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Magnetic Anomaly Map of the Weddell Sea Region: a New Compilation of the Russian Data.

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Summary: This paper describes a 1 : 2 500 000 scale aeromagnetic anomaly map produced by the joint efforts of VNIIOkeangeologia, Polar Marine Geological Research Expedition (PMGRE) and the Alfred Wegener Institute for Polar and Marine Research (AWI) for the Weddell Sea region covering 1 850 000 km² of West Antarctica. Extensive regional magnetic survey flights with line-spacing of about 20 km and 5 km were carried out by the PMGRE between 1977 and 1989. In course of these investigations the PMGRE flew 9 surveys with flight-line spacing of 20 km and 6 surveys with flight-line spacing of 5 km mainly over the mountain areas of southern Palmer Land, western Dronning Maud Land, Coats Land and Pensacola Mountains, over the Ronne Ice Shelf and the Filchner Ice Shelf and the central part of the Weddell Sea. More than 215 000 line-kilometers of total field aeromagnetic data have been acquired by using an Ilyushin Il-14 ski-equipped aircraft. Survey operations were centered on the field base stations Druzhnaya-1, -2, and -3, from which the majority of the Weddell Sea region network was completed. The composite map of the Weddell Sea region is prepared in colour, showing magnetic anomaly contours at intervals of 50-100 nT with supplemental contours at an interval of 25 nT in low gradient areas, on a polar stereographic projection.

The compiled colour magnetic anomaly map of the Weddell Sea region demonstrates that features of large areal extent, such as geologic provinces, fold-belts, ancient cratonic fragments and other regional structural features can be readily delineated. The map allows a comparison of regional magnetic features with similar-scale geological structures on geological and geophysical maps. It also provides a database for the future production of the „Digital Magnetic Anomaly Map of Antarctica" in the framework of the Scientific Committee on Antarctic Research/International Association of Geomagnetism and Aeronomy (SCAR/IAGA) compilation.

Zusammenfassung: Dieser Artikel beschreibt eine flugmagnetische Anomaliekarte im Maßstab 1 : 2 500 000, die durch gemeinsames Engagement von VNIIOkeangeologia, der Polar Marine Geological Research Expedition (PMGRE) und dem Alfred-Wegener-Institut für Polar- und Meeresforschung (AWI) für die Weddellmeer-Region zusammengestellt wurde und die eine Fläche von 1 850 000 km² der Westantarktis abdeck. Ausgedehnte regionale magnetische Vermessungsflüge mit Linienabständen von ca. 20 und 5 km sind von der PMGRE zwischen 1977 und 1989 durchgeführt worden. Im Verlauf dieser Untersuchungen flog die PMGRE 9 Vermessungen mit einem Linienabstand von 20 km und 6 Vermessungen mit einem Linienabstand von 5 km hauptsächlich über den gebirgigen Gebieten des südlichen Palmer Land, des westlichen Dronning Maud Land, des Coats Land und der Pensacola Mountains und über den Ronne- und Filchner-Eisschelfen und der zentralen Weddellsee. Mehr als 215 000 Flugkilometer Aeromagnetik sind insgesamt mit einer Ilyushin Il-14 registriert worden. Von den Feldbasisstationen Druzhnaya-1, -2 und -3 aus wurde die Messoperation zentral gesteuert und das Netz um die Weddellmeer-Region vervollständigt. Die zusammengestellte farbige Karte der Weddellmeer-Region ist in polarstereografischer Projektion hergestellt und zeigt Konturen magnetischer Anomalien mit Intervallen von 50-100 nT und mit zusätzlichen Konturen mit Intervallen von 25 nT in Gebieten niedriger Gradienten.

Die zusammengestellte farbige magnetische Anomaliekarte des Weddellmeeres zeigt, dass Strukturen von großer flächenhafter Ausdehnung, wie geologische Provinzen, Faltengürtel, alte kratonische Fragmente und andere regionale Strukturen, leicht beschrieben werden können. Die Karte erlaubt einen Vergleich von regionalen magnetischen Strukturen mit ähnlich skalierten geologischen Strukturen aus geologischen und geophysikalischen Karten. Sie liefert ebenso eine Datenbasis für die zukünftige Herstellung der „Digital Magnetic Anomaly Map of Antarctica" im Rahmen der Zusammenstellung des "Scientific Committee on Antarctic Research/International Association of Geomagnetism and Aeronomy" (SCAR/IAGA).

INTRODUCTION

Regional geologic investigations of major tectonic features are often aided by complementary studies of their associated magnetic anomalies. The approximate distribution of upper crustal, magnetized rock units may convey new information about known rock units or may reveal unsuspected new structures. The first information about the character of distribution of magnetic anomalies for the Weddell Sea region mainly for the offshore areas but also with crossing into the Antarctic Peninsula was obtained during regional flights conducted in 1960-65 by the U.S. Naval Oceanographic Office, Project Magnet (BEHRENDT & BENTLEY 1968). Total magnetic intensity measurements over the continental area were made along reconnaissance lines in the Pensacola Mountains during the 1965-66 austral summer (BEHRENDT et al. 1966). Aeromagnetic profiles delineate anomalies up to 1800 nT associated with the mafic stratiform Middle Jurassic intrusion which comprises the Dufek and Forrestal Ranges. A probable minimum area of 9 500 km² was calculated for the intrusive body on the basis of the magnetic anomalies, making it one of the largest layered gabbro intrusions in the World.

In the following years aeromagnetic surveys were carried out in the Weddell Sea region by a number of countries including Great Britain, Russia and Germany; and in collaborative projects such as of Great Britain and United States (DALZIEL & PANKHURST 1987) and United States and Argentina-Chile (LABRECQUE 1986) surveys. Aeromagnetic surveys conducted by the British Antarctic Survey (BAS) between 1973 and 1987 concentrated on the Antarctic Peninsula and surrounded areas, around the Ellsworth and Thiel Mountains and over the Ronne Ice Shelf (MASLANYJ et al. 1991, JOHNSON & SMITH 1992). The recent aeromagnetic surveys with flight-line spacing of 3 km were carried out by the British Antarctic Survey (BAS) in 1990/91 and 1992/93 austral summers between 67-70 °S crossing the Antarctic Peninsula and adjacent offshore areas (JOHNSON & SWAIN 1995). The aeromagnetic data place additional constrains on the extent of the West Antarctic crustal blocks such as the Antarctic Peninsula, Thurston Island, Haag Nunataks, Ellsworth-Whitmore Mountains and Marie Byrd Land.

Aeromagnetic surveys, covering approximately 1 850 000 km² of the Weddell Sea region, were carried out by the Polar Marine Geological Research Expedition in the 1970s and 80s

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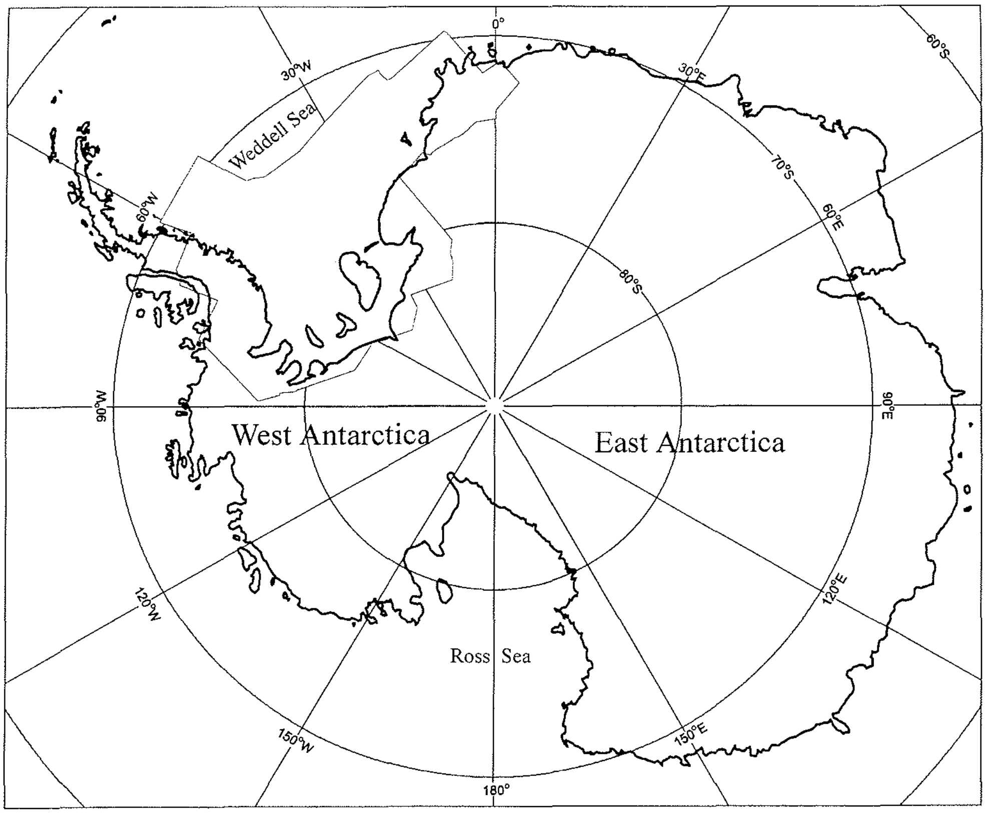

Fig. 1: Location map of the aeromagnetic surveys completed by the PMGRE in West Antarctica in 1977-1994.

Abb. 1: Lokationskarte der flugmagnetischen Vermessungen der PMGRE, durchgeführt von 1977 bis 1994 in der Westantarktis.

(Fig. 1). The area extends from the northern Weddell Sea (70 °S) to the Pensacola Mountains (84 °S), from the Sverdrupfjella Mountains in the east (2 °E) to the Ellsworth Mountains in the west (85 °W). The mapped area has a complex tectonic history and comprises the East Antarctic Shield, the Weddell Sea sedimentary basin, the Mesozoic magmatic arc of the Antarctic Peninsula and the Precambrian Haag Nunataks block.

Cooperation between Britain and Russian institutions allowed JOHNSON et al. (1992) to combine regional data with flight-line spacing of 20 km from BAS and PMGRE surveys and present a preliminary aeromagnetic anomaly map of the Weddell Sea sector of West Antarctica. HUNTER et al. (1996) produced a more advanced version of this map mainly for the Weddell Sea Embayment using more rigorous data processing techniques. In this study we present a new version of the aeromagnetic map which is based only on the Russian data (5 km and 20 km datasets).

The compiled colour magnetic anomaly map of the Weddell Sea region demonstrates that features of large areal extent, such as geologic provinces, fold-belts, ancient cratonic fragments and other regional structural features are readily delineated and proves the usefulness of producing such regional compilations.

AEROMAGNETIC SURVEYS

Aeromagnetic surveying in West Antarctica by the PMGRE commenced under the banner of the former Soviet Antarctic Expedition in 1976/77 austral summer when the field base station Druzhnaya-1 was established on the Filchner Ice Shelf. In subsequent years (1978-89), PMGRE flew 8 surveys with flight-line spacing of 20 km and 6 surveys with flight-line spacing of 5 km mainly over mountain areas of southern Palmer Land, western Maud Dronning Land, Coats Land and Pensacola Mountains, as well as over the Ronne Ice Shelf and Filchner Ice Shelf and the central part of the Weddell Sea. It is necessary to note that a detailed survey (5 km flight-line spacing) carried out over the central part of the Weddell Sea was mostly not used in this study. As a result, a vast and largely inaccessible region of about 1 850 000 km^2 has been covered by aeromagnetic survey partly accompanied by airborne gravity and radio-echosounding observations (Fig. 1).

The most significant differences between the different aeromagnetic surveys are in the measuring equipment, navigation systems and recording techniques. Total field magnetic measurements of the majority of surveys were registered on an analog chart recorder and during 1989 surveys season by using magnetic tape recorder. More than 215 000 line km of aeromagnetic data have been gathered by using an Ilyushin Il-14 ski-equipped aircraft (Fig. 2). Magnetic measurements were made by different modification of proton-precession magnetometers such as AMM-13, AMPM-1, AMP-7, JaMP-3 and MMS-214, with a sensor mounted in a 5 m tail stinger, the aircraft was partly magnetically compensated. Lines were flown perpendicular to the predominant topography and to structural trends suggested by exposed rocks.

Diurnal magnetic variations have been continuously monitored at Druzhnaya-1, Druzhnaya-2, Druzhnaya-3 stations and in the immediate survey areas using mainly M-33 portable base station magnetometer. Flights were restricted to epochs of low external magnetic activity when possible. During earlier flying seasons the regional data were collected with a

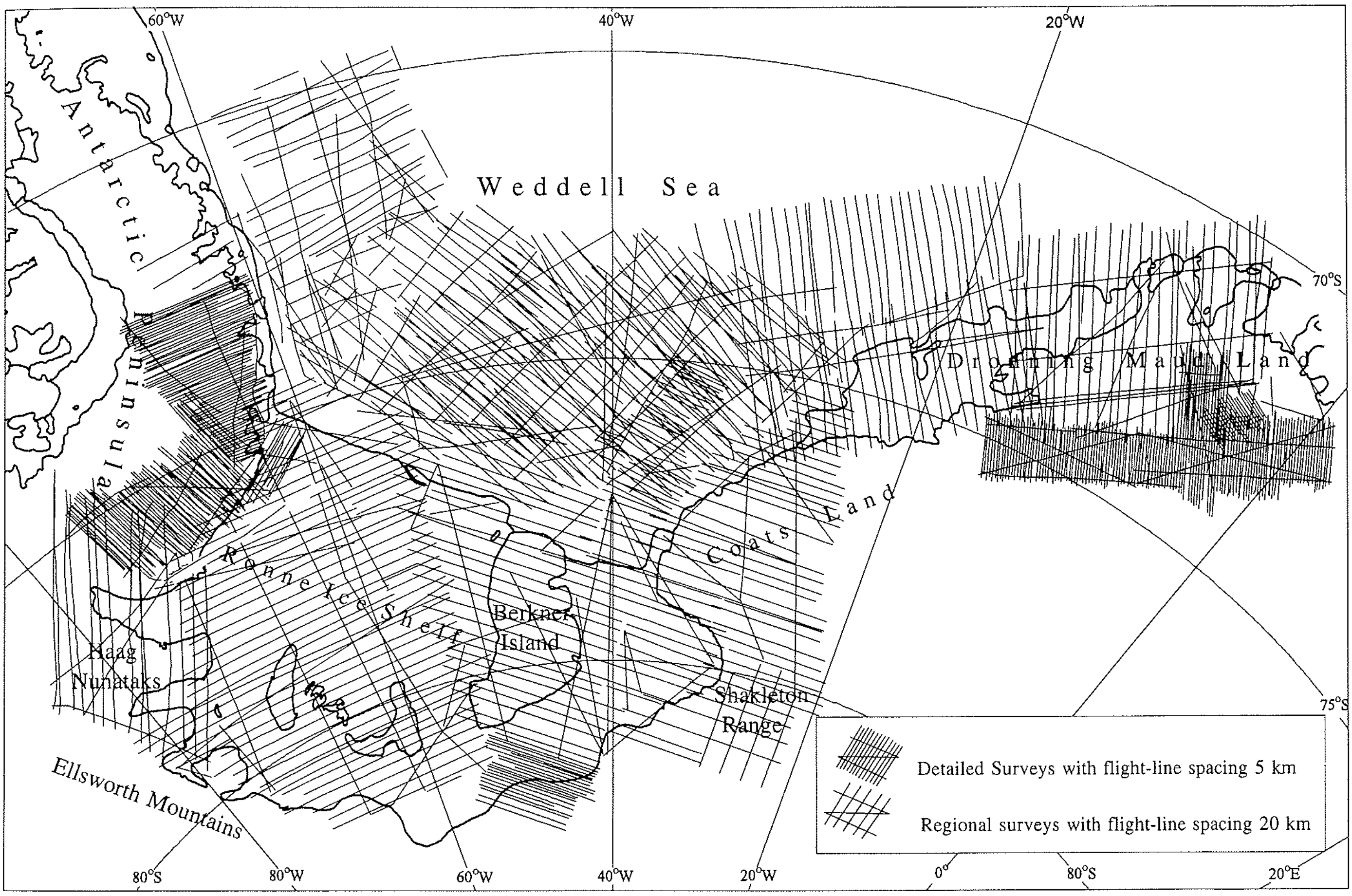

Fig. 2: Aeromagnetic flight-line network collected by the PMGRE in the Weddell Sea region.

Abb. 2: Flugmagnetisches Profilnetz der Weddellmeer-Region, vermessen von der PMGRE.

line spacing of approximately 20 km and recorded on paper records. The recording equipment throughout the 1989 field season was based on the "Graviton" digital data acquisition system, which was specially developed for scientific installation in the aircraft. The total intensity data were sampled at an interval of 15 s with a flight speed of 4 km/min, which approximated spatial sampling of every 1 km along the profiles. For the more detailed survey of the 1989 field season with a 5 km flight-line spacing the sample frequency was increased to 1 Hz (60-70 m).

Navigation prior to 1989 relied on DISS Doppler radar units supplemented by a flight-path camera which was electronically synchronized with the enforcing current of the magnetometer. In the offshore areas the radio-location system „Poisk" was used. Since the 1989 season the standard pseudo-range Global Positioning System (GPS) satellite navigation was also applied. For the regional surveys, position accuracy is 1-2 km and 500 m for more detailed surveys. The position accuracy of the flight-lines was greatly improved (less than 100-150 m) when the GPS was installed on the aircraft. Surveys were generally flown at 2000 m above sea level, although over rugged terrain and offshore this parameter has been varied to meet the particular requirements of these areas. A digital pressure transducer and radar altimeter were used for altitude determination.

DATA PROCESSING

The flight-path-recovery procedure and primary reduction of the profile data were accomplished by PMGRE for each data set individually year-by-year. The magnetic profiles were filtered to remove high-frequency noise due to interference from aircraft electrical systems, and were corrected for diurnal variations of the external magnetic field. Profiles and tie-lines were subjected to a leveling procedure in which the differences among the intersection points were minimized using a least squares fit.

Contour magnetic anomaly maps of the Weddell Sea region have been available since 1980 (MASOLOV 1980) and were prepared for publishing in 1985 in the second edition of the Russian Atlas Antarctica, as well as in the magnetic anomaly map of the World (GOLYNSKY et al. 1992). They are not published yet.

By early 1991 the digitization of aeromagnetic data had been completed for the whole of the Weddell Sea region by using previously compiled diurnally corrected values from the profile maps. This presented the opportunity of applying new techniques to the magnetic dataset. The compiled aeromagnetic data consist of digitally recorded total intensity values and digitized intensity values from the analog profiles.

Two different geomagnetic reference fields had been used to reduce the PMGRE data from total field values to magnetic anomaly. Data from earlier surveys flown in 1977, 1978 and 1979 had been reduced by using the „Cain-22" reference field model (CAIN et al. 1974). For surveys flown in 1985, 1986, 1987 and 1989, an extended version of the 1985 International Geomagnetic Reference Field (IGRF; BARACLOUGH 1985) had been used. All other surveys had been reduced using the 1980 Definitive Geomagnetic Reference Field (DGRF; BARACLOUGH 1981). For the production of the new aeromagnetic anomaly map, all profiles were re-processed using the IGRF 1985 coefficients. This work was done by BAS geophysicists (HUNTER et al. 1996).

All subsequent data processing was made by applying the GSC (Atlantic, Geological Survey of Canada) geophysical image processing and visualization tool package on a SUN SPARC Station 20 at VNIIOkeangeologia, St. Petersburg, Russia. Careful inspection of the levelled dataset processed by BAS and creation of the preliminary shaded-relief images by applying an artificial illumination to the gridded data revealed some residual errors in the form of spurious elongated anomalies, which may occur because of errors in conventional tie-line levelling of airborne survey data, or due to diurnal fluctuations not accurately measured at the base station. It is known that a solution of this problem can be achived by applying a two-dimensional grid filtering program specially designed to remove anomalies elongate in the line direction (Desmond FitzGerald & Associates Pty Ltd. 1995). For eliminating such errors the GSC's directional filtering program was used.

To avoid removing real anomalies, we extract residual errors with the longest possible wavelength along the acquisition lines, the shortest wavelength perpendicular to the lines and the smallest dynamic range that still produces a well-levelled grid. The filtering was performed on individual surveys when one of the grid axes was parallel to the acquisition line direction. This involved some trial and error before getting a satisfactory result. When it was impossible to remove elongate anomalies along acquisition lines, the erroneous lines were excluded from subsequent processing. Lines without intersection with tie-lines required additional attention. Such lines are the main source of corrugations on the map. They were adjusted individually before directional filtering was applied.

The adjusted magnetic data of each individual survey were interpolated onto a 5 km grid using a minimum curvature algorithm (BRIGGS 1974). This procedure takes into account randomly distributed values and generates a smooth surface, especially in areas of sparse data. In the process of merging grids into one dataset, the aeromagnetic survey of the 1989 field season with registration of information in primary digital form and when the Global Positioning System satellite navigation was also used, was chosen as a basic level for other surveys. Discontinuities at survey boundaries are removed by first calculating a first-order fit along the boundary of the area to be adjusted and the fixed area. The resulting first-order surface is subtracted. The remained discrepancies were removed by applying a simple Laplacian differential equation to the residual errors in order that the smoothest surface consistent with the boundary differences can be achieved. It is anticipated that some situations will occur in which a complete removal of boundary differences will not be desirable. However, a first vertical derivative map calculated from the total magnetic intensity anomaly data showed no spurious values at the boundaries between the merged areas, indicating that the surveys were properly adjusted.

The detailed magnetic data were levelled, filtered, and adjusted using the GSC package, the grid interval was selected as 1.5 km; one third of the flight-line spacing. For the purpose of this publication the detailed data were re-gridded to the 5 km interval. Before contouring, the resulting grid was filtered with a 7.5 km radius running mean technique. Calculation of the best fit plane for the whole survey area revealed that reference level of the dataset has a slope of approximately 35 nT and varied from 5 nT in the south-western corner of the survey area to -30 nT in the north-eastern part (Fig. 3). Its appearance is clearly due to the merging (stitching) procedure of individual surveys into one dataset. After subtracting this surface from the dataset, the final 5 km grid was calculated.

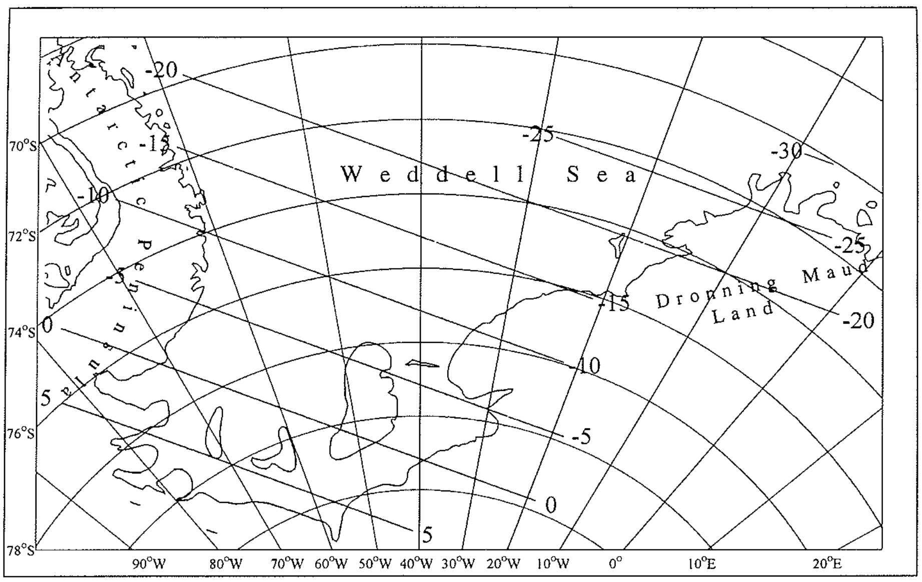

Fig. 3: Distribution of the regional correction for IGRF (Weddell Sea region, contour interval is 5 nT).

Abb. 3: Verteilung der regionalen Korrektur für das IGRF (Weddellmeer-Region, Konturintervall ist 5 nT).

The grid was contoured and plotted using a variable interval of 50-100 nT with supplemental contours at an interval of 25 nT in low gradient areas on a scale of 1 : 2 500 000 (enclosure). The geodetic coordinates of the profile data were converted to rectangular (X-Y) coordinates, using a polar stereographic projection with a central meridian of 40 °W longitude and standard parallel of 71 °S.

The comparison of the processed profile data and the contoured values, shown in Figure 4, demonstrates the preservation of major anomalies through the gridding and contouring operation. The resulting magnetic anomaly map with a contour interval of 100 nT is shown in Figure 5 and was compiled from the 5 km grid of values. 5 km is less than 1 mm at the scale (1 : 10 000 000) of Figure 5, and utilization of the 5 km grid should not affect the following interpretations of regional-scale anomalies.

The magnetic anomaly map of the Weddell Sea region has been prepared entirely using a digital process by the removal of an appropriate geomagnetic reference field. Although airborne surveys used to construct the map were carried out at different times, with different flight-line spacing and elevations, measuring equipment and navigation systems, no attempt was made to continue the anomaly data to a common altitude. Obviously, some errors in the field values of the present map may exist because, of the differences between survey elevations (from 300 m to 2700 m). It is not believed, however, that these errors are important when studying anomalies at the present scale.

The availability of the digital data allowed application of a variety of image processing techniques to enhance the anomalies because the traditional methods of presentation filter out much of the original information content of the data relating to geological structure and trend. Colour and gray-scale shaded-relief images have proved particularly effective forms of presentation for regional and detail data. They contain information on both anomaly amplitude (colour) and anomaly gradient (relief). The latter is especially important as anomaly gradients are directly related to the depth of buried and causative structures. Shaded-relief presentations illuminated from a particular direction have the additional property of enhancing features with trends roughly perpendicular to the direction of illumination, providing information on important lineaments which are not apparent on the original contour maps.

The colour and gray-scale shaded-relief maps (Fig. 6) of the Weddell Sea region were created by using the ER Mapper software system (Earth Resource Mapping Pty Ltd. 1995). For the purpose of the present study a variety of filtering techniques were employed in order to enhance the dataset. The obtained final grid was used for calculating pseudogravity and the horizontal gradient of pseudogravity, first vertical derivative, horizontal gradient and 3D magnetic analytical signal. Careful inspection of the filtered maps/images suggests that they may be useful in enhancing basement features and in determining boundaries of generalized tectonic provinces or regions, each characterized by structures of similar trend and geophysical characteristics.

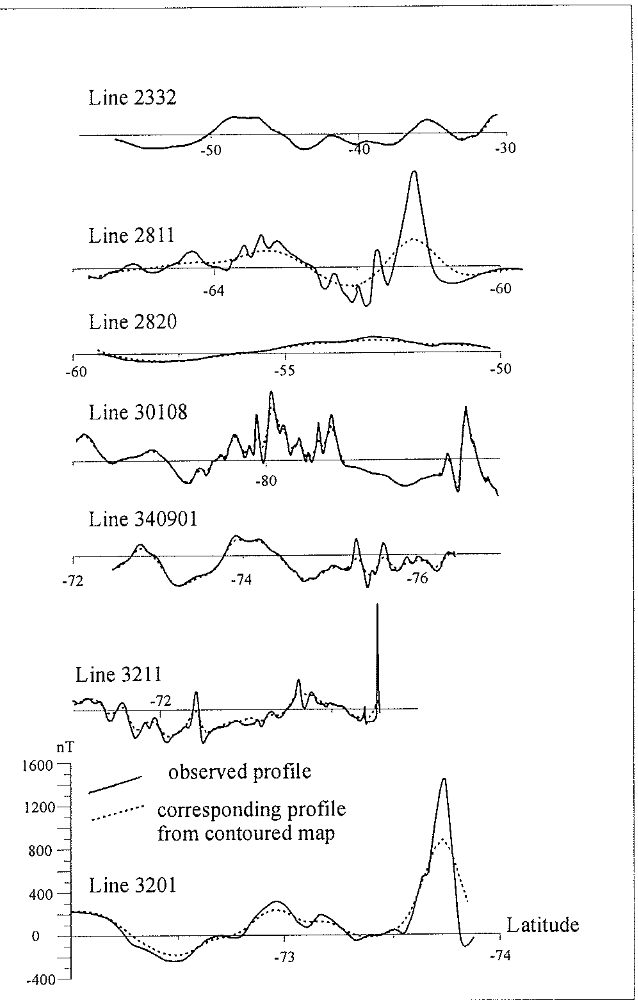

Fig. 4: Comparison of the processed profile data and the contoured values.

Abb. 4: Vergleich der prozessierten Profildaten und der Konturenwerte.

The filtered grids were originally compiled using programs of the GSC package and then were transferred into the ER Mapper (Earth Resource Mapping Pty Ltd. 1995) where the grid values were scaled to a range of 256 using histogram-equalization and converted into a 3-band pseudo-coloured image by using the RGB (Red, Green, Blue) combinations. All colour shaded-relief images including colour shaded-relief presentation of magnetic anomalies of the Weddell Sea region were produced by using a sun-angle routine with artificial illumination from north-north-east (0°, 45°) and an inclination of 45° by applying a two-dimensional transform to the gray-scale images instead of the more traditional contour lines. This format of presentation was chosen for several reasons. Some of the filtered maps/images have a large dynamic range or may have sharp gradients that are difficult to contour. Also, the reader can more easily discern relative magnitudes on shaded-relief maps when restricted to a colour format.

For the calculation of pseudogravity, the aeromagnetic data were reduced to the pole assuming that observed anomalies are induced by a magnetic field with constant values an inclination of -65° and declination of 10° for the whole area. The assumed ratio of susceptibility to density was chosen as 1. The horizontal gradient of pseudogravity image is useful in locating structural trends or contacts. First vertical derivative

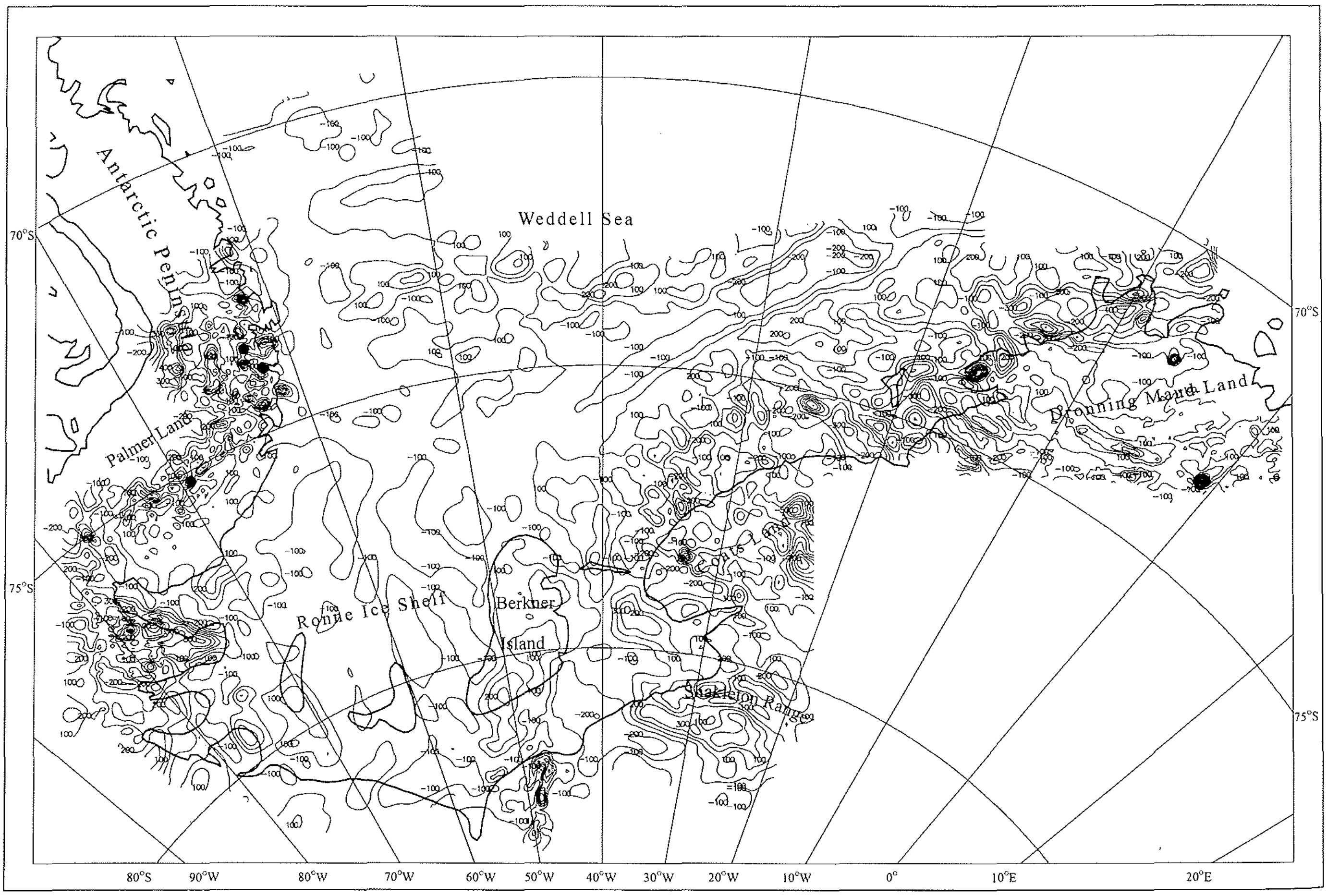

Fig. 5: Aeromagnetic anomaly map of the Weddell Sea region (1 : 10 000 000, contour interval is 100 nT).

Abb. 5: Karte der flugmagnetischen Anomalien der Weddellsee-Region (1 : 10 000 000, Konturenintervall ist 100 nT).

of the magnetic field can be utilized to outline vertical contacts at high latitudes. The aeromagnetic map with the horizontal derivative calculated emphasizes the structural grain of magnetic anomalies. The magnetic data have been analyzed by using the 3D magnetic analytic signal which was calculated by applying the USGS package. Accordingly to NABIGHIAN (1972), the 3D magnetic analytic signal amplitude is vectorial addition of the magnetic gradients in all three directions which produces maxima over magnetic contacts and is related to the magnetization contrast of the underlying rocks. A map of the analytic signal shows the edges of magnetic bodies, which, if these edges represent rocks contacts, can be roughly interpreted as a geological map or "pseudo-geology" map.

THE AEROMAGNETIC ANOMALY MAP

The amplitudes and wavelengths of anomalies exhibited on the compiled map (Fig. 5) vary considerably within the study area, suggesting that it has experienced a long and complex history that resulted in the formation of a variety of lithologies and structures. The highest values with amplitudes up to 5000 nT are associated with the Cretaceous mafic intrusions of the Antarctic Peninsula. At the same time the lowest values can be observed either over areas of the deepening Precambrian basement under the Weddell Sea basin or in other places (for example, Borg Massivet) accounting lithologic variation. In the first case, magnetic anomalies are broadened, their wavelengths could reach up to 100-150 km. The relatively subdued magnetic anomalies over coastal areas of Dronning Maud Land for instance, characterized by short wavelength components of 10-20 km and less which are clearly distinguishable only on the graph maps. Lithologic variation accounts for some of the wide variety of magnetic patterns. For example, magnetic anomalies over Coats Land have different amplitudes and wavelengths from those observed in western Dronning Maud Land, over the Shackleton Range or near Haag Nunataks, although Precambrian basement is exposed in all regions. Variation in depth to magnetic basement also produces a wide variety of magnetic patterns. The outstanding long-wavelength anomalies observed along the continental margin of western Dronning Maud Land are apparently produced by intrusive magmatic rocks into the basement rather than by the volcanic sedimentary sequences forming the Explora Wedge, the latter of which are related to the initial rifting events of Gondwana separation.

In the Ronne Ice Shelf area, the magnetic basement is generally assumed to consist of Precambrian crystalline rocks (Haag Nunataks type basement) or igneous rocks of younger age (GARRET at el. 1987, MASLANYJ & STOREY 1990, ALESHKOVA et al. 1994, HUNTER et al. 1996). Phanerozoic sedimentary rocks here are assumed to be nonmagnetic and to

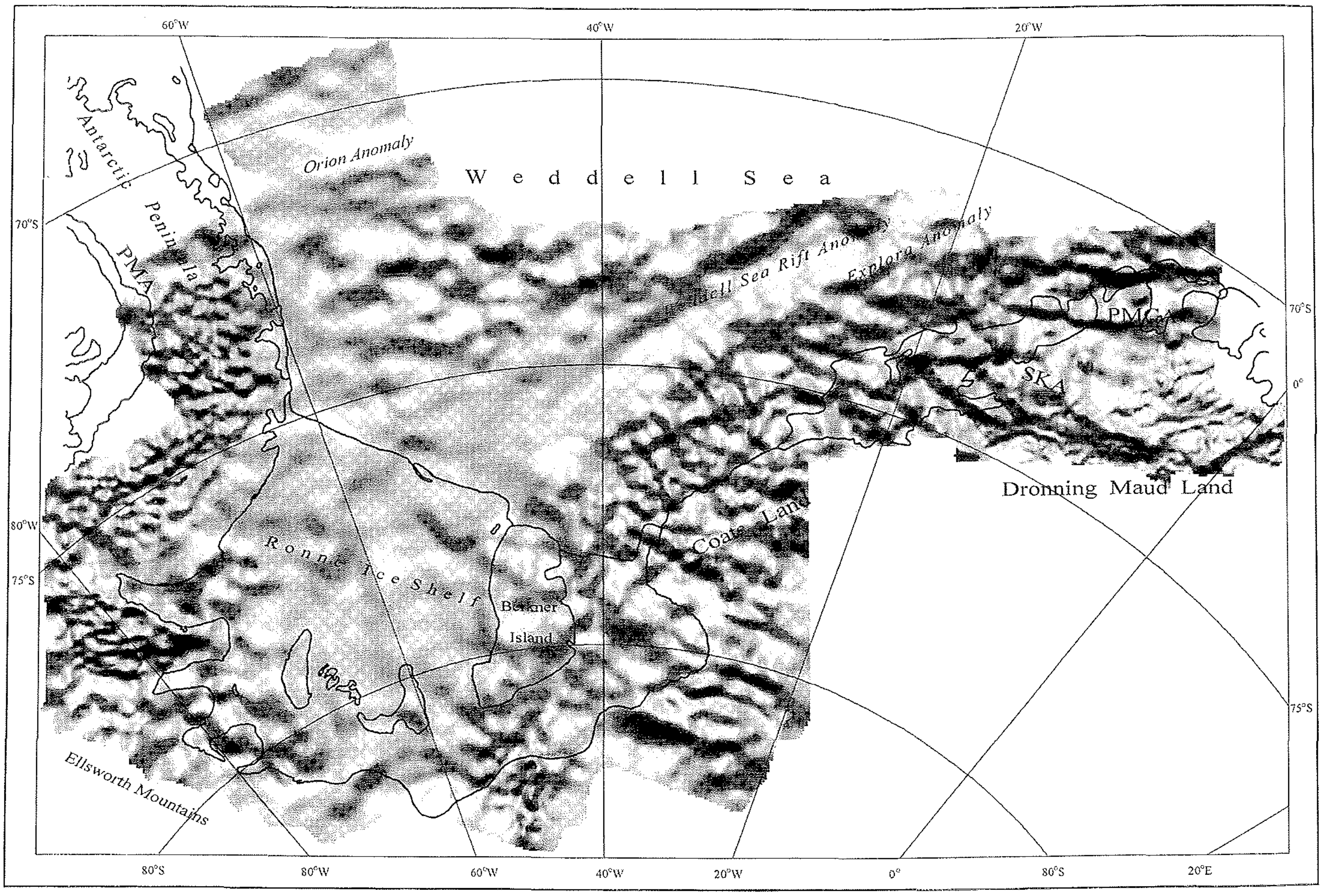

Fig. 6: Gray-scale shaded-relief map of the magnetic field illuminated from the north at 45° inclination.

Abb. 6: Schattierte Reliefkarte des Magnetfeldes im Grauton, beleuchtet vom Norden mit einer Inklination von 45°.

produce little or no change in the magnetic field. Over southern Palmer Land (Antarctic Peninsula) magnetic basement is coincident with the surface of the Mesozoic igneous rocks.

Of particular interest are several magnetic megalineaments observed on the map that may reflect continental-scale tectonic features (Fig. 5). A magnetic lineament is defined as a straight or curvilinear alignment of anomalies or gradients that extends horizontally for distances greater than 400 km. It may have substantial width, expressing a zone rather than a narrow feature. Examples are the Pacific Margin Anomaly (MASLANYJ et al. 1991), the Central Plateau Magnetic Anomaly and East Coast Magnetic Anomaly (GOLYNSKY & MASOLOV 1999) along the Antarctic Peninsula are striking geophysical features and represent major crustal discontinuities.

In the eastern part of the region magnetic lineaments are outlined on the shelf and coastal areas. These are the Explora Anomaly, the Weddell Sea Rift Anomaly, the H.U. Sverdrupfjella-Kirwanveggen Anomaly (SKA), the Princess Martha Coast Anomaly.

On the basis of characteristic anomaly-wavelength and amplitude distributions within the map it is possible to distinguish a number of magnetic patterns attributed to three major crustal units: the West and East Antarctic terranes and the Weddell Sea Embayment (WSE) area.

The East Antarctic (EA) magnetic zone is found in the easternmost part of the map and covers the edge of the East Antarctic Shield. It can be subdivided into six magnetic units, two of them recognized over Dronning Maud Land and another four over Coats Land.

The West Antarctic magnetic zone comprises the Palmer Land Unit and the Haag Nunataks Unit. Both units are mainly characterized by short-wavelength magnetic anomalies (<50 km) but their trends are discordant to each other.

The magnetic field of the WS zone in contrast to the adjacent provinces is relatively smooth, uncomplicated with a less differentiated magnetic pattern of low gradients (<5 nT/km) and low amplitude of predominantly long-wavelength (100-150 km) anomalies. This picture, well corresponding to the typical "basin anomaly" pattern, is mostly due to the large thickness of sedimentary strata reaching 15 km in the central part of the WSE, in vicinity of the shelf ice front (KUDRYAVTZEV et al. 1987). From the magnetic anomaly pattern, the WS zone can be subdivided into three main parts: the Ronne Ice Shelf unit, the southern Weddell Sea margin unit and the East Antarctica margin unit.

A detailed description of the different magnetic units is given in GOLYNSKY & ALESHKOVA (2000).

SUMMARY

The aeromagnetic surveys carried out by the PMGRE in the Weddell Sea region has resulted in over 215 000 line kilometres of data flown at a mean elevation 2000 m and a line separation of 20 km and 5 km. In course of these investigations, a vast and largely inaccessible region comprising the East Antarctic Shield, Weddell Sea sedimentary basin, Mesozoic magmatic arc of the Antarctic Peninsula and Precambrian Haag Nunataks block has been covered by aeromagnetic survey over an area of about 1 850 000 km^2 partly accompanied by airborne gravity and radio-echosounding observations. These data have been digitized (if not originally digitally recorded) and used to produce the 1 : 2 500 000 scale aeromagnetic anomaly map and associated gridded data.

The compiled map has a wide variation of magnetic anomaly patterns, trends and types reflecting the diversity of the geologic terranes of the Weddell Sea sector of Antarctica. Interpretation of the magnetic anomaly pattern in terms of structural features allows us to distinguish a number of magnetic patterns attributed to different crustal units and combine them into three major zones associated with the West and East Antarctic terranes and the Weddell Sea Embayment area.

It is clear that this map allows a comparison of the regional magnetic features with those appearing on similar-scale geological and geophysical maps and as a database for future production of the 'Digital Magnetic Anomaly Map of Antarctica' in the framework of the Scientific Committee on Antarctic Research/International Association of Geomagnetism and Aeronomy (SCAR/IAGA) compilation (JOHNSON et al. 1997).

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