

SUPPLEMENTARY INFORMATION

The Southern Ocean deep sea: first insights into biodiversity and biogeography

1. Supplementary methods

The ANDEEP programme primarily operated in the Atlantic sector of the Southern Ocean, which is scientifically interesting because of the deep-water formation, as well as more easily accessible for the German polar icebreaker PV *Polarstern*. During ANDEEP I (ANT XIX-2) and ANDEEP II (ANT XIX-3), *Polarstern* operated in the Drake Passage, in the area of the South Shetland Islands and South Shetland Trench, along the western Antarctic Peninsula, to the east of the Antarctic Peninsula in the area where the Larsen B ice shelf disintegrated in February/March 2002, and across the Weddell Sea towards the South Sandwich Islands³¹. During ANDEEP III, samples were taken in the Cape Basin, in the Weddell Sea basin at Maud Rise, off Kapp Norvegia, across the Weddell Sea towards the Antarctic Peninsula, in the Powell Basin, the Bransfield strait and finally in the Bellingshausen Sea off Anvers Island³² (supplementary Table 1).

A CTD profile of the water column was obtained at the beginning of each biological station. Next, the sediment profile imaging system (SPI)³³ (supplementary Table 2; supplementary Figures 1-2) was deployed in order to obtain still photographs and video footage of the surface of the seafloor and profiles through the sediment-water interface and upper sediment layers. A variety of sampling gears was then used to collect animals of different size classes living in and on the sea floor. Two Barnett-type, hydraulically-damped multicorers³⁴ equipped with 57 mm and 100 mm diameter tubes (= 25.5 and 78.6 cm² surface area respectively), and two box corers of 2500 cm² surface area subdivided into 10x10 cm ‘vegematic’ subcores, recovered sediment samples of different, but well-defined surface areas together with the overlying bottom water. The multicores were used principally for the smallest size fraction, the meiofauna (32-300 µm size range), and for the characterisation of sediment parameters. The box corers were used mainly to sample the macrofauna (size class >300 µm).

Two other biological sampling devices were towed across the bottom and obtained material from a much larger but less well-defined area of seafloor. These provided the bulk of the material for taxonomic studies. The epibenthic sledge was used for the macrofauna and the Agassiz trawl for the larger animals, the megafauna. All methods of deployment of the different gear are described in³². The epibenthic sledge was equipped with two nets, a lower epibenthic net (500 µm mesh size) and an upper suprabenthic net (300 µm mesh size), each 1 m in width³⁵. The sledge was lowering at 1 m/sec until the ratio of cable length to water depth reached 1.5 and then pulled across the seabed for 10 min at a mean velocity of 1 knot. During recovery, initial hauling was at 0.7 m/sec until the sledge left the seafloor (as indicated by the winch tension meter), thereafter at 1 m/sec. The haul distances included the distance travelled while hauling. Total distances across the seafloor varied from 711 to 6464 m but were standardised to 1000 m hauls, equivalent to a bottom area of 1000 m² sampled by the sledge for the comparative analyses. In total, 129,895 m² of ocean bottom were sampled with the epibenthic sledge. The 3m wide Agassiz trawl was equipped with a cod end mesh size of 500µm except at Stns 74, 78 and 81 where a 10 mm mesh size was used. It was fished in a similar way to the epibenthic sledge. The sledge usually yielded a fairly clean catch whereas the trawl often recovered large quantities of mud³⁶. On deck, the complete samples were immediately transferred into pre-cooled 96% ethanol and kept at least for 48 hours in -20°C for DNA extraction. First extractions of DNA performed at sea. Specimens were partly sorted on board or later in the laboratory in the Zoological Museum of the University of Hamburg.

2. Supplementary discussion

Sediment data

The ANDEEP project sampled a wide variety of deep-water settings all predominantly characterised by fine-grained sediment with increasing amounts of ice-rafterd debris with proximity towards the Antarctic margin. Sediments were sampled and photographed from water depths between 1181m (Weddell Continental Slope) to 6326m (South Sandwich Trench) and from such diverse depositional settings as continental slope, rise, abyssal plains, trench floors, channel levees and adjacent to fracture zones³⁷⁻⁴¹.

Sediments from the sub-Antarctic basins, including the Agulhas Basin were mainly muds or muddy sands composed of siliceous biogenic material; diatoms, radiolarians, silicoflagellates with subordinate calcareous foraminifera, interpreted as siliceous pelagites supplied from surface and intermediate water mass productivity. The Weddell Continental Slope is characterised by silts and silty-sands. The eastern continental slope, south of Maud Rise and adjacent to Kapp Norvegia is composed of sandy muds with abundant manganese-covered ice rafted debris indicating low sedimentation rates and oxygen-rich bottom waters. The sediment is interpreted as hemipelagic in origin with periodic inputs of sand via turbidites. The western continental slope, east of the Antarctic Peninsula is characterised by laminated muds interpreted as contourites, resulting from the persistent alongslope flow of Weddell Sea Bottom Water³⁷. A surface, fine-grained layer with abundant ice rafted debris is also present, possibly originating from the 1995 Larsen A and 2002 Larsen B ice shelf disintegration^{37,42}. Sediment supply is provided by the direct input of clastic material from ice with some alongslope transport. In contrast, the Weddell Abyssal Plain consists of fine-grained mud containing radiolarians and diatoms with manganese-covered ice rafted debris interpreted as a hemipelagic depositional environment. Sediment supply is from ice rafting and pelagic settling during productive, seasonally ice-free periods.

North of the abyssal plain, the slope and floor of the South Sandwich trench is characterized by sandy muds and laminated sands interpreted as originating from pelagic settling and turbidites supplied from surface productivity and localised downslope mass-movements on the slope and floor. Abundant (5-15%) volcanic tephra were also noted within the sediments, presumably derived sub-aerially from the volcanic arc. High ratios of Mn/Li (70-140) and elevated U/Li ratios demonstrate a strong concentration of Mn in organic-poor sediment. The high Ba/Li (500 ppm) concentrations found on the trench floor reflect some limited enhanced productivity³⁷.

Sedimentation in the deep-water basins of the northern Antarctic Peninsula, notably Powell Basin and the Bransfield Strait is characterized by fine-grained muds and sandy muds containing diatoms, radiolarians, silicoflagellates and some foraminifera. In the Powell Basin abundant, large ice-rafterd debris is present, some clasts being over 1m in diameter and lacking manganese crusts, suggesting higher sedimentation rates than the slope or abyssal plain. The sediment here is interpreted as a contourite³⁹. Seabed photographs display crag and tail structures around the clasts, seabed roughening and a nepheloid layer indicating strong Weddell Sea Bottom Water activity estimated at 50-100cm/sec³². In the Bransfield Strait, sediments are monosulphide-rich with abundant diatoms, radiolarians with little or no ice rafted debris. The high sediment accumulation rates in this tectonically active deep-water basin are controlled primarily by hemipelagic settling. The continental rise northwest of Anvers Island is also composed of sandy muds with abundant diatoms, radiolarians and ice-rafterd debris. Only a very weak bottom current was noted and the sediment is interpreted as being of hemipelagic.

Faunal information

Biodiversity of faunal groups was high and differed in various size classes and between animal taxa (supplementary Table 3).

Archaeabacteria

We investigated archaeal diversity in sediments from three bathyal (1,000–3,500 m) stations sampled during ANDEEP III. These stations were located in the eastern Weddell Sea off the Kapp Norwegia slope (PS67-78) and west of the Antarctic Peninsula close to the Powell Basin (PS67-121 and PS67-142). They were investigated using a 16S ribosomal RNA cloning and sequencing strategy. Complete 16S rDNA sequences were obtained using Arch21F and U1492R primers^{43–45}. The 146 clones sequenced completely yielded 47 phylotypes, 24 in the area off Kapp Norwegia and 23 close to the Powell Basin (GenBank no. EF069336 to EF069388). All of the sequences but one (which grouped in the Euryarchaeota) formed three clusters within the Marine Group 1 Crenarchaeota. Astonishingly, the biggest of these clusters, with 78.8% of the clones, featured *Candidatus Nitrosopumilus maritimus*, the first mesophilic Crenarchaeote isolated so far in pure culture and able to grow by aerobically oxidizing ammonia to nitrite⁴⁶. The cluster also featured many sequences previously isolated from other deep-sea sediments such as clone APA4-0cm isolated in the NW Atlantic Ocean abyssal plain⁴⁷. At all three stations, the majority of the clones were closely associated with clone APA4-0cm, suggesting that these sequences may represent important Crenarchaeota in the functioning of the bathypelagic sedimentary ecosystems of the Weddell Sea.

Comparable results were obtained from east Antarctic deep-sea sediments⁴⁸ and from the deep Pacific bacterioplankton⁴⁹. Interestingly, a recent report conducted in the soil environment concluded that Crenarchaeota may be the most abundant ammonia-oxidizing organisms in soil ecosystems on Earth⁵⁰. According to the present results, archaeal ammonia-oxidizers might also be abundant in Antarctic bathyal sediments.

Protista - Foraminifera. Weddell Sea samples (1100 to 5000 m water depth) yielded typical deep-water assemblages of meiofauna-sized foraminifera (>63 µm size fraction). In total, 158 live species were recognized with the greatest diversity occurring on the lower slope (3100–4100 m). A particular feature was the large number (72) of soft-shelled monothalamous species, most of them undescribed. These increased in relative abundance from 8% of all live foraminifera at 1100 m to 33% at 4975 m. Many of the Weddell Sea species are typical bathyal and abyssal forms well known from the North Atlantic and elsewhere. More than a third of the live assemblage in some bathyal samples (1100 and 2100 m) were hidden within phytodetrital aggregates, which covered >75% of the sediment surface at many Weddell stations. These phytodetrital assemblages, dominated by species such as *Epistominella exigua*, *Alabaminella weddellensis* and *Tinogulmia riemannii*, are strikingly similar to those reported from the abyssal North Atlantic, pointing to ecological as well as faunal similarities between the two regions (supplementary Table 4).

Macrofaunal samples yielded numerous representatives of the Komokiacea, large (typically 1–2 mm) testate protists currently placed within the foraminifera, but possibly representing a new eukaryotic group according to a recent molecular study (Lecroq et al., in prep). From ANDEEP III samples, we recognised 34 komokiaceans *sensu strictu* and another 14 species which exhibited some komokiacean-like features^{51,52}. At least 34 of these 48 species were new to science. They were most abundant and diverse in the deepest part of the Weddell Sea at depths ≥4800 m. As in the case of the smaller (meiofaunal) foraminifera, there was a strong similarity between Weddell Sea and North Atlantic komokiacean assemblages with more than half of the species, including many which are undescribed, being common to both regions.

Metazoan meiobenthos. The higher taxon composition of SO metazoan meiobenthos (<1 mm) resembles that in other oceans: Nematoda are dominant (often >90%), followed by harpacticoid Copepoda and Ostracoda. Other taxa are uncommon or rare. On the continental shelf, slope and the abyssal plains of the SO, meiobenthic densities in general, and nematode abundances in particular, are among the highest recorded anywhere in the deep ocean. The genus-level composition of deep-sea nematodes is rather homogeneous and does not differ in the SO. Unlike

many macrobenthic taxa, no genera are confined to deep-water habitats around Antarctica. There is, however, a difference in relative abundances of some genera along bathymetric gradients in the SO compared with other parts of the world. In particular, *Dichromadora* and *Microlaimus* are more abundant in the Weddell Sea than at comparable water depths elsewhere (supplementary Figure 3, supplementary Table 5). Their buccal cavity morphology suggests that these genera eat diatoms which are deposited in large quantities on the Antarctic seafloor.

A different picture emerges when considering nematode species composition in the deep SO. The ecology and distribution of *Acantholaimus*, *Dichromadora*, *Desmodora*, *Desmodorella*, and *Molgolaimus* species has been studied on Antarctic shelves and slopes⁵³⁻⁵⁶. Of the 57 species recognised, at least 56% were new to science. In addition, 37% were recorded at one location, while 56% were confined to one region (e.g. Weddell Sea, Antarctic Peninsula, South Sandwich Trench), suggesting very high local species diversity. At 2000 m water depth off Vestkapp, 3 of the 68 genera present, representing 14% of the total community density, contained 29 species. These results, in combination with the restricted distributions of many species, indicate a high species turn-over between sites (β -diversity) and thus high regional diversity. At the same time, some species had a wide distribution across the ANDEEP study areas, although whether their distributions are circum-Antarctic is unknown because species-level information is only available from the Atlantic Sector of the SO.

Ostracoda are breaking a paradigm. More than 100 species of these small, bivalved crustaceans were obtained alive in the ANDEEP samples. Several had already been collected as dried carapaces and illustrated in the few publications from the SO deep sea, but were assigned, usually erroneously, to “cosmopolitan, pan-abyssal” taxa (see below). As a consequence, at least 70% of the ANDEEP species are new to science. Surprisingly, the Podocopa (57% of specimens) were only slightly more diverse and abundant than the Myodocopa (43%). The family Macrocyprididae was the most abundant (30% of all ostracods) and very diverse (15% of the species), although this deep-sea family is usually represented by only a few species and specimens in samples from other regions. Other abundant and typical deep-sea families were the Trachyleberididae, Hemicytheridae and Cytheruridae. ANDEEP material yielded the first record of a recent species of the order Platycopida in Antarctica. A new species of *Cytherella* was present in large numbers (152 specimens) in a unique sample collected off Western Antarctic Peninsula. The genus *Philoneptunus*⁵⁷ is recorded for the first time in the SO, joining the two previous records of the genus from the southwestern Pacific and the southwestern Atlantic. The family Krithidae, usually abundant in the deep sea, represents only 5% of the ANDEEP specimens. Most of the ostracod species are very rare, occurring in one or few samples (e.g. 72% in 1 or 2 samples; 85% in < 5 samples), possibly reflecting the very limited swimming capabilities of ostracods and their almost completely lack planktonic stages. This finding contradicts the paradigm that deep-sea ostracod species are cosmopolitans (or “pan-abyssals”). The most important contribution of the ANDEEP Project to the study of deep-sea Ostracoda was therefore the collection of live specimens which allow an accurate identification of the taxa. The thorough study of the soft parts of the different species (especially the hemipenis), shows that the previously considered “pan-abyssal” species are in fact groups of several (sometimes >10) different species, each one occurring in a restricted area. Considerable morphological differences are also found in the carapace of these different species; e.g., different spine types in *Henryhowella dasyderma* (Brady, 1880), distinct reticulation patterns in *Bradleya dictio* (Brady, 1880), different numbers of alae in *Bythoceratina scaberrima* (Brady, 1887). These observations have considerable relevance for paleoenvironmental studies in which ostracods are frequently used. Ostracods have the most complete fossil record among extant arthropods and single taxa are interpreted to represent particular environmental conditions. In most studies of deep-sea Ostracoda there is some taxonomic confusion. For example, cosmopolitan ‘species’ such as *Bradleya dictio*, *Bythoceratina scaberrima*, *Cytherella lata* (Brady, 1880), *Cytherella serratula* (Brady, 1880), *Dutoitella suhmi* (Brady, 1880), *Henryhowella asperrima* (Reuss, 1850), *Henryhowella dasyderma* (Brady, 1880), *Legitimocythere presenquenta* (Benson),

Macropyxis similis (Brady, 1880), *Pennyella dorsoserrata* (Brady, 1880), *Pseudocythere testudo* (Sars, 1869) and *Pterygocythere mucronalatum* (Brady, 1880)⁵⁸⁻⁶⁷ are actually complexes of closely related species. Many of the ANDEEP Ostracoda are known only from the Atlantic sector of the SO and our samples yielded few species in common with the Pacific, Indian or Arctic Oceans. However, at the genus level ostracods are distributed worldwide.

The ANDEEP expeditions also provided specimens for the first ever molecular study on deep-sea Ostracoda. The molecular data (based on the markers 16S, ITS and COI) confirm the restricted geographical distribution of single species. Three populations of *Macroscapha opaca* Maddocks, 1990 collected in the Western Weddell Sea (2011m), Eastern Weddell Sea, (1030m) and Eastern Weddell Sea (2147m) show genetic distances to 14% (COI), a level of divergence usually indicating different species or genera^{68,69}. Careful analyses also revealed morphological differences between specimens from these stations. As a result, a new species of *Macroscapha* is being described from the shallowest station in the eastern Weddell Sea. These results suggest that the previously reported large bathymetric distribution of *M. opaca* - 95 to 2738m⁷⁰ might be due to erroneous identification. For a total of 20 species we plan to have the DNA "barcoded" (www.barcoding.si.edu). Another interesting finding is the occurrence of an eyed thaerocytherid species, (*Australicythere cf. polylyca* (G. W. Müller, 1908) common in Antarctic shallow waters (48 to 464m) in the eastern Weddell Sea at 1030m depth, possibly indicating its submergence from the Antarctic shelf. This submergence is possibly related to the extensive downslope water movement, which contributes to the formation of the bottom water masses worldwide.

Macrofauna - Isopoda. This was the second most abundant peracarid taxon after the Amphipoda with 35 % of all species. More than 13,000 specimens of the ANDEEP isopods identified from 40 stations are remarkably diverse with 674 species, 97 genera and 22 families consisting almost entirely (97%) of the suborder Asellota, while on the shelf the Asellot comprise < 50% of the isopod species. These are almost twice as many species than those 371 reported from the entire Antarctic continental shelf^{71,72}. The only comparable diversity data from SO deep-sea Agassiz trawl samples documents less than half this number of species⁷³. The cosmopolitan family Munnopsidae, which includes 208 species, 31 genera and 8 subfamilies was the most abundant and diverse with about 50% of all collected isopods. 34% of all munnopsid species belong to the subfamily Eurycopinae, which is followed in importance by Lipomerinae (19%). The latter shows a lower percentage (7%) in the North Atlantic and is absent in the Arctic and in the North Pacific. It is considered as a young taxon having radiated from a centre of diversification in the Southern Ocean⁷⁴. The most frequent species was *Betamorpha fusiformis* (29 stations), followed by a species of the *Eurycope complanata* complex (22 stations), *Ilyarachna antarctica* and *Eurycope* sp. 4 (18 stations each). However, *B. fusiformis* is known to comprise several haplotypes (cryptic species)⁷⁵, implying that the number of isopod species will increase dramatically in the future^{76,77}. Studies of the ANDEEP-material represent the first molecular data of deep-sea organisms from the Southern Ocean, but many results have relevance for all other deep-sea regions, too. For example, the analysis of the nuclear 18S rRNA gene of asellote isopods, a dominant, morphologically highly diverse group of benthic crustaceans, indicate a multiple colonisation of the deep-sea⁷⁸. This study shows that most of the deep-sea lineages belong to a single clade, which evolved *in situ* in the abyssal oceanic regions. Cryptic speciation is also known from a number of other deep-sea organisms⁷⁹⁻⁸¹, and seems to be a common phenomenon in the deep ocean.

Roughly 86 % of isopod species in ANDEEP samples are presently either known only from the SO and are new and undescribed; the remaining 13 % were reported mainly from the South and North Atlantic. In addition to two isopod families, ANDEEP added 43 genera to SO biodiversity and zoogeography, the most common being *Mirabilicoxa*, *Prochelator*, *Momedossa*, and *Notopais*. Our knowledge of SO isopods occurrence at bathyal and abyssal depths has increased tremendously; for example, from 30 to 216 species in 3000 m depth. Despite this high species richness, the species area plot indicates that the 40 ANDEEP stations did not

representatively sample the SO deep-sea Isopoda, a fact attributable to the high number of “rare” species occurring at only one station. Isopod diversity ($[E(S_{100})]$) was highest at around 3000 m depth and trends with latitude were much stronger than those with longitude (supplementary Figure 4). Our new data add 15.3 % to the world’s known marine isopod diversity, which currently stands at ~4,400 species⁸².

Macrofauna - Polychaeta. Little information on polychaete diversity in the deep SO existed before the ANDEEP project. Although species richness was fairly low compared to the Isopoda, 295 species, 81 are new to science, were recognised. Diversity indices were high, reflecting the low number of individuals per sample (10-1000, mean 285, per m²). Patterns of polychaete diversity were complex with depth related trends overlain by strong regional differences. For example, species richness on the shelf and upper slope off the Antarctic Peninsula was about half that on the Weddell Sea shelf.

Families of opportunistic polychaetes, such as the Spionidae, Paraonidae, and Cirratulidae which are often common in slope and rise depths in temperate latitudes^{83,84} were rare. Instead, dominant polychaetes included three new species belonging to the families Sphaerodoridae, Pholoidae, and Ampharetidae. In other respects, however, ANDEEP polychaetes resembled faunas north of the Antarctic Convergence⁸⁵ and included new species belonging to genera previously reported only from the northern hemisphere, e. g., the ampharetids *Egamella*, *Mugga*, and *Muggoides*. Other new species belonged to the cossurid *Cossura* and the chrysopetalid *Dysponetus*, typical faunal elements on continental slopes around the world. The occurrence of two new species of the dorvilleid genus *Ophryotrocha*, an abundant and speciose genus in other oceans but highly underrepresented in deep waters of the SO⁸⁵, was also noteworthy.

The bathymetric distribution of polychaetes is distinctive. A “eurybathic” shelf community extends beyond 2000 m water depth. Below ~1000-1500 m, the fauna becomes increasingly depauperate with no replacement of shelf species by a slope and rise community. A shift to a true deep-sea assemblage, composed of genera considered typical for the deep sea worldwide, occurs at 2500-3000 m. This fauna extends onto the abyssal plain. Unlike many isopods, the degree of eurybathy among SO polychaete species is not substantially different to that found in other deep-sea areas (supplementary Figure 5). The wide geographical ranges of many SO polychaete species may reflect their dispersive larval stages and evolutionary longevity. These patterns contrast strongly with the high degree of possible endemism among brooding isopods.

Macrofauna - Mollusca. All seven molluscan classes are present in the SO deep sea. Around 260 species have been recognised⁸⁶, compared to ~800 on the much better sampled Antarctic shelf. However, the difference was substantially reduced in the Weddell Sea where ANDEEP samples yielded 160 species of shelled gastropods and bivalves compared to 279 species on the shelf (<1000m). The decrease was more marked for gastropods than for bivalves; the ratio of gastropod to bivalve species decreased from 2.9 on the shelf to 1.4 in the deep. Bivalve and scaphopod species were often represented by multiple individuals at several sites while gastropods were found as singletons or pairs at only one or few sites.

As on the shelf, many molluscs (~75%) are unknown outside the SO and there is an absence of wide-ranging Atlantic deep-sea species such as the gastropod *Benthonella tenella*. Around 40% of species were only found in abyssal depths. The deep-sea gastropod fauna was dominated by omnivorous and predatory species, especially buccinoids, turrids and naticids, and deposit feeders such as littorinoids and rissoids^{87,88}. The abyssal Antarctic buccinoid genera shared no species with the sublittoral and bathyal faunas. The deep-sea bivalve fauna is dominated by taxodont taxa, especially of the Nuculanidae and Limopsidae, but carnivorous genera like *Cardiomya* and *Cuspidaria* are also present⁸⁹. There is molecular evidence for

emergence of species evolved from the deep-sea bivalve *Limopsis tenella* onto the Antarctic shelf (Linse, pers. comm.).

Megafauna - Porifera. The sponges of the deep Weddell Sea are very diverse with 76 species from 47 genera and 30 families distributed among all three classes, the Calcarea, Demospongiae and Hexactinellida. Seventeen species are new to science and 37 new for the SO. Most surprising was the discovery of the first Calcarea from the SO deep sea. Calcareous sponges have traditionally been regarded as shallow-water animals. They have only been recorded sporadically in deeper water from the SO⁹⁰, and below 850 m there were no previous records. The ANDEEP project yielded six calcarean species from 1120 - 4400 m depth, four being undescribed. The Demospongiae comprise the bulk of the ANDEEP collection, both regarding numbers of species and specimens. A particular surprise was the wide distribution of the carnivore sponge family, Cladorhizidae. Members of three cladorhizide genera (*Cladorhiza*, *Asbestopluma*, *Chondrocladia*) were discovered, comprising at least eight species, three of them new. The abundance and richness of this peculiar group of predatory sponges has not been recognised previously, probably due to their small size (commonly <5mm), and warrants a re-evaluation of their ecological importance in the deep sea. On the Antarctic shelf, the Hexactinellida occur in dense populations, reach large body sizes and high individual ages⁹¹. Abyssal Hexactinellida up to 70 cm in height were collected with 46 % of the species new to science⁹². The role of these large and efficient filter-feeders in the pelago-benthic trophic webs is largely underestimated. In addition, their siliceous skeletons help to structure the sea floor and create habitat structures for other organisms such as vagile polychaetes, isopods and nematodes, thereby exerting an important control on benthic meio- and macrofaunal diversity and distribution.

References

31. Fütterer, D. K.; Brandt, A., Poore, G.C.B. The expeditions Antarktis-XIX/3 and XIX/4 of the Research Vessel POLARSTERN in 2002 (ANDEEP I and II: Antarctic Benthic deep-sea Biodiversity: colonisation history and recent community patterns). *Ber. Polar- Meeresforsch.* **470**, 1-174 (2003)
32. Fahrbach, E. The expedition ANTARKTIS-XXII/3 of the research vessel “Polarstern” in 2005. *Ber. Polar- Meeresforsch.* **533**, 1-246 (2005)
33. Diaz, R.J. Biological and physical processes structuring deep-sea surface sediments in the Scotia and Weddell Seas, Antarctica. *Deep-Sea Res. II* **51**, 1515-1532 (2004)
34. Barnett, P.R.O., Watson, J., Connelly, D. A multiple corer for taking virtually undisturbed samples from shelf, bathyal and abyssal sediments. *Oceanol. Acta* **7**, 401-408 (1984)
35. Brenke, N. An epibenthic sledge for operations on marine soft bottom and bedrock. *Mar. Technol. Soc. J.* **39**(2), 10-19 (2005)
36. Linse, K., Brandt, A., Bohn, J., Danis, B. De Broyer, C., Heterier, V., Ebbe, B., Janussen, D., López González, P.J. Schüller, M., Schwabe, E., Thomson, M.R.A. Macro- and megabenthic communities in the abyssal Weddell Sea (Southern Ocean). *Deep-Sea Res. II* (in review)
37. Howe, J.A., Shimmield, T.M., Diaz, R. Deep-water sedimentary environments of the northwestern Weddell Sea and South Sandwich Islands, Antarctica. *Deep-Sea Res. II*, **51**, 1489-1514 (2004)
38. Howe J.A. Recent sedimentation and geochemistry across the Weddell Sea and adjacent deep-water regions, Antarctica In: Fahrbach, E. and Lemke, P. (Eds) The expeditions Antarktis ANT XXII/3 of the research vessel Polarstern. *Ber. Polar-Meeresforsch.* (2006)
39. Howe, J.A., Wilson, C. R., Shimmield, T.M., Diaz, R.J. and Carpenter, L. W. Recent deep-water sedimentation, trace metal and radioisotope geochemistry across the Southern Ocean and Northern Weddell Sea, Antarctica. *Deep-Sea Research II* (submitted)
40. Harland, R., Fitzpatrick, M.E.J., Pudsey, C.J. Latest Quaternary dinoflagellate cyst clinostratigraphy for three cores from the Falkland Trough, Scotia and Weddell seas, Southern Ocean. *Rev. Palaeobot. Palyn.* **107**, 265-281. (1999)
41. Gilbert, I. M., Pudsey, C.J., Murray, J.W. A sediment record of cyclic bottom-current variability from the northwest Weddell Sea. *Sediment. Geol.* **115**, 185-214. (1998)
42. Scambos, T., Hulbe, C., Fahnestock, M. Climate-induced ice shelf disintegration in the Antarctic Peninsula. In: Domack, E., et al. (eds) *Antarctic Peninsula climate variability: Historical and palaeoenvironmental perspectives*. Ant. Res. Ser. 79, American Geophysical Union, Washington DC, 79-92 (2003)
43. DeLong, E.F. Archaea in coastal marine environments. *Proc. Nat. Acad. Sci. US* **89**, 5685-5689 (1992)

44. Orphan, V.J. *et al.* Comparative analysis of methane-oxidizing Archaea and sulfate-reducing bacteria in Anoxic marine sediments. *Appl. Environ. Microbiol.* **67**, 1922-1934 (2001)
45. Gillan, D.C., Danis, B., Pernet, P., Joly, G., Dubois, P. Structure of sediment-associated microbial communities along a heavy-metal contamination gradient in the marine environment. *Appl. Environ. Microbiol.* **71**, 679-690 (2005)
46. Könneke, M. *et al.* Isolation of an autotrophic ammonia-oxidizing marine archaeon. *Nature* **437**, 543-546 (2005)
47. Vetriani, C., Jannasch, H.W., MacGregor, B.J., Stahl, D.A., Reysenbach, A.L. Population structure and phylogenetic characterization of marine benthic Archaea in deep-sea sediments. *Appl. Environ. Microbiol.* **65**, 4375-4384 (1999)
48. Bowman, J.P., McCuaig, R.D. Biodiversity, community structural shifts, and biogeography of prokaryotes within Antarctic continental shelf sediment. *Appl. Environ. Microbiol.* **69**, 2463-2483 (2003)
49. Karner, M.B., DeLong, E.F., Karl, D.M. Archaeal dominance in the mesopelagic zone of the Pacific Ocean. *Nature* **409**, 507-510 (2001)
50. Leininger, S., *et al.* Archaea predominate among ammonia-oxidizing prokaryotes in soils. *Nature* **442**, 806-809 (2006)
51. Gooday, A.J., Cedhagen, T., Kamenskaya, O.E., Cornelius, N. The biodiversity and biogeography of komokiaceans and other enigmatic foraminiferan-like protists in the bathyal and abyssal Southern Ocean. *Deep-Sea Research II* (submitted)
52. Gooday, A.J., Cedhagen, T., Kamenskaya, O.E., New and little-known Komokiacea (Foraminifera) from the Weddell Sea and adjacent areas of the Southern Ocean. *Zoological Journal of the Linnean Society* (in revision)
53. Vermeeren, H., Vanreusel, A., Vanhove, S. Species distribution within the free-living marine nematode genus *Dichromadora* in the Weddell Sea and adjacent areas. *Deep Sea Res. II* **51**, 1643-166 (2006)
54. Fonseca, G., Vanreusel, A., Decraemer, W. Taxonomy and biogeography of Molgolaimus Ditlevsen, 1921 (Nematoda: Chromadorea) with reference to the origins of deep sea nematodes. *Ant. Sci.* **18**, 23-50 (2006)
55. Ingels, J., De Mesel, I., Vanhove, S., Vanreusel, A. The biodiversity and biogeography of the free-living nematode genera *Desmodora* and *Desmodorella* (family Desmodoridae) at both sides of the Scotia Arc. *Polar Biol.* **10**, 936-949 (2006)
56. De Mesel, I., Lee, H.J., Vanhove, S., Vincx, M., Vanreusel, A. Species diversity and distribution within the deep-sea nematode genus *Acantholaimus* on the continental shelf and slope in Antarctica. *Polar Biol.* **29**, 860-871 (2006)
57. Jellinek, T., Swanson, K.M. Report on the taxonomy, biogeography and phylogeny of mostly living benthic Ostracoda (Crustacea) from deep-sea samples (Intermediate Water depths) from the Challenger Plateau (Tasman Sea) and Campbell Plateau (Southern Ocean), New Zealand. *Abh. Senckenberg. Nat.forsch. Ges.* **558**, 1-329 (2003)

58. Ayress, M. A., De Deckker, P., Coles, G. P. A taxonomic and distributional survey of marine benthonic Ostracoda off Kerguelen and Heard Islands, South Indian Ocean. *J. Micropalaeontol.* **23**(1): 15-38 (2004)
59. Benson, R. H. Recent Cytheracean Ostracodes from McMurdo Sound and the Ross Sea, Antarctica. *Univ. Kansas Paleontol. Contr.* **6**, 1-36 (1964)
60. Benson, R. H. In search of lost oceans: a paradox in discovery. *Proc. Ann. Biol. Colloqu.* **37**, 379-389 (1979)
61. Bonaduce, G., Barra, D., Aiello, G. The genus *Henryhowella* Puri, 1957 (Crustacea, Ostracoda) in the Atlantic and Mediterranean from Miocene to Recent. *Boll. Soc. Paleontol. Ital.* **38**(1), 59-72 (1999)
62. Dingle, R.V. Recent Subantarctic benthic ostracod faunas from the Marion and Prince Edward Islands Archipelago, Southern Ocean. *Rev. Esp. Micropaleontol.* **35** (1): 119-155 (2003)
63. Majoran, S., Dingle, R. V. Cenozoic deep-sea ostracods from southwestern South Atlantic (DSDP/ODP sites 329, 513 and 699). *Rev. Esp. Micropaleontol* **33**(2), 205-215 (2001)
64. Neale, J.W. An ostracod fauna from Halley Bay, Coats Land, British Antarctic Territory. *Brit. Ant. Surv. Sci. Rep.* **58**, 1-50 (1967)
65. Whatley, R. C., Staunton, M., Kaesler, R. L., Moguilevsky, A. The taxonomy of Recent Ostracoda from the southern part of the Strait of Magellan. *Rev. Esp. Micropaleontol.* **28**(3), 51-76 (1996)
66. Whatley, R. C., Eynon, M., Moguilevsky, A. The depth distribution of Ostracoda from the Greenland Sea. *J. Micropalaeontol.* **17**(1), 15-32 (1998a)
67. Whatley, R. C., Moguilevsky, A., Ramos, M. I. F., Coxill, D. J. Recent deep and shallow water Ostracoda from the Antarctic Peninsula and the Scotia Sea. *Rev. Esp. Micropaleontol.* **30**(3), 111-135 (1998b)
68. Schön, I. Primers and PCR conditions for non-marine ostracods. *BioTech.* **31**, 1012-1016 (2001)
69. Schön, I. *et al.* Long-term persistence of asexuality through mixed reproduction in *Eucypris virens*. *Heredity* **84**, 161-169 (2000)
70. Hartmann, G. Antarctic and Subantarctic Podocopa (Ostracoda). *Theses Zoologicae* **26**: 1-355 (1997)
71. Brandt, A. Zur Besiedlungsgeschichte des antarktischen Schelfes am Beispiel der Isopoda (Crustacea, Malacostraca). *Ber. Polarforsch.* **98**, 1-240 (1991)
72. Brandt, A. Evolution of Antarctic biodiversity in the context of the past: the importance of the Southern Ocean deep sea. *Ant. Sci.* **17**(4), 509-521 (2005)
73. Brey, T. *et al.* Antarctic benthic diversity. *Nature* **368**, 297 (1994)

74. Malyutina, M.V., Brandt, A. Diversity and zoogeography of Antarctic deep-sea Munnnopsidae (Crustacea, Isopoda, Asellota). *Deep-Sea Res. II* (submitted)
75. Raupach, M.J., Malyutina, M., Brandt, A., Wägele, J.-W. Molecular data reveal a highly diverse species flock within the munnnopsoid deep-sea isopod *Betamorpha fusiformis* (Barnard, 1920) (Crustacea: Isopoda: Asellota) in the Southern Ocean. *Deep-Sea Res. II* (submitted)
76. Raupach, M.J., Wägele, J.-W. Distinguishing cryptic species in Antarctic Asellota (Crustacea, Isopoda) – a preliminary study of mitochondrial DNA in *Acanthaspidia drygalskii*. *Ant. Sci.* **18**, 191-198 (2006)
77. Creasey, S.S., Rogers, A.D. Population genetics of bathyal and abyssal organisms. *Adv. Mar. Biol.* **35**, 1-151 (1999)
78. Raupach, M.J., Held, C., Wägele, J.-W. Multiple colonization of the deep-sea by the Asellota (Crustacea: Peracarida: Asellota). *Deep-Sea Res. II* **51**, 1787-1795 (2004)
79. France, S.C., Kocher, T.D. Geographic and bathymetric patterns of mitochondrial 16S rRNA sequence divergence among deep-sea amphipods, *Eurythenes gryllus*. *Mar. Biol.* **126**, 633-643 (1996)
80. Quattro, J.M., Chase, M.R., Rex, M.A., Greig, T.W., Etter, R.J. Extreme mitochondrial DNA divergence within populations of the deep-sea gastropod *Frigidoalvania brychia*. *Mar. Biol.* **139**, 1107-1113 (2001)
81. Larsen, K. Morphological and molecular investigation of polymorphism and cryptic species in tanaid crustaceans: implications for tanaid systematics and biodiversity estimates. *Zool. Jour. Linn. Soc.* **131**, 353-379 (2001)
82. Kensley, B. Estimates of species diversity of free-living marine isopod crustaceans on coral reefs. *Coral Reefs* **17**, 83-88 (1998)
83. Blake, J.A., Grassle, J.F. Benthic community structure on the U.S. South Atlantic Slope off the Carolinas: Spatial heterogeneity in a current-dominated system. *Deep-Sea Res.* **41**, 835-874 (1994)
84. Hilbig, B., Blake, J. A. Deep-sea polychaete communities in the northeast Pacific Ocean off the Gulf of the Farallones, California. *Bull. Mar. Sci.* **78**(2), 243-269 (2006)
85. Hilbig, B. Polychaetes of the deep Weddell and Scotia Seas - composition and zoogeographical links. *Deep-Sea Res. II*, **51**, 1817-1827 (2004)
86. Linse, K., Griffiths H.J., Barnes, D.K.A., Clarke, A. Biodiversity and biogeography of Antarctic and Sub-Antarctic Mollusca. *Deep-Sea Res. II* **53**, 985-1008 (2006)
87. Harasewych, M.G., Kantor Y.I. The deep-sea Buccinoidea (Gastropoda: Neogastropoda) of the Scotia Sea and adjacent abyssal plains and trenches. *The Nautilus* **118**, 1–42 (2004)
88. Schrödl, M., Linse, K., Schwabe, E. Review on the distribution and biology of Antarctic Monoplacophora, with first abyssal record of *Laevipilina antarctica*. *Polar Biol.* **29**, 721-727 (2006)

89. Linse, K. Scotia Arc deep-water bivalves: composition, distribution and relationship to the Antarctic shelf fauna. *Deep-Sea Res. II* **51**, 1827-1838 (2004)
90. Koltun, V. M. Porifera Part I: Antarctic sponges. *B.A.N.Z. Ant. Res. Exp. 1929-1931. Rep. Ser. B.* **IX**(4), 147-198 (1976)
91. Gatti, S. The role of sponges in High-Antarctic Carbon and Silicon cycling – a modelling approach. *Ber. Polarforsch.* **434**, 1-124 (2002)
92. Janussen, D., Tabachnick, K.R., Tendal, O.S. Deep-sea Hexactinellida (Porifera) of the Weddell Sea. *Deep-Sea Res. II*, **51**, 1857-1883 (2004)

4. Supplementary tables

Supplementary Table 1: Station table of ANDEEP I-III EBS (EpiBenthic Sled) stations with abundance and ES(100) of Isopoda (lat° and long° indicate the start of the haul).

stations	date	depth (m)	lat°	long°	haul length (m)	Isopoda /1000 m	ES(100)
41-3	26.01.02	2370	59°22.24	S-59°22.57 S	60°04.06 W-60°04.05 W	4928	43,83
42-2	27.01.02	3689	59°40.30	S-59°40.32 S	57°35.42 W-57°35.64 W	4766	189,89
43-8	03.02.02	3962	60°27.13	S-60°27.19 S	56°05.12 W-56°04.81 W	4782	41,20
46-7	30.01.02	3894	60°38.33	S-60°38.06 S	53°57.38 W-53°57.51 W	5639	256,63
99-4	12.02.02	5191	61°06.40	S-61°06.40 S	59°16.57 W-59°17.61 W	5336	5,60
105-7	12.02.02	2308	61°24.16	S-61°24.25 S	58°51.56 W-58°51.56 W	2881	2,34
114-4	17.02.02	2921	61°43.54	S-61°43.51 S	60°44.21 W-60°44.43 W	4482	99,73
129-2	22.02.02	3640	59°52.21	S-59°52.20 S	59°58.75 W-59°58.63 W	4076	21,59
131-3	05.03.02	3053	65°19.83	S-65°19.99 S	51°31.61 W-51°31.23 W	3553	258,09
132-2	06.03.02	2086	65°17.75	S-65°17.62 S	53°22.81 W-53°22.86 W	2523	13,48
133-3	07.02.02	1121	65°20.17	S-65°20.08 S	54°14.30 W-54°14.34 W	1314	564,69
134-3	09.03.02	4069	65°19.20	S-65°19.05 S	48°03.77 W-48°02.92 W	4553	11,20
135-4	10.03.02	4678	65°00.05	S-65°59.97 S	43°03.02 W-43°00.82 W	2773	149,3
136-4	12.03.02	4747	64°01.54	S-64°01.51 S	39°06.88 W-39°06.88 W	5306	6,97
137-4	14.03.02	4976	63°44.98	S-63°44.74 S	38°47.75 W-38°48.23 W	4581	15,28
138-6	17.03.02	4542	62°58.08	S-62°57.99 S	27°54.10 W-27°54.28 W	4147	46,06
139-6	20.03.02	3950	58°14.10	S-58°14.15 S	24°21.20 W-24°21.21 W	6464	9,90
140-8	21.03.02	2970	58°15.98	S-58°16.28 S	24°53.73 W-24°54.09 W	4183	32,99
141-10	23.03.02	2312	58°25.07	S-58°24.63 S	24°00.78 W-24°00.74 W	3094	11,83
142-6	24.03.02	6348	58°50.78	S-58°50.44 S	23°57.75 W-23°57.59 W	4221	0,47
143-1	25.03.02	774	58°44.69	S-58°44.45 S	25°10.28 W-25°10.66 W	1441	40,25
16-10	26.01.05	4720	41°07.55	S-41°07.02 S	09°55.94 E-09°54.85 E	3198	70,36
21-7	29.01.05	4577	47°39.87	S-47°38.52 S	04°15.79 E-04°14.94 E	2923	23,61
59-5	14.02.05	4655	67°30.75	S-67°29.81 S	00°00.23 W-00°01.94 E	2878	37,53
74-6	20.02.05	1032	71°18.42	S-71°18.33 S	13°58.21 W-13°57.65 W	711	1037,97
78-9	22.02.05	2149	71°09.52	S-71°09.34 S	14°00.76 W-13°58.85 W	2376	172,56
80-923.02.05	3100	70°38.45	S-70°39.18 S	14°42.86 W-14°43.43 W	1778	346,46	
81-8	24.02.05	4382	70°31.08	S-70°32.23 S	14°34.82 W-14°34.90 W	2935	128,45
88-8	27.02.05	4931	68°03.84	S-68°03.64 S	20°31.39 W-20°27.49 W	3488	76,83
94-14	02.03.05	4891	66°39.08	S-66°37.16	27°09.26 W-27°10.13 W	3476	26,47
102-3	06.03.05	4801	65°33.18	S-65°34.32 S	36°33.24 W-36°31.05 W	3283	28,33
110-8	10.03.05	4695	64°59.20	S-64°00.91 S	43°02.05 W-43°02.10 W	2904	172,18
121-11	14.03.05	2659	63°38.27	S-63°37.31 S	50°37.16 W-50°38.04 W	1945	192,8
133-2	16.03.05	1584	62°46.73	S-62°46.33 S	53°02.57 W-53°04.14 W	1164	2441,58
142-5	18.03.05	3405	62°11.36	S-62°11.36 S	49°27.62 W-49°29.57 W	2251	41,31
150-6	20.03.05	1984	61°49.13	S-61°48.52 S	47°27.51 W-47°28.16 W	1567	199,11
151-7	21.03.05	1183	61°45.67	S-61°45.42 S	47°07.19 W-47°08.07 W	1383	78,81
152-6	23.03.05	1998	62°20.64	S-62°19.91 S	57°53.12 W-57°53.68 W	2113	2,84
153-7	29.03.05	2096	63°19.82	S-63°19.18 S	64°36.44 W-64°37.53 W	1954	110,03
154-9	30.03.05	3803	62°32.52	S-62°31.31 S	64°39.45 W-64°38.66 W	2525	10,30

Supplementary Table 2: Surficial sediment characteristics and interpretations for ANDEEP stations based on sediment cores and surface and sediment profile images. Percentages refer to the image area covered by each variable and represent the range of values from stations in a region. Biogenic features are categorized as present (+) or absent (-).

Region	Cape Basin	Anvers Island	Bransfield Strait	Elephant Island	Kapp Norvegia	King George Island	Ona Basin	Powell Basin	Shackleton Fracture Zone	South Sandwich Islands	South Sandwich Trench	South Sandwich Trench	Weddell Abyssal Plain	Weddell Sea
Number of Stations	2	2	1	2	3	2	2	3	3	4	1	1	10	4
Station Numbers	16, 21	153, 154	152	43, 46	74, 76, 78, 80	105, 114	121, 133	142, 150, 151	40, 41, 129	139, 140, 141, 142	143	99	81, 88, 94, 102, 110, 134-138	131, 132, 133
Tectonic Setting	Fracture Zone basin	Continental Arc	Back-arc basin	Island arc	Passive margin	Island arc	Fracture zone basin	Rifted basin	Fracture zone	Intra-oceanic arc	Trench	Trench	Abyssal plain	Passive margin
Depth Range	4500-4700	2000-3700	1900	1100-2900	2100-4300	2300-2900	3700-4000	1200-3300	1800-3600	800-3900	6300	5200	4100-5000	1100-3000
Sediment Features:														
Description	Yellow-brown mud	Olive-grey sandy mud	Green-grey mud	N/A	Olive-grey sandy mud	N/A	N/A	Olive-grey sandy mud	N/A	Grey-brown sandy mud	Grey-brown sandy mud	N/A	Green-grey mud	Green-grey mud
Minimum Grain Size	Silt-Clay	Silt-Clay	Silt-Clay	Silt-Clay	Silty-clay to Sandy-silt	Silt-Clay	Silt-Clay	Silty-Clay to Sandy-Silt	Silty-Clay to Coarse-Sand	Silty-Clay to Sandy-Silt	Sandy-Silt	Silt-Clay	Silt-Clay	Silt-Clay
Maximum Grain Size	Silt-Clay	Pebble-Cobble	Silt-Clay	Cobble	Pebble-Cobble	Cobble	Silt-Clay	Pebble-Cobble	Pebble-Rock	Pebble	Pebble	Silt-Clay	Pebble-Cobble	Pebble-Cobble
Mean Grain Size (microns*)	14 & 42	32 & 33	17	N/A	25-36	N/A	N/A	14	N/A	35-235	36-69	N/A	8-20	7-31
Mn-covered limestones	0%	<5%	0%	0%	0-75%	0%	0%	<5-50%	0-75%	25-75%	0%	0%	<5-25%	<5-25%
Limestones	0%	0%	0%	0%	0-50%	0%	0%	<25%	0%	<5%	<25%	0%	<25%	<5-25%
Phytodetritus	0%-0%	<5%	0%	0%	<25%	0%	0%	<25%	0%	<5%	0%	0%	<5%->75%	<25->75%
Depositional Environment**	Pelagic	Hemipelagic	Hemipelagic/Turbiditic	N/A	Hemipelagic/Contouritic	N/A	N/A	Contouritic	N/A	Pelagic	Pelagic/Turbiditic	N/A	Pelagic	Contouritic
Biogenic Features:														
Surface Bioturbation	>75%	>75%	>75%	>75%	<5->75%	50->75%	50-75%	50->75%	<25%	<25->75%	>75%	50-75%	50-75%	<25->75%

Burrow Openings	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+
Feeding mounds/pits	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Tubes	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+

* derived using laser-diffraction on bulk, wet sample from box core surface.

** interpreted from sub-bottom profiles, core and photo/video observations.

Supplementary Table 3: ANDEEP data for selected major taxa (* = insufficient data for comparison)

Taxon	Pre-ANDEEP species total	ANDEEP species total	New SO deep-sea records	New species	Post-ANDEEP species total	Presently known only from SO (%)
Komokiacea ¹	0	48	48	~34	50	~37
Porifera:						
Hexactinellida	50	21	11	7	61	~70
Demospongiae	400	48	20	6	420	~50
Calcarea	20	7	6	4	26	~60
Isopoda	371	674	585	585	956	~ 87
Bivalvia	121	65	26	~20	158	~ 57
Gastropoda (shelled)	471	130	43	*	523	~80
Scaphopoda	8	8	1	0	8	50
Polychaeta	274	295	90	81	569	~50

¹Includes Komokiacea *sensu strictu* (34 species) and various komokiacean-like species (9 chain-like species and 5 other species)

Supplementary Table 4. Complementary data on sampling sites and sequence divergence of bipolar foraminifera

Morphospecies	Sampling sites	Depths (m)	SSU rDNA			ITS rDNA		
			N	Sequence divergence	SO vs AO divergence	N	Sequence divergence	SO vs AO divergence
<i>Epistominella exigua</i>	Southern Ocean	Weddell Sea	2609-4975	6	0,20%	0,20%	42	1,20%
	Arctic Ocean	Fram Strait	1548-2784	8	0,10%		40	1,12%
<i>Epistominella vitrea</i>	Southern Ocean	Weddell Sea	1080	3	0,10%	0,52%	4	1,18%
	Southern Ocean	McMurdo Sound	15-20	4	0,62%		5	0,74%
<i>Cibicides wuellerstorfi</i>	Southern Ocean	Weddell Sea	1581-1970	6	0%	0%	12	0,61%
	Arctic Ocean	Fram Strait	1106-3485	4	0%		20	0,78%
<i>Oridorsalis umbonatus</i>	Southern Ocean	Weddell Sea	2167-4407	10	2,68%	2,26%	18	1,16%
	Arctic Ocean	Fram Strait	572-3127	13	2%		24	0,69%
<i>Gloiohullmia</i> sp.	Southern Ocean	McMurdo Sound	15-20	7	8,70%	12,10%	n/a	n/a
	Arctic Ocean	Svalbard	26	2	0,60%		n/a	n/a
<i>Bathyallgromia weddellensis</i>	Southern Ocean	Weddell Sea	2986-3050	4	1,40%	1,40%	3	0,29%
	Arctic Ocean	Fram Strait	1548-2462	13	0,47%		12	0,58%
<i>Psammophaga</i> sp.	Southern Ocean	McMurdo Sound	15-20	4	0,89%	1,91%	n/a	n/a
	Arctic Ocean	Svalbard	80-110	13	1,91%		n/a	n/a
<i>Conqueria laevis</i>	Southern Ocean	Weddell Sea	4060-4980	2	0,33%	1,68%	n/a	n/a
	Arctic Ocean	Fram Strait	2462-2465	2	0,10%		n/a	n/a
<i>Hippocrepinella hirudinea</i>	Southern Ocean	McMurdo Sound	15-20	8	7,23%	6,63%	n/a	n/a
	Arctic Ocean	Svalbard	104-150	3	6,63%		n/a	n/a
<i>Micrometula</i> sp.	Southern Ocean	McMurdo Sound	15-20	9	6,60%	6,71%	n/a	n/a
	Arctic Ocean	Svalbard	20-240	11	1,99%		n/a	n/a

Notes: For each species sequence divergence was calculated separately for Southern Ocean (SO) and Arctic Ocean (AO) populations and compared between both regions. ITS rDNA sequence data are available only for some species. Shelf bipolar species are labelled in blue. N refers to the number of sequences

Ocean	Geographical area	Coordinates	Author
Arctic	Central Arctic ocean	75° - 89°N	Vanreusel et al, 2000
	Laptev Sea	77°-79°N – 114°-122°E	Vanaverbeke et al, 1997a
Atlantic	Porcupine abyssal plain	48°50'N – 16°30'W	Vanreusel, unpublished
	Madeira abyssal plain	31°N – 21°W	Vanreusel, unpublished
	Goban Spur	49°N - 11°-13°W	Vanaverbeke et al, 1997b
	Puerto Rico Trench	32°N - 70°W	Tietjen, 1989
Indian	West Indian Ocean -Off Kenya	02°-05°S – 39-42°E	Muthumbi et al, 2004
Pacific	Fiji Basin	16°57'S – 173°53'E	Vanreusel et al, 1997
	Peru basin	07°04'S - 88°27'W	Bussau, 1993
	Clipperton Fracture zone	2°-23°N – 139°-157°W	Lambshead et al 2003
Southern	SE Weddell margin	71°-75°S – 12°-29°W	Vanhove et al, 1999
	Weddell Abyssal plain	62°-64°S – 33°-54°W	De Mesel, unpublished
	South Sandwich trench	58°S – 25°W	Vanhove, et al, 2004

Supplementary Table 5: Geographical areas used for nematode genera distribution data from fig 3. All studies were quantitative and used standard techniques of sampling and sample processing. Unpublished data from abyssal plains in Atlantic and Southern ocean were collected with a multi corer and processed according to the methods used in Vanhove et al, 2004

- Bussau, C. Taxonomische und ökologische Untersuchungen an Nematoden des Peru-Beckens *PHd dissertation University Kiel* (1993)
- Lambshead, P.J.D., Brown, C.J., Ferrero, T.J., Mitchell, N.J., Smith, C.R., Hawkins, L.E., Tietjen, J.. Latitudinal diversity patterns of deep-sea marine nematodes and organic fluxes: a test from the central equatorial Pacific *Mar Ecol Prog Ser.* **236**, 129-135 (2003).
- Muthumbi, A.W., Vanreusel, A., Duineveld, G., Soetaert, K., Vincx, M. Nematode community structure along the continental slope off the Kenyan Coast, Western Indian Ocean. *Intern. Rev.Hydrobiol.* **89**, 188-205 (2004)
- Tietjen, J.H . Ecology of deep-sea Nematodes from the Puerto Rico Trench Area and Hatteras Abyssal plain. *Deep Sea Res I* **36**, 1567- 1575 (1989)
- Vanaverbeke, J., Arbizu, P.M., Dahms, H.U., Schminke, H.K. The Metazoan meiobenthos along a depth gradient in the Arctic Laptev Sea with special attention to nematode communities *Polar biol.* **18**, 391-401 (1997)a
- Vanaverbeke, J., Soetaert, K., Heip, C., Vanreusel, A. The metazoan meiobenthos along the continental slope of the Goban Spur (NE Atlantic) *Journal of Sea research*, **38**, 93-107 (1997)b
- Vanhove ,S., Arntz, W., Vincx, M. Comparative study of the nematode communities on the southeastern Weddell Sea shelf and slope (Antarctica) *Mar Ecol Prog Ser.* **181**, 237-256 (1999)
- Vanhove S., Vermeeren, H., Vanreusel, A. Meiotauna towards the South Sandwich Trench (750-6300m), focus on nematodes *Deep -Sea Res. II* **51**, 1665-1687 (2004)
- Vanreusel, A., VandenBossche, I., Thiermann, F. Free-living marine nematodes from hydrothermal sediments: similarities with communities from diverse reduced habitats. *Mar Ecol Prog Ser* **157**, 207-219 (1997)
- Vanreusel, A., Clough, L., Jacobsen, K., Ambrose, W., Jivaluk, J., Ryheul, V., Herman, R., Vincx, M. Meiobenthos of the central Arctic Ocean with special emphasis on the nematode community structure . *Deep Sea Res II* **47**, 1855-1879 (2000)

5. Supplementary Figures

Supplementary Figure 1:

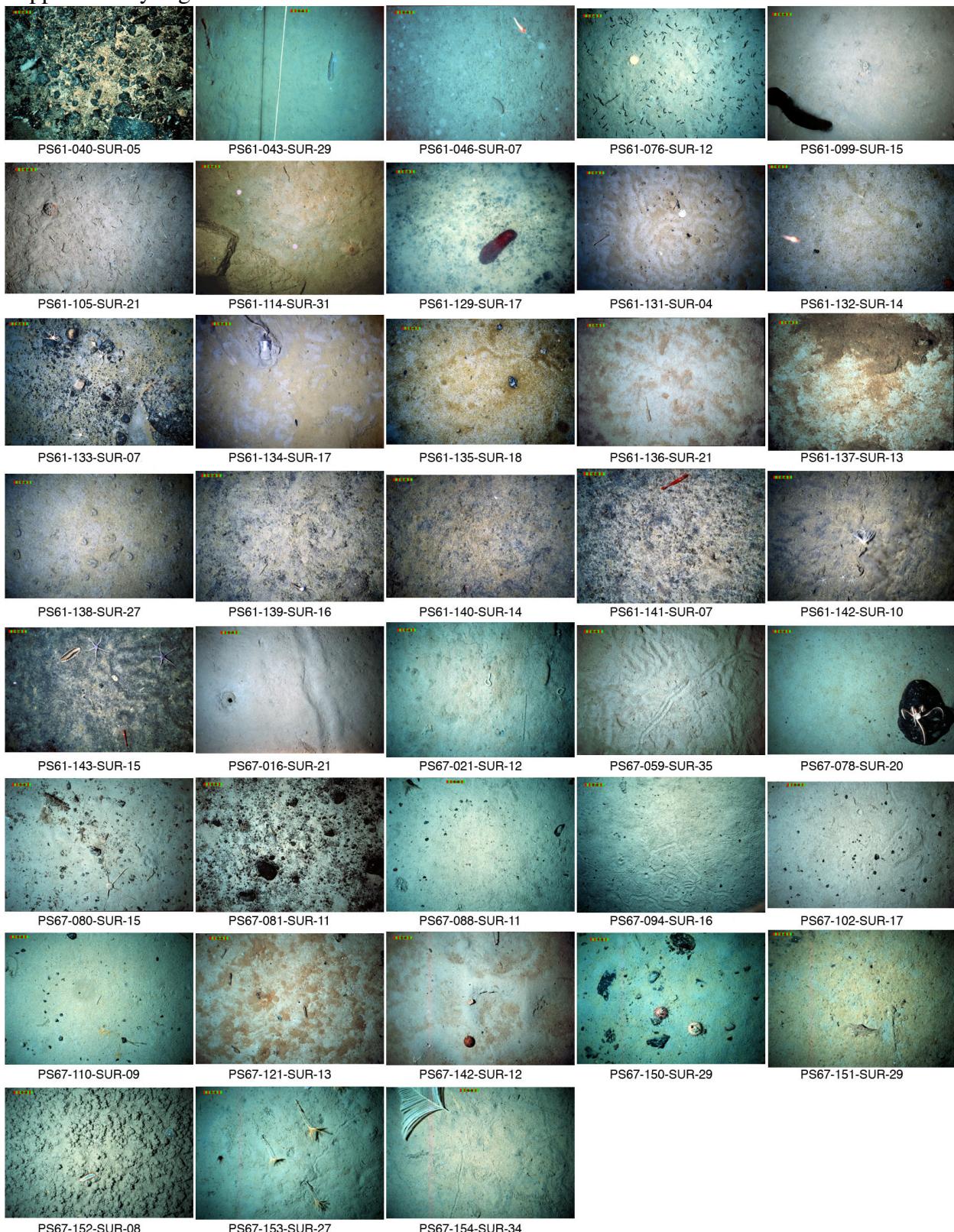


Figure 1: Sediment profile- and surface images from ANDEEP stations. © Bob Diaz, VIMS. Station numbers correspond to those in supplementary Table 1.

Supplementary Figure 2:

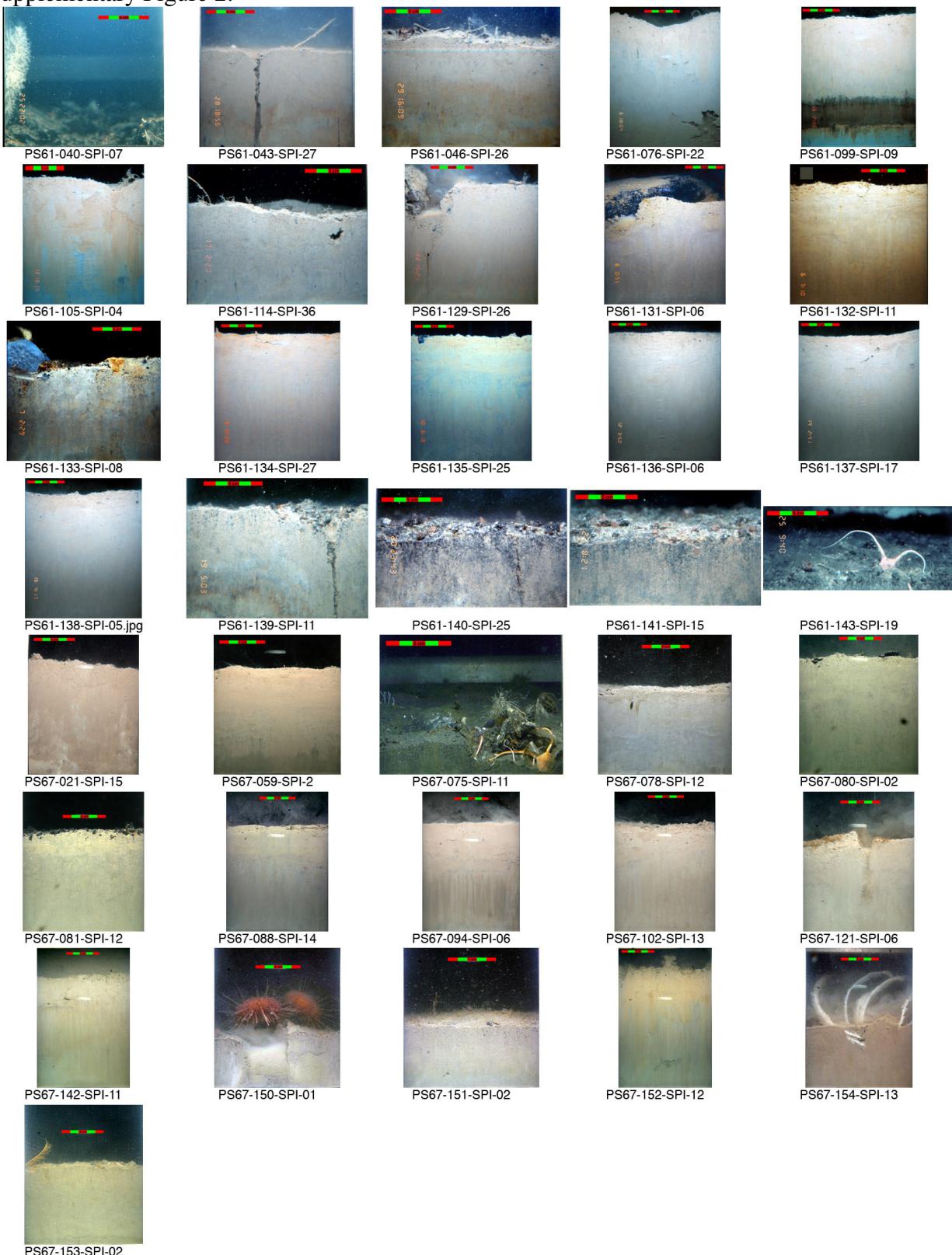


Figure 2: Sediment profile images of ANDEEP stations. © Bob Diaz, VIMS. Station numbers correspond to those in supplementary Table 1.

Supplementary Figure 3:

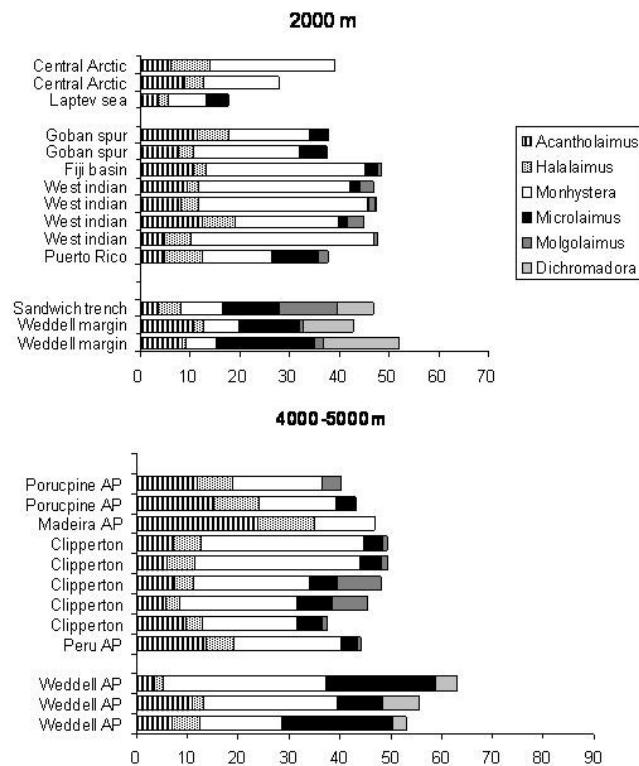
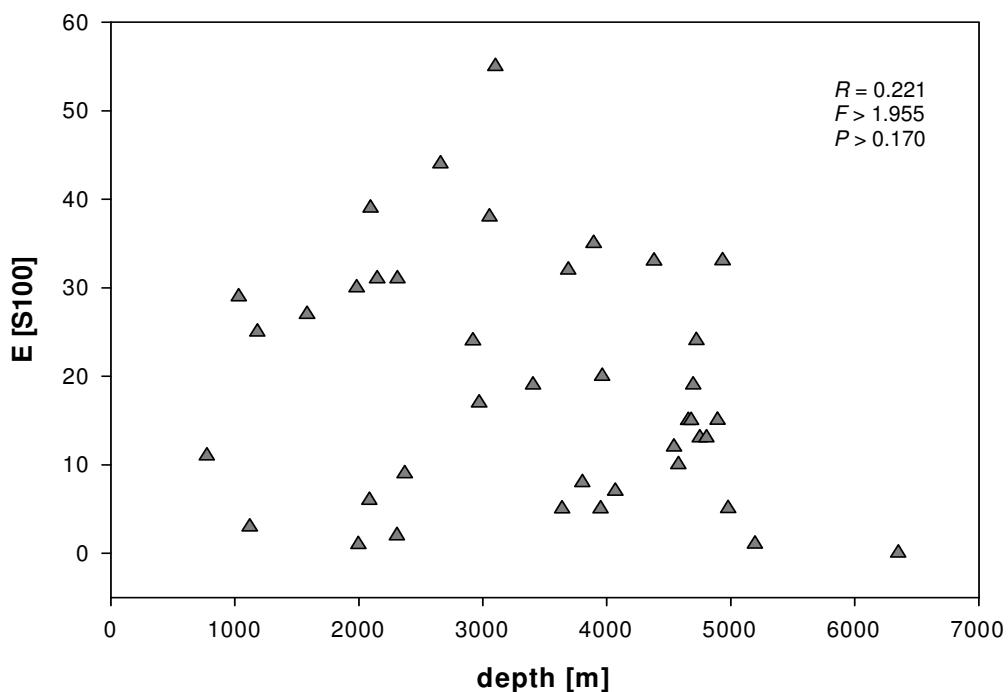


Figure 3: Abundance of selected deep-sea nematode genera. Percentage abundance of selected deep-sea nematode genera in ANDEEP samples from the Southern Ocean and in other samples from the Atlantic, Indian and Pacific Oceans. Details of sampling stations are given in supplementary Table 5.

Supplementary Figure 4:

A)



B)

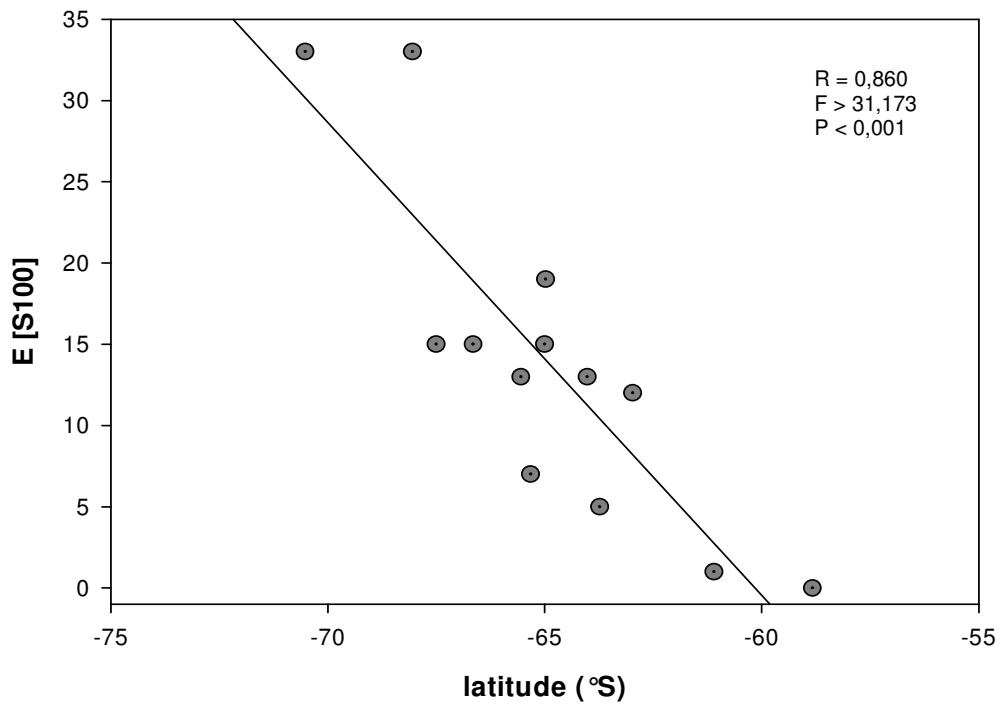


Figure 4: Isopod diversity. Isopod diversity from epibenthic sledge stations sampled during ANDEEP I-III related to (A) depth (all stations) and (B) latitude ($58-70^{\circ}$ S, stations below 4000 m water depth). Diversity of Isopoda is calculated as Hurlbert's expected number (n) of species ($E[S_n]$). For comparison with other studies n is the normalised to 100.

Supplementary Figure 5:

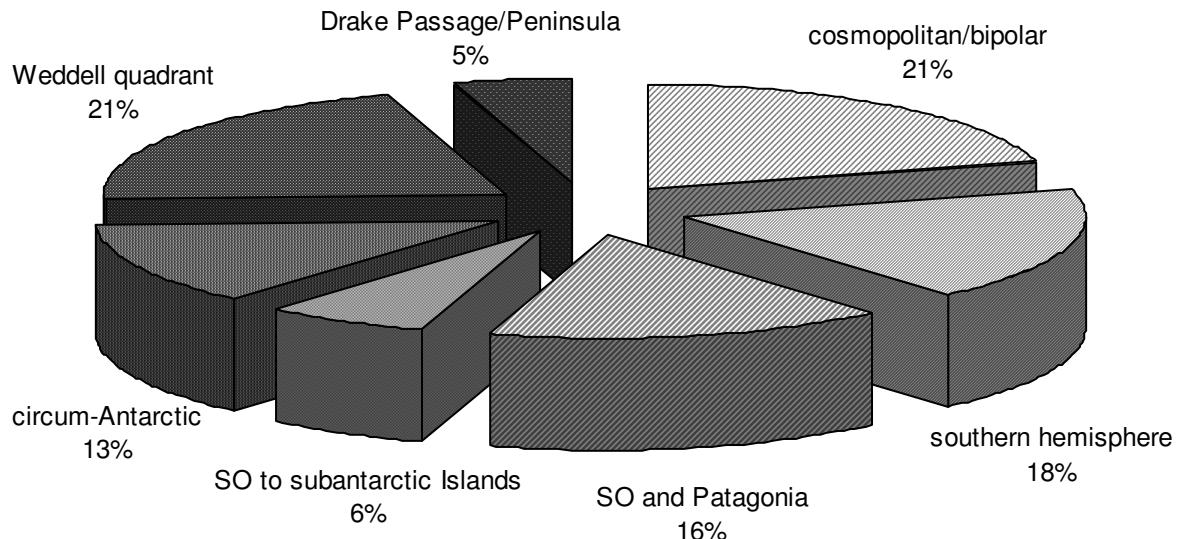


Figure 5: Geographical distribution of deep-sea polychaete species. The geographical distribution of deep-sea polychaete species found in ANDEEP samples. The figure indicates the percentage of species (total = 295) that are distributed in particular geographical regions, both within the Southern Ocean and to the north of the Polar Front.