59'E	5299
108		15:21	39°30'S	05°54'E	5507
109		16:22	39°21'S	05°48'E	5488
110		17:26	39°12'S	05°42'E	5418
111		18:25	39°03'S	05°38'E	5320
112		20:40	38°58'S	05°34'E	5079
113		21:33	38°49'S	05°30'E	5299
114		22:40	38°40'S	05°24'E	5070
115		23:58	38°29'S	05°18'E	4990
116	29.03.97	01:15	38°20'S	05°12'E	5030
117		02:30	38°11'S	05°07'E	5120
118		03:41	38°02'S	05°02'E	4980
119		09:03	38°00'S	05°00°'E	5042
120	30.03.97	11:30	41°57'S	00°02'W	877
121		13:12	41°45'S	00°30'W	4060
122		14:55	41°35'S	00°58'W	4717
123		16:30	41°25'S	01°26'W	4664
125		18:06	41°15'S	01°52'W	4646
126		19:40	41°05'S	02°17'W	4314
127		21:58	40°59'S	02°32'W	4449
128		23:30	40°49'S	02°56'W	4198
129	31.03.97	01:00	40°40'S	03°19'W	3588
130	31.03.97	02:34	40°30'S	03°46'W	4680

Drop	Date [UTC]	Time [UTC]	Latitude	Longitude	Depth [m]
131		04:11	40°20'S	04°11'W	4519
132		06:00	40°10'S	04°37'W	4266
133		09:15	39°59'S	05°03'W	3771
134		10:47	39°50'S	05°28'W	1710
135		12:00	39°39'S	05°16'W	3550
136		13:00	39°30'S	05°05'W	3870
137		14:00	39°20'S	04°53'W	4069
138		14:55	39°10'S	04°43'W	3718
139		17:11	39°00'S	04°30'W	4000
140		19:12	38°50'S	03°57'W	4196
141		21:05	38°39'S	03°25'W	4507
142		23:03	38°30'S	02°51'W	4570
143	01.04.97	00:50	38°20'S	02°20'W	5050
144		02:33	38°10'S	01°50'W	5148
145		05:46	37°59'S	01°18'W	5027
146		07:35	37°50'S	00°50'W	5119
147		09:18	37°40'S	00°23'W	4976
148		11:07	37°28'S	00°01'E	5010
149		11:47	37°20'S	00°01'E	5040
150		12:38	37°10'S	00°00'E	4970
151		15:25	36°50'S	00°00'W	4974
152		16:11	36°40'S	00°00'E	5110

Tab. 3.2-4: List of T7-XBT drops. The data are limited to the upper 850 dbar.

3.3 Geophysical Investigations (Ana Macario, David Völker, Vladimir Hopfauf, Tilmann Schwenk, FGB)

The primary goal of the geophysical programme during the *Polarstern* Cruise ANT-XIV/4 was to investigate the deep water circulation in the central Cape Basin and southern portion of the Angola Basin using PARASOUND and HYDROSWEEP acoustic systems. In particular, we were interested in using the sedimentary record to identify possible pathways for bottom water currents and to understand how their intensity have varied through time. This project is part of a long-term collaborative work in the South Atlantic between the Department of Geoscience at University of Bremen and the Alfred-Wegener-Institut in the framework of SFB 261: *"The South Atlantic in the Late Quaternay: recontruction of mass budget and current systems"*.

During the cruise ANT-XIV/4 we have succesfully acquired over 8500 km of continuos sediment echosounder, multibeam bathymetry and side-scan data (Fig 3.3-1). In this report we show that the ultra-high resolution sediment echosounder Parasound data together with multibeam bathymetry and side scan HYDROSWEEP data can be used to identify different sediment types and structures, map the spatial distribution of erosional features, and, to determine temporal variations in the intensity of erosional events. Spatial variations in small-scale seafloor roughness associated with different sediment types and/or erosional episodes will be the target of future quantitative studies. Finally, we suggest possible target areas for future studies on bottom water circulation in the Cape and Angola basins.

Geological Setting

The Cape Basin, off the southern portion of the African continent, is delimited to the west by the Mid-Atlantic Ridge, to the north by the Walvis ridge and to the south by the Agulhas Ridge (Fig 3.3-1) . Early studies in the Cape basin by DuPlessis et al. (1972, Emery et al. (1975 and Rabinowitz & LaBrecque (1979) were mainly focused on the general plate-tectonic framework, structure and history of the South African continental margin. In this context, two DSDP Sites 360 and 361 on the continental rise were selected to provide continuous stratigraphic sections for the Mesozoic and Cenozoic.

Based on seismic reflection profiles, Tucholke & Embley (1984) have proposed the presence of a continuos circum-basin erosional zone between 4 and 5 km water depth which lies beneath the deep Antarctic Bottom Water (AABW) boundary current. Because the speed of AABW current, is thought to be less than 20 cm/yr (Tucholke & Carpenter 1977) and authigenic manganese nodules are present within this erosional belt (Rogers 1995), it is commonly thought that erosional processes within the Cape Basin are limited and are in dynamic equilibrium with currently reduced sediment supply. According to Tucholke & Embley (1984), this erosional zone is a relict feature formed during the late Miocene when large volumes of bottom water were formed due to heavy glaciation of the Antarctic continent.

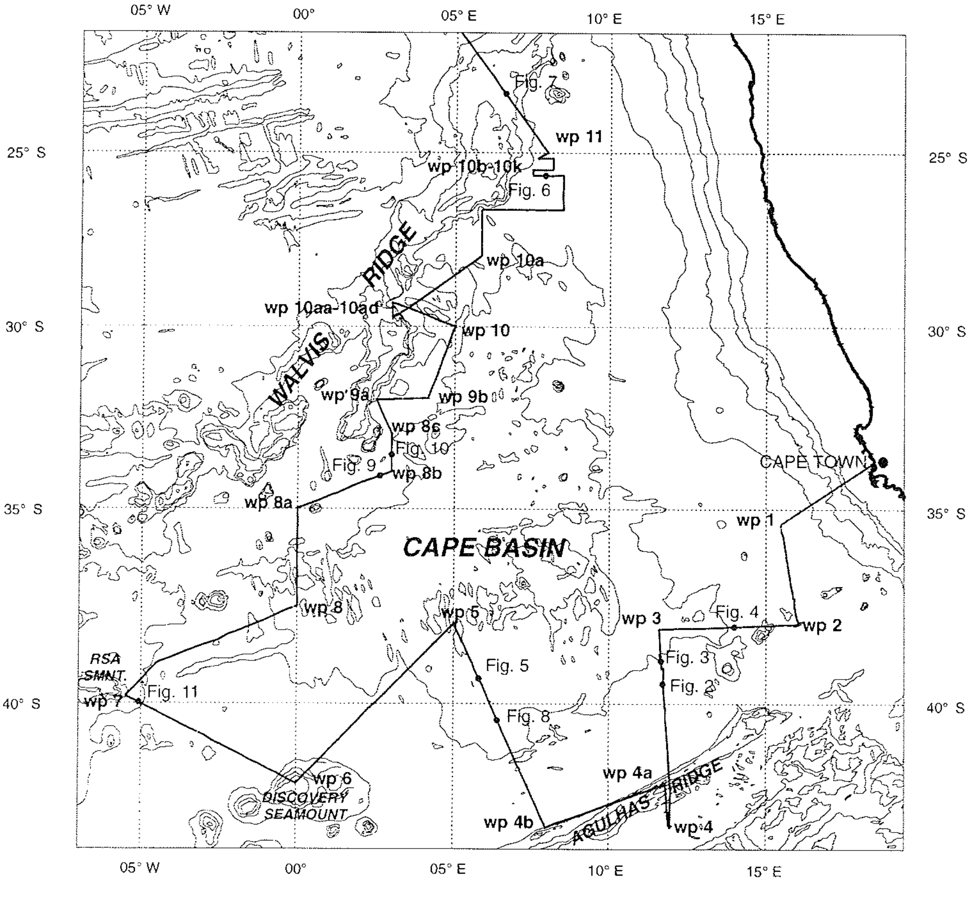

Fig. 3.3-1: Simplified bathymetric map of the surveyed area showing *Polarstern* tracklines, waypoints (wp) and location of subsequent Figures. The main bathymetric features within the study areas are also marked in the map.

Within the Cape Basin, sediments are primarily composed of terrigenous detritus from the Orange River and biogenic sediments. Because of the high biologic productivity associated with the Benguela Current along the Southwest African margin, biogenic silica deposits are also found. Due to decreasing carbonate content of sedments with increasing depths, chalks and oozes are limited to the continental slope and Walvis ridge. The high biogenic input induced by the Benguela Ecosystem is restricted to the shelf and upper-slope regions of western South Africa and of Namibia (Dingle 1993), with the broad shelf and slope regions acting as effective traps for both terrigenous and biogenic sediment input.

In addition to bottom water erosion and steady-state pelagic accumulaton, allochthonous sediment input by episodic mass-movement processes such as slumps, slides, debris flows and turbidites have been documented in the outern continental margin of southwest Africa (Bornhold & Summerhayes 1977, Dingle 1980, Dingle 1983, Abelmann et al. 1992). Highly calcareous sediments have also been transported into the Cape Basin by turbidities, which originate from the continental slope, seamounts and marginal ridges like the Walvis Ridge and Agulhas Ridge (Abelmann et al. 1992, 1994, Spieß et al. 1994). Sedimentary rocks recovered from DSDP Site 524 (Leg 73), on a fan at the end of a major canyon which drains the Walvis Ridge, revelead that the youngest sediments of lower Eocene and upper Paleocene age are nannofossil oozes with thin layers of chalk and limestone (Hsü & LaBrecque 1984).

Present bottom water circulation: oceanographic constraints

The Antarctic Bottom Water (AABW) is the main water mass within the Cape Basin and is characterised by temperature and salinity values ranging from of -0.9 to 1.7 °C and from 34.64 to 34.72 ‰ respectively (Shannon & Nelson 1994). One of the prevailing ideas is that the Walvis Ridge acts as an obstacle to the northward flow of AABW which is then forced into a clockwise rotation until it finally exits the Agulhas basin via the Cape Passage south of Cape Town (Tucholke & Embley 1984, Rogers 1995. Based on differences in the bottom water temperatures on opposite sides of the Walvis Ridge, previous studies have suggested that part of the AABW may reach the Angola Basin through a gap at the Walvis Ridge. However, it is worth noting that, due to sparse bottom water potential temperature data points at water depths greater than 4000 m, the AABW flow pattern within the Cape Basin described above is poorly constrained (Reid, 1996). In particular, the entrance path of the AABW in the Cape Basin is still very speculative and more data is needed to further constrain it.

Although the acoustical data acquired during Cruise ANT-XIV/4 is not extensive enough to provide information on bottom current direction, the identification of erosional belts can be used to constrain bottom water pathways. The mapped erosional pathways can then be contrasted with bottom water flow solutions of existing numerical models. In this study we have attempted to locally verify some of the bottom water flow solutions proposed by Miranda et al. (1997) for the South Atlantic. Their model is based on the topography-following coordinate model of Haidvogel et al. (1991) and uses a smoothed version of the digital 5-minute bathymetric grid ETOPO5 (NOAA 1988). Tracklines between way points 4a-4b were chosen so as to verify whether the gap along the Agulhas Ridge indeed exists as suggested by

ETOPO5 (NOAA, 1988). Evidences for strong bottom water current activity, as suggested by Miranda et al. (1997) bottom flow solutions, were also sought between way points 5 and 6 and 6 and 7.

Instrumentation

During Cruise ANT-XIV/4, HYDROSWEEP and PARASOUND acoustic systems, both designed by STN Atlas Elektronik GmbH Bremen, were used to trace bottom water circulation. The HYDROSWEEP system is a hull-mounted multibeam swath mapping sonar which provides high resolution bathymetry and side-scan scatter information along the ship track. It operates at a frequency of 15.5 Hz providing a typical bathymetric accuracy of 0.5 times the water depth (Gutberlet & Schenke 1989). The width of the swath is typically 200 % of the water depth and during the cruise was operated on deep sea mode (90°) using 59 preformed beams. Because every single sound beam acts as a directional filter, a high resolution scattering information of the insonified seabed can be obtained using a sidescan algorithm. The result is a geometrically correct sidescan imagery of the seafloor which can be overlaid with bathymetric contours. Seabed scattering strength provided by the side scan sonar can be used to study small scale seafloor features such as erosional channels and scars which otherwise would not be detected by bathymetry. In addition, spatial changes in sediment type can also in principal be determined based on variations in scattering strength.

The ultra-high resolution PARASOUND Sediment Echosounder System is a modern version of the conventional 3.5 kHz echosounder providing detailed information on the upper 10-200 m of the sediment cover (Rostek et al. 1991). Because of the parametric effect, which results from nonlinear interaction of high-amplitude and high-frequency signals (18 and 22 kHz), emission of low-frequency acoustic energy around 4 kHz within a narrow beam of about 4° opening angle is possible. As a result, the diameter of the footprint area is only ~7 % of the water depth compared to >30 % for 3.5 kHz echosounders. Typical phenomena of conventional wide-angle echosounders such as hyperbolic echoes and scattered signals in the presence of microtopography have been partly overcome. Side echoes commonly present in conventional echosounders have been eliminated and both vertical and lateral resolution is increased significantly in the PARASOUND system (Spiess 1993). In addition, PARASOUND provides a more flexible access to instrument control, as well as acquisition of analog and digital records.

A digital acquisition system, specifically designed for the PARASOUND Echosounder System, was recently developed by Spiess (1993) and is currently under use aboard of the research vessels *Polarstern, Meteor*, and *Sonne.* This system, named ParaDigMa, digitises the data with a frequency of 40 KHz and uses well-established data-processing techniques. ParaDigMa produces a continuos on-line plot of the seismograms and tables containing relevant information on navigation and system information. On-line filtering of the data is one of the many data processing procedures that can be applied to the data in real time using ParaDigMa. The data is stored on magnetic tapes for further post-processing and viewing.

Observations and Interpretations

The tracklines shown in Fig 3.3-1 were designed so as to accommodate our main goal of tracing bottom water pathways and waypoints previously selected by oceanographers. Besides the general purpose of spatially mapping the erosional belt, some of the waypoints were chosen with specific purposes, namely: (1) waypoints 4a-4b to constrain the presence of a bathymetric gap along the Agulhas Ridge (as suggested by digital topography ETOPO5; NOAA 1988) which, according to Miranda et al. (1997) model results, would act as a pathway to AABW flow into the Cape Basin, (2) waypoints 10aa-10ad to re-survey DSDP site 524 allowing ground truthing of the PARASOUND records with physical property data, and, (3) waypoints 10d-11 to further constrain the zone of scour and deposition at the foot of the Walvis ridge originally mapped by Bornhold & Summerhayes (1977) using 3.5 kHz echo-sounder.

After hand editing the bag pings in the bathymetric and side-scan data, CARIS software was used to co-register both data types onto one single digital terrain model. Preliminary analysis of this combined product has been used to constrain some of the PARASOUND interpretations. Existing core data will be used to groundtruth some of the sidescan scatter data and to develop a quantitative classification scqueme for mapping textural variations associated with distinct sediment types. The main observations and respective interpretations extracted from the PARASOUND and HYDROSWEEP can be summarised as follows:

(1) Bottom water current activity - evidences for bottom water current activity were found between waypoints 3 and 4 in the form of unconformities (the main one is marked as "erosional horizon" in Fig 3.3-2). Significant local changes in the thickness of some of the sedimentary units over distances less than a couple of kilometers are also indicative of bottom water activity (Fig 3.3-3). In addition, examples of erosional truncation were also found near waypoints 2-3 (Fig 3.3-4).

(2) Debris flow - because the process of sediment transport is associated with a mixture of sediment types and destruction of internal structures, debris flow are accoustically transparent and often display a lens-shaped form. Examples of debris flow deposits were found at remarkable distances from the continent (over 1000 km) on the Cape Basin between waypoints 4b and 5 (Fig 3.3-5). It is worth noting that the these deposits have varying thickness and follow pre-existing bathymetry.

(3) Drift sediments and turbidities - broad, elongated swells approximately 30 m high of accoustically transparent sediments were found at the foot of the Walvis Ridge at water depths of about 4700 m (waypoints 10b-10k; Fig 3.3-6). The nature of these sediment deposits is currently unknown; drift deposits, originally suggested by Bornhold & Summerhayes (1977), is a possible interpretation for these sedimentary structures. While a narrow trench formed by intensive scour of the seabed is found westward of these elongated swells (towards the Walvis Ridge), well stratified and accoustically reflective sediments that resemble turbidites are identified eastward (towards the basin). (3) Biogenic sediments - while carbonate oozes are often associated with low signal penetration and high reflection amplitudes, siliceous oozes are known for their high signal penetration and low reflection amplitudes. Evidences for the presence of carbonates were found on the Walvis Ridge (waypoints 11-12; Fig 3.3-7). Alternatively, siliceous oozes are present between waypoints 4b and 5 (Fig 3.3-8).

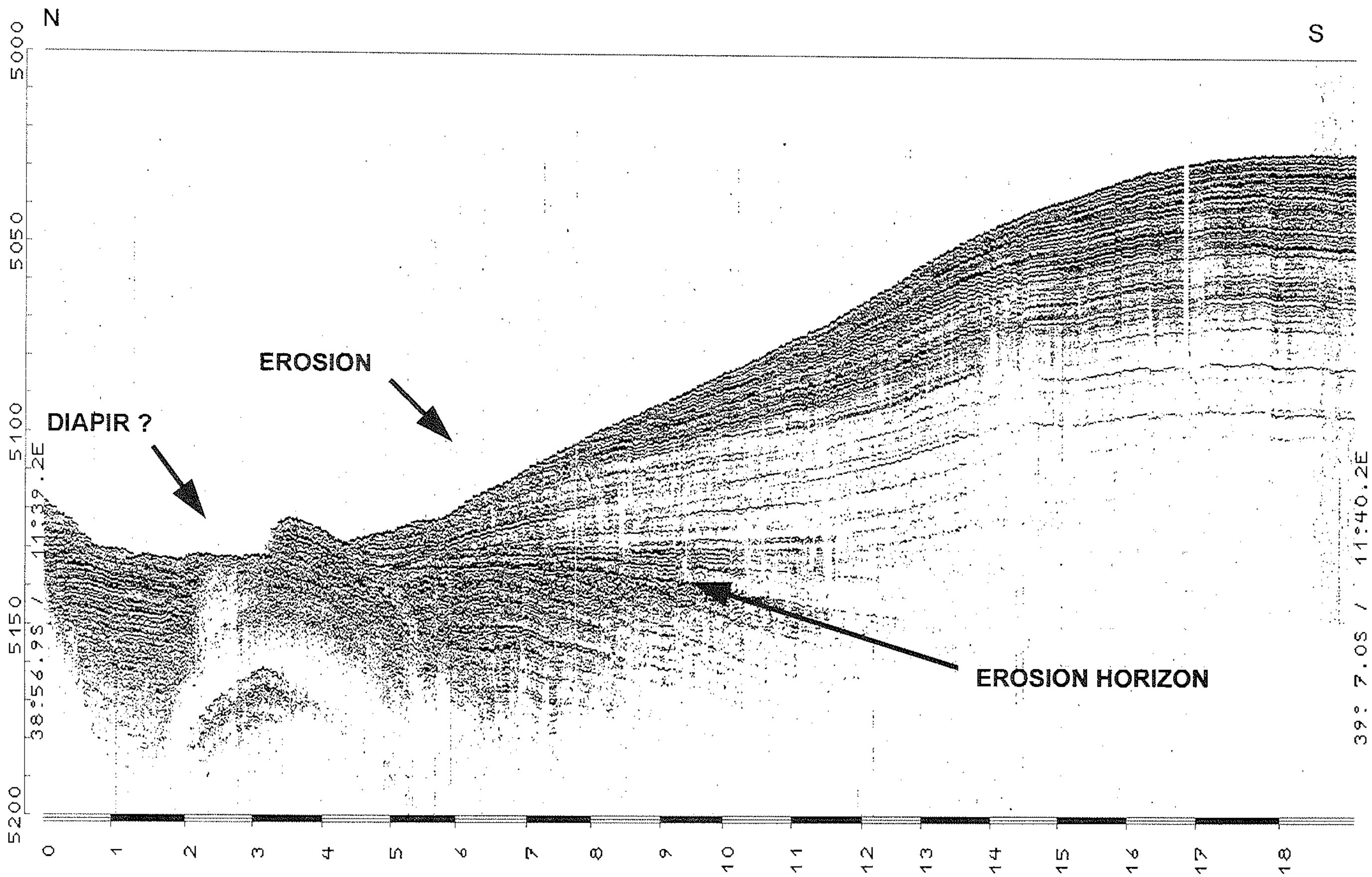

Fig. 3.3-2: PARASOUND image showing the effect of bottom water current activity on the sedimentary record (see erosion horizon) and the presence of a diapir. This profile was extracted between waypoints 3 and 4. The horizontal scale is distance in kilometers and the vertical one is uncorrected water depth in meters.

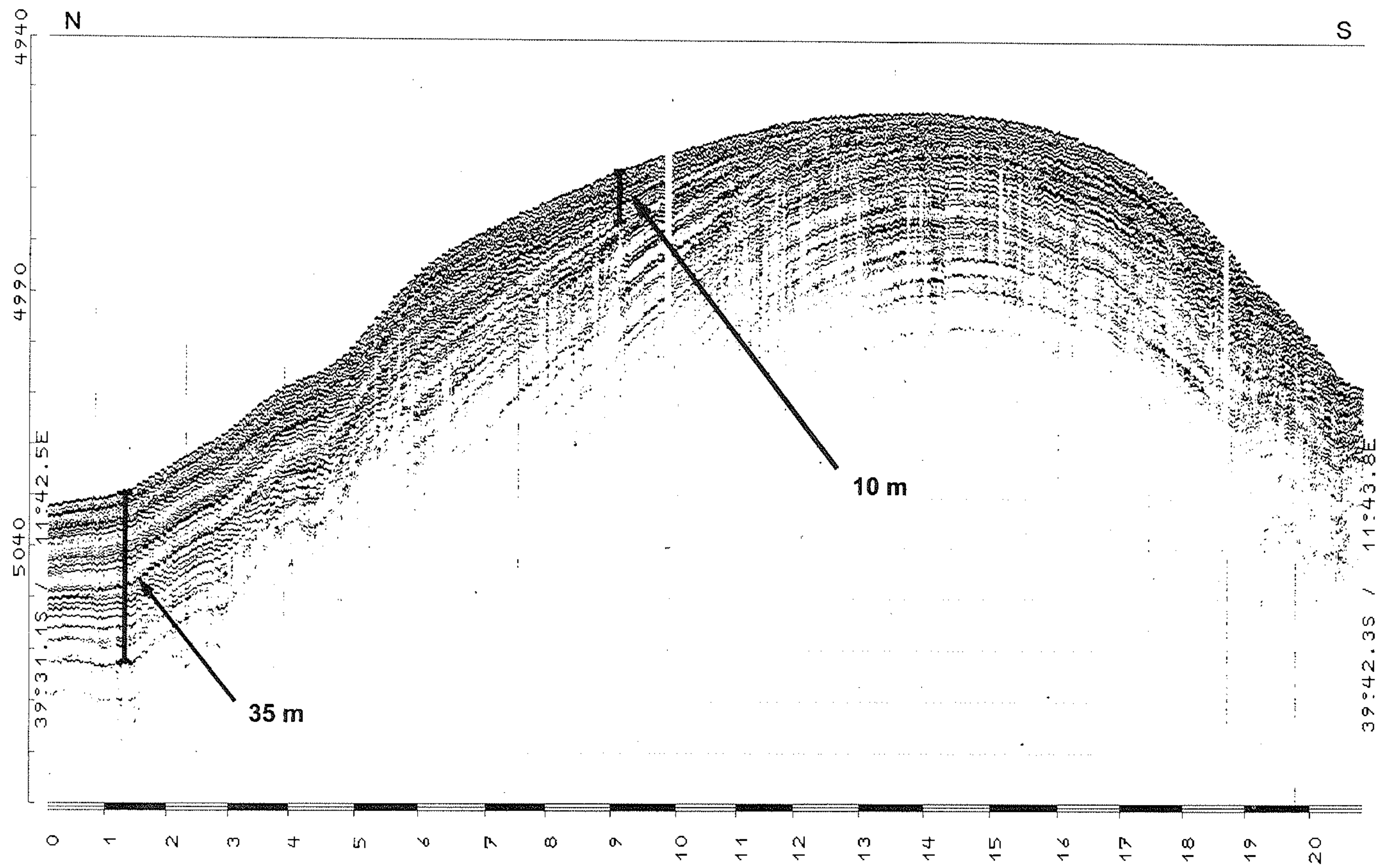

Fig. 3.3-3: PARASOUND image showing sharp changes in the thickness of sedimentary units (between waypoints 3 and 4). This is attributed to the effcet of bottom water currents. The horizontal scale is distance in kilometers and the vertical one is uncorrected water depth in meters.

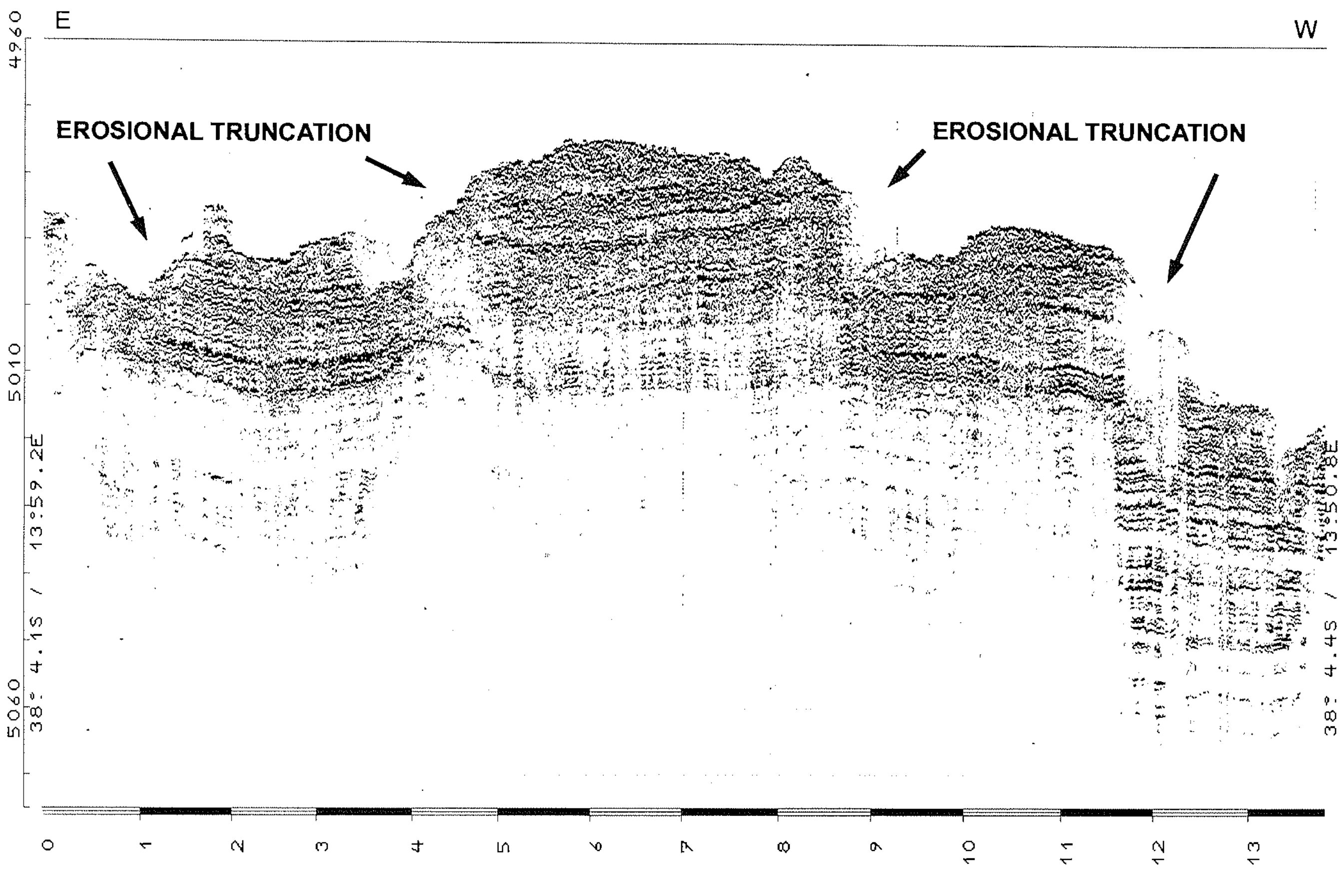

Fig. 3.3-4: PARASOUND image illustrating the presence of erosional truncation associated with bottom water activity (between waypoints 2 and 3). The horizontal scale is distance in kilometers and the vertical one is uncorrected water depth in meters.

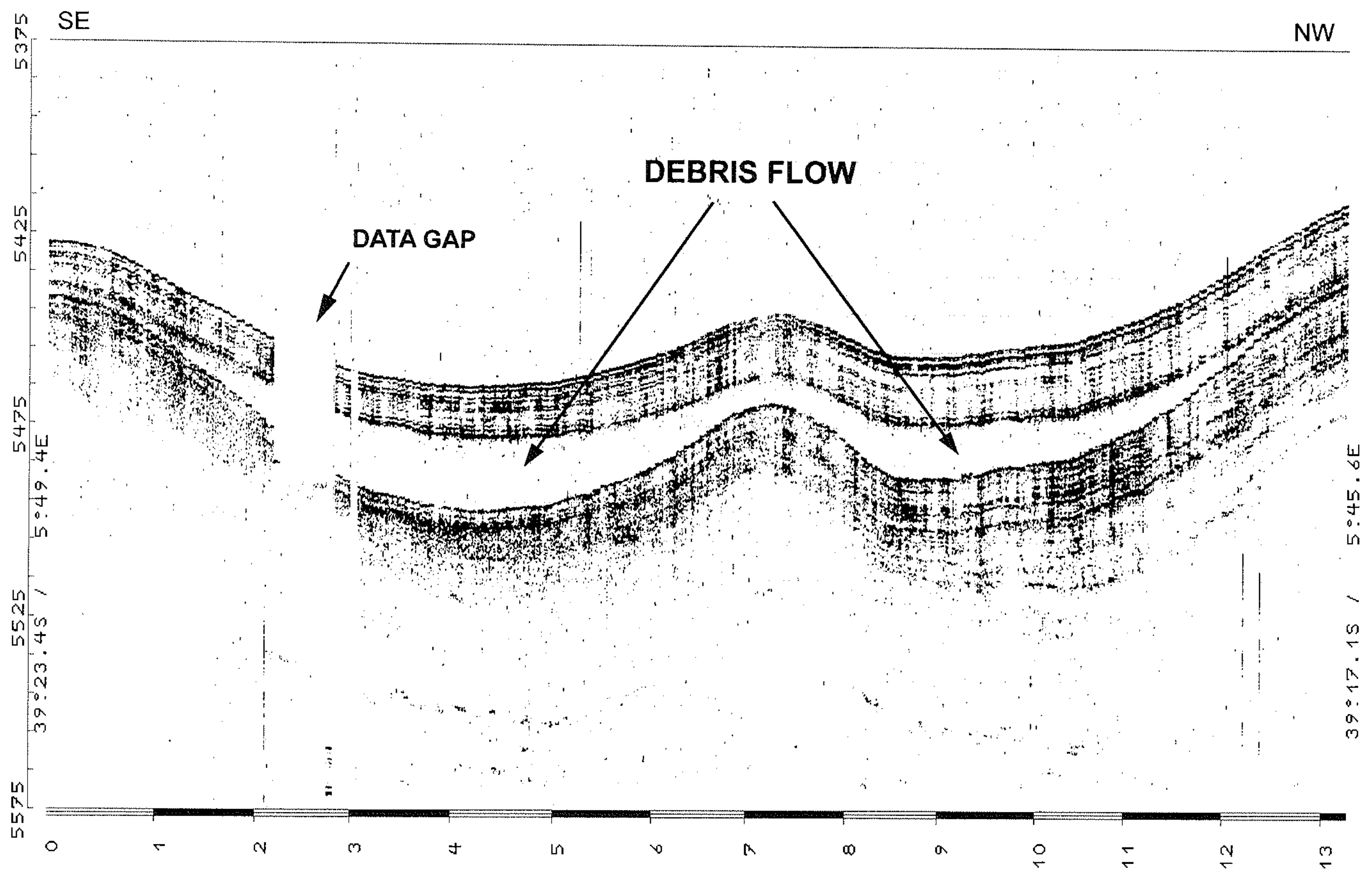

Fig. 3.3-5: PARASOUND image showing the presence of debris flow deposits along a profile extracted between waypoints 4b and 5. These deposits vary in thickness and follow pre-existing bathymetry. The horizontal scale is distance in kilometers and the vertical one is uncorrected water depth in meters.

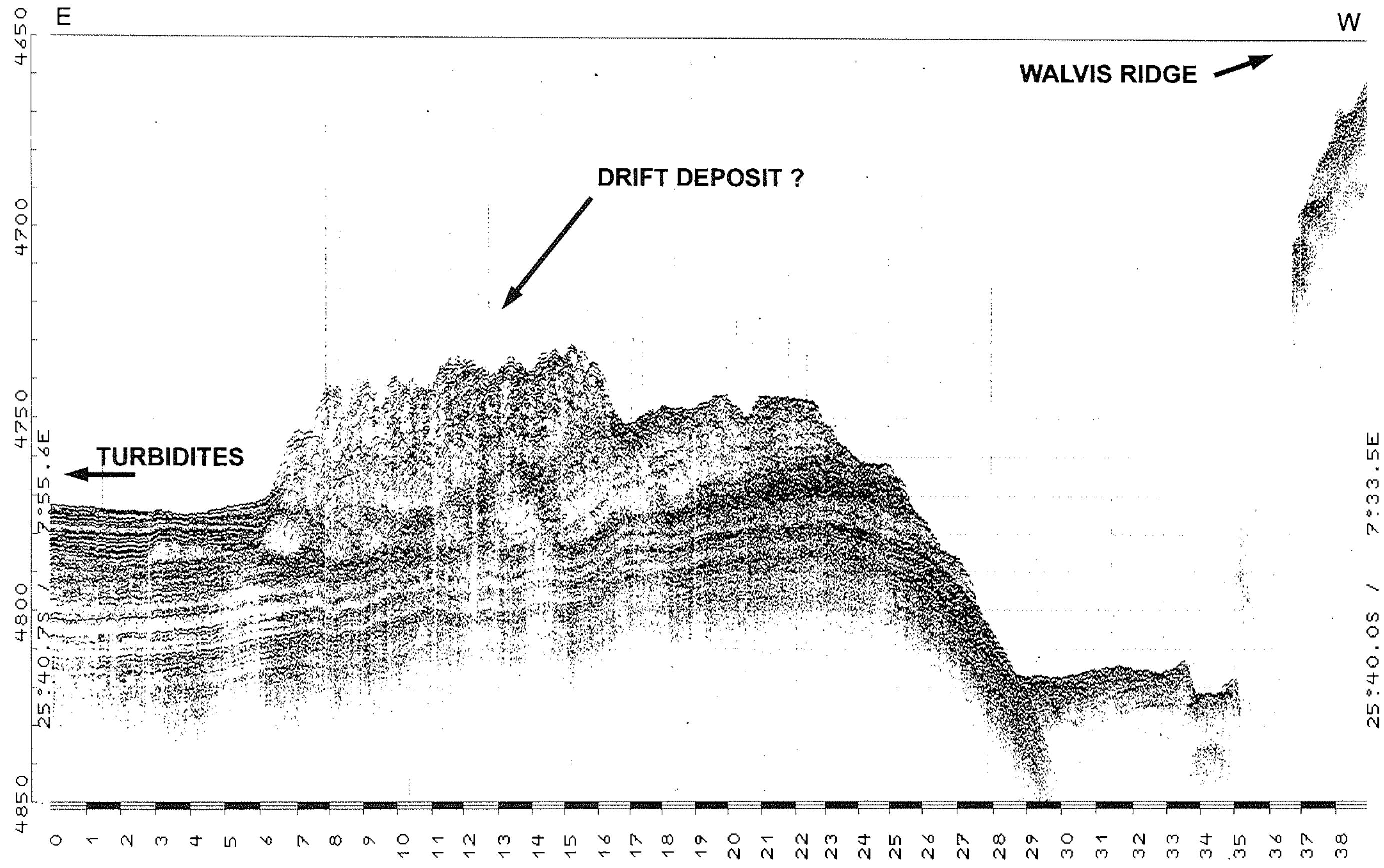

Fig. 3.3-6: PARASOUND image near the Walvis Ridge (waypoints 10b-10k) illustrating the presence of an elongated swell (possibly drift deposits). Turbidites were found adjacent to these deposits, towards the Cape basin (eastward). A trench is located westward of these deposits, in the vicinity of the Walvis Ridge. The horizontal scale is distance in kilometers and the vertical one is uncorrected water depth in meters.

4) Diapirism - when muds with high water content are overlaid by denser sediments, diapirism may occur leading to folding of the overlying units. Fig 3.3-9 (between waypoints 8a and 8b) and Fig 3.3-10 (between waypoints 8b and 8c) show diapirs with distinct size found during our survey.

(5) Sedimentary waves - undulating seabed structures that seem to be linear (based on bathymetric data) were found near the vicinity of two large seamounts, Discovery (waypoint 6) and RSA (waypoint 7) seamounts. The wavelength of these features varies between 1 to 6 km with a typical height of 25 meters. Fig 3.3-11 illustrates the case for sedimentary waves with wavelengths exceeding 5 km found near the RSA seamount.

According to the digital 5 minute ETOPO5 bathymetric data, a bathymetric gap at least 200 km wide is present along the Agulhas Ridge. Based on Miranda et al. (1996) modeling results for bottom water flow, it can be infered that this gap may serve as possible pathway for bottom water to enter the Cape Basin. After surveying along the proposed gap in the Agulhas Ridge (waypoints 4a-4b), our preliminary analysis of the bathymetry data indicate that, if present, this gap does not exceed 30-40 km. In addition, evidences for bottom water erosion were not found in the Parasound data. Because bottom water flow modeling results are strictly constrained by bathymetry, our findings emphasize the need to exercise caution when using ETOPO5. In addition to the sedimentary and erosional features described above, complex structures which seem to combine one of more types of features were found. For example, between waypoints 8b and 8c, some reflectors at depth are not continuos, i.e., show breaks in the reflection pattern (Fig 3.3-10). The "missing" reflectors are associated with a low penetration and high reflection amplitudes (possibly carbonates) and are intercalated with layered acoustically transparent reflectors (possibly turbidities). Diapirism together with bottom water activity are also noted in this area.

Conclusions and Future Work

We have demonstrated that PARASOUND and HYDROSWEEP data can be successfully used to map the spatial distribution of active erosional belts and sediment type and to determine temporal variations in the intensity of erosional events. Because existing bottom water circulation models are controlled by bathymetry, we have also shown that additional acoustical data are crucial to verify/refute existing oceanographic model results. Future work will concentrate on studying spatial variations in small-scale seafloor roughness associated with different surficial sediment types and/or erosional episodes imaged by the Side Scan Sonar. Large data gaps still remain within the Cape and Angola basins. In particular, box type of surveys would help constraining the three-dimensional form and shape of sedimentary features found in two areas: (1) the foot of the Walvis Ridge, where drift sediments were found - with the current data we cannot constrain the shape of the sedimentary deposits, and, (2) the area near the Discovery and RSA seamounts, where sediment waves were found. - an extensive coverage in this area would allow us to make predictions on the current regime and possibly distinguish between clockwise and counterclokwise circulation patterns in the Cape basin. Navigational information together with preliminary results from cruise ANT-XIV/4 will be available via Internet for viewing and retrieval via FTP using the URL: http://www.mtu.uni-bremen.de/ant144.

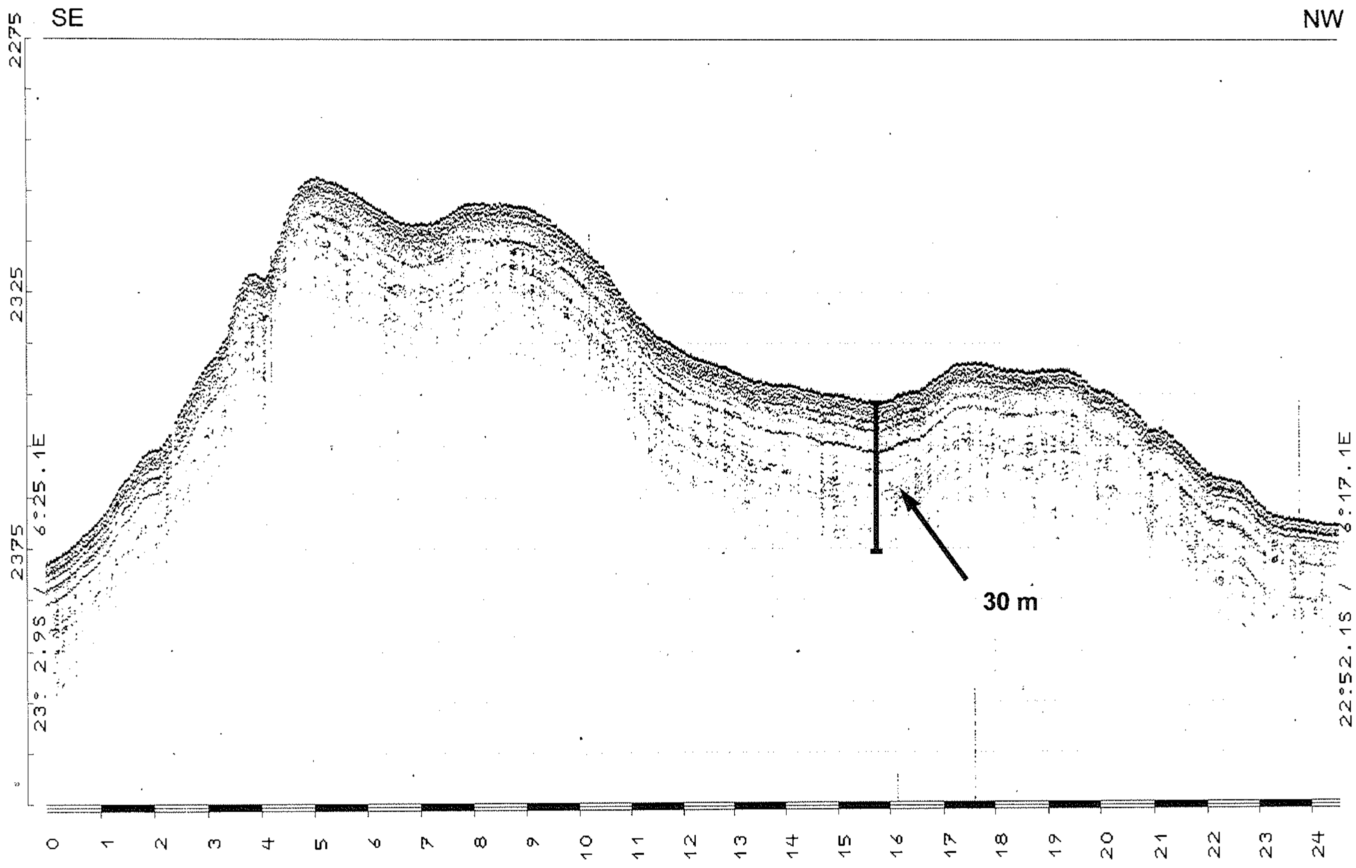

Fig. 3.3-7: PARASOUND image near the Walvis Ridge (wp 11-12) showing carbonates associated with signal penetration of up to 30 meters. The horizontal scale is distance in kilometers and the vertical one is uncorrected water depth in meters.

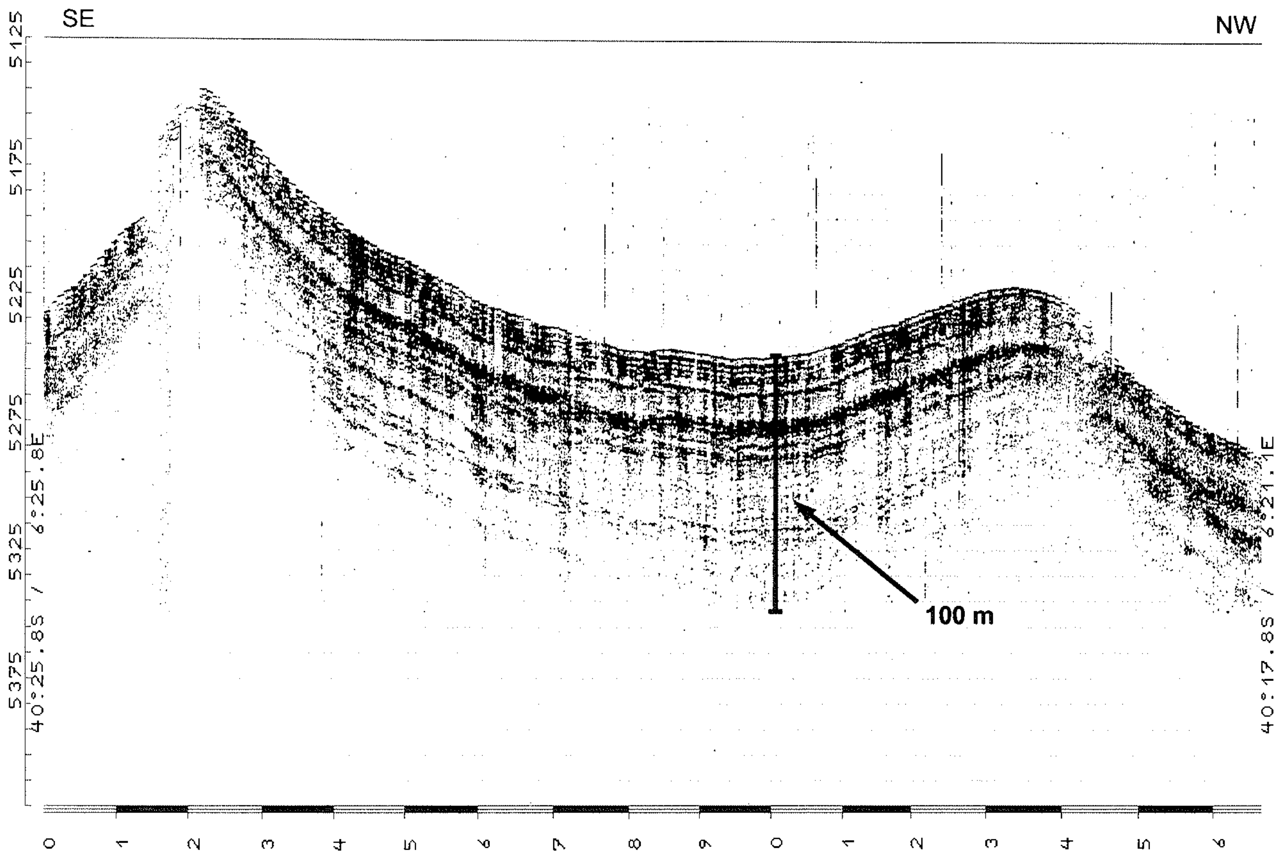

Fig. 3.3-8: PARASOUND image illustrating siliceous oozes found along a profile extracted between waypoints 4b-5. The depth of signal penetration is in this case 100 meters. The horizontal scale is distance in kilometers and the vertical one is uncorrected water depth in meters.

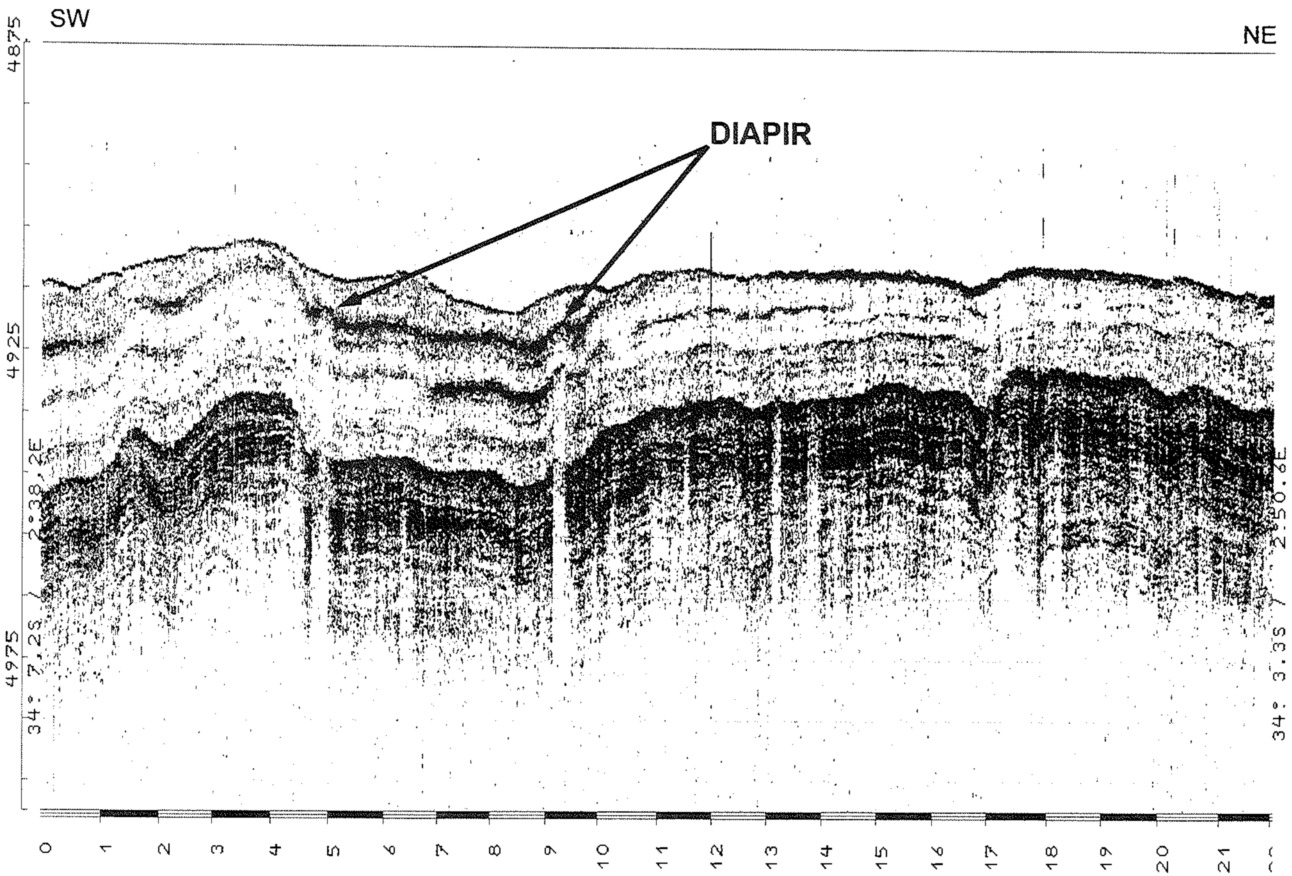

Fig. 3.3-9: PARASOUND image (waypoints 8a and 8b) showing the presence of a diapir field. The horizontal scale is distance in kilometers and the vertical one is uncorrected water depth in meters.

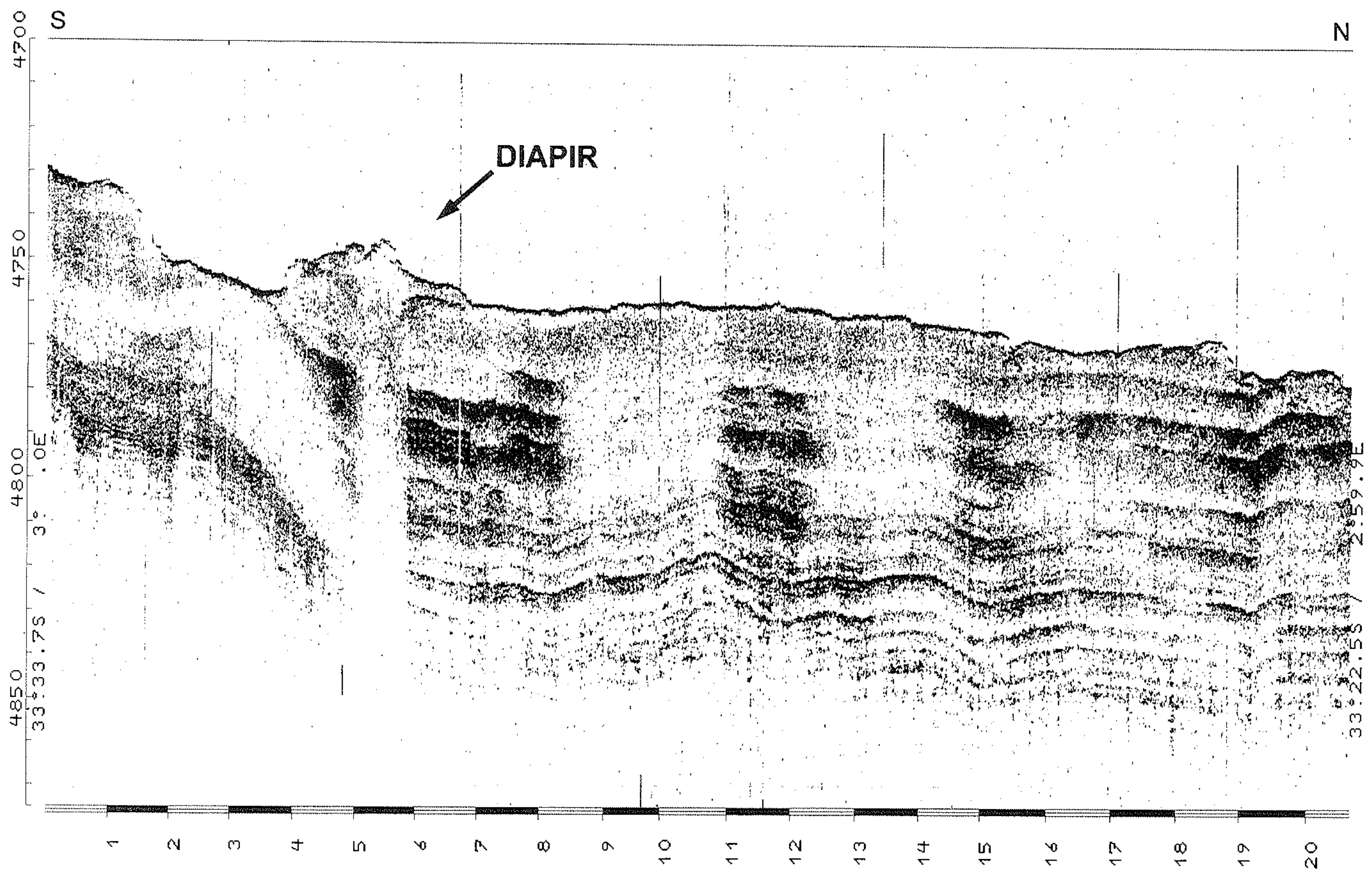

Fig. 3.3-10: PARASOUND image extracted from a profile between waypoints 8c and 8d. Diapirs together with unusual breaks in the reflection patterns were found in this area. The horizontal scale is distance in kilometers and the vertical one is uncorrected water depth in meters.

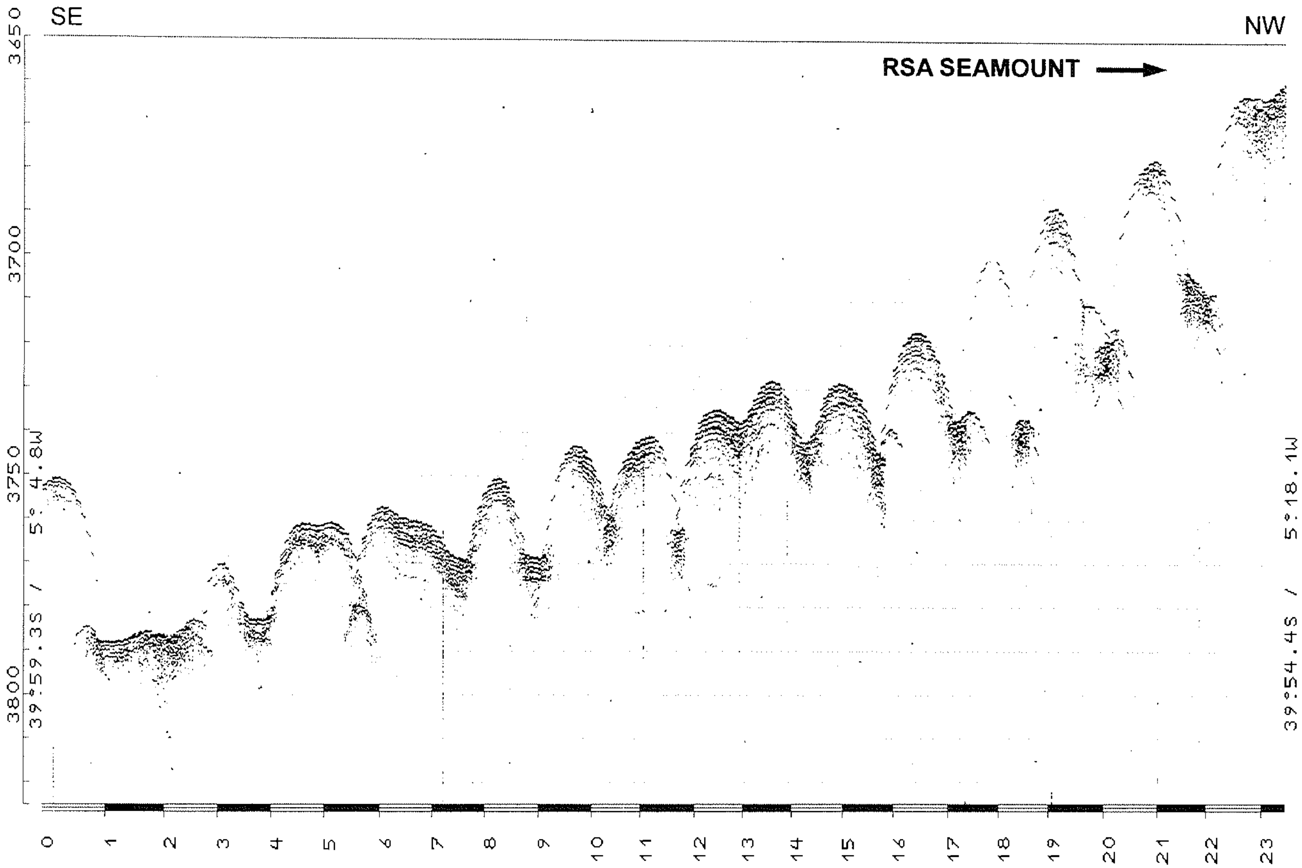

Fig. 3.3-11: PARASOUND image extracted near the vicinity of the RSA seamount (wp 7). Sedimentary waves with wavelengths exceeding 5 km are present in this area. The horizontal scale is distance in kilometers and the vertical one is uncorrected water depth in meters.

References

Abelmann, A., Hubberten, H.-W., Knappertsbusch, M., Mackensen, A. & Zielinski, U. (1992): Fahrtabschnitt ANT-IX/4: Stratigraphische Ergebnisse.- In: U. BATHMANN, M. SCHULZ-BALDES, E. FAHRBACH, V. SMETACEK, & H.-W. HUBBERTEN (Eds.), Die Expeditionen ANTARKTIS IX/1-4 des Forschungsschiffs POLARSTERN 1990-1991, Berichte Polarforsch. 100: 307-311.
Dingle, R.V. (1980). Large allochthonuos sediment masses and their role in the construction of the continental shelf and slope off southwestern Africa. Marine Geology, 37, 333-354.
Dingle, R.V. (1993): Structural and sedimentary development of the continental margin off southwestern Africa.- Communs Geological Survey Namibia, 8, 35-43.
DuPlessis, A., Scrutton, R.A., Barnaby, A.M. & Simpson, E.S.W. (1972): Shallow structure of the continental margin of southwestern Africa.- Marine Geol. 13: 77-89.
Emery, K.O., Uchupi, E., Bowin, C.O., Phillips, J. & Simpson, E.S.W. (1975): Continental margin off western Africa: Cape St. Francis to Walvis Ridge.- AAPG Bulletin 59: 3-59.
Gutberlet, M. & Schenke, H-W. (1989): Hydrosweep: New era in high precision bathymetric surveying in deep and shallow water.- Marine Geodesy 13: 1-23.
Haidvogel, D.B., Wilkin, J.L. & Young R. (1991): A semi-spectal primitive equation ocean circulation model using vertical sigma and orthogonal coordinates.- J. Comp. Phys 94:151-185.
Hsu, K.J. & LaBrecque, J.L. (1984): Init. Repts. *DSDP*, 73: Washington (U.S. Govt. Printing Office).
Miranda, Anne Pimenta (1996): Application d'un modelle numerique de circulation generale oceanique permettant la generation de turbulence de meso-echelle a l'etude de l'Atlantique Sud.- Universite Joseph Fourier, Grenoble I, These, 290 pp.
NOAA (1988): NGDC Data anouncement 88-MG-02: Digital relief onthe surface of the earth.- US Department of Commerce, NOAA, NGDC, Boulder, Colorado.
Rabinowitz, P. D. & LaBrecque, J. (1979): The Mesocoic South Atlantic Ocean and the evolution of its continental margins.- J. Geophys. Res. 84: 5973-6002.
Reid, J.R. (1996): On the circulation in the South Atlantic.- In: G. WEFER, W. BERGER, G. SIEDLER & D.J. WEBB (Eds), The South Atlantic, Present and Past Circulation, 13-44.
Rogers, J. (1995). A comparative study of manganese nodules off southern Africa.- Suid Afrikanse Tydskrift voor Geologie, 98: 208-216.
Rostek, F, Spiess, V. & Bleil, U. (1991): Parasound echosounding: Comparison of analogue and digital echosounder records and physical properties of sediments from the Equatorial South Atlantic.- Marine Geology 99: 1-18.
Shanon, L.V. & Nelson, G. (1996): The Beguela: Large scale features and system variability. In: G. WEFER, W. BERGER, G. SIEDLER & D.J. WEBB (Eds), The South Atlantic, Present and Past Circulation, 163-210.
Summerhayes, C.P., Bornhold, B.D. & Embley, R.W. (1979): Surficial slides and slumps on the continental rise and slope of South-West Africa: a reconaissance study.- Marine Geology 31: 265-277.
Spiess, V (1993): Digitale Sedimentechographie - Neue Wege zu einer hochauflösenden Akustostratigraphie.- Berichte Fachbereich Geowiss., Univ. Bremen, 35, 199 S., 101 Abb, 6 Tab., Bremen.
Tucholke, B. E. & Embley, R. W. (1984): Cenocoic regional erosion of the abyssal sea floor off South Africa.- In: J. SCHLEE (Ed.), Interregional Unconformities and Hydrocarbon Accumulation, 145-164, T

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Acronym	*Institution*	*No. of Participants*
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FBG	Meerestechnik/Umweltforschung FB Geowissenschaften Universität Bremen Postfach 33 04 40 28334 Bremen	4
IfMK	Institut für Meereskunde an der Universität Kiel Abteilung Meeresphysik Düsternbrooker Weg 20 24105 Kiel	6
SWA	Deutscher Wetterdienst Seewetteramt Bernhard-Nocht-Str. 76 20359 Hamburg	1

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Carlsen, Dieter	IfMK
Fütterer, Dieter (Fahrtleiter)	AWI
Gräser, Jürgen	AWI Potsdam
Hopfauf, Vladimir	FGB
Jochum, Markus	IfMK
Köhler, Herbert	SWA
Macario, Ana	FBG
Meyer, Peter	IfMK
Schmid, Claudia	IfMK
Schwenk, Tilmann	FGB
Völker, David	FGB

6. Ship's Crews / Schiffsbesatzung

Function	*Name*
Master	Jürgen Keil
1st Officer	Martin Rodewald
Chief Engineer	Detlef Knoop
2nd Officer	Lutz Peine
2nd Officer	Michael Block
Medical Doctor	Christina Conrad
Radioperator	Georg Koch
2nd Engineer	Gyula Erreth Mon.
2nd Engineer	Olaf Ziemann
2nd Engineer	Martin Fleischer
Electronic Technician	Helmar Pabst
Electronic Technician	Helmut Muhle
Electronic Technician	A. Greitemann-Hackl
Electronic Technician	Jörg Roschinsky
Electronic Technician	Heiko Muhle
Boatswain	Burkhard Clasen
Carpenter	Lutz Reise
Sailor	Luis Gil Iglesias
Sailor	S. Pousada Martinez
Sailor	Reinhard Kreis
Sailor	Ottomar Schultz
Sailor	G.-Ekkehard Burzan
Sailor	Horst Pulss
Storekeeper	Klaus Müller
Technician	Michael Ipsen
Technician	Udo Husung
Technician	Jens Grafe
Technician	Ernst-Uwe Hartmann
Technician	Jörg Preußner
Chief Cook	Wolfgang Haubold
Cook	Thomas Völske
1st Stewardess	Monika Jürgens
Stewardess/Nurse	Ulrike Dähn
2nd Stewardess	Bärbel Czyborra
2nd Stewardess	Stefanie Deuß
2nd Steward	Alexandre Neves
2nd Steward	Tu, Jian Min
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